PLANNING REPORT NO. 21

A REGIONAL AIRPORT SYSTEM PLAN FOR SOUTHEASTERN WISCONSIN

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NUMBER 21

A REGIONAL AIRPORT SYSTEM PLAN FOR SOUTHEASTERN WISCONSIN

Prepared by the
Southeastern Wisconsin Regional Planning Commission

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The preparation of this report was financed in part through an airport system planning grant from the U. S. Department of Transportation, Federal Aviation Administration under the planning grant program as provided in the Airport and Airway Development Act of 1970; in part through a planning grant from the Wisconsin Department of Transportation, Division of Aeronautics; and in part through a planning grant from the U. S. Department of Housing and Urban Development under the provisions of Section 701 of the Housing Act of 1954, as amended. The findings and recommendations of this report have been carefully reviewed and approved by a Technical Coordinating and Advisory Committee having representation from concerned federal, state, and local units and agencies of government, as well as from concerned private interests. Nevertheless, acceptance of this report by the Federal Aviation Administration does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable in accordance with Public Laws 91-190, 91-258, and/or 90-495.

December 1975

Inside Region $10
Outside Region $20

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SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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STATEMENT OF THE CHAIRMAN

The Regional Planning Commission in 1970, upon the specific request of Milwaukee County and the Wisconsin Department of Transportation, and after preparation and approval by the constituent county boards of a prospectus, undertook the preparation of a regional airport system plan. The planning work was funded by the U. S. Department of Housing and Urban Development, the U. S. and State Departments of Transportation, and the seven constituent county boards. Technical direction for the study was provided from its inception by a Technical Coordinating and Advisory Committee composed of 13 public officials and private citizens knowledgeable about aviation and airport development, representing certain state and federal, as well as local, units of government within the Region and representing commercial and military, as well as general-purpose, aviation interests operating within the Region. The complex technical work involved was carried out by the Commission staff with the assistance of a private engineering firm specializing in airport planning and development.

Publication of this report represents the product of over five years of intensive planning effort culminating in a series of public informational meetings and a formal public hearing in which the findings and recommendations of the work were presented to local elected officials and interested citizens. These meetings and hearing generated a great deal of public interest, and in the case of two of the airports generated considerable public controversy and deliberation. As a result of the meetings and hearing, modifications in the plan, as originally recommended by the consultant, the staff, and the Advisory Committee, were made by the Commission and are reflected in the final recommended plan presented herein. This final recommended plan is summarized in Chapter XIV of this report.

Implementation of the recommended regional airport system plan should not only achieve a safer, more efficient, and more economical air transportation system within the Region, but should help promote the coordination of airport facility development with land use and surface transportation system development in the Region. A regional airport system plan provides one more important element in the evolving comprehensive development plan which the Commission is charged by law with preparing for the Region. Airports merit explicit consideration in the regional plan, both because of their special needs and because of their pervasive effects upon the continued economic vitality of the Region and upon the overall quality of the environment within the Region. Individual airport facilities cannot be properly planned and designed in isolation, but only as integral parts of a total areawide system wherein the major airport facilities studied as a whole are carefully fitted to existing and probable future traffic loads derived from adopted areawide land use plans; or designed to meet regional, as well as federal, state, and local development objectives, and are properly integrated with other modes of transportation. Only within the context of an areawide airport system plan can the day-to-day decisions relating to individual airport facility development be properly made; federal, state, and local airport development programs properly coordinated; and jurisdictional responsibilities for airport development soundly assigned on the basis of overall needs.

As is true of all the Commission's work, the regional airport system plan is entirely advisory to the local, state, and federal units and agencies of government concerned. In its continuing role of acting as a center for the coordination of plan implementation activities within the Region, the Commission stands ready to provide such assistance as may be requested of it by the various units and agencies of government concerned in implementing the regional airport system plan.

Respectfully submitted,

George C. Berteau
Chairman

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Chapter I

INTRODUCTION

The regional airport system planning program is the fourth major planning program to be undertaken by the Southeastern Wisconsin Regional Planning Commission which has as its objective the preparation of an important element of a long-range, comprehensive plan for the physical development of the Region. Because the program is an integral part of a broader regional planning program, an understanding of the need for and objectives of regional planning and the manner in which these needs and objectives are being met in southeastern Wisconsin is necessary for a complete understanding of the airport system planning program, its findings, and its recommendations.

NEED FOR REGIONAL PLANNING

Regional planning may be defined as comprehensive planning for a geographic area larger than a county but smaller than a state, united by economic interests, geography, and common areawide problems. The need for such planning has been brought about by important national social and economic changes which have had far-reaching impacts on the problems facing local government. These changes include rapid population growth and urbanization; increasing agricultural and industrial productivity, income levels, and leisure time; generation of mass recreational needs and pursuits; intensive use and consumption of natural resources; development of private water supply and sewage disposal systems; development of extensive electric power and communications networks; and development of limited-access highways and mass automotive transportation. Under these changes, entire regions like southeastern Wisconsin are becoming one large urban complex, creating areawide environmental and developmental problems of a massive scale and complexity.

The areawide problems which necessitate a regional planning effort in southeastern Wisconsin all have their source in the rapid population growth and urbanization occurring within the Region. These areawide problems have included, among others, economic development, traffic congestion, inadequate housing, air and water pollution, flooding, deterioration and destruction of the underlying and sustaining natural resource base, and underlying all of the foregoing problems, rapidly changing and unplanned land use development. These problems are all truly regional in scope since they transcend the boundaries of any one municipality or any one county, and can only be resolved within the context of a comprehensive regional planning effort and through the cooperation of all units and levels of government concerned.

THE REGIONAL PLANNING COMMISSION

The Southeastern Wisconsin Regional Planning Commission represents an attempt to provide the necessary areawide planning services for one of the nation's large urbanizing regions. The Commission was created in August 1960, under provisions of Section 66.945 of the Wisconsin Statutes, to serve and assist the local, state, and federal units of government in planning for orderly and economic development in southeastern Wisconsin. The Commission's role is entirely advisory, and participation by local units of government in its work is on a voluntary, cooperative basis. The Commission is composed of 21 citizen members, three from each county in the Region, who serve without pay.

The powers, duties, and functions of the Commission and the qualifications of the Commissioners are carefully set forth in the state enabling legislation. The Commission is authorized to employ experts and needed staff to execute its responsibilities. Basic funds necessary to support Commission operations are provided by the member counties, with the budget apportioned among the seven counties on the basis of relative equalized assessed property valuation. The Commission is authorized to request and accept aid in any form from all levels and agencies of government to accomplish its objectives and is authorized to deal directly with the state and federal governments for this purpose. The organizational structure of the Commission and its relationship to the constituent units and agencies of government comprising or operating within the Region is shown in Figure 1.

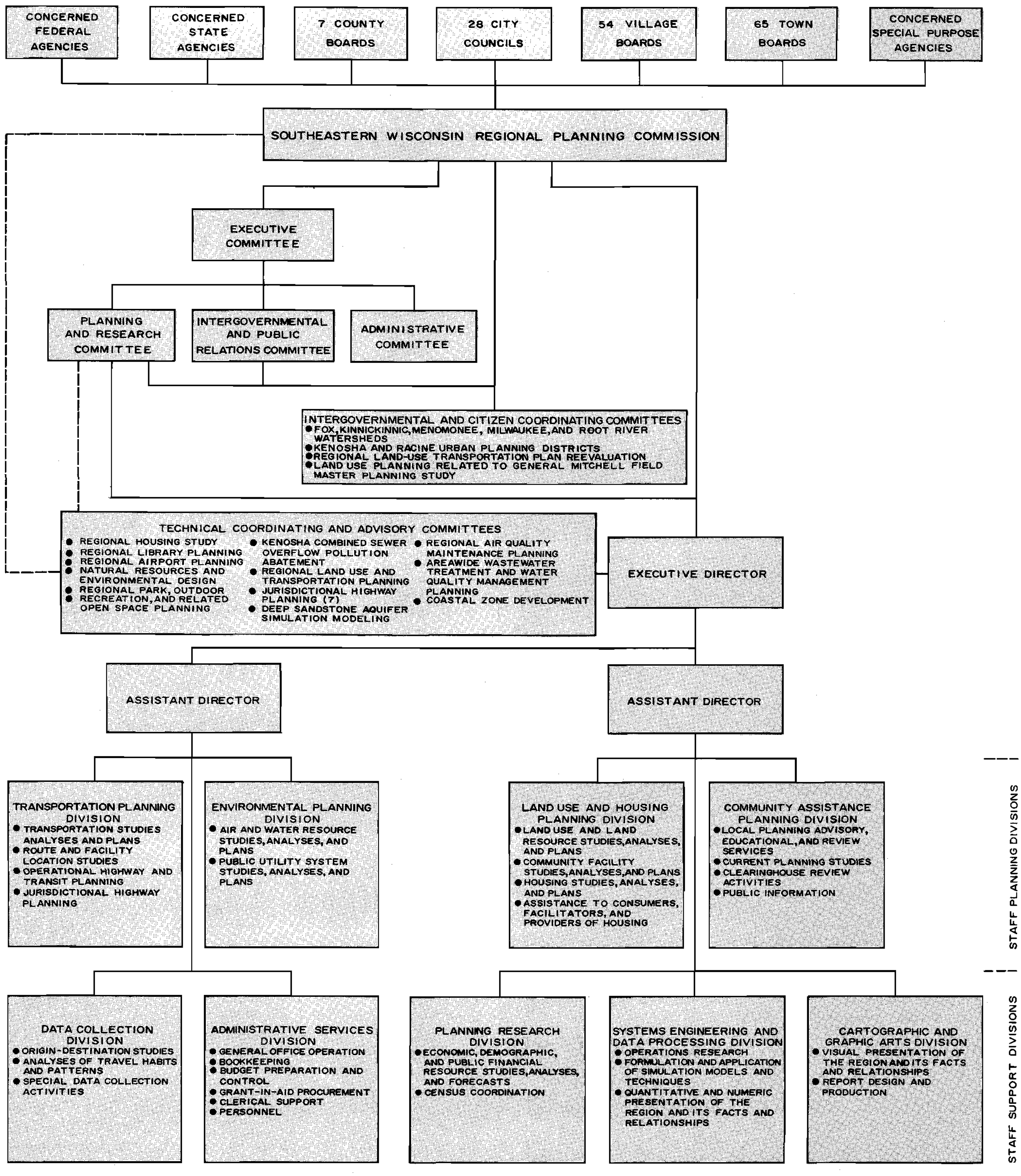
THE REGIONAL PLANNING CONCEPT IN SOUTHEASTERN WISCONSIN

Regional planning as conceived by the Commission is not a substitute for, but a supplement to, local, state, and federal planning. Its objective is to assist the various levels and units of government in finding solutions to areawide developmental and environmental problems which cannot be properly resolved within the framework of a single municipality or county. As such, regional planning has three principle functions to perform:

1. Inventory—the collection, analysis, and dissemination of basic planning and engineering data on a uniform, areawide basis, so that in light of such data, the various levels and agencies of government and private investors operating within the Region can better make decisions concerning community development.

Figure 1

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION: ORGANIZATIONAL STRUCTURE



Source: SEWRPC.

2. Plan Design—the preparation of a framework of long-range plans for the physical development of the Region, these plans being limited to functional elements having areawide significance. To this end, the Commission is charged by law with the function and duty of "making and adopting a master plan for the physical development of the Region." The permissible scope and content of this plan, as outlined in the enabling legislation, extend to all phases of regional development, implicitly emphasizing preparation of alternative spatial designs for land use and for supporting transportation and utility facilities.

3. Plan Implementation—promotion of plan implementation through provision of a center to coordinate the planning and plan implementation activities of the various levels and agencies of government in the Region, and through the introduction of information on areawide problems, to recommend solutions to these problems, and alternatives thereto into the existing decision-making process.

The work of the Commission, therefore, is seen as a continuing planning process providing outputs of value to the making of development decisions by public and private agencies, and to the preparation of plans and plan implementation programs at the local, state, and federal levels. It emphasizes close cooperation between the governmental agencies and private enterprise responsible for the development and maintenance of land uses in the Region, and for the design, construction, operation, and maintenance of the supporting public works facilities. All Commission work programs are intended to be carried out within the context of a continuing planning program which provides for periodic reevaluation of the plans produced, and for the extension of planning information and advice necessary to convert the plans into action programs at the local, regional, state, and federal levels.

THE REGION

The Southeastern Wisconsin Planning Region, as shown on Map 1, is comprised of Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha Counties. Exclusive of Lake Michigan, these seven counties have a total area of 2,689 square miles, or about 5 percent of the total area of Wisconsin. About 40 percent of the state population lives in these seven counties, which contain three of the seven and one-half Standard Metropolitan Statistical Areas in Wisconsin. The Region contains about half the tangible wealth in Wisconsin as measured by equalized assessed property valuation, and represents the greatest wealth-producing area of the state, having about 40 percent of the state's total employment. The Region contains 154 local units of government, exclusive of school and other special-purpose districts. The Region has been subject to rapid population growth and urbanization, and from 1960 to 1970 accounted for approximately 40 percent of the population increase in the state.

Geographically the Region is located in a relatively good position with regard to continued growth and development. It is bounded on the east by Lake Michigan, which provides an ample supply of fresh water for both domestic and industrial use as well as being an integral part of a major international transportation network. It is bounded on the south by the rapidly expanding northeastern Illinois metropolitan region, and on the west and north by the fertile agricultural lands and desirable recreational areas of the rest of the State of Wisconsin. Many of the most important industrial areas and heaviest population concentrations in the midwest are located within approximately 250 miles of the Region, and slightly more than 35 million people reside within this radius, an increase of approximately 5 million persons over the 1960 level.

COMMISSION WORK PROGRAMS

Initial Work Program

The Commission has since 1960 pursued its three principal functions of inventory, plan design, and the promotion of plan implementation activities by the various local, state, and federal units and agencies of government. Initially, the Commission emphasized the inventory function by concentrating on the compilation of a regional planning data bank through several major interrelated inventory efforts, including a systems analysis and data processing study, a base mapping program, an economic base and structure study, a population study, a natural resources inventory, and a public utilities inventory.

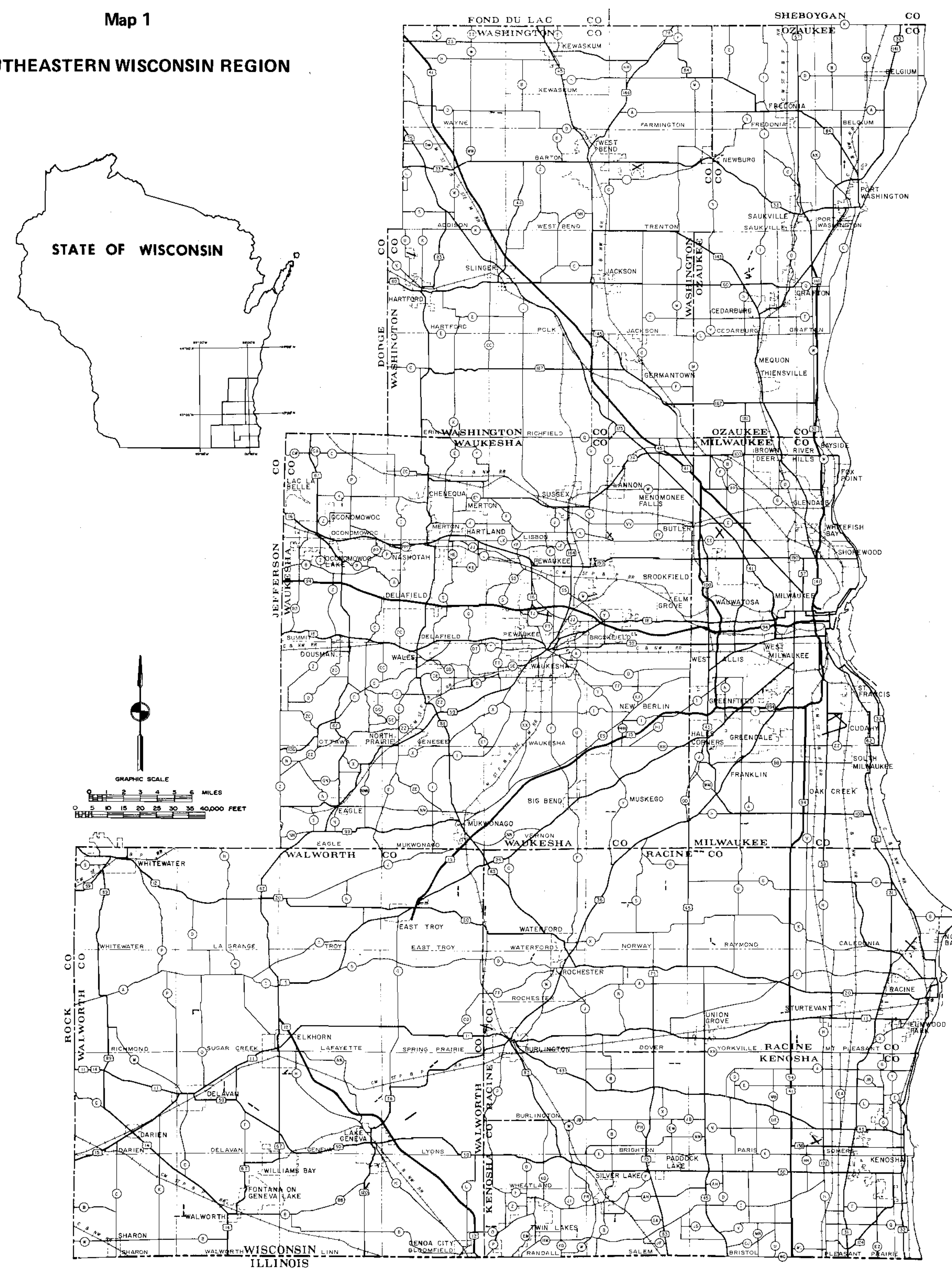
As part of its initial work program, the Commission also adopted a policy of community planning assistance in which functional guidance and advice on planning problems are provided to local units of government, and in which regional planning studies are interpreted locally so that the findings and recommendations of these studies may be integrated into local development plans. Six local planning guides were prepared under this community assistance program, the subject of these guides being land subdivision control, official mapping, comprehensive zoning, organization of local planning agencies, floodland and shoreland development, and the use of soils data in both rural and urban planning and development. All of the guides include model ordinances and thereby a framework for regional plan implementation through local land use control measures. All of these initial studies were directed toward providing a basic foundation of planning and engineering data and a structure for regional plan implementation through integration with local planning efforts, and as such, provide a valuable point of departure for all subsequent areawide planning efforts within the Region.

Land Use-Transportation Study

The first major work program of the Commission actually directed toward the preparation of a framework of advisory plans for the physical development of the Region was a comprehensive regional land use-transportation study initiated in January 1963 and completed in December 1966. This study produced two key elements

Map 1

SOUTHEASTERN WISCONSIN REGION



The seven-county Southeastern Wisconsin Region encompasses a total area of about 2,689 square miles, or about 5 percent of the total area of the State of Wisconsin. About 40 percent of the state's population, however, resides in these seven southeastern counties. The Region has about 40 percent of the state's total employment, and contains about half of all the tangible wealth in the state as measured by equalized assessed property valuation. The Region has been subject to rapid population growth and urbanization, and from 1960 to 1970 accounted for about 40 percent of the total population increase of the state.

Source: SEWRPC.

of a comprehensive plan for the physical development of the Region: a land use plan and a transportation plan. The transportation plan was confined to consideration of highway and mass transit facilities, with air, rail, and water transportation facilities considered only insofar as the terminals of these facilities within the Region constituted major traffic generators for the highway and mass transit facilities.

The Commission adopted the land use and transportation plans on December 1, 1966, and, pursuant to the provisions of Section 66.945 of the Wisconsin Statutes, certified the plans to the 153 local units of government then comprising the Region and to certain concerned state and federal agencies in March 1967. All seven county boards within the Region acted to adopt the recommended transportation plan in 1967, as did such important state agencies as the State Highway Commission and the State Department of Natural Resources and such important areawide plan implementation agencies as the Milwaukee County Expressway and Transportation Commission and the Metropolitan Sewerage Commission of the County of Milwaukee. All of these agencies except the Ozaukee County Board similarly acted to adopt the recommended land use plan in 1967. In addition, both the land use and transportation plans have been adopted to date by 36 of the 147 cities, villages, and towns within the Region, thus reenforcing the action of the constituent county boards, the concerned state agencies, and local special-purpose commissions and districts.

The adopted land use plan envisions a conscious continuation of historical development trends within the Region with the proposal to more effectively regulate the effect of the urban land market on land use development in order to provide for a more orderly and economical regional settlement pattern, and in order to avoid intensification of existing areawide developmental and environmental problems. The plan allocates sufficient land to each of the various land use categories to satisfy the known and anticipated demand for each use. The plan seeks to protect and preserve all of the primary environmental corridors and the best remaining agricultural areas of the Region from incompatible development. The plan further calls for the development of certain new regional retail and service centers, regional industrial areas, and regional park and outdoor recreation areas. The preparation and adoption of the regional land use plan is extremely important to all other areawide planning efforts, since it provides the fundamental basis for the preparation of additional plan elements, including transportation, utility, and community facility elements.

The adopted regional transportation plan provides for a well-integrated, well-balanced, and economical surface transportation system consisting of an expanded regional freeway system, a new regional rapid and modified rapid transit system, and an improved arterial street and highway and supporting mass transit system. The adopted plan is designed to meet the travel demands generated by the existing and proposed regional land use patterns, to provide the appropriate types and levels of transportation service needed by the various subareas of the Region, to achieve a balance between travel demand and the spatial configuration and capacity of surface transportation facilities, to achieve a balance between the utilization of the automobile and mass transit vehicles as modes of transportation, to alleviate traffic congestion and reduce travel time, to reduce accident exposure, and to minimize the sum of transportation system operating costs and capital investment costs.

Subsequent to the completion and adoption of the regional land use and transportation plans, the Commission initiated a continuing regional land use-transportation planning process. Under this continuing process the basic planning and engineering data collected in, and the forecasts prepared under, the initial regional land use-transportation study are continuously updated and revised so that the full value of these data and forecasts can be realized and development decisions within the Region made intelligently based upon current factual information. The plans prepared in the initial study are periodically updated and revised to reflect changing conditions within the Region. Information and guidance are provided to public decision makers, and additional detailed studies are undertaken to further support, encourage, and direct plan implementation. A particularly significant objective of the continuing regional land use-transportation study is to provide for the continued integration of the land use and transportation planning and development efforts within the Region with other elements of the comprehensive regional planning effort, including the preparation of water resource development, sewerage and water supply, park and open space, housing, and airport plan elements.

The adopted land use and transportation plans not only provide an essential framework of land use and surface transportation facility plans on which to base the preparation of a regional airport system plan, but also provide much information essential to the preparation of such a plan. This information includes current aerial photography and base maps and definitive data on land use, travel habits and patterns, surface transportation facility capacity and service levels, soils, woodlands, wetlands, potential park and related open space sites, community plans and zoning, planning law, public financial resources, and detailed planning base maps and survey control. The continuing land use-transportation study also provides a staff experienced in, and able to undertake, additional planning and engineering studies related to airport system development within the Region.

To further refine and detail the adopted land use and transportation plan elements, the Commission has undertaken the preparation of comprehensive plans for urban planning districts within the Region and the preparation of jurisdictional highway system plans. Urban planning district planning programs have been completed for the Kenosha and Racine Urban Planning Districts. These district plans, in effect, constitute detailed urban development plans for these two important urbanizing areas of the Region. Jurisdictional highway system plans have been completed for Milwaukee, Ozaukee, and Walworth Counties, and the preparation of such plans are underway for Kenosha, Racine, Washington, and Waukesha Counties. These plans refine and detail the adopted regional transportation plan with respect to the arterial street and highway system, and assign jurisdictional responsibility for implementation of the adopted functional plan to the various levels and agencies of government concerned by recommending realignment of the state, county, and local trunk highway systems and of the various underlying federal aid routes. The detailing and refining of the adopted regional land use and transportation plans provided by these additional subregional studies also provide additional important inputs to the development of a regional airport system plan.

Comprehensive Watershed Studies

The Commission's planning program also recognizes the importance of water and water-related resource problems within the Region, including problems of flooding and water pollution. The watershed was selected by the Commission as the basic water and water-related resource planning unit. To date, comprehensive watershed plans have been completed for the Root, Fox, and Milwaukee River watersheds within the Region, and such plans are under preparation for the Menomonee and Kinnickinnic River watersheds. The watershed planning programs, in addition to refining and detailing the regional land use plans in the riverine areas, provide streamflow and stream water quality, flood hazard, and water control facility information useful to airport system planning.

Other Regional Planning Programs

The Commission has undertaken six additional regional planning programs: a regional sanitary sewerage system planning program; a regional library facilities and services planning program; a regional housing study; a regional park, outdoor recreation, and related open space study; a regional air quality maintenance planning program; and a regional water quality maintenance planning program. All of these have important implications for regional airport system planning.

REGIONAL AIRPORT SYSTEM PLANNING PROGRAM

In considering its future work program, the Commission recognizes the need to maintain flexibility in light of the rapidly changing character of the environmental and developmental problems of the Region, as well as the need to remain responsive to the expressed needs and desires of the constituent local units of government and of concerned state and federal agencies of government. Accordingly, the Commission as a matter of policy normally considers additional regional planning programs only upon the specific request of federal, state, or constituent local units of government and upon a showing of significant and urgent need.

On May 10, 1968, Milwaukee County Executive John L. Doyne formally requested the Southeastern Wisconsin Regional Planning Commission to undertake a comprehensive regional airport planning program looking toward the ultimate resolution of the growing air transportation problems of the Region. On June 4, 1968, a similar request was made by the then Secretary of the Wisconsin Department of Transportation, Mr. G. H. Bakke. These requests recognized that only within the context of a long-range, comprehensive regional planning effort can an adequate airport system plan be prepared to guide the staged development of airport facilities within the Region, and that such an airport system plan must be fully integrated with land use and surface transportation plans for the Region. Acting in response to these requests, the Commission, pursuant to Section 66.945 of the Wisconsin Statutes, on June 6, 1968, created a Technical Coordinating and Advisory Committee on Regional Airport Planning to assist it in the study of the airport problems of the Region. This Committee is comprised of selected local officials directly concerned with the provision of airport facilities within the Region, as well as state and federal aviation officials and representatives of private groups concerned with the provision of airport facilities. The purpose of the Committee was to actively involve the agencies most concerned with airport development within the Region in the airport planning work of the Commission, as well as to bring the knowledge of individuals possessing broad experience in the planning, design, construction, operation and maintenance, and use of airport facilities to bear on the problem.

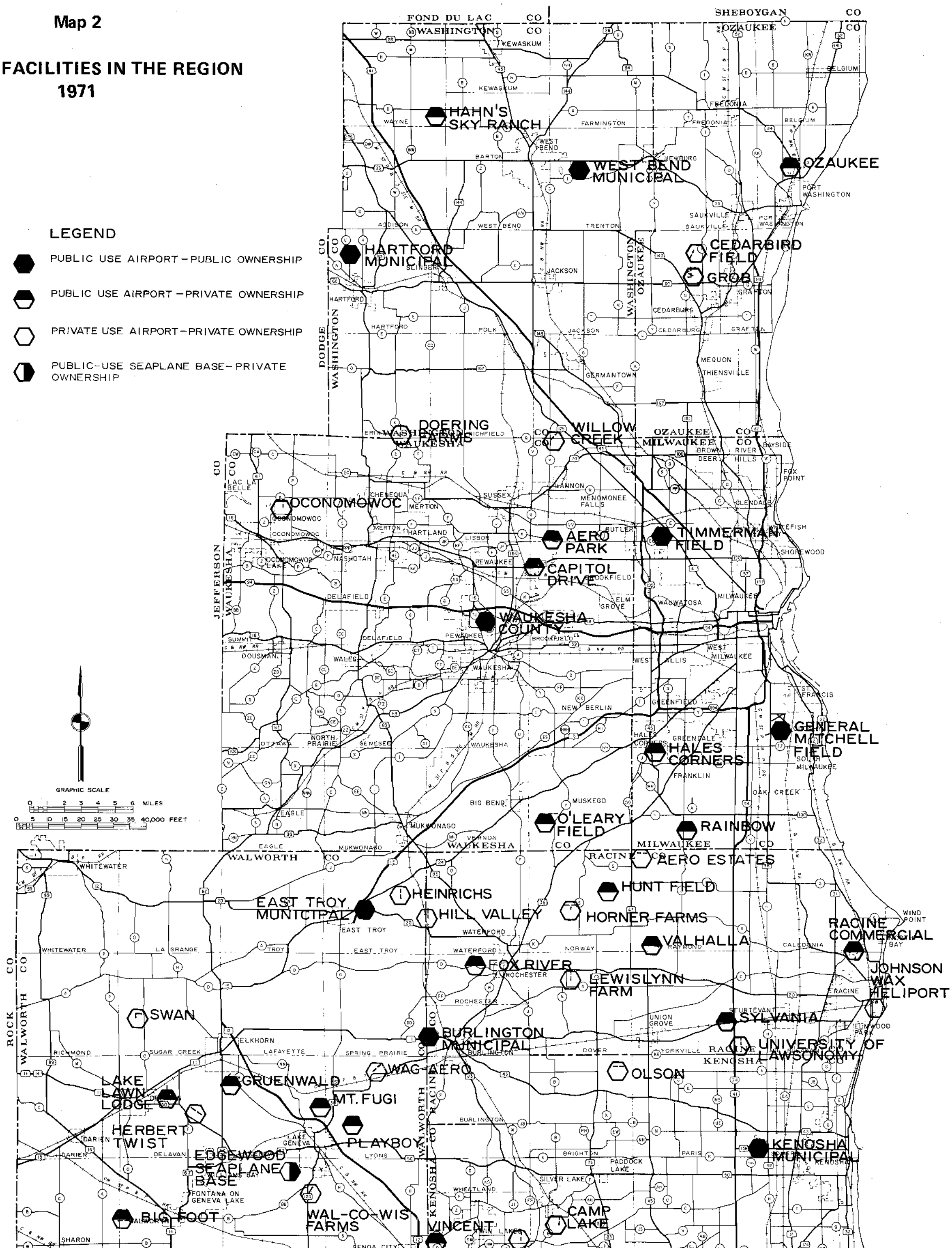
The Committee held its organizational meeting on December 31, 1968, and working from then until June 20, 1969, prepared a Prospectus for a comprehensive, areawide airport system planning program for the Southeastern Wisconsin Region. That Prospectus, approved and published by the Commission on December 4, 1969, documented the need for a regional airport system planning program within the Region; set forth the desirable scope and content of such a program; and recommended time schedules, staff organization, and a budget for the needed program. The Prospectus was a preliminary design prepared to obtain support and financing for the study, an objective which it fully achieved. The airport planning program on which this report is based was conducted pursuant to the recommendations contained in that Prospectus.

PREVIOUS AIRPORT STUDIES

The existing air transportation system of the Southeastern Wisconsin Region consists of a complex network of airways and the 46 airports or air bases shown on Map 2. This system has evolved over a period of approximately 50 years, largely without the benefit of an overall system plan. Yet airport planning studies are not new to the Region. The state and federal levels of government have provided some guidance for development of the more important facilities in the form of state and national transportation plans. Both of these plans, however, are of a very general type and do not specify site location or land requirements. In addition, the local units of government responsible for airport facility improvement have from time to time prepared local airport development plans but without benefit of an overall regional system plan.

Map 2

AIRPORT FACILITIES IN THE REGION
1971



The growing importance of air travel in the Region has led to the establishment of a regional airport system planning program designed to prepare a long-range plan for the future development of airport facilities in the Region for 1990. An inventory of all existing airport facilities in the Region revealed, as shown on this map, that there are a total of 46 airports or air bases in the Region (1971), including one scheduled air carrier airport, 25 general aviation public use airports, one public use seaplane base, and 19 general aviation private use airports. Of the 27 public use airports, eight are owned and operated by local units of government in the Region.

Source: SEWRPC.

Four previous airport planning studies carried out by the state and federal levels of government and by individual counties and communities within the Region warrant brief discussion here. These are the federal National Airport System Plan; the State Airport Plan; the Timberlake Study of Airport Needs Within the Milwaukee Metropolitan Air Trade Area; and the Site Development Plan prepared for General Mitchell Field by the New York firm of Arnold Thompson Associates, Inc. In addition, airport layout plans have been prepared for seven airports in the Region as a prerequisite to the approval of federal grants in partial support of airport improvements, and are also discussed here.

National Airport System Plan

The Airport and Airway Development Act of 1970 directs the U. S. Secretary of Transportation to prepare, publish, and thereafter revise as necessary a National Airport System Plan (NASP) "for the development of public airports in the United States...adequate to anticipate the needs of civil aeronautics, to meet requirements in support of national defense...and to meet the special needs of the postal service." The Congressional directive to prepare this plan was in recognition of the important role that aviation plays in the national transportation system. The national plan provides a broad basis for planning airport development throughout the United States, and in operational terms, the plan provides the means of identifying those airport development projects of potential federal interest on which federal funds may be spent under the capital airport development aid program (ADAP). The Federal Aviation Administration (FAA) in October of 1970 was delegated the responsibility of preparing and administering the NASP. Preparation of the NASP builds upon work by the FAA under prior national airport plans, which were annually revised plans for the development of public airports in the United States.

The initial 1972 NASP is documented in 12 volumes—a narrative volume explaining the purpose and content of the NASP, with certain summary tables; and one volume for each of the eleven FAA regions, which contains detailed data for airports within each state and region. The Great Lakes Region encompasses the states of Minnesota, Wisconsin, Michigan, Illinois, Indiana, and Ohio.

Airports and airport facility estimates in the NASP are determined on the basis of aeronautical activity related to socioeconomic factors and constraints. Basically, forecasts of aeronautical activity are produced from current data over 5-, 10-, and in some cases 20-year periods and, by comparing these forecasts with the capability of existing airports, facility needs are estimated. The level of airport development described in the NASP was prepared using uniform national criteria concerning the local service provided by the airport system, including congestion delay, safety, and ease of access to the system. The development shown in the NASP is that necessary to obtain these levels of service under assumptions about future traffic levels and operating rules.

The planning periods covered in the 1972 NASP are current (fiscal 1972); short range (fiscal 1973-1977); intermediate range (fiscal 1978-1982); and long range (fiscal 1983-1992). Detailed airport development for both existing and new facilities is shown for the short-range period only. In the intermediate range, facility estimates include new and existing airports that are not in the short-range period but which are forecast to be included in the intermediate range. Only total facilities estimates for a few large, complete new airports, none of which are in Wisconsin, are shown in the long-range period.

In prior national airport plans, airports were eligible or ineligible for inclusion on the basis of whether they currently met certain entry criteria. Forecasting of aeronautical activity was limited, as was the determination of the development estimates within the five-year period. Initial NASP procedures now allow for locations to be included in the NASP based upon forecasts showing that minimum entry criteria will likely be met in some specific time period within the next 10 years.

The NASP document sets forth recommended development cost summaries by state and by facility improvement item for a current total of 2,908 airports, which are expected to increase to 3,890 airports over the next five years and to 3,967 airports over the next 10 years. Volume AGL presents planning data and facility estimates for airport development within the Great Lakes Region by state and by airport. The summary tables contained within Volume AGL list the role and operating characteristics of existing and proposed airports, whether or not the facility is intended to serve as a reliever-type airport, estimates of aircraft operations and annual enplaning passengers, and the number of based aircraft for each of the current, short-range, and intermediate-range time periods.

A listing of the nine existing and seven proposed airports within the southeastern Wisconsin Region that are included in the 1972 NASP, and the prominent operational classification assigned by FAA during each of the three planning periods—current, short range, and intermediate range—are provided in Table 1.

It is important to note that of the 16 airport facilities identified within the Region as part of the National Airport System Plan, seven are listed in the plan as new, and therefore "site undecided" facilities, indicating that further study is needed to determine whether the needed facility can or cannot be developed on existing sites. Further, it is important to note that the NASP is a general plan with a limited amount of development data supplied for the short-range planning period and only an indication of operational demand through the intermediate-range planning period. Moreover, the plan does not consider airspace needs, establish site requirements, or consider the ability of sponsoring agencies to finance necessary improvements. The NASP does recognize the need for the conduct of regional system planning programs to determine the relationship of each airport to the rest of

Table 1

EXISTING AND PROPOSED AIRPORTS IN SOUTHEASTERN WISCONSIN INCLUDED IN THE 1972 NATIONAL AIRPORT SYSTEM PLAN

Airport	Operational Classification[a] Current	Short Range (0-5 Years)	Intermediate Range (6-10 Years)
Existing			
General Mitchell Field	B2	B2	A2
Timmerman (designated reliever)	BT	BT	BT
Waukesha (designated reliever)	BT	BT	GT
West Bend	BT	BT	BT
Hartford	GU	GU	GU
Kenosha	BT	GT	GT
Racine Commercial	BT	GT	GT
Burlington	BT	BT	BT
East Troy	GU	BT	BT
Proposed			
Franklin-Hales Corners (designated reliever)	--	GU	BT
Menomonee Falls (potential reliever)	--	BT	BT
Grafton	--	GU	GU
Port Washington	--	--	BU
Oconomowoc	--	GU	BT
Delavan/Elkhorn	--	GU	GU
Lake Geneva	--	GU	GU

[a] *The operational classifications assigned by FAA include the following designations:*

Air Carrier Aircraft Groups

A-2 - Airline service for A aircraft group (B-747, DC-8, B-707, etc.) having similar general runway requirement and length of haul. Code 2 - 500 to 1,500 miles.

B-2 - Airline service for B aircraft group (B-727, B-737, DC-10, L-1011, etc.) having similar general runway requirement and length of haul. Code 2 - 500 to 1,500 miles.

The general aviation aircraft groupings are:

GT - General Transport

BT - Basic Transport

GU - General Utility

BU - Basic Utility

Source: Federal Aviation Administration.

the transportation system serving each particular region, to forecast technological development in aeronautics, and to forecast developments in other modes of intercity transportation. Thus, to provide a truly useful guide in decision making, the NASP must be refined and detailed at a regional level.

State Airport System Plan

Wisconsin is one of the relatively few states in the nation which has prepared a state airport plan.[1] Section 114.01 of the Wisconsin Statutes, in effect since 1947, directs the State Aeronautics Commission, now the Division of Aeronautics, Wisconsin Department of Transportation, to not only cooperate with the federal government in the preparation and annual revision of the National Airport System Plan, but to prepare a statewide airport system plan. This statewide airport system plan must include every airport on the national airport system and may include such additional airports as are deemed necessary to meet the needs of the state. Prior to the enactment of Section 114.01 of the Wisconsin Statutes, and at the specific direction of the 1943 State Legislature, a State Airport System Plan was developed by the Wisconsin State Planning Board. This plan was published in 1945 and was instrumental in the passage of legislation establishing the present system of state aids for airport system development.

[1] *State Airport System Plan: Technical Supplement, Wisconsin Department of Resource Development, Madison, Wisconsin, 1966.*

The initial plan has since been replaced by a new interim plan first approved by the Secretary of the Wisconsin Department of Transportation in January 1971, and revised in April 1972. This interim plan is serving to guide planning and design decisions while the state is in the process of a full-scale review of airport needs and development of a new statewide airport system plan. The grant from the FAA for conduct of the state airport system planning study was received June 15, 1972. The regional airport system plan documented within this report will be incorporated in its entirety into the state airport system plan. Only those airports included in the state plan are eligible for state aid, and since the state plan incorporates all Wisconsin airports included in the national plan, it includes all airports eligible for federal, as well as state, aid.

Like the national plan, the state plan contains gross projections of certain indicators of airport need for the state as a whole to the year 1990, classifies airports into five categories[2] and relates these to communities served, and contains recommendations for the development of a statewide system of airports consisting of 68 existing and 44 proposed facilities. The interim plan proposes the development of seven new airports within southeastern Wisconsin and recommends ultimate size categories for a total of 15 airports within the Region, including the seven new airports.[3] The interim state plan is, in some respects, even less detailed than the national plan. It does not consider airspace needs, does not identify site locations or requirements, and, like the national plan, lacks detailed information concerning financial and jurisdictional means for carrying out the plan.

Milwaukee County Timberlake Study

In 1957 the Milwaukee County Board adopted a resolution directing the Milwaukee County Department of Public Works, in cooperation with the Wisconsin State Aeronautics Commission, to undertake a cooperative study of future airport needs within the Milwaukee metropolitan area. The Nevada firm of Timberlake and Timberlake, specializing in the economic aspects of air transportation, was accordingly engaged, and in December 1960 completed a report on aviation activities in the Milwaukee metropolitan air trade area, with recommendations for necessary future airport site acquisitions.[4]

The study had as its objectives the delineation of the Milwaukee metropolitan air trade area, the determination of the aeronautical potential of the area, and the preparation of recommendations with respect to the number of publicly owned airports thought to be necessary to serve the metropolitan air trade area through the year 1975. The report defined the Milwaukee metropolitan air trade area as consisting of Kenosha, Milwaukee, Ozaukee, Racine, Washington, and Waukesha Counties. It analyzed the economic and demographic growth of this air trade area, provided employment but not population forecasts for this air trade area to the year 1975, analyzed enplaned passenger traffic and general-aviation activity within this air trade area, and forecast both air-carrier and general-aviation activity within the metropolitan air trade area to the year 1975. Airport service areas were delineated for 15 airports within the metropolitan air trade area (seven publicly owned and eight privately owned),[5] and deficiencies established. The report recommended the acquisition and development of public heliport sites within the air trade area without specifying the number, and recommended the development of three additional publicly owned airports by or before 1979—one in the Port Washington area, one in the Racine area, and one in southwestern Milwaukee County—with minimum runway lengths of 5,200 feet. The report did not, however, identify specific sites for the heliports or the recommended new airports, did not integrate the airport development recommendations with land use or surface transportation system development, and did not recognize the need for the preparation of a long-range master plan for all public airports in the area.

General Mitchell Field Site Development Plan

Early in 1968 the Milwaukee County Board commissioned the New York firm of Arnold Thompson Associates, Inc., to evaluate trends affecting terminal facilities at General Mitchell Field and to make recommendations concerning future terminal facility development.[6] The study, com-

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[2] *The interim Wisconsin Airport System Plan includes the following classifications: Scheduled Air Transport Airport (AT)—serves all levels of general aviation and certified air carriers; General Transport Airport (GT)—serves all levels of general aviation; Basic Transport Airport (BT)—serves all aircraft under 60,000 pounds, which includes most business jets; General Utility Airport (GU)—serves all propeller-driven aircraft under 12,000 pounds; and Reliever Airport (R)—is intended to divert general aviation traffic from scheduled air transport airports.*

[3] *The regional airports included in the interim state plan, together with the recommended system plan classifications, are: General Mitchell (AT), Kenosha (GT), Racine (new GT), Burlington (BT), Delavan-Elkhorn (new BT), Lake Geneva (new BT), Oconomowoc (new BT), West Bend (BT), Hartford (GU), Port Washington (new GU), Timmerman (R), Waukesha (R), and three new relievers in the Milwaukee area.*

[4] *A Preliminary Study of Estimated Aviation Activities in the Milwaukee Metropolitan Air Trade Area in Future Years and Recommendations with Regard to Necessary Airport Site Acquisition in Connection Therewith, Timberlake and Timberlake, Economic Consultants, Las Vegas, Nevada, December 1960.*

[5] *The airports for which service areas were established were: Aero Park, Air City, Burlington, Capitol Drive, General Mitchell, Grob, Hales Corners, Hartford, Racine Commercial, Kenosha, Rainbow, Sylvania, Timmerman, Waukesha County, and West Bend.*

[6] *General Mitchell Field, Passenger and Air Cargo Facilities Master Plan, Arnold Thompson Associates, Inc., Airport Facility Consultants, White Plains, New York, October 1968.*

pleted in October 1968 at a cost of $64,000, forecast facility and internal roadway requirements for the movement of passengers through 1990 and cargo through 1985; recommended the staged construction of terminal, parking, and roadway facilities; and set forth capital investment requirements to effect the recommended improvements. The study reviewed available source material on the economic and demographic base of the Region and on ground and air travel demand, inventoried existing airport facilities at General Mitchell Field, forecast passenger and air cargo movements at General Mitchell Field, and recommended the following site improvements at General Mitchell Field: provision of direct freeway access from IH 94 to the airport terminal area; provision of additional ticket lobby and baggage facilities; acquisition of additional land for required air cargo handling facilities; provision of new aprons, taxiways, and control tower; and construction of new terminal wings and an automobile parking structure. The study and report did not call for nor include a detailed revision of the overall airport layout plan or give consideration to the needs of general-aviation, fixed-based operators on the Field.

Airport Layout Plans

Federal Aviation Administration regulations also require the preparation of "airport layout plans" as a prerequisite to the approval of federal grants in partial support of airport improvements. An airport layout plan is a plan showing the boundaries of all areas owned or controlled by the sponsor for airport purposes, together with proposed additions thereto, the location and nature of existing and proposed airport facilities and structures, and the location on the airport of existing and proposed nonaviation areas and improvements. These layout plans thus represent site development plans for individual airport facilities, and are intended to be the controlling document for the review and approval of federal grants in partial support of proposed airport improvements.

These layout plans do not, however, embrace a long-range systems planning concept. As already noted, the layout plans show the airport location and site boundaries; existing and proposed facilities and land uses; and clear zones, approach areas, and other environmental features that may influence airport use and expansion, together with pertinent dimensional information on clearances required to show conformance with applicable standards. The airport layout plan normally consists of several components, depending upon airport size and use, including an airport layout plan drawing; supplementary drawings consisting of a location map, vicinity map, approach and clear zone layout map, and terminal area layout map; and an airport layout plan report. The report normally describes the existing and proposed physical facilities, including runways, taxiways, aprons, buildings, navigational aids, roads and automobile parking areas, lighting, runway marking, fencing, sewerage and water supply facilities, fueling facilities, and site boundaries. In addition, prominent topographic and cultural features of the airport environs may be described, with particular emphasis upon possible obstructions. Also included in the report is information on the zoning, if any, of the airport and its environs.

Airport layout plans for seven airports within southeastern Wisconsin have been prepared by local staffs or by consultants acting under the direction of the Wisconsin Department of Transportation, Division of Aeronautics. The preparation of these plans has been cooperatively funded by the federal, state, and local units of government concerned. The plans must be approved by the Wisconsin Division of Aeronautics and the Federal Aviation Administration to qualify for future state and federal aids for improvements. The seven airports having layout plans include the following:

1. Burlington—The airport layout plan for the Burlington Air Field was last revised in March 1968 by William J. Zutter, Consulting Engineer, Madison, Wisconsin. It constitutes a complete short-range site plan including a recommended height zoning ordinance. The height zoning ordinance has not been adopted, however.

2. Hartford—The airport layout plan for the City of Hartford airport is currently being revised by Mead and Hunt, Inc., Consulting Engineers, Madison, Wisconsin. The plan will recommend a 900-foot extension to the longest existing runway, which is 3,000 feet. The height zoning ordinance requires revision.

3. Kenosha—The airport layout plan for the Kenosha Airport was last revised by the Wisconsin Division of Aeronautics in February 1972. The plan shows the longest existing runway to be 4,200 feet. Recent developments indicate that a runway length of 7,000 feet may be justified, and the Kenosha Airport Commission has proposed an additional runway of 9,000 feet in length. No detailed studies are available to determine if a 7,000- or a 9,000-foot runway can or should be built on this site. The height zoning ordinance requires revision.

4. Milwaukee—Timmerman Field—The airport layout plan for Milwaukee County—Lawrence J. Timmerman Field was last revised in July 1965 by the Milwaukee County Department of Public Works, Airport Planning and Construction Division. The plan shows the longest runway to be 4,100 feet. No studies are available to determine if longer runways can or should be built on this site. The height zoning ordinance requires revision.

5. Milwaukee—General Mitchell Field—The airport layout plan for Milwaukee County—General Mitchell Field was last revised in April 1972 by the

Milwaukee County Department of Public Works, Airport Planning and Construction Division. It constitutes a complete site plan with the exception that the height zoning ordinance needs revision.

6. Waukesha County—The airport layout plan for the Waukesha County Airport was last revised in January 1971 by Foth and Van Dyke, Consulting Engineers, Green Bay, Wisconsin. The plan shows the longest runway to be 5,800 feet, including a 600-foot displaced threshold. No detailed studies are available to determine if a 5,800-foot runway can or should be built on the site. Moreover, the height zoning ordinance requires revision.

7. West Bend—The airport layout plan for the West Bend Airport was last revised in February 1971 by Donohue and Associates, Consulting Engineers, Sheboygan, Wisconsin. The plan shows the longest runway to be 6,200 feet. Additional studies should be made, however, to determine if a 6,200-foot runway can or should be built on the site. The height zoning ordinance was revised to conform to the current airport layout plan.

Although there is no airport layout plan for the East Troy Municipal Airport, construction plans for the airport are dated July 1957. The present turf runway has a length of 2,075 feet, and it is not known if this site is adequate to accommodate a longer runway length. There is no height limitation zoning ordinance.

Information in the files of the Federal Aviation Administration and the Wisconsin Division of Aeronautics indicates that all of the public airports within southeastern Wisconsin require additional engineering studies to determine whether the sites have sufficient capabilities to accommodate runway extensions and realignments that may be required to meet future air traffic demands. Four public agencies within the Region are seeking federal and state aid to carry out airport master planning studies. Milwaukee County, Waukesha County, and the City of Kenosha have obtained grants from the Federal Aviation Administration to conduct such studies. The City of West Bend has petitioned the Wisconsin Division of Aeronautics for state aid and to serve as an agent for the local governmental units in seeking federal aids for airport master planning studies.

NEED FOR A REGIONAL AIRPORT SYSTEM PLAN

Five factors contribute to the need for a comprehensive regional airport system plan for the Southeastern Wisconsin Region. These are:

1. Regional urbanization and the consequent need to coordinate airport facility development with regional land use development.

2. Rapid changes in surface transportation system development and the consequent need to coordinate airport facility development with surface transportation facility development.

3. Rapid growth and change in air traffic demand.

4. Rapid change in aircraft size, type, and performance, and related changes in airport facility requirements.

5. State and federal grant eligibility and review requirements.

Regional Urbanization

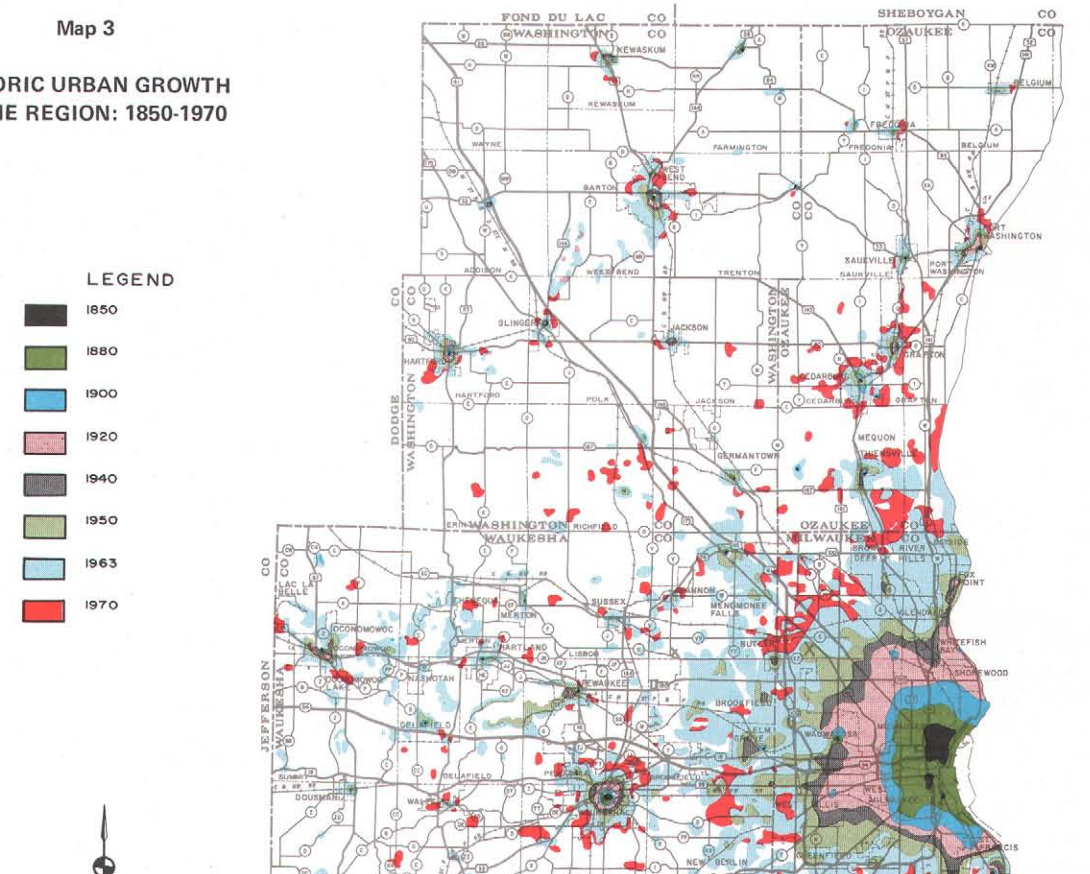
The population of the seven-county Region, which presently stands at about 1.8 million persons, is increasing at the rate of about 18,000 persons per year. This population growth is entirely urban and is being accompanied by radical changes in the density and pattern of distribution of the various urban land uses required to serve the growing population of the Region. The changing nature of the urban development pattern within the Region is indicated on Map 3. Urbanization within the Region has increased steadily since its settlement by Europeans in 1836. In 1850 only 4 square miles of the Region's 2,689 square miles were developed for urban use, and nearly three-fourths of the population lived on farms. After a century of urban growth, patterned in tight concentric rings as indicated on Map 3, only 130 square miles of land had been converted from rural to urban use to accommodate an increase in population of over one million persons.

A dramatic change in the nature of urban development in the Region occurred about 1950. From 1950 to 1963, while the regional population increased by about 35 percent, the amount of land devoted to urban use increased by almost 150 percent. Population densities within the developed urban areas of the Region dropped sharply from about 8,500 persons per square mile in 1950 to about 4,800 persons per square mile in 1963. During this period all of the seven counties within the Region came under the influence of urbanization, and four of the seven counties changed from primarily rural, agriculturally oriented areas to primarily urban, industrially oriented areas. This trend toward a highly dispersed, low-density type of urban development is continuing. Commission studies indicate that from 1963 to 1970 an additional 57 square miles of land within the Region were converted from rural to urban use, and overall population densities within the developed urban area of the Region dropped from about 4,800 to about 4,355 persons per square mile. The highly dispersed, low-density nature of this urban expansion may be expected to effect shifts in the demand for airport service within the Region and thereby contribute to the need for a comprehensive regional airport system plan.

More importantly, the rapid rate of urban development within the Region may, in the absence of a long-range airport system plan, preempt not only the remaining good sites for the location of new airports that may be required to serve the growing air transportation needs of the

Map 3

HISTORIC URBAN GROWTH IN THE REGION: 1850-1970



Urban development within the Region occurred in a fairly regular pattern until about 1950, forming concentric rings of relatively high-density urban development contiguous to, and outward from, the existing urban areas and long-established mass transit, utility, and community facility systems. Soon after World War II, however, the character of urban growth in the Region began to change to a much more diffused pattern of development, with relatively low densities and high proliferation of clusters of noncontiguous development. Between 1963 and 1970, this sprawl pattern of development continued, with an additional 57 square miles of land within the Region being converted from rural to urban use. The continuation of this sprawl pattern of land use development threatens further destruction of prime agricultural lands and of the underlying and sustaining natural resource base.

Source: SEWRPC.

Region, but also land required for the expansion of existing airports. Although only 397 square miles, or about 15 percent of the total area of the Region, had been committed to urban use by 1970, land is presently being converted from rural to urban use at the rate of approximately eight square miles per year. Failure to protect open land required for new airport development or for the expansion of existing airports will not only lead to unnecessary expenditures of public funds for land acquisition and clearance, but may cause great disruption to future urban development. Moreover, failure to preserve land required for expansion of existing facilities may lead to the premature obsolescence of these facilities and greatly increased public expenditures for the development of replacement facilities.

It should also be noted that changes in urban development may actually make it desirable in some instances to abandon certain existing airport facilities and convert their sites to other urban uses. Any decision to abandon a major public airport facility, however, should be made only within the context of an overall regional airport system plan which not only establishes the soundness and desirability of the abandonment and recommends sound reuses for the abandoned site, but which also provides for the proper location of necessary replacement facilities and the preservation of land for such replacement facilities. A particularly pressing development decision which will significantly affect both land use and airport facility development within the Region must be made in the near future. This decision concerns the ultimate use of the abandoned Richard I. Bong Air Force Base in western Kenosha and southern Racine Counties. Various proposals have been advanced by interested individuals in northeastern Illinois and southeastern Wisconsin concerning the use of this abandoned Air Force Base for both airport and nonairport purposes.

A sound decision concerning the future use of this abandoned Air Force Base as an airport facility, with its attendant major impacts on land use and surface transportation facility development within the Region, can properly be made only within the context of a carefully prepared comprehensive regional airport system plan, which not only identifies the long-range airport capacity deficiencies within the Region but also relates any proposals for relief to a total system of airport facilities and to areawide land use and surface transportation system development.

Full coordination of airport development with land use development extends beyond the need to preserve land for the required airport facilities to the need to avoid incompatible, and to promote compatible, land use arrangements in the vicinity of airports. The fact that airport facilities enhance and attract certain kinds of commercial, industrial, and recreational development but depreciate other kinds of urban development, particularly residential, has already been noted in Chapter I of the Prospectus. If future land use development is to be adjusted to necessary airport facility development, and future conflicts between airports and adjacent land uses avoided, full coordination between airport and land use development must be provided through a comprehensive airport system development plan. Such coordination should seek to minimize the nuisance effects of airport facilities on their surroundings, minimize the restrictions placed on airport operations by their surroundings, and capitalize on the potential impact of airport facilities on land development. Such coordination must include not only provisions for sound airport zoning in order to provide the necessary clear zones and flight paths and thereby provide for the safe operation of aircraft, but also the promotion of a more efficient land use pattern through the location of compatible commercial, industrial, and recreational land uses in the proximity of airports; the protection of residential areas from the noise, air and ground traffic, and air pollution generated by aircraft and airports; the efficient provision of essential utility services to airports; and the coordination of airport development with natural resource conservation needs.

<u>Coordination of Airport Facility and Surface Transportation Facility Development</u>

The rapid population growth and urbanization taking place in southeastern Wisconsin is being accompanied by rapid increases in surface travel demand and by major shifts in the geographic pattern and intensity of this demand. In response to these changes in surface travel demand, a long-range highway and transit system plan has been prepared for the Southeastern Wisconsin Region. Pursuant to this plan, an entirely new surface transportation system is being developed within the Region, a system which is safer and vastly more efficient than that existing prior to development of the comprehensive land use-transportation plan. The new system is changing accessibility patterns and travel habits and will greatly influence the pattern of urban land use development within the Region. A pressing need exists, therefore, to more fully coordinate airport system development with surface transportation system development in order to attain a more efficient interchange between air and surface transportation modes within the Region, and to achieve the greatest possible effectiveness in both the airport and highway transportation systems. All forms of transportation are interrelated. Air transportation, however, is particularly intermodal by nature in that almost all person-trips, as well as almost all cargo movements, involve dual air-surface movements. Surface transportation is thus an inseparable part of air travel, and the efficient movement of persons and goods between surface points of final origin and destination and airports is essential to the attainment of good air transportation services within the Region.

<u>Rapid Growth and Change In Air Traffic Demand</u>

Urbanization within the Southeastern Wisconsin Region is being accompanied by rapid growth and change in air traffic demand. As shown in Table 2, the number of aircraft pilots within the Region, as measured by Airman Certificates issued to residents of the seven-county Region, has increased from 3,481 in 1966 to 4,393 in 1972, a 26 percent increase in seven years. Table 2 also shows that, of the 4,393 licensed pilots in the Region in 1972, 25 percent, or 1,110, hold student certificates; 47 per-

Table 2

AIRMAN CERTIFICATES ISSUED TO RESIDENTS OF THE REGION: 1966 and 1972

Type of Certificate	1966 Number	1966 Percent of Total	1972 Number	1972 Percent of Total	Percent Increase 1966 to 1972
Student Certificate	967	28	1,110	25	15
Private License	1,676	48	2,066	47	23
Commercial License	757	22	1,111	25	48
Air Transport Rating . . .	81	2	106	3	31
Total	3,481	100	4,393	100	26

Source: Federal Aviation Administration and Wisconsin Department of Transportation.

cent, or 2,066, hold private licenses; 25 percent, or 1,111, hold commercial licenses; and the remaining 3 percent, or 106, hold air transport ratings. These regional percentages compare to 27, 41, 27, and 5 percent, respectively, for the nation as a whole. In addition, 40 percent, or 4,393, of the total 11,056 licensed pilots in the State of Wisconsin live within the Region. Forecast increases in per capita income and in available leisure time make it reasonable to expect an accelerated increase in individuals desiring Airman Certificates for recreational purposes. Continued increase in persons desiring such certificates for business reasons may also be expected, due to the increasing importance which competitive industries serving national markets place on rapid transportation for sales and executive positions, as well as for certain highly skilled trade personnel engaged in maintenance and service functions.

As shown in Figure 2 and Table 3, registered aircraft based in the Region have increased from a total of 620 in 1959 to 984 in 1970, a 59 percent increase in 12 years. This compares to a 72 percent increase within Wisconsin and a 103 percent increase nationally over the same period. Total aircraft operations measured in aircraft arrivals and departures within the Region are estimated to have increased from an annual total of 155,773 to 370,035 over the same 12-year period, a 138 percent increase. This compares to a 216 percent increase within the state and a 105 percent increase nationally over the same period. Scheduled commercial airline flights measured in terms of aircraft departures increased from 31,639 in 1959 to 36,908 in 1970, an increase of only 17 percent over the 12-year period, as shown in Table 3. This relatively small increase in commercial flights was offset, however, by the introduction of larger aircraft, so that originating air carrier passengers at General Mitchell Field increased from 316,770 to 714,530 over this same period, a 126 percent increase, with originating passengers per aircraft departure increasing from 10.0 in 1959 to 19.4 in 1970. This compares to a 142 percent increase statewide and a 179 percent increase nationally in originating air carrier passengers, and an increase in originating passengers per aircraft departure from 7.2 to 17.1 in Wisconsin and 15.7 to 29.3 nationally. Air mail originated over this 12-year period increased from 828 to 4,230 tons, a 411 percent increase, while air cargo originated increased from 3,763 to 19,435 tons, a 416 percent increase. This compares to state increases of 380 and 433 percent, respectively, and national increases of 374 percent and 276 percent, respectively, over the 12-year period.

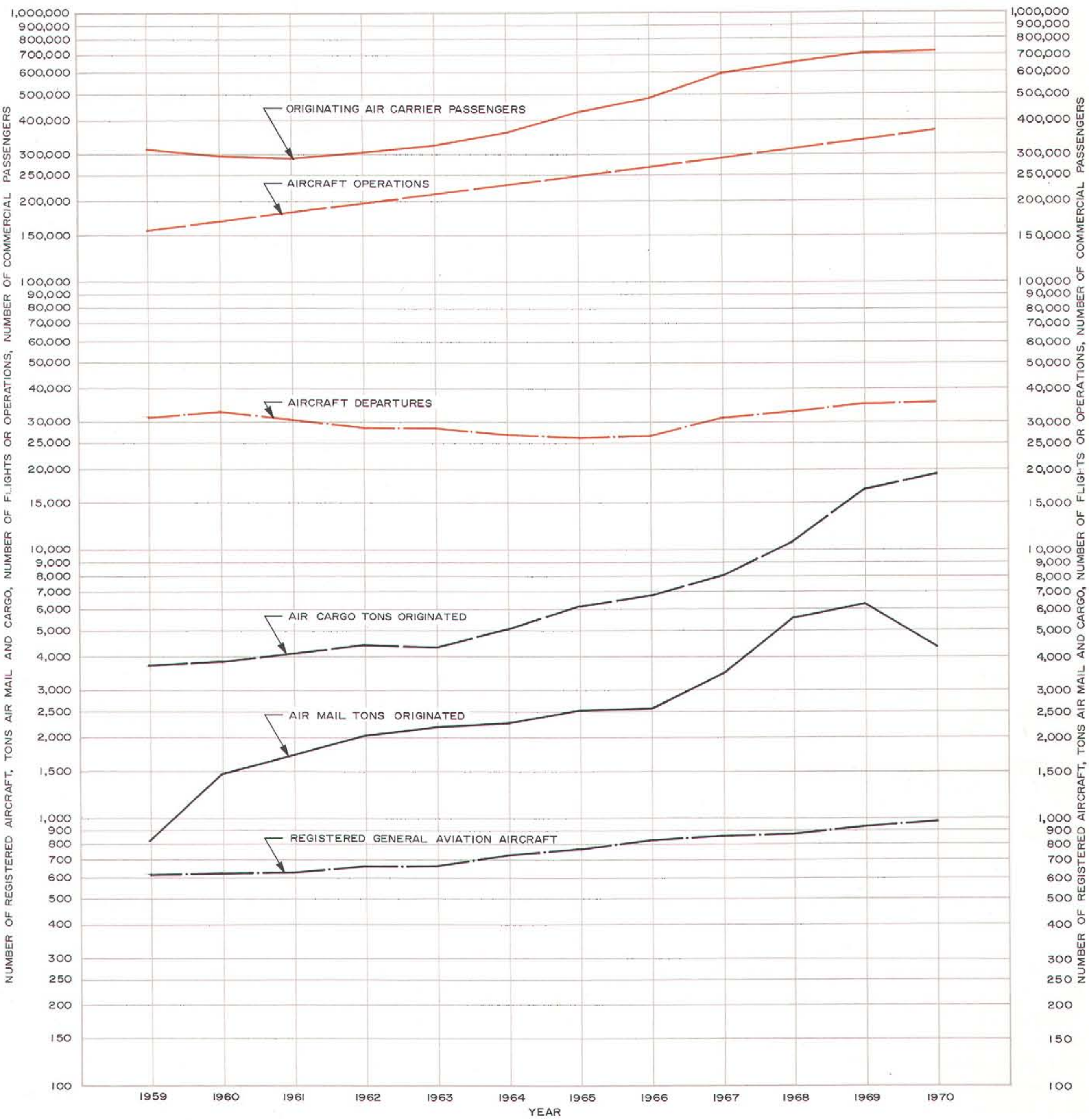
The 59 percent increase in registered aircraft, 138 percent increase in aircraft operations, 126 percent increase in commercial airline passenger originations, 411 percent increase in air mail, and 416 percent increase in air cargo from 1959 to 1970 contrast to an estimated 14 percent increase in population (1,540,314 to 1,756,100 residents), and 25 percent increase in employment (591,651 to 741,600 jobs) within the Region during this same period. National, state, and regional forecasts indicate that the rapid increase in the demand for air transportation experienced within the Region over the last 12 years can be expected to continue in the near future.

Efficient use of the available airspace and airport capacity within the Region in the face of this growing demand for air transportation requires the preparation of a long-range regional airport system plan and, based upon that plan, a program for the staged improvement of airport facilities. Failure to prepare and implement the required regional airport plan will inevitably lead to air traffic congestion and serious safety hazards. Because new airport facilities may take at least five years of lead time to plan, design, and construct, and new airports at least 10 years, the need to plan now for the expected rapid growth in air traffic demand is critical.

It should be noted that failure to prepare and implement the required regional airport system plan may also restrict the continued economic growth and development of the seven-county Region. The importance of good transportation to economic development is well recognized. Transportation costs contribute directly to the cost of producing goods and services in any given area and, therefore, have an important effect on the ability of

Figure 2

AIRCRAFT REGISTRATION AND AIR TRAFFIC GROWTH IN THE REGION: 1959-1970



Source: *U. S. Department of Transportation, Federal Aviation Administration; Civil Aeronautics Board; and Wisconsin Department of Transportation.*

Table 3

AIR TRAFFIC GROWTH INDICATORS FOR THE REGION, WISCONSIN, AND THE UNITED STATES: 1959 and 1970

Air Traffic Growth Indicator	Region			Wisconsin			United States		
	1959	1970	Percent Change	1959	1970	Percent Change	1959	1970	Percent Change
Registered General Aviation Aircraft	620	984	58.7	1,708	2,945	72.4	68,727	139,765[a]	103.4
Aircraft Operations[b].	155,773	370,035	137.6	279,069	881,707	216.0	26,905,856	55,280,498	105.3
Total Certificated Air Carrier Departures[c].	31,639	36,908	16.7	76,007	77,800	2.4	3,420,682	5,101,462	49.1
Originating Air Carrier Passengers— Domestic Operations	316,770	714,530	125.6	550,902	1,334,196	142.2	53,544,000	149,592,000	179.4
Passengers Per Departure	10.0	19.4	94.0	7.2	17.1	125.0	15.7	29.3	86.6
Air Mail Tons Originated	828	4,230	410.9	1,244.1	5,978	380.5	165,000	782,000	374.0
Air Cargo Tons Originated	3,763	19,435	416.5	4,773.0	25,460	433.4	512,000	1,925,000	276.0

[a] *Unofficial figure reported in "Airport Services Management Magazine," June 1972.*

[b] *Aircraft operations include those operations at airports with FAA operated control towers. In 1959 there was one control tower in the Region and two in the state; in 1970 there were two control towers in the Region and seven in the state.*

[c] *Departures in this category do not include third level carriers.*

Source: U. S. Department of Transportation, Federal Aviation Administration; Civil Aeronautics Board; Wisconsin Department of Transportation, Division of Aeronautics; Madison and Milwaukee airport managers; and North Central Airlines.

a geographic area to compete with other areas in attracting economic enterprises. In addition to contributing to the economic viability of all economic enterprises—manufacturing, wholesale trade, and retail trade—in the area served, airport facilities comprise important centers of economic activity per se, providing employment for airport operating staffs, personnel of service businesses directly supported by the airport, and personnel of airport users. As air transportation grows in importance nationally, carrying an increasing share of total person and goods movements, business and industries considering regional locations for new enterprises and for expansion of established enterprises may be expected to place increasing importance upon the availability of good air transportation, both general-aviation and air-carrier. Consequently, private associations concerned with the economic development of an area, such as the Milwaukee Metropolitan Association of Commerce, and public agencies concerned with economic development, such as local industrial development corporations, have traditionally stressed the importance of good air transportation, and have supported measures to improve such transportation.

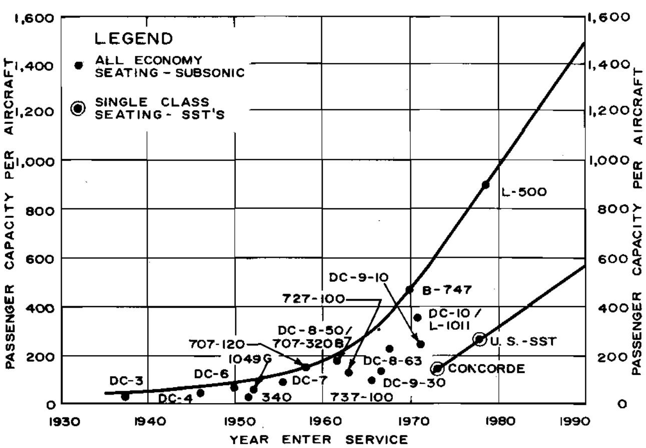
Rapid Change in the Character of Aircraft

Another factor contributing to the need for a regional airport planning program in southeastern Wisconsin is the rapid change occurring in the character of the aircraft fleet. A new generation of commercial aircraft is introduced approximately every 10 years, so that the present generation of air transport craft, introduced in the late 1950s, may be expected to be replaced in the near future. Most of the new generation of air transport craft will be significantly different than the present generation. For example, the Boeing 747 introduced in 1970 has a passenger capacity ranging from approximately 360 to 450 passengers and a cargo load capacity of 100 tons. This contrasts to the Boeing 707 introduced in late 1958, which has a passenger capacity ranging from approximately 110 to 180 passengers and a cargo load capacity of 47 tons. Forecasts indicate that, if present trends in aircraft design continue, an airplane having a passenger capacity of approximately 900 passengers and a cargo load capacity of 150 tons, such as the Lockheed 500, may be expected to become operable in the late 1970s (see Figure 3 and 4). Accompanying major changes in factors affecting airport facilities such as gross weight; aircraft ground handling, including runway lengths and dynamic loadings; body length; wingspan; tail height; and deck height may be expected.

The introduction of larger commercial aircraft in the form of both mixed cargo-passenger configurations, such as the Boeing 747 with a cargo capacity of 100 tons, and in all cargo configurations, such as the Lockheed C-5A with a cargo capacity of 150 tons, may also be expected to result in significant changes in freight cargo handling, with attendant impacts upon airport facilities. Some forecasts indicate that cargo revenues should exceed passenger revenues sometime between 1975 and 1980. The mixed aircraft configurations will provide a greater cargo capacity than today's passenger aircraft, which

Figure 3

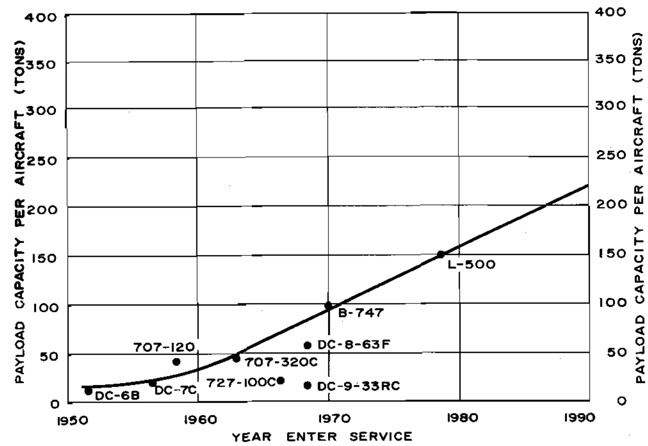
AIRCRAFT PASSENGER CAPACITY GROWTH TRENDS AND FORECASTS: 1930-1990



Source: Transport Aircraft Council; Aerospace Industries Association of America, Inc.; and SEWRPC.

Figure 4

AIRCRAFT CARGO CAPACITY GROWTH TRENDS AND FORECASTS: 1950-1990



Source: Transport Aircraft Council; Aerospace Industries Association of America, Inc; and SEWRPC.

cargo capacity must be filled at passenger terminals. Single-purpose, all-cargo airports may be required for the all-cargo craft but may be limited to loading and processing of air cargo consigned to the air freighters or, in some cases, quick-change aircraft configured for all freight operations. These changes in aircraft configurations will require some difficult decisions, such as whether separate, all-cargo airports should be developed or whether alternative ways to handle the increased cargo traffic at passenger terminals can be developed. If all-cargo airports are to be developed, a decision must be made as to whether to develop new airports to fulfill this function or to convert existing airports from passenger service to freight service, replacing the passenger service function at a new location. The anticipated increases in aircraft size and cargo loadings will have major impacts not only upon the airport facilities themselves but also upon the ground transportation facilities serving these airports.

Other important changes in aircraft type and design affecting the air-carrier airports will be the introduction of larger and more efficient vertical-takeoff-and-landing (VTOL) craft and short-takeoff-and-landing (STOL) craft. These kinds of aircraft may find use in short-range urban and interurban service. Their introduction would have a far-reaching effect on airport facility planning, requiring changes not only in major airport buildings, revision of terminal area and terminal space use, and changes in the structural as well as geometric design of runways, taxiways, and aprons, but also in the overall configuration of the total regional airport system. Indeed, when the aircraft now under development go into service, many existing facilities from air terminal buildings to air navigation aids may become obsolete. The possible introduction of the supersonic air transport (SST) into international commercial service could also have a significant impact on the airport needs of the Region. The Region's unique geographic location at the southerly end of a potential SST approach corridor over Lake Michigan and Superior and sparsely populated portions of Upper Michigan and Ontario serves to make the Region a prospective location for an SST terminal.

Changes in the character of the general-aviation fleet may be expected to have an even greater impact upon airport facility planning than changes in the commercial fleet. General-aviation aircraft outnumber airliners in the total national air fleet (1970) by a ratio of approximately 55 to 1, and as a fleet they fly four times as many hours and use 15 times as many airports as the commercial aircraft. Not only is the size of the general-aviation fleet expected to increase rapidly in the next 10 years, but the composition of this fleet is also expected to change, with higher proportions of multi-engine and turbine engine aircraft in the fleet. A sharp increase is expected in the number of turbine powered, fixed-wing aircraft, from 1,280 such craft in the general-aviation fleet in 1968 to 7,800 in 1980. These changes in the general-aviation fleet will result not only in the introduction of larger, higher capacity, and faster aircraft, but also in the increased use of avionics equipment, permitting operation under instrument flight rules (IFR). The number of general-aviation flights operating under IFR is accordingly expected to increase from 2.8 million logged in 1968 to 17.4 million in 1980, while total flights operating under IFR are expected to increase from 18.1 million in 1968 to 45.3 million in 1980. The combined effect may be expected to tax existing airway and airport capacity, and it will be essential that additional capacity be provided in the most efficient and effective way possible.

The rapid changes occurring in the type and character of both commercial and general-aviation aircraft will require an important decision to be made within the Region concerning alternative regional airport systems. These alternative systems may involve the designation of single-purpose airports limited to one type of function such as cargo, general-aviation, or long-haul passenger or short-haul passenger, or the use of satellite collection concepts which could be used to disperse certain functions traditionally located at airports, such as passenger and baggage processing and perhaps cargo processing. Rapid changes in the character of aircraft may be expected to require major changes in airport equipment and fixtures for fuel handling and storage, ground handling of aircraft, ground servicing of aircraft, fire protection, runway and taxiway pavement strengths and widths, and traffic control. The changes required may be relatively more drastic at the general-aviation than at the commercial air-carrier airports. The economical provision of efficient airport facilities in the face of the rapidly changing character of both commercial and general-aviation aircraft will require the preparation of a comprehensive regional airport system plan.

Federal Grant Eligibility and Review

The federal government is increasingly requiring the preparation of areawide facility plans as a prerequisite to the approval of federal grants in partial support of all types of public facility and utility construction. The FAA (in a letter dated April 25, 1968, to Mr. F. E. Wolf, Administrator of the Wisconsin Division of Aeronautics), advised Milwaukee County that future federal grants in partial support of the development of airport facilities will require, as a prerequisite, the initiation of a comprehensive, areawide airport system planning program within the Southeastern Wisconsin Region. This planning requirement extends to all of the counties within the Region. The Commission, therefore, would be remiss in its responsibilities to the state and to the constituent local units of government if it failed to undertake the preparation of the necessary regional airport planning program.

The federal government in this respect apparently envisions a systematic procedure for planning regional airport systems and integrating these systems into comprehensive, areawide development plans. This procedure as applied to southeastern Wisconsin envisions, first, the preparation of a long-range, comprehensive regional or metropolitan development plan, including recommendations for land use and surface transportation system development; second, the preparation of a long-range areawide airport system plan identifying the need for new or expanded airport facilities and the general location of the new or expanded facilities; third, the preparation of a short-range regional or metropolitan development program indicating five-year development priorities for such functional elements of the comprehensive plan as highways, transit, open space, public utilities, land use, and flood control and drainage; and fourth, the preparation of a short-range airport development program indicating the five-year development plan for airport facilities based upon inputs from the long-range, comprehensive areawide development plan, the long-range airport system plan, and the short-range comprehensive development program. Southeastern Wisconsin presently lacks the long-range airport system plan envisioned by the foregoing procedure.

In this connection, it is also important to note that Section 204 of the Demonstration Cities and Metropolitan Development Act of 1966 (Public Law 89-754) and Circular A-95 of the U. S. Office of Management and Budget require regional or metropolitan planning agency review of all applications for federal grants in partial support of the acquisition of land for, and the construction of, most major public facilities and utilities, including airport facilities. The Regional Planning Commission has been designated as the official areawide review agency under this Act by the U. S. Secretary of Housing and Urban Development, the U. S. Office of Management and Budget, and the Governor of the State of Wisconsin. Intelligent review by the Commission of applications for airport facility improvement programs requires the preparation of an areawide airport system plan, for only within the context of such a plan can the areawide desirability of individual airport facility improvements be properly determined and grant applications intelligently commented upon.

It should be noted that the foregoing five factors contributing to the need for a regional airport plan apply specifically to the Southeastern Wisconsin Region and are in addition to, and support the general need for, an airport system plan in any urbanizing region, which general need derives from sound planning and engineering practice. Such practice dictates that individual airport facilities should not be planned and designed in isolation but as an integral part of the total areawide system, so that their interactions are not detrimental to their capacities and so that their functions are complementary. The major airport facilities, studied as a whole, must be carefully fitted to projected traffic loadings derived from adopted areawide land use plans in order to obtain the most efficient traffic flow and most effective utilization of facilities, and in order to meet regional as well as federal, state, and local development objectives and standards. Only within the context of such an areawide system plan can the day-to-day decisions relating to individual airport facility development be properly made, federal, state, and local government objectives be properly integrated into these decisions, and jurisdictional responsibilities soundly assigned on the basis of overall needs.

PROGRAM OBJECTIVES

The primary objective of the regional airport system planning program is the development of a sound and workable plan to guide the staged improvement of public airport facilities to serve the developing Region, providing not only for the full coordination of airport facility development within the Region but also for the coordination of airport development with areawide land use, surface transportation facility, and community facility development.

Attention has been given to airspace utilization and to general-aviation and commercial air service requirements. Particular attention has been given to the problem of relating airport development to land use development to abate the undesirable effects of noise, air pollution, and safety hazards attendant to aircraft operations of existing and proposed airport facilities upon proximate land uses.

The airport facility plans produced by the planning program are in sufficient depth and detail to provide a sound basis for Commission review of federal grant applications for airport facility improvements, as well as a basis for the preparation of airport master plans and the design and construction of airport improvements. The plan not only considers and recommends the number, type, size, and location of airports needed to serve the Region to the plan design year of 1990, but also considers and recommends runway orientation and length for each existing and proposed public airport within the Region; specifies navigational aid and site requirements in sufficient detail to permit the advance reservation of land for needed facilities or facility expansion; recommends appropriate land use regulations in the vicinity of all public airport facilities; and recommends the organizational, fiscal, legislative, and regulatory measures necessary for implementation of all public airport facilities. The plan does not, however, include any detailed engineering design of specific airport facilities. The planning program recognizes the interrelationships existing between land use and surface transportation facility development and airport facility development; relates each individual airport to all other airports in the total system; utilizes the latest planning and engineering techniques; and makes full use of all existing and available surveys, studies, reports, and other data influencing or affecting the program. Additional data were collected only as necessary to develop original data essential to preparation of the workable airport development plan.

Additional objectives of the planning program include establishment of a continuing comprehensive areawide airport system planning program; the collection, analysis, and monitoring of data under such a program; and the formulation of plan implementation devices, all requiring close and continuing cooperation among the various levels, agencies, and units of government and private agencies concerned with, and involved in, air transportation within the Region.

STAFF, CONSULTANT, AND COMMITTEE STRUCTURE

The basic organizational structure for the study as outlined in Figure 5 consisted of consultant and Commission staffs reporting to the Commission Executive Director as project sponsor. The Executive Director in turn reports to the Southeastern Wisconsin Regional Planning Commission, which has ultimate legal authority and responsibility for the entire planning program. The responsibilities of the consultant and Commission staffs for various work elements in the program are also indicated in Figure 5.

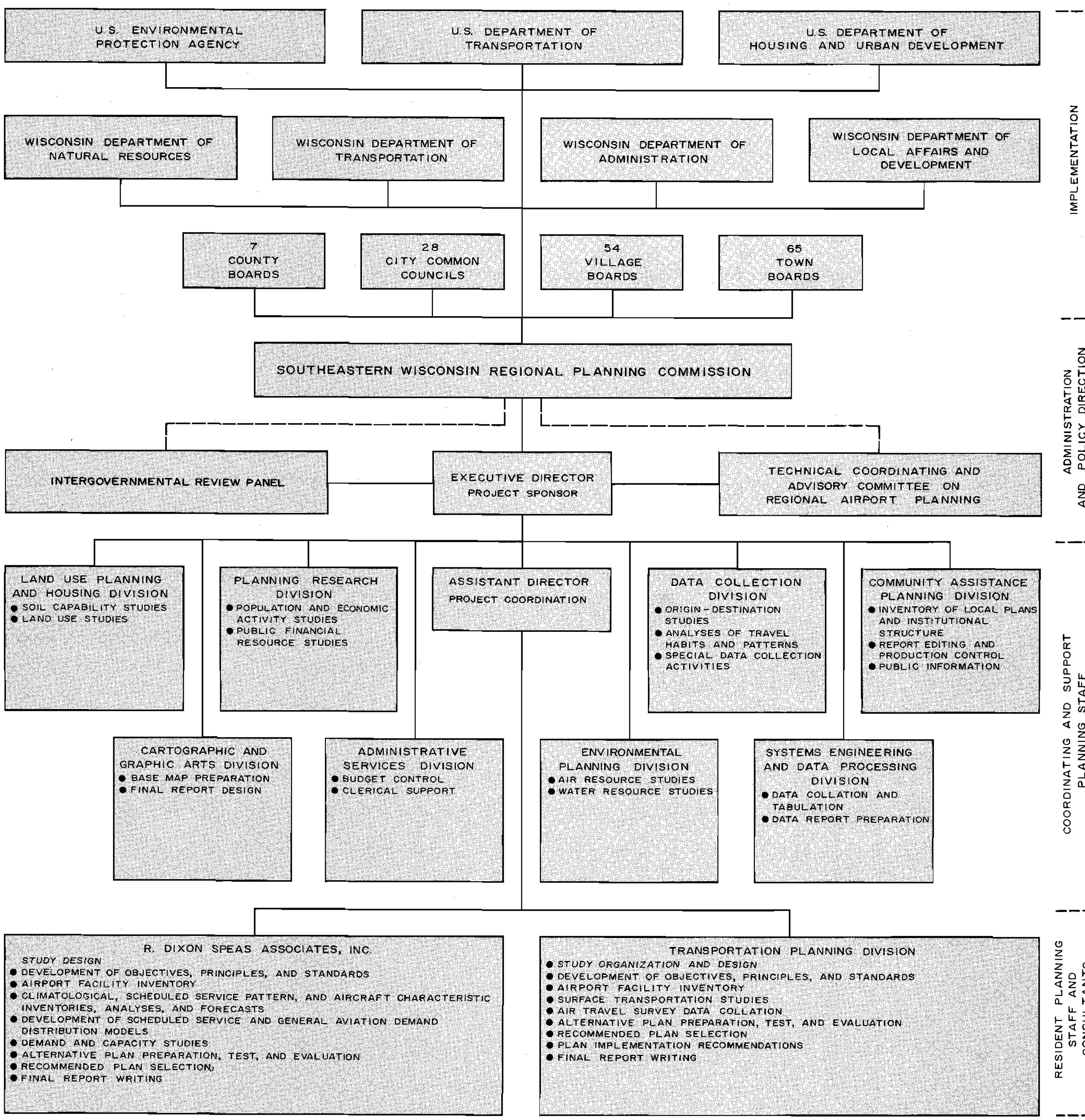
Through the establishment of advisory committees, pursuant to Section 66.945(7) of the Wisconsin Statutes, the Commission seeks to obtain the active participation of concerned governmental agencies and citizen leaders in the regional planning program. To provide for this active participation and for the necessary technical and policy guidance in the conduct of the regional airport system planning program, the Commission in June 1968 created the Technical Coordinating and Advisory Committee on Regional Airport Planning. This Committee consists of officials from both private and governmental agencies particularly knowledgeable about airport system development and related aviation problems within the Region. In light of the Commission's advisory role in shaping regional development, involvement by local public officials in the planning program through this Committee is particularly important to implementation of the recommended airport system plan. An important function of the Committee members is to familiarize local elected officials with the study and its findings and recommendations, and to generate understanding of study objectives, plan recommendations, and plan implementation procedures among such officials. The Committee has a particularly important role in selecting the final plan and assuring its financial and administrative feasibility. The full membership of this Committee is set forth in Appendix A.

Under guidance of the Technical Coordinating and Advisory Committee, the regional airport system planning program has been conducted by the Commission staff, supplemented by the contractual services of R. Dixon Speas Associates, Inc., Aviation Consultants, Manhasset, New York. The Commission staff assumed responsibility for those work elements of a general regional planning nature, as well as for certain work elements of a functional planning nature. These elements include the land use, surface transportation, population, economic, utilities, community plans, legal, and public financial resource inventories, analyses, and forecasts; the map inventory; the air travel survey data collation and summaries; and preparation of plan implementation recommendations. R. Dixon Speas Associates, Inc., was responsible for all other functional planning elements such as the climatological, scheduled service pattern, and aircraft characteristic inventories, analyses, and forecasts; the development of the scheduled service and general aviation demand distribution models; and the demand and capacity studies for the existing and forecast regional airport system. Work elements shared by the Commission staff and consultant included study design; formulation of regional airport system development objectives, principles, and standards; airport facility inventory; alternative plan preparation, test, and evaluation; and recommended plan selection and final report writing.

In addition to the Technical Coordinating and Advisory Committee formed to provide basic technical guidance in the conduct of the regional airport system planning program, the Commission established an ad hoc intergovernmental review panel to review the regional airport system plan recommendations prior to their presentation at public informational hearings. The purpose of this review panel was to facilitate the more active involvement of elected local governmental officials, key state agency personnel, and private airport owners and operators in evaluating the alternative regional airport system plans considered, in selecting a recommended regional airport system plan for presentation at public informational hearings, and in formulating plan implementation recom-

Figure 5

ORGANIZATIONAL STRUCTURE FOR THE REGIONAL AIRPORT SYSTEM PLANNING PROGRAM



Source: SEWRPC.

mendations. The panel was assembled by calling a special intergovernmental meeting on August 5, 1975, at which those in attendance were given a briefing on the preliminary findings of the program and an opportunity to question and comment on the preliminary plan recommendations as advanced by the Technical Coordinating and Advisory Committee. Minutes of this meeting of the ad hoc panel were published by the Commission together with the minutes of a series of public informational meetings and a formal public hearing.

STUDY FINANCING

On December 3, 1970, a cooperative agreement was entered into between the Wisconsin Department of Transportation and the Southeastern Wisconsin Regional Planning Commission wherein the Commission agreed to carry out a regional airport planning program as outlined in the Comprehensive Regional Airport Planning Program prospectus dated December 1969. The total cost of the project, estimated to be $384,000, is financed in part by a grant of $197,492 from the Federal Aviation Administration dated June 29, 1971 under the federal Airport and Airway Development Act of 1970, and a grant of $31,496 from the U. S. Department of Housing and Urban Development under Section 701 of the Federal Housing Act of 1954 as amended. The seven counties' share totals $39,600, with the remaining $115,412 provided by the Wisconsin Department of Transportation, Division of Aeronautics. Also on December 3, 1970, the Commission entered into an agreement with R. Dixon Speas Associates, Inc., describing consultant services to be performed under the regional airport system planning program.

SCHEME OF PRESENTATION

The major findings and recommendations of the regional airport system planning program are documented and presented in this report, which also sets forth the basic concepts underlying the program. By using estimates of future socioeconomic activity and population growth, air transportation demand forecasts and distribution have been developed. The concomitant future land use demands as necessary for areawide airport system planning are also identified and documented herein. Thus, the report identifies and, to the extent possible, quantifies the developmental and environmental problems associated with airport system development.

The report describes and evaluates alternative plans relating to land use and airport system development, and recommends a plan for developing a regional airport system based on regional development objectives adopted by the Technical Coordinating and Advisory Committee and the Commission. In addition, it contains a financial analysis and specific implementation recommendations.

The final report is intended to allow careful, critical review of the alternative plan elements by public officials, agency staff personnel, and citizen leaders within the Region and to provide the basis for plan adoption and implementation by the federal, state, and local agencies of government concerned. The report can only summarize in brief fashion the information assembled in the extensive data collection, analysis, and forecasting phases of the regional airport system planning program. Although the reproduction of all of this information in report form is impractical due to its magnitude and complexity, all of the basic data are on file in the Commission offices and are available to member units and agencies of government and to the public in general upon specific request. This report, therefore, serves the additional purpose of indicating the type of data available from the Commission which may be of value in assisting federal, state, and local units of government and private investors in making better decisions about airport system and related land use development in the Region.

Chapter II

BASIC PRINCIPLES AND CONCEPTS

INTRODUCTION

Airport facilities are among the most important public works having a major influence on the development of an urbanizing Region. If not properly conceived and executed, airport system development will inevitably emerge as a major obstacle to the sound growth and development of a metropolitan area and, therefore, become a major policy issue for public officials, citizen leaders, and technicians. The basic function of the Regional Planning Commission is to assist the local, state, and federal units and agencies of government and the private interests concerned in resolving areawide developmental and environmental problems. The provision of adequate airport facilities is one such areawide problem. The State Legislature recognized this fact when in Section 66.945 of the Wisconsin Statutes, it charged Regional Planning Commissions with the responsibility for preparing comprehensive plans for the development of multicounty regions and specifically included airports within the scope of such plans.

AIRPORT PLANNING—A REGIONAL PROBLEM

The following five factors combine to make it necessary to approach airport planning on a coordinated areawide basis in southeastern Wisconsin:

1. Areawide Nature of Airport Service Areas

   The first and perhaps the most basic factor which compels a regional approach to airport planning is the areawide nature of airport service areas. The origin-destination studies of the Commission clearly indicate the areawide nature of surface travel patterns centered on the major airports of the Region. For example, General Mitchell Field presently generates a total of about 15,000 surface person trips on an average weekday, of which approximately 4,300, or about 30 percent, are airline passengers. The ground-linked origins and destinations of these trips are widely dispersed throughout the Region, with all seven counties contributing to the traffic. Trip lengths average 12 miles but range up to 59 miles. The pattern is clearly related to urban development, with the most heavily urbanized areas of the Region contributing the highest proportion of the total traffic. A similar pattern exists with respect to the approximately 700 truck trips generated by General Mitchell Field on an average weekday. These truck trips average nine miles but range up to 48 miles in length, with all seven counties contributing to the traffic. The importance of General Mitchell Field to the economic development of the entire Region is clearly apparent from the areawide nature of the travel patterns centered on this major airport facility. As an important interregional transportation terminal, Mitchell Field greatly enhances the economic development potential of the Region and of each of its constituent counties and communities. The proper development of the Field should, therefore, be of concern to all counties and communities comprising the Region.

   Although the areawide nature of the service area and attendant economic importance are greatest for a large airport serving both commercial air-carrier and general-aviation traffic, such as General Mitchell Field, similar but smaller service areas, generally transcending municipal and county boundary lines, exist for many of the 25 public-use general-aviation airports and the one public-use seaplane base within the Region. The increasing importance of these general aviation airports to industrial development is indicated by the fact that some of these airports within the Region, such as the Racine Commercial Airport, serve an air travel demand which is almost entirely industrial in origin.

   The location of airport facilities thus becomes, in part, a regional problem of properly relating the service areas of each individual airport to all other airports within the Region and, in turn, to the regional land use pattern and supporting surface transportation system so as to provide the highest level of air transportation service practicable to the Region at the lowest cost.

2. Integration of Airport Development with Surface Transportation System Development

   A second factor which compels a regional approach to airport facility planning is the need to properly integrate airport development with surface transportation system development. The ability of an airport to efficiently perform its primary function as a transportation terminal is determined to a considerable extent by the quality of the surface transportation facilities linking the airport to its service area. Not only do surface transportation facilities directly influence the extent and location of the airport service area, but they may actually be the limiting factor determining the capacity of a given airport facility, particularly a large facility serving commercial air carriers. Moreover, since airports are major surface traffic generators, they must be considered in the planning and development of the surface transportation system. That such surface transportation system planning and development is a regional problem has already been clearly demonstrated and documented by the Regional Planning Commission in its initial and continuing regional transportation studies.

3. Coordination of Airport Development with Areawide Urban Land Use Development

A third factor which compels a regional approach to airport facility planning and development is the need to coordinate airport development with areawide urban land use development. Urban land use development and airport facility development interact in several important ways. First, the urban land use pattern is a major influence on the extent, location, and character of the service area of an airport and on the specific need for air transportation service. Second, airport location and development are important determinants of urban land use development, enhancing and attracting certain kinds of commercial, industrial, and recreational development while depreciating and discouraging other kinds of urban land use development. Airports are incompatible with good residential development and constitute an inherent nuisance when placed in proximity to such development. The noise levels associated with air traffic movements, the air pollution generated by such movements and attendant surface transportation movements, and the safety hazards attendant thereto extend the adverse effect of airports on surrounding residential land use development for considerable distances, often transcending municipal and county boundary lines. Third, airport and land use development must be carefully coordinated in order to achieve a proper relationship between the airport and basically compatible land uses. Although an airport is an extensive land use, it generates intensive land uses around it. Airport operations demand that certain restrictions be placed on the kinds of land uses and on the height of structures in immediately adjacent areas in order to achieve the necessary clear zones and flight paths required for safe aircraft operations. These restrictions may, in some cases, require cooperative intergovernmental action on an areawide basis. It is important to note that both the positive and negative effects of major airport facilities on land use are areawide, usually extending well beyond the boundaries of a single municipality.

4. Siting and Spacing of Airports

A fourth factor which compels a regional approach to airport facility planning and development is the level of detail required to make the planning operation meaningful. If the airport planning effort is to effect significant economies in airport development, the effort must be carried to sufficient depth and detail to permit the determination of land requirements. This necessitates the delineation of specific areas required for the expansion of existing airports and for the siting of any new airports required to serve the existing and probable future air transportation needs of the Region. Site selection and delineation are heavily influenced by airway and air traffic patterns and by runway orientation, as well as by instrument approach procedures, airport service areas, land use compatibility, and surface transportation facilities and, therefore, require a cooperative approach by the federal, state, and local units of government concerned, an approach that can only be achieved at the regional level.

5. Airway System Requirements

The fifth factor which compels a regional approach to airport facility planning is the need to coordinate individual airport development and to properly relate such development to the national airspace system within the Region in order to achieve a single integrated airport system. The amount and character of the air traffic utilizing any given airport facility are influenced by the location and capacity of adjacent airport facilities. This means that development decisions relating to any single airport can be properly made only within the context of an areawide system plan. This is true not only because of the need to relate airport facilities to the attendant airways which form a regional pattern in order to achieve maximum capacity and maximum safety, but also because economy may dictate the development of alternative airport capacity in adjacent locations rather than the expansion of any one particular airport under consideration. For example, the decision of whether to add runway capacity at a given airport cannot properly be made without knowing whether the necessary capacity should be provided at an adjacent airport and the excess load requiring the added capacity shifted to that airport.

Airport facilities for public use within the Region are owned and developed by either local units of government or private investors. Thus, the one commercial air-carrier and 25 public-use, general-aviation airports and one public-use seaplane base within the Region are designed, constructed, operated, and maintained by seven units of government—two counties, four cities, and one village—and by 19 private individuals or corporations. Yet, these airports must form a single integrated system able to effectively serve the growing air transportation needs of the Region. Even though the service areas of the airport facilities may be areawide in extent; the development and operation of the individual facilities may be closely interrelated; and proper development of the facilities may affect the physical, social, and economic development of many local communities, the localized nature of airport ownership and development makes it difficult for any higher level of government to impose the decisions required to provide an economical, effective, and integrated areawide system of commercial and general-aviation airports. Rather, such decisions must currently come from a consensus among the many governmental and private agencies involved. This consensus can best be achieved at the regional level, for it is only at this level that the federal, state, county, and local interests concerned can be brought together in a cooperative effort to prepare plans which can then be jointly adopted and implemented.

BASIC PRINCIPLES

As noted in the preceding chapter of this report, airport planning within the Region is not new. The application of comprehensive areawide planning principles and practices to airport system planning, however, is a relatively new concept. Consequently, at the time the Commission initiated its comprehensive regional airport system planning program, little practical experience had been accumulated in such comprehensive airport system plans, and widely accepted principles governing such planning had not been established. Therefore, based upon the foregoing considerations, five principles were formulated which together form the basis for the planning process applied in the regional airport system planning program.

1. Airport system planning must be regional in scope. Airport service areas develop over an entire urban region without regard to corporate limit lines. Thus, airport system planning cannot be accomplished successfully within the confines of a single municipality or even a single county if that municipality or county is part of a larger urban complex. The airport system, comprised of commercial and general-aviation, and publicly and privately owned, airport facilities, must form a properly integrated system throughout the entire Region to adequately serve the developing regional air travel demands.

2. Airport system planning must be conducted concurrently with, and cannot be separated from, land use planning. The land use pattern determines the extent, location, and character of airport service areas and the specific need for air transportation service. Airport facilities in turn, attract certain kinds of commercial, industrial, and recreational development while discouraging other kinds of urban land use development.

3. Airport and surface transportation systems must be planned together. Surface transportation facilities directly influence the extent and location of airport service areas and may limit the capacity and determine the effectiveness of a given airport facility, while, in turn, airport facilities are major surface traffic generators.

4. Airport facilities must be planned as an integrated system. Airport facility and airway capacities in the system must be carefully fitted to the air travel demands, and the effects of each airport facility on the remainder of the system quantitatively determined and evaluated.

5. Both land use and airport facility planning must recognize the existence of a limited natural resource base to which urban, rural, and airport development must be properly adjusted to ensure a pleasant and habitable environment. Land, water, and air resources are limited and subject to grave misuse through improper land use and airport facility development. Such misuse can lead to serious environmental problems that may be difficult or impossible to correct.

THE AIRPORT SYSTEM PLANNING PROCESS

The Commission follows a seven-step planning process through which the principal functional relationships existing within the Region that affect airport system development can be accurately described, both graphically and numerically; the traffic loads upon the airport system of the Region quantified; and the effect of different courses of action with respect to land use, surface transportation facility, and airport facility development tested and evaluated. These steps are study design; formulation of objectives and standards; inventory; analysis and forecast; preparation, test, and evaluation of alternative plans; plan selection and adoption; and preparation of precise plans and plan implementation devices.

The result of this process is a regional airport system plan scaled to provide adequate air transportation service to the existing and probable future development within the Region, consistent with the adopted regional land use and surface transportation plans, a plan which minimizes noise and air pollution problems, and which seeks to protect and wisely use the underlying and sustaining natural resource base. In addition, the process is the beginning of a continuing planning effort which permits modification and adaptation of the plans to changing conditions and which can be used to provide plan implementation.

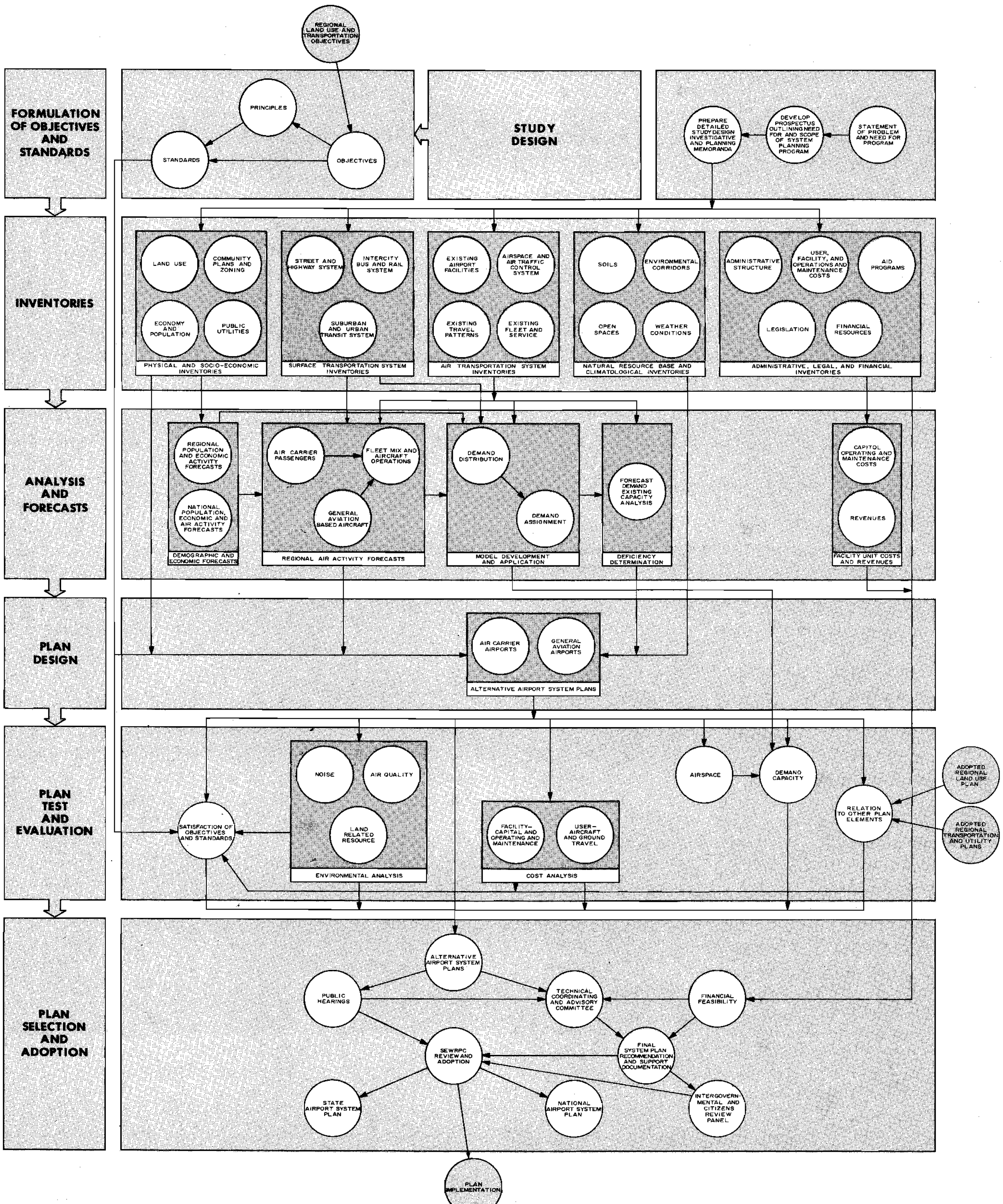
Each step in this process includes individual operations which must be carefully designed, scheduled, and controlled to fit the overall process. An understanding of this is essential to appreciate and understand the results. Each step and its major component operations is diagrammed in Figure 6 and described briefly below.

Study Design

Every planning program must include a formal structure or study design so it can be carried out logically and consistently. The study design must specify the content of each fact-gathering operation; define the geographic area for which data will be gathered and plans prepared; outline the manner in which the data are to be gathered, processed, and analyzed; specify forecast requirements, techniques, and accuracy; define the nature of each of the plan elements and the criteria to be used in their evaluation, review, and adoption; and specify the time and resources required to perform the work elements.

Figure 6

GENERAL STEPS IN A REGIONAL AIRPORT SYSTEM PLANNING PROGRAM



Source: SEWRPC.

The study design for the regional airport system planning program, prepared jointly by the staffs of the Commission and R. Dixon Speas Associates, Inc., took the form of detailed staff memoranda setting forth methods and procedures to be followed in accomplishing each work element.[1] As each staff memorandum was completed, it was presented to the Technical Coordinating and Advisory Committee for review and approval before becoming the working guide for program execution and review.

Formulation of Objectives and Standards

In its most basic sense, planning is a rational process to establish and meet objectives. The formulation of objectives is, therefore, an essential task before alternative plans can be prepared and evaluated and a final plan adopted. To be useful, the objectives must be stated clearly, be logically sound, and must relate to alternative physical development proposals. It is the duty and function of the Commission to prepare a comprehensive plan for the Region's physical development and its component parts, and it is the objective of the regional airport system study to prepare one of the key elements of such a plan—a long-range plan for areawide airport facility development. Only if the objectives clearly relate to physical development and are subject to quantitative test can a choice be made from alternative plans to select the one which best meets agreed-upon objectives. Logically conceived and well-expressed objectives must be translated into detailed design standards to provide the basis for plan preparation, test, and evaluation.

The airport system development objectives and standards formulated ranged from general objectives relating to the provision of adequate air transportation service to subareas of the Region to detailed design standards relating to airport runway lengths, navigational aids, and lighting requirements. All objectives and standards were carefully reviewed and adopted by the Technical Coordinating and Advisory Committee.

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[1] *The Study Design was comprised of the following staff memoranda: Investigation Memoranda No. I-1, "Schedule Service Patterns"; No. I-2, "Climatological Data Inventory"; No. I-3, "Airways Inventory"; No. I-4, "Airports Inventory"; No. I-5, "Air Travel Inventory"; No. I-6, "Soil Capabilities Inventory"; No. 7, "Land Use Inventory"; No. I-8, "Population and Economic Activity Inventory"; No. I-9, "Public Utility Inventory"; No. I-10, "Community Plans and Zoning Inventory"; No. I-11, "Legal Framework, Institutional Structure, and Public Financial Resources Inventory"; No. I-12, "Surface Transportation Inventory"; No. I-13, "Mapping Inventory"; No. I-14, "Aircraft Characteristics"; No. A-1, "Demand Distribution Model-Scheduled Service and General Aviation"; No. A-2, "Operational Analysis"; No. A-3, "Airport Capacity"; No. A-4, "Airspace Capacity"; and No. F-1, "Airline and General Aviation Demand Forecasts." It also included Planning Memoranda No. D-1, "Preparation, Test, and Evaluation of Alternative Plans; and No. D-2, "Plan Selection and Adoption." These memoranda are on file in the Commission offices.*

Inventory

Reliable basic planning and engineering data collected on a uniform, areawide basis are essential to formulation of workable development plans. Consequently, inventory becomes the first operational step in the planning process growing out of the study design. The crucial nature of factual information in the planning process should be evident, since no intelligent forecasts can be made or alternative courses of action selected without knowledge of the current state of the system being planned.

Sound airport system plan formulation requires data on climate; the amount, type, intensity, and spatial distribution of existing and probable future land uses; population levels and densities; economic activity; soil capabilities; existing public utility facilities and their pertinent service areas; the location, type, and capacity of the existing and proposed highway and railway facilities; performance characteristics of the existing and probable future stock of aircraft serving the Region; the patterns and limitations of the airway system; the location, type, capacity, activity, and potential of the existing airport facilities; the existing travel habits and patterns of air travel and interconnected surface travel at airport facilities; and the existing public institutional structure and legal framework governing airport development.

In the regional airport system study, the most expedient methods of obtaining adequate information of the necessary quality were followed. The means of data collection included review of prior publications, perusal of agency files, personal interviews with private citizens and public officials, committee meetings of staff and technical advisors, postal questionnaire surveys, and original field investigations.

Analysis and Forecast

Inventories provide factual information about past and present situations, but analyses and forecasts are necessary to provide estimates of future needs for air transportation system capacity. Future needs must be determined from a sequence of interlocking forecasts. Economic activity and population forecasts permit determination of future land use demand within the Region, and all three must, in turn, be translated into future demand for air transportation. These future demands can then be scaled against the existing supply of airport facilities and plans formulated to meet any existing or probable future deficiencies.

Two important considerations involved in the preparation of necessary forecasts are the forecast target date and the forecast accuracy requirements. Both the land use pattern and the supporting airport facilities must be planned for anticipated demand at some selected future point in time. In the planning of airport facilities, this "design year" is usually established by the expected life of the first facilities to be constructed in implementation of the plan. Although it may be argued that the design year for land use development should be extended further into the future than that for the transportation facilities because of the basic irreversibility of many land development decisions, practical considerations dictate that the land use planning design year be scaled to the facility design year requirement. In the regional airport system study, the necessary forecast period was set at 20 years, both as a very conservative approximation of facility life and as a means for relating the air travel demand forecast periods into the previously determined regional land use and transportation study forecast periods.

Forecast accuracy requirements depend on the use to be made of the forecasts. Applied to land use and airport system planning, the critical question relates to the effect of any forecast inaccuracies on the basic structure of the plans to be produced. It is important to keep the forecast tolerances within the range wherein only the timing and not the basic structure of the plans will be affected.

Plan Design, Test, and Evaluation

Plan design is the heart of the planning process. The most well-conceived objectives; the most sophisticated data collection, processing, and analysis operations; and the most accurate forecasts are of little value if they do not lead to sound development plans. The outputs of these planning operations—formulation of objectives and standards, inventory, and forecast—become inputs to the development, testing, and evaluation of alternative plans.

The airport system plan design problem requires a reconciliation between air travel demands and airport facility capacity, continued use or expansion of existing facilities and development of new facilities, development of airport facilities compatible with or serving to implement adjacent land use activities, and development of airport facilities in proper relationship to the surface transportation system which serve them but which also must be capable of accommodating the traffic generation of the airports, all at a feasible cost.

If plans developed in the design stage are to be realized in terms of facility development, some measures must be applied to quantitatively test them before they are adopted and implemented. The engineering performance and technical and economic feasibility of each alternative can be tested and quantified in the plan design stage. Each alternative plan can be measured against the standards established to quantify the objectives of airport system planning. The plans must also be rigorously subjected to additional review and evaluation including financial feasibility, legal and administrative possibility, and social and political practicability. Testing and evaluation of alternatives will range from comparisons of assigned air travel demands and capacity loadings to the existing and proposed airport facilities, to deliberation at interagency staff meetings and reaction from public hearings. The plan test and evaluation procedures should clearly show which plans or parts of plans are technically and economically sound, financially feasible, legally possible, and socially obtainable and politically realistic.

Plan Selection and Adoption

Following the design, test, and evaluation of several alternative plans, each capable of meeting the regional airport system development objectives and standards, it is necessary to select one system plan which best accomplishes the airport system objectives and standards. The recommended plan may be one of the alternatives previously designed or may consist of the best features from each of the several alternatives. One additional test of the selected airport system plan is an evaluation of its viability should the basic assumptions on land use development not occur as planned in the adopted regional land use and transportation plans. The plan selected from the evaluation of alternatives previously described is presented, along with a thorough description of the test and evaluation procedures and documentation of the rationale leading to specific plan selections, to the Technical Coordinating and Advisory Committee. Following approval of that Committee, the plan is reviewed by the ad hoc intergovernmental review panel. Finally, public hearings are held to obtain additional response and reaction to the selected plan. The use of advisory committees and formal and informal hearings appears to be the most practical and effective procedure to involve public officials, technicians, and citizens in the planning process and of openly arriving at an agreement of governmental bodies and agencies on objectives and plans which can be jointly implemented.

The selected plan, following any modification or additional study required in response to Technical Coordinating and Advisory Committee and public hearing review, is then presented to the Southeastern Wisconsin Regional Planning Commission for adoption in accordance with the provisions of the state regional planning enabling legislation. The Commission will submit the plan to the various state and local units of government concerned for their endorsement and approval and for use as a guide to subsequent airport development within the Region.

Preparation of Precise Plan and Plan Implementation Devices

In a practical sense, the recommended plan is not complete until the steps required for its implementation are specified. The regional airport system plan provides substantial planning data, cost information, and design standards as important guides to subsequent implementation of specific airport facility recommendations. The plan also identifies applicable sources of revenue, appropriate institutional and administrative organizations, and any changes to legislative and regulatory measures necessary to implement the plan.

The physical capabilities of the levels, units, and agencies of government concerned with and responsible for airport development within the Region were analyzed in terms of the airport needs as defined in the plan. Available federal and state financial and technical assistance were also identified, and a recommended organizational structure and financial program for plan implementation described. Because of the completely advisory role of the Commission, implementation of the recommended plan will be entirely dependent upon action by local, state, and federal agencies of government. The Commission will, however, develop a continuing airport system planning process to monitor the planning inputs and implementation activities and, in cooperation with the Technical Coordinating and Advisory Committee for Regional Airport Planning, maintain coordination among the planning and plan implementation agencies.

Chapter III

NATURAL RESOURCE AND SOCIOECONOMIC BASE CONSIDERATIONS IN REGIONAL AIRPORT SYSTEM PLANNING

INTRODUCTION

The seven-county Southeastern Wisconsin Region is an interrelated complex of natural and man-made features, which together form a rapidly changing environment for human life. The natural resource base is the primary determinant of the development potential of a region and of its ability to provide a pleasant and habitable environment for all forms of life. The principal elements of the natural resource base important to regional development are climate, physiography, geology, soils, mineral and organic resources, vegetation, water resources, and fish and wildlife. Without a proper understanding of these elements and of their interrelationships, human use and alteration of the natural environment proceeds at the risk of excessive costs in terms of both monetary expenditures and destruction of nonrenewable or slowly renewable resources. In this age of high resource demand, urban expansion, and rapidly changing technology, it is especially important that the natural resource base be an important consideration in any areawide planning effort, since these aspects of contemporary civilization make the underlying and sustaining resource base highly vulnerable to misuse and destruction.

The important man-made features of the Region include its land use pattern, public utility networks, and transportation systems. Together with the population residing, and the economic activities taking place, in the Region, these features may be thought of as the socioeconomic base of the Region. The basic purpose of airport system planning is to provide for the sound development of public air transportation facilities to meet the air transportation needs of the existing and probable future resident population and of the economic activities taking place within the Region, while protecting and enhancing the underlying and sustaining natural resource base. An understanding of both the natural resource and socioeconomic bases is, therefore, essential to sound regional airport system planning. This chapter accordingly identifies and describes the significant elements of the natural resource and socioeconomic bases of the Southeastern Wisconsin Planning Region.

With respect to the natural resource base, this chapter presents in summary form definitive data on the spatial distribution and extent of the various elements comprising this base, characterizing, where possible, the quantitative and qualitative aspects of each component element; and identifying those elements and characteristics of the natural resource base which must be considered in the planning, design, construction, and operation of airport facilities. The importance of such consideration cannot be overemphasized, not only because airport system development is influenced by natural phenomenon, but also because airport and related urban development have important impacts upon the natural resource base and, therefore, on the potential to either degrade or to protect and enhance the Region's natural heritage and environmental quality.

Since transportation facilities exist to serve basic social and economic needs for the movement of people and goods, an understanding of the present as well as future size, composition, and spatial distribution of the regional population and of the size and characteristics of the regional economy is essential to sound airport facilities planning. Further increasing the complexity of socioeconomic activities within the Region as a basis for regional airport system planning is the fact that population characteristics are greatly influenced by growth and change in the economy, and both population and economic activity levels and characteristics are related to trends in land use development patterns; the availability of public utilities, such as water supply, sewer service, and gas and electric power facilities; and the characteristics of existing and proposed transportation facilities—both surface and air transport facilities.

The significant elements of the natural resource base of the Region important to airport system planning and development are presented in three sections. The first describes the climatological conditions of the Region, with particular emphasis upon the microclimatologic conditions existing along the Lake Michigan shoreline as they relate to airport development. The second section describes the soil conditions in the Region and their relationships to airport location and attendant urban development. The third section describes the other elements of the natural resource base in relation to airport and attendant urban development.

The significant elements of the socioeconomic base of the Region important to airport system planning and development are presented in five sections. The first and second sections describe the demographic and economic bases of the Region in terms of historical trends, as well as existing conditions with respect to population size, composition, and distribution and with respect to employment and income levels and distribution. The third section describes the patterns of land use in the Region in terms of historical development and existing (1970) conditions. The fourth section describes the existing public utility systems within the Region, and the final section discusses the surface transportation systems serving the Region, a discussion which is more fully pursued in a subsequent chapter devoted to the inventory of airport system facilities, of which surface transportation facilities are an important supporting element. Following the several subsections that describe the natural resource and socioeconomic bases, a final section summarizes data about these natural and man-made bases as they influence, or are influenced by, airport facility development.

General Climatic Conditions

The Region's mid-continent location, far removed from the moderating effect of oceans, gives the Region a typical continental type climate characterized primarily by a progression of markedly different seasons and a large range in annual temperature. Low temperatures during the long, cold winters are accentuated by prevailing frigid northwesterly winds, while high summer temperatures are reinforced by the warm southwesterly winds common during the season.

The Southeastern Wisconsin Region is positioned astride cyclonic storm tracks along which low pressure centers move from the west and southwest. The Region also lies in the path of high pressure centers moving in a generally southeasterly direction. This location at the confluence of major migratory air masses results in the Region being influenced by a continuously changing pattern of different air masses having alternately low and high pressure centers, and results in frequent weather changes, particularly in winter and spring when distinct weather changes normally occur at least once every two or three days. These temporal weather changes consist of marked variations in temperature, type and amount of precipitation, relative humidity, wind magnitude and direction, and cloud cover.

In addition to these temporal variations, the Region, due primarily to its proximity to Lake Michigan, exhibits spatial variation in weather, particularly during the spring, summer, and fall seasons when the temperature differential between the lake water and land air masses tends to be the greatest. During these periods, the presence of the lake tends to moderate the climate of the eastern border of the Region. It is common, for example, for midday summer temperatures in shoreline areas to abruptly drop to a level 10°F lower than inland areas because of cooling lake breezes generated by air rising from the warmer land surfaces. This Lake Michigan temperature influence is, however, generally limited to a narrow band of the Region lying within several miles of the shoreline.

Wind

Prevailing wind direction in the Region follows a clockwise pattern throughout the year, being northwesterly in the late fall and winter, northeasterly in the spring, and southwesterly in the summer and early fall. The various wind directions and velocities experienced within the Region definitely influence airport planning, design, and operation. Since aircraft are designed to land and take off within specified limitations of crosswind and tail wind conditions, runway orientations should relate to prevailing wind direction and velocity for the location in question. The number of different runway orientations needed at a location is dependent upon the variations in wind direction and velocity experienced at the location.

Figure 7 presents wind direction data for seven locations within the Region and for seven additional sites located immediately north or west of the Region. As shown in Figure 7 and indicated in Table 4, wind directions exhibit no significant or extreme differences on an annual basis from one location to another. Of the eight compass points depicted for each of the seven in-Region locations in Figure 7, the dominant wind directions tend to be the southwest, northwest, northeast, and southeast. Based on averages of the indicated percentages for each of the seven in-Region locations, the wind may be expected to blow from the southwest and northwest each about 20 percent of the time, and from the southeast and northeast each about 15 percent of the time. Thus, the winds in southeastern Wisconsin may be expected to blow from these four compass points about 70 percent of the time. The above data indicate that runways oriented northeast-southwest and northwest-southeast will produce the most favorable wind coverage for operating aircraft, whereas, except for Williams Bay and Milwaukee, runways oriented north-south will produce the least favorable coverage.

Table 4

PRIMARY WIND DIRECTION AT SELECTED LOCATIONS IN THE REGION

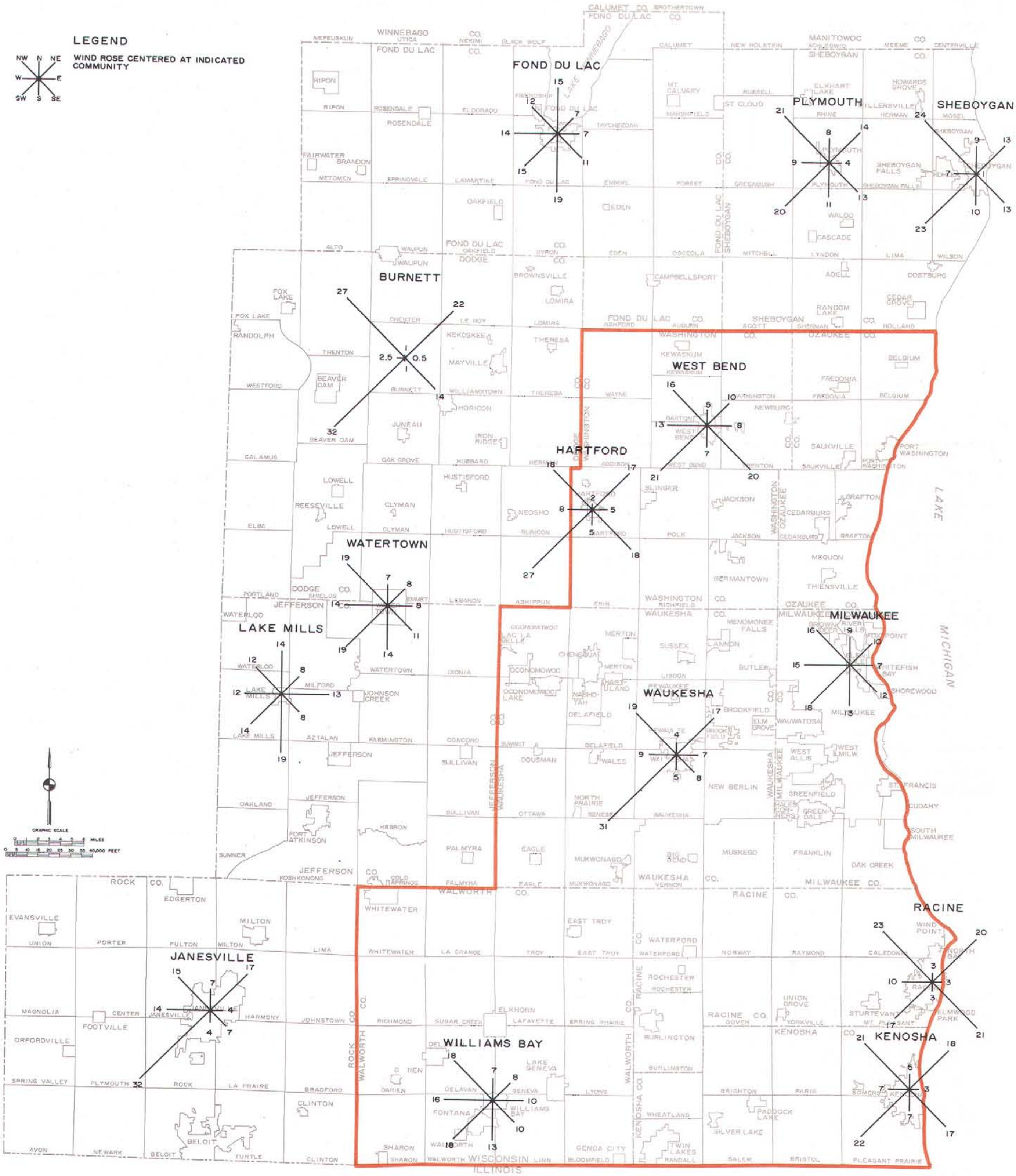
Location	Annual Wind Direction (Percent)				Total
	NE-SW	NW-SE	N-S	E-W	
Milwaukee	28	28	22	22	100
Racine	37	44	6	13	100
Kenosha	40	38	12	10	100
Waukesha	48	27	9	16	100
Williams Bay	26	28	20	26	100
Hartford	44	36	7	13	100
West Bend	31	36	12	21	100
Average	36	34	13	17	100

Source: Substation monthly record sheets compiled by the Wisconsin State Planning Board in 1944. (Data adjusted to equal 100 percent.)

Data on wind velocity as well as direction are important to airport system planning. The National Climatic Center in Asheville, North Carolina, the central repository of weather information from observation stations throughout the nation, maintains a computerized data bank of hourly weather observations with details on wind direction and velocity and the ceiling and visibility conditions that existed for each observation. Specific wind direction and velocity information at General Mitchell Field, extracted from the Center's computerized data bank, has been analyzed and summarized in Tables 5 and 6. The data indicate, as expected, that higher wind velocities—those 10 knots and greater—occur most often in the dominant wind directions from the southwest, northwest, southeast, and northeast. Table 5 also illustrates that wind

Figure 7

ANNUAL FREQUENCY DISTRIBUTION OF WIND DIRECTION IN SOUTHEASTERN WISCONSIN



Source: Substation monthly record sheets compiled by the Wisconsin State Planning Board in 1944. (Data adjusted to equal 100 percent.)

Table 5

FREQUENCY DISTRIBUTION OF ANNUAL WIND VELOCITY AT GENERAL MITCHELL FIELD, MILWAUKEE

Annual Wind Velocity (Knots)	Percent of Occurrence
0- 4.	12.17
5- 9.	30.79
10-14.	30.78
15-19.	18.00
20 or More	8.27

Source: National Climatic Center and R. Dixon Speas Associates, Inc.

Table 6

ANNUAL WIND VELOCITY BY WIND DIRECTION GENERAL MITCHELL FIELD, MILWAUKEE

Wind Direction	Percent of Time Wind Velocity Exceeds 10 Knots	Percent of Time Wind Velocity Exceeds 15 Knots
N-S	6.81	2.99
NNE-SSW . . .	10.53	5.49
NE-SW	7.50	3.24
ENE-WSW . . .	6.41	2.75
E-W	4.89	2.24
ESE-WNW . . .	8.97	4.41
SE-NW	7.13	3.08
SSE-NNW . . .	4.81	2.14
Total	57.05	26.34

Source: National Climatic Center and R. Dixon Speas Associates, Inc.

velocities at General Mitchell Field and throughout the Region may be expected to be less than four knots about 12 percent of the time, between four and 14 knots about 62 percent of the time, and in excess of 14 knots about 26 percent of the time.

Table 7 summarizes weather conditions by season and by day and night stratification for ceiling and visibility conditions that permit visual flight rule (VFR)[1] aircraft operations or require Category I[2] and II[3] instrument flight rule (IFR)[4] aircraft operations at Milwaukee and Madison. Information about the probable extent of weather conditions requiring IFR operations is an important consideration in the determination of navigational aid requirements at airports for all-weather operations.

Ceiling and visibility weather conditions at Milwaukee and Madison display similar seasonal variations. On an annual basis, weather conditions permitting VFR operations occur about 90 percent of the time, while weather conditions requiring IFR operations occur only about 10 percent of the time. The most favorable weather conditions permitting VFR operations occur during the summer daylight hours, when such conditions may be expected to exist for over 96 percent of the time at both locations. Weather conditions requiring IFR operations occur most frequently during the winter daylight periods at Milwaukee and the fall night periods at Madison. Weather conditions requiring Category II IFR operations prevail about 2 percent of the year at Milwaukee compared to about 1 percent of the year at Madison. This difference can be explained primarily by the higher incidence of weather conditions necessitating Category II IFR operations occurring during spring night periods at Milwaukee.

A summary of wind velocity occurrences during the various ceiling and visibility conditions at General Mitchell Field is presented in Table 8. Higher wind velocities, in excess of 10 and 15 knots, occur about 60 and 25 percent of the time, respectively, on an annual basis, primarily during weather conditions permitting VFR operations.

Temperature

Temperature in southeastern Wisconsin exhibits a large annual range and, as such, is an important parameter to be considered in airport planning and design. The ease with which outdoor construction and maintenance activities can be carried out is temperature dependent, and therefore annual temperature variations enter into the scheduling of such activities. More importantly, runway length is directly influenced by temperature. Air heated by increasing temperatures expands and becomes less

[1] *Visual flight rules—Operating instructions governing flights conducted with visual reference to the ground under weather conditions in which visibility is greater than three miles and the pilot can safely remain 1,000 feet beneath any cloud cover.*

[2] *CAT I IFR—Category of instrument flight rules that applies when weather conditions exist such that the ceiling is less than 1,000 feet but greater than 200 feet, and visibility is less than three miles but greater than one-half mile.*

[3] *CAT II IFR—Category of instrument flight rules that applies when weather conditions exist such that ceiling and visibility are less than 200 feet and one-half mile, respectively.*

[4] *Instrument flight rules—Operating instructions governing flights conducted without visual reference to the ground, such as when weather conditions restrict the ceiling and visibility to less than 1,000 feet or three miles, respectively.*

Table 7

PERCENT VARIATIONS IN CEILING AND VISIBILITY CONDITIONS FOR MILWAUKEE AND MADISON: 1955-1959

		Ceiling and Visibility Conditions					
		Milwaukee			Madison		
Season	Day or Night	VFR[a]	CAT I IFR[b]	CAT II IFR[c]	VFR[a]	CAT I IFR[b]	CAT II IFR[c]
Winter	Day	85.64	13.00	1.36	86.43	12.65	0.92
	Night. . . .	87.03	11.31	1.66	86.64	11.61	1.75
Spring	Day	90.66	7.99	1.35	93.27	6.51	0.22
	Night. . . .	87.58	8.46	3.96	88.82	8.93	2.25
Summer	Day	96.09	3.65	0.26	96.63	3.26	0.11
	Night. . . .	92.33	6.28	1.39	90.92	7.20	1.88
Fall	Day	85.94	12.39	1.67	86.69	11.73	1.58
	Night. . . .	86.85	11.04	2.11	85.90	11.71	2.39
Annual Total	--	89.22	9.25	1.53	89.87	8.97	1.16

[a] *Visual flight rules—Ceiling 1,000 feet or more and visibility greater than three miles.*

[b] *Category I, instrument flight rules—Ceiling between 200 and 1,000 feet and visibility between one-half and three miles.*

[c] *Category II, instrument flight rules—Ceiling less than 200 feet and visibility less than one-half mile.*

Source: National Climatic Center and R. Dixon Speas Associates, Inc.

Table 8

ANNUAL WIND VELOCITY FOR VARIOUS CEILING AND VISIBILITY CONDITIONS GENERAL MITCHELL FIELD, MILWAUKEE

Ceiling/Visibility	Percent of Time Wind Velocity Exceeds 10 Knots	Percent of Time Wind Velocity Exceeds 15 Knots
1,000′ - 3 miles	51.23	23.22
800′ - 2 miles	1.60	0.85
200′ - 1/2 mile	3.87	2.15
0′ - 0	0.35	0.12
Annual Total	57.05	26.34

Source: National Climatic Center and R. Dixon Speas Associates, Inc.

dense, thereby effectively decreasing engine horsepower—unless the engine is supercharged—and reducing propeller and jet thrust in the thinner air. An increase in temperature which makes the air less dense forces aircraft to require a longer takeoff run, a slower rate of climb, and a faster landing speed.

Data from six selected temperature observation stations in southeastern Wisconsin, three of which—Port Washington, Milwaukee, and Kenosha—are located near the Lake Michigan shoreline and three of which—West Bend, Waukesha, and Lake Geneva—are located at least 15 miles inland, are presented in Table 9 and Figure 8. These data, encompassing periods of record ranging from 10 to 30 years, indicate the temporal and spatial variations in temperature and temperature ranges which may be expected to occur within the Region. The temperature data also illustrate how regional air temperatures lag approximately one month behind summer and winter solstices during the annual cycle, with the result that July is the warmest month in southeastern Wisconsin and January the coldest.

The temperature effects of Lake Michigan are also indicated by these data when comparisons are made between inland and shoreland observation stations having the same latitude, that is, stations located generally along the same east-west line. It is possible to identify latitudinal temperature effects by comparing data for observation stations generally located along the same longitudinal, or north-south, line.

Prevailing summer temperatures throughout the Region, indicated by monthly means for July and August, are in the 68 to 73 degree Fahrenheit range, with northerly

Table 9

TEMPERATURE CHARACTERISTICS AT SELECTED LOCATIONS IN THE REGION

Month	Observation Station[a]								
	Lakeshore Location								
	Port Washington			Milwaukee			Kenosha		
	Period of Record: 1961-1970			Period of Record: 1931-1960			Period of Record: 1945-1959		
	Average Daily Maximum[b]	Average Daily Minimum[b]	Mean[c]	Average Daily Maximum[b]	Average Daily Minimum[b]	Mean[c]	Average Daily Maximum[b]	Average Daily Minimum[b]	Mean[c]
January . . .	26.1	10.1	18.1	28.3	12.8	20.6	31.4	14.9	23.2
February . .	30.5	14.0	22.3	30.2	14.6	22.4	34.2	18.0	26.2
March . . .	39.1	24.2	31.7	38.8	23.2	31.0	42.8	26.6	34.7
April	50.4	34.3	42.4	53.1	34.1	43.6	55.7	36.8	46.2
May	60.8	42.9	51.9	63.9	42.9	53.4	66.4	45.1	55.8
June	71.0	52.1	61.6	73.9	52.6	63.3	77.1	55.7	66.4
July	76.7	59.2	68.0	78.9	58.4	68.7	81.9	62.3	72.1
August . . .	76.7	58.3	67.5	77.7	57.8	67.8	81.5	62.3	71.9
September . .	69.1	51.7	60.4	70.7	49.9	60.3	74.0	53.8	63.9
October . . .	59.3	41.8	50.6	60.1	39.9	50.0	64.2	44.2	54.2
November . .	45.3	30.4	37.9	44.1	27.5	35.8	47.3	30.2	38.8
December . .	28.9	15.3	22.1	32.0	17.1	24.6	35.6	19.5	27.6
Year	52.8	36.2	44.5	54.3	35.9	45.1	57.7	39.1	48.4

Month	Observation Station[a]											
	Inland Location											
	West Bend			Waukesha			Lake Geneva					
	Period of Record: 1930-1959			Period of Record: 1930-1959			Period of Record: 1945-1959			Regional Summary		
	Average Daily Maximum[b]	Average Daily Minimum[b]	Mean[c]	Average Daily Maximum[b]	Average Daily Minimum[b]	Mean[c]	Average Daily Maximum[b]	Average Daily Minimum[b]	Mean[c]	Average Daily Maximum[d]	Average Daily Minimum[d]	Mean[e]
January . . .	28.6	11.7	20.2	29.0	12.3	20.7	29.8	13.2	21.5	28.9	12.5	20.7
February . .	31.0	13.5	22.3	31.6	14.5	23.1	33.2	16.4	24.8	31.8	15.2	23.5
March . . .	39.9	23.0	31.5	40.8	23.4	32.1	42.6	24.5	33.6	40.7	24.2	32.4
April	54.9	34.6	44.8	56.0	34.7	45.4	58.6	36.4	47.5	54.8	35.2	45.0
May	67.5	45.4	56.5	68.2	44.8	56.5	69.6	45.9	57.8	66.1	44.5	55.3
June	77.4	55.8	66.6	78.6	55.2	66.9	79.2	56.8	68.0	76.2	54.7	65.5
July	82.9	60.7	71.8	84.1	60.1	72.1	84.0	61.9	73.0	81.4	60.4	71.0
August . . .	80.8	59.5	70.2	82.6	59.0	70.8	82.6	61.3	72.0	80.3	59.7	70.0
September . .	72.4	51.3	61.9	74.1	50.6	62.4	74.1	52.4	63.3	72.4	51.6	62.0
October . . .	60.8	41.1	51.0	62.3	40.2	51.3	63.7	42.7	53.2	61.7	41.7	51.7
November. . .	44.1	27.8	36.0	44.8	27.9	36.4	45.0	28.7	36.9	45.1	28.8	37.0
December . .	32.0	16.7	24.4	32.4	17.4	24.9	33.2	18.6	25.9	32.4	17.4	24.9
Year	56.0	36.8	46.4	57.0	36.7	46.9	58.0	38.2	48.1	56.0	37.2	46.6

[a] *Observation stations were selected both on the basis of the length of record available and geographic location within the Southeastern Wisconsin Region. Port Washington, Milwaukee, and Kenosha are representative of areas with temperatures influenced by Lake Michigan, whereas West Bend, Waukesha, and Lake Geneva are typical of inland areas having temperatures that are not generally influenced by Lake Michigan. Kenosha and Lake Geneva are representative of southerly areas in the Region, whereas Port Washington and West Bend typify northern locations.*

[b] *The monthly average daily maximum temperature and the monthly average daily minimum temperature are obtained by using daily measurements to compute an average for each month in the period of record; the results are then averaged for all the months in the period of record.*

[c] *The monthly mean temperature is the mean of the average daily maximum temperature and the average daily minimum temperature for each month.*

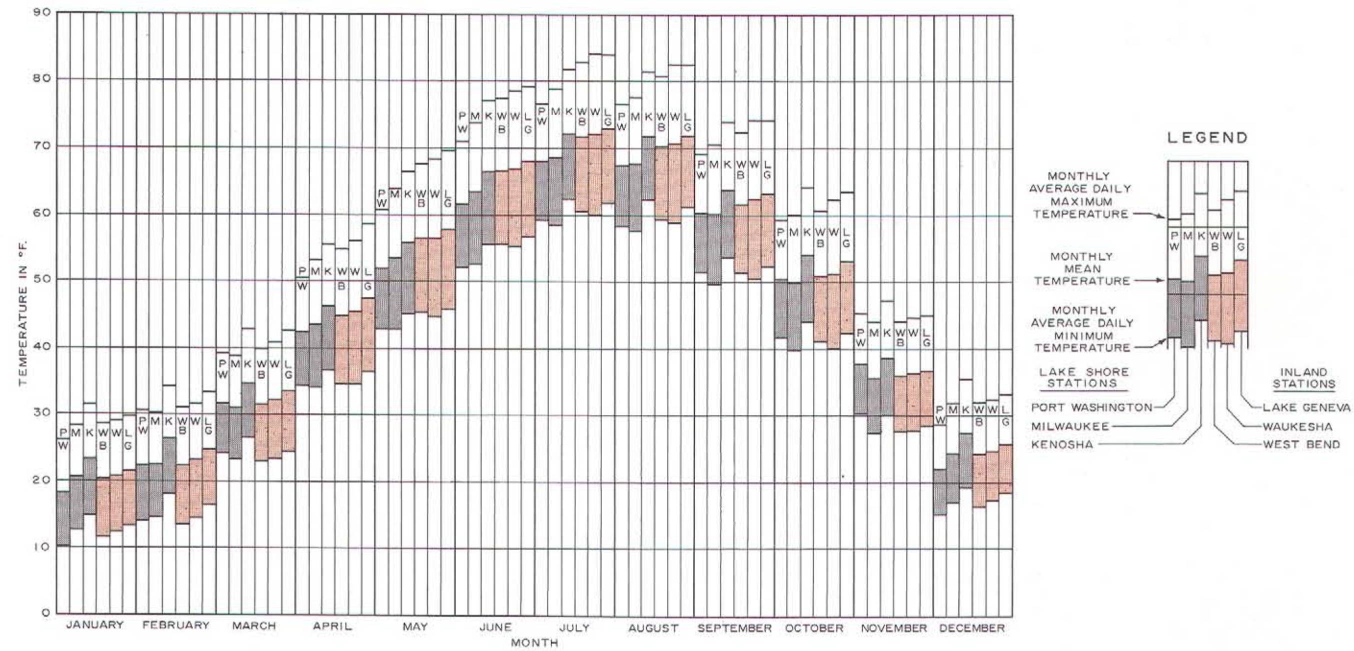
[d] *The monthly average daily maximum and minimum temperatures for the Region as a whole were computed as averages of the corresponding values for the six observation stations.*

[e] *The monthly mean for the Region as a whole is the mean of the regional monthly average daily maximum and average daily minimum, which is equivalent to the average monthly means for the six observation stations.*

Source: Wisconsin Statistical Reporting Service, National Weather Service, and SEWRPC.

Figure 8

TEMPERATURE CHARACTERISTICS AT SELECTED LOCATIONS IN THE REGION



Source: Wisconsin Statistical Reporting Service and National Weather Service.

lakeshore locations exhibiting lower monthly mean summer temperatures than southerly inland locations. Lake Michigan's influence on summer temperatures may be demonstrated by contrasting Waukesha and Milwaukee data. July and August mean temperatures at Waukesha are 72.1 and 70.8 degrees Fahrenheit, respectively, whereas monthly mean temperatures at Milwaukee, which is subject to the influence of Lake Michigan, are 3.4 and 3.0 Fahrenheit degrees lower. The influence of Lake Michigan on summer temperatures is also demonstrated by comparing average daily maximum and minimum temperatures for inland and lakeshore locations. Thus, in addition to abrupt daytime drops in summer shoreland temperatures attributable to wind shifts that produce cooling lake breezes, Lake Michigan also affects the overall summer temperature conditions as reflected by markedly lower monthly mean and average daily maximum temperatures for land areas in close proximity to the lake compared to inland areas located approximately along the same latitudinal line.

Winter temperatures in southeastern Wisconsin, as measured by monthly means for January and February shown in Table 9 and Figure 8, are in the range of 18 to 26 degrees Fahrenheit for all stations. No significant regionwide difference in monthly means, average daily minimum, and average daily maximums are noted for inland locations contrasted with locations in proximity to Lake Michigan.

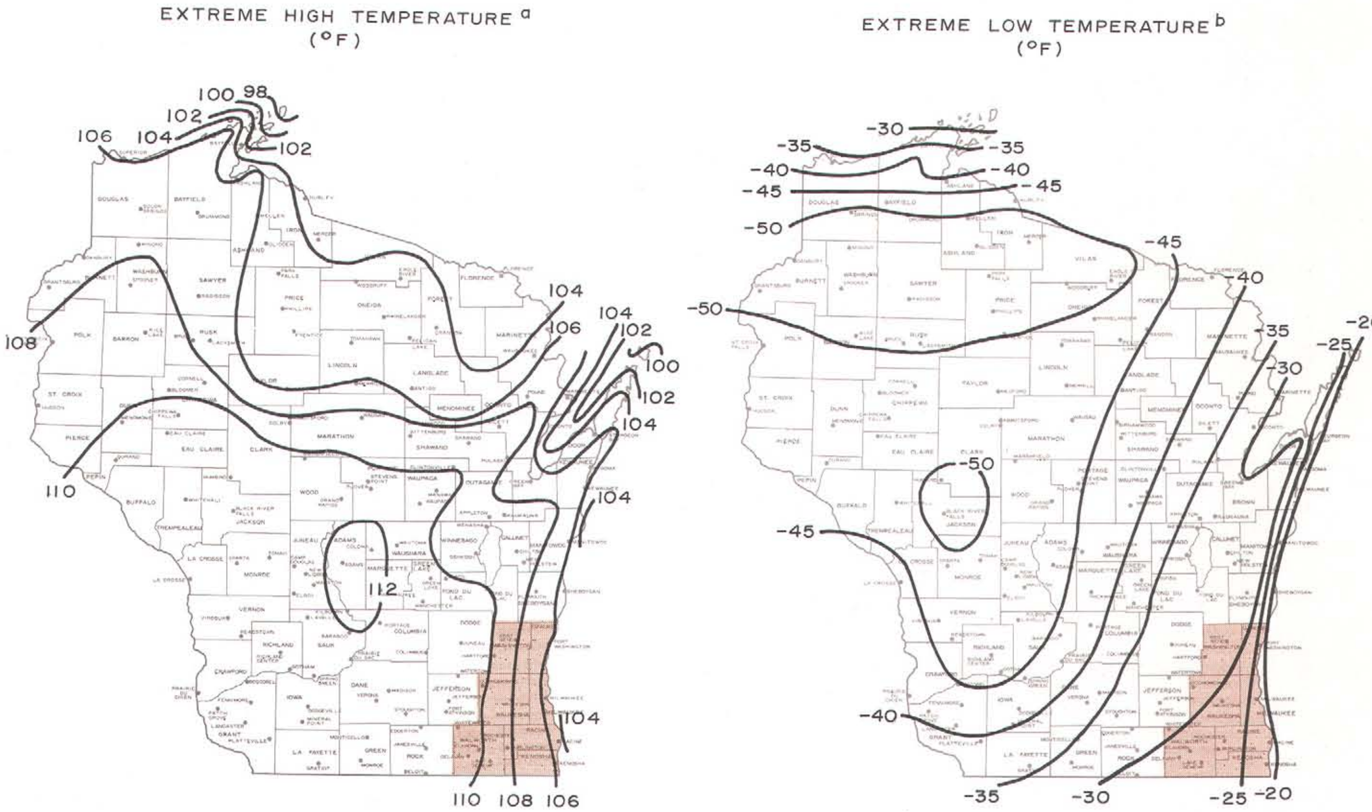
Lake Michigan also significantly affects temperatures of the Region during the transitional period of March, April, and May, at which time the lake, warming more slowly than the adjacent land areas, retards the temperature rise for land areas located along the shoreline. Since Lake Michigan never does achieve a temperature level as high as that reached inland, the winter to summer transition is followed by the summer conditions described earlier. The summer to winter transition period, as shown graphically in Figure 8, is characterized by a slightly greater drop in monthly mean temperature in inland areas than shoreline areas, since the former begin the transition period at a higher level than the latter. Both inland and shoreline areas converge to similar temperature levels in winter.

Marked latitudinal differences, clearly evident in Figure 8, occur along the approximately 80-mile long portion of Lake Michigan shoreline comprising the eastern boundary of the Region. Southerly locations, typified by Kenosha, exhibit significantly higher monthly mean, average daily maximum, and average daily minimum temperatures than northerly areas, as typified by Port Washington.

Extreme high and low temperatures for southeastern Wisconsin, based on 30 years or more of historical records at observation stations throughout the Region, are shown in Figure 9. The data indicate that high temperatures within the Region have ranged from 104°F in eastern

Figure 9

EXTREME HIGH AND LOW TEMPERATURES IN THE REGION BASED ON DATA FOR STATIONS HAVING AT LEAST 30 YEARS OF RECORD



[a] THE EXPECTED EXTREME HIGH TEMPERATURE FOR AN AVERAGE YEAR AT A GIVEN LOCATION MAY BE APPROXIMATED BY SUBTRACTING 10 TO 15°F FROM THE EXTREME HIGH TEMPERATURE SHOWN ON THE FIGURE.

[b] THE EXPECTED EXTREME LOW TEMPERATURE FOR AN AVERAGE YEAR AT A GIVEN LOCATION MAY BE APPROXIMATED BY ADDING 10 TO 15°F TO THE EXTREME LOW TEMPERATURE SHOWN ON THE FIGURE.

Source: Wisconsin Statistical Reporting Service, National Weather Service, and SEWRPC.

Racine County to slightly more than 110°F in western Washington, Waukesha, and Walworth Counties; and extreme low temperatures have ranged from about -20°F along the entire Lake Michigan shoreline to -33°F in the northwestern corner of Washington County. The expected extreme high temperature during an average year for a particular location within the Region may be estimated by subtracting 10 to 15°F from the value shown in Figure 9, whereas the expected extreme low temperature may be approximated by adding 10 to 15°F.

Precipitation

Precipitation within the Region takes the form of rain, sleet, hail, and snow, and ranges from gentle showers to destructive thunderstorms, as well as major rainfall-snowmelt events causing property and crop damage and inundation of poorly drained areas. The kind and amount of precipitation that may be expected to occur within the Region influences the nature of man's activities in general, and particularly airport planning, design, construction, operation, and maintenance. Airport system problems created by various forms of precipitation are restricted visibility; atmospheric turbulence; slippery conditions on hard surface runways; nonuse of turf runways, sometimes for days; decreased rate of climb for some aircraft; and congested air space and general congestion created at the airport because of operational delays. Unusually high rates and amounts of freezing precipitation are required to close an airport with hard surface runways. Airports with only turf runways, however, may become soggy and unusable with relatively small amounts of precipitation. Of the total of 46 airports within the Region, 32, or 70 percent, do not have hard surface runways. The 32 airports include 15, or 56 percent, of the 27 public-use airports, and 17, or 89 percent, of the 19 private-use airports. Precipitation events that produce IFR weather conditions and eliminate all VFR flights at airports are significant, since there are only eight airports located within the Region capable of accommodating aircraft operating under IFR procedures approved by the Federal Aviation Administration.

Precipitation and snowfall data for six representative precipitation observation stations in southeastern Wisconsin located near the Lake Michigan shoreline at Port Washington, Milwaukee, and Kenosha and inland at West Bend, Waukesha, and Lake Geneva are presented in Table 10 and Figure 10. These data, encompassing periods of record ranging from 15 to 65 years, illustrate temporal and spatial variations in the type and amount of precipitation that normally occurs within the Region.

The data indicate that the average annual total precipitation in the Region, based on data for the six representative stations, is 30.3 inches, expressed as water equivalent, and that the average annual snowfall, measured as snow at the time of snowfall, is 43.2 inches. Average total monthly precipitation for the Region ranges from 1.32 inches in February to 3.86 inches in June. The principal snowfall months are December, January, February, and March, when average monthly snowfalls are 8.8, 11.9, 8.4, and 9.3 inches, respectively, and during which time 89 percent of the average annual snowfall may be expected to occur. The predominant form of precipitation during these months is snow, which usually totals over half of the total precipitation, expressed as water equivalent. Approximately 20 inches, or two-thirds of the average annual precipitation, normally occurs during the late April through mid-October growing season, primarily as rainfall. Assuming that 10 inches of measured snowfall is equivalent to one inch of water, the average annual snowfall of 43.4 inches is equivalent to 4.34 inches of water and, therefore, only 14 percent of the average annual total precipitation occurs as snowfall.

Precipitation data indicate that Lake Michigan does not have as pronounced an effect on precipitation within the Region as it does on temperature. A minor Lake Michigan effect is evident in a rainfall reduction of up to about 0.5 inch per month in late spring and summer in the eastern areas of the Region relative to the western areas, which may be attributed to the cool lake waters maintaining a cooler lower atmosphere and thereby inhibiting convective precipitation.

The influence of Lake Michigan as a source of moisture is reflected by slightly higher seasonal snowfalls for the entire Region relative to inland areas lying west of the Region. Minor intraregional snowfall differences occur in that seasonal snowfall tends to be greatest in the topographically higher northwest portion of the Region because moisture masses moving through that area are forced up onto the higher terrain, where lower temperatures normally associated with increased height induce more snowfall than that which would occur in the absence of the topographic barrier.

Extreme precipitation data for the entire Region, based on observations for stations located throughout southeastern Wisconsin having relatively long periods of record, are presented in Table 11. The minimum annual precipitation within the Region, as determined from the tabulated data for the indicated observation period, occurred at Waukesha in 1901, when only 17.30 inches of precipitation fell, or 57 percent of the average annual precipitation of 30.3 inches for southeastern Wisconsin. The maximum annual precipitation within the Region occurred at Milwaukee in 1876, when 50.36 inches of precipitation fell, or 166 percent of the average annual precipitation for southeastern Wisconsin. The minimum annual snowfall of 5.0 inches, or about 11 percent of the regional annual average snowfall, was recorded at Racine during the winter of 1901-1902, whereas the maximum annual snowfall of 109 inches, or about 251 percent of the regional annual average, was recorded at Milwaukee during the winter of 1885-1886.

The maximum monthly precipitation measured in the Region was 13.17 inches, which occurred at West Bend in August of 1924, while the maximum monthly snowfall was 56.0 inches, recorded at Waukesha in January of 1918. The maximum 24-hour, or daily, precipitation recorded in southeastern Wisconsin, based on the data presented in Table 11, occurred in the West Bend area on August 4, 1924, when 7.58 inches of rain fell. The greatest 24-hour snowfall was 30.0 inches recorded at Racine in February 1898. With these excessive quantities of precipitation, operations even at air-carrier airports such as General Mitchell Field can become so unbalanced as to cause mass flight cancellations, ferrying of aircraft, terminal confusion, and inconvenience to the traveling public.

Snow Cover

The likelihood of snow cover and the depth of snow on the ground are important precipitation-related factors that influence the planning, design, construction, operation, and maintenance of airports. Snow cover, particularly early in the winter season, significantly influences the depth and duration of frozen ground, which in turn affects engineering works involving extensive excavation and underground construction. Accumulated snow depth at a particular location and time is primarily dependent on antecedent snowfall, rainfall, and temperature characteristics, and the amount of solar radiation. Rainfall is relatively unimportant as a melting agent, but can, because of compaction effects, significantly affect the depth of snow cover on the ground.

Snow depth as measured at Milwaukee for the 70-year period 1900 through 1969 and published in "Snow and Frost in Wisconsin," a 1970 Wisconsin Statistical Reporting Service report, is summarized in Table 12. It should be emphasized that the tabulated data pertain to snow depth on the ground as measured at the place and time of observation, and are not a direct measure of average snowfall. Recognizing that snowfall and temperatures and, therefore, snow accumulation on the ground vary spatially within the Region, the Milwaukee area data presented in Table 12 should be considered only as an approximation of conditions that would be encountered in other parts of the Region. As indicated by the data, snow cover is most likely during the months of December, January, and February, during which at least a 0.40 probability exists of having one inch or more of snow cover at Milwaukee. Furthermore, during January and the first

Table 10

PRECIPITATION CHARACTERISTICS AT SELECTED LOCATIONS IN THE REGION

Month	Observation Station[a]					
	Lakeshore Location					
	Port Washington		Milwaukee		Kenosha	
	Period of Record: 1896-1960[b]		Period of Record: 1931-1960		Period of Record: 1945-1959	
	Average Total Precipitation[c]	Average Snow and Sleet[d]	Average Total Precipitation[c]	Average Snow and Sleet[d]	Average Total Precipitation[c]	Average Snow and Sleet[d]
January . . .	1.61	11.5	1.83	12.7	1.56	11.9
February . .	1.56	10.2	1.40	8.0	1.08	12.1
March . . .	2.21	8.0	2.31	9.3	2.29	7.3
April	2.73	1.9	2.53	1.2	3.19	1.4
May	3.37	0.1	3.16	0.0	3.49	0.2
June	3.32	0.0	3.64	0.0	4.05	0.0
July	2.79	0.0	2.95	0.0	3.23	0.0
August . . .	2.92	0.0	3.06	0.0	3.08	0.0
September . .	3.20	0.0	2.72	0.0	2.19	0.0
October . . .	2.30	0.2	2.10	0.0	1.85	0.1
November . .	2.06	3.0	2.18	2.5	1.96	2.5
December . .	1.55	7.2	1.63	9.8	1.89	9.7
Year	29.62	42.1	29.51	43.5	29.86	45.2

Month	Observation Station[a]						Regional Summary	
	Inland Location							
	West Bend		Waukesha		Lake Geneva			
	Period of Record: 1930-1959		Period of Record: 1930-1959		Period of Record: 1945-1959			
	Average Total Precipitation[c]	Average Snow and Sleet[d]	Average Total Precipitation[c]	Average Snow and Sleet[d]	Average Total Precipitation[c]	Average Snow and Sleet[d]	Average Total Precipitation[c]	Average Snow and Sleet[d]
January . . .	1.68	12.3	1.70	11.8	1.73	11.0	1.69	11.9
February . .	1.36	8.1	1.26	6.6	1.26	5.5	1.32	8.4
March . . .	2.01	10.5	2.16	10.7	2.55	10.1	2.26	9.3
April	2.54	1.2	2.52	1.1	3.24	1.1	2.79	1.3
May	2.98	0.4	3.46	0.4	3.69	0.1	3.36	0.2
June	3.96	0.0	3.72	0.0	4.46	0.0	3.86	0.0
July	3.34	0.0	3.31	0.0	4.18	0.0	3.30	0.0
August . . .	2.89	0.0	3.06	0.0	3.60	0.0	3.10	0.0
September . .	3.16	0.0	2.93	0.0	1.98	0.0	2.70	0.0
October . . .	2.21	0.1	2.09	0.0	2.13	0.0	2.11	0.1
November . .	2.13	2.9	2.30	3.5	2.16	4.5	2.13	3.2
December . .	1.50	7.8	1.56	7.7	2.12	10.8	1.71	8.8
Year	29.76	43.3	30.07	41.8	33.10	43.1	30.33	43.2

[a] *Observation stations were selected both on the basis of the length of record available and geographic location within the Southeastern Wisconsin Region. Port Washington, Milwaukee, and Kenosha are representative of areas where precipitation would be influenced by Lake Michigan, whereas West Bend, Waukesha, and Lake Geneva are typical of inland areas having precipitation that is not generally influenced by Lake Michigan. Kenosha and Lake Geneva are representative of southerly areas in the Region, whereas Port Washington and West Bend typify northern locations.*

[b] *Snow and sleet data for Port Washington are based on the 56-year period 1894 through 1950.*

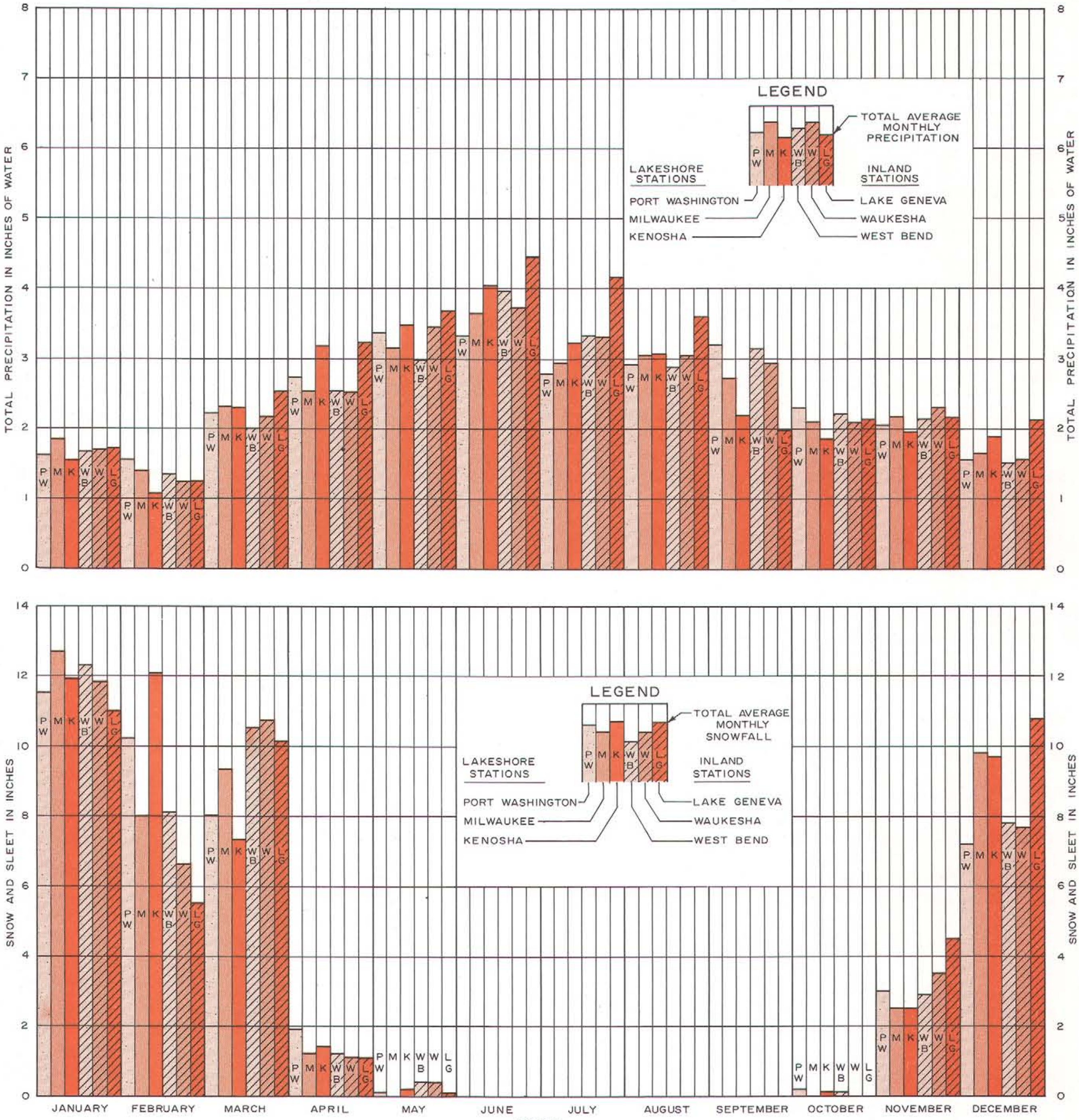
[c] *Precipitation is measured in inches of water.*

[d] *Snow and sleet are measured in inches.*

Source: Wisconsin Statistical Reporting Service, National Weather Service, and SEWRPC.

Figure 10

PRECIPITATION CHARACTERISTICS AT SELECTED LOCATIONS IN THE REGION



Source: Wisconsin Crop Reporting Service, National Weather Service, and SEWRPC.

half of February, at least a 0.25 probability exists of having five inches or more of snow cover at Milwaukee. During March, when severe spring snowmelt-rainfall flood events are most likely to occur, at least a 0.30 probability exists of having one inch or more of snow on the ground during the first half of the month, while the probability of having that much snow cover diminishes to 0.07 by the end of the month.

Table 11

EXTREME PRECIPITATION EVENTS IN THE REGION

Observation Station[a]		Period of Precipitation Records Except Where Indicated Otherwise	Total Precipitation (Water Equivalent)										
			Maximum Annual		Minimum Annual		Maximum Monthly			Maximum Daily			
Name	County		Amount	Year	Amount	Year	Amount	Month	Year	Amount	Day	Month	Year
Milwaukee	Milwaukee	1870-1970	50.36[b]	1876	18.69[b]	1901	10.03	June	1917	5.76[d]	22-23	June	1917
Racine	Racine	1895-1970	48.33	1954	17.75	1910	10.98	May	1933	4.00	11	September	1933
Waukesha	Waukesha	1892-1970	43.57	1938	17.30	1901	11.41	July	1952	5.09	18	July	1952
West Bend	Washington	1922-1970	40.52	1938	19.72	1901	13.17[c]	August	1924	7.58[c]	4	August	1924

Observation Station[a]		Period of Precipitation Records Except Where Indicated Otherwise	Snowfall										
			Maximum Annual		Minimum Annual		Maximum Monthly			Maximum Daily			
Name	County		Amount	Year	Amount	Year	Amount	Month	Year	Amount	Day	Month	Year
Milwaukee	Milwaukee	1870-1970	109.0[e]	1885-1886	11.0[e]	1884-1885	52.6	January	1918	20.3[f]	4-5	February	1924
Racine	Racine	1895-1970	85.0	1897-1898	5.0[g]	1901-1902	38.0	February	1898	30.0[f]	19-20	February	1898
Waukesha	Waukesha	1892-1970	83.0[g]	1917-1918	9.1	1967-1968	56.0	January	1918	20.0[f]	5-6	January	1918
West Bend	Washington	1922-1970	86.5	1935-1936	19.6	1967-1968	38.0	January	1943	21.0	10-11	December	1970

[a] *An observation station was included if a minimum of 30 years of record was available.*

[b] *Based on the period 1841-1970.*

[c] *Based on the period 1895-1959 as reported in "A Survey Report for Flood Control on the Milwaukee River and Tributaries," U. S. Army Engineer District, Chicago, Corps of Engineers, November 1964.*

[d] *Maximum precipitation for a 24-hour period.*

[e] *Maximum and minimum snowfalls for a winter season.*

[f] *Maximum snowfall for a 24-hour period.*

[g] *Estimated from incomplete records.*

Source: Wisconsin Statistical Reporting Service, National Weather Service, U. S. Army Corps of Engineers, and SEWRPC.

The table facilitates an estimation of snow cover probability and should, therefore, be useful in planning winter outdoor work and construction activities, as well as estimating airport operation and maintenance requirements. There is, for example, only a 0.07 probability of encountering one or more inches of snow cover on November 15 of any year, whereas there is a much higher probability, 0.61, of having that much snow cover on January 15.

Frost Depth

Ground frost, or frozen ground, refers to that condition in which the ground contains variable amounts of water in the form of ice. Frost influences hydrologic processes, particularly the percent of rainfall or snowmelt that will run off the land. Anticipated frost conditions influence the design of structures and facilities to either prevent water accumulation and, therefore, the formation of damaging frost, as in the case of runways, pavements, and retaining walls; or to be partially or completely below the frost susceptible zone in the soil, as in the case of foundations and water mains. For example, to avoid or minimize structural damage, foundation footings must be located below that zone in which the soil may be expected to contract, expand, or shift due to frost action. In the case of runways and pavements, a granular base coarse is placed below the surface coarse to provide drainage area that prevents the accumulation of water and, therefore, the formation of damaging frost lenses. Frost conditions also affect airport maintenance operations, particularly affecting in an adverse manner, snow removal over unpaved and unfrozen surfaces.

Snow cover is a primary determinant of the depth of frost penetration and of the duration of frozen ground. The thermal conductivity of snow cover is less than one-fifth that of moist soil, so that heat loss from the soil to the cold atmosphere is greatly inhibited by an insulating snow cover. An early, major snowfall that is retained on the ground as a substantial snow cover will inhibit or prevent frost development in unfrozen ground,

Table 12

SNOW COVER PROBABILITIES AT MILWAUKEE BASED ON DATA FOR THE PERIOD 1900-1970

Date		Snow Cover[a]									
		1.0 Inch or More		5.0 Inches or More		10.0 Inches or More		15.0 Inches or More		Average (Inches)	
Month	Day	Number of Occurrences[b]	Probability of Occurrence[c]	Number of Occurrences[b]	Probability of Occurrence[c]	Number of Occurrences[b]	Probability of Occurrence[c]	Number of Occurrences[b]	Probability of Occurrence[c]	Per Occurrence[d]	Overall[e]
November	15	5	0.07	0	0.00	0	0.00	0	0.00	1.2	0.09
	30	12	0.17	1	0.01	1	0.01	0	0.00	2.8	0.49
December	15	33	0.47	10	0.14	0	0.00	0	0.00	3.3	1.54
	31	32	0.46	9	0.13	1	0.01	0	0.00	3.6	1.66
January	15	43	0.61	17	0.24	4	0.06	2	0.03	4.9	2.94
	31	48	0.69	22	0.31	9	0.13	4	0.06	6.2	4.26
February	15	44	0.63	23	0.33	7	0.10	3	0.04	6.0	3.69
	28	27	0.39	8	0.11	3	0.04	1	0.01	4.5	1.69
March	15	23	0.33	6	0.09	4	0.06	0	0.00	3.9	1.21
	31	5	0.07	1	0.01	1	0.01	0	0.00	3.4	0.24

[a] *Data pertain to snow depth on the ground as it was measured at the time and place of observation, and are not a direct measure of average snowfall.*

[b] *Number of occurrences is the number of times during the 70-year period of record when measurements revealed that the indicated snow depth was equaled or exceeded on the indicated date.*

[c] *Probability of occurrence for a given snow depth and date is computed by dividing the number of occurrences by 70, and is defined as the probability that the indicated snow cover will be reached or exceeded on the indicated date.*

[d] *Average snow cover per occurrence is defined as the sum of all snow cover measurements in inches for the indicated date divided by the number of occurrences for that date, that is, the number of times in which 1.0 inch or more of snow cover was recorded.*

[e] *Overall average snow cover is defined as the sum of all snow cover measurements in inches for the indicated date divided by 70, that is, the number of observation times.*

Source: Wisconsin Statistical Reporting Service, National Weather Service, and SEWRPC.

and may even result in a reduction or elimination of frost in already frozen ground. If an early, significant snow cover is maintained by additional regular snowfall throughout the winter season, frozen ground may not develop at all or, at most, a relatively small frost penetration will occur. Frost depth is also dependent on vegetal cover and soil type. Assuming similar soil types, for example, frost will penetrate more deeply into bare, unprotected soil than into soil covered with an insulating layer of sod.

Ground freeze varies in time period and depth within the Region depending on specific locations, snow cover, and other short-term changes in weather conditions; however, as shown in Figure 11, frost depths in the Region by midwinter range up to 12 to 18 inches. The first 32°F freeze usually occurs during the second week of October while the last 32°F freeze occurs during the last week of April for areas near Lake Michigan and during the first half of May for inland areas.

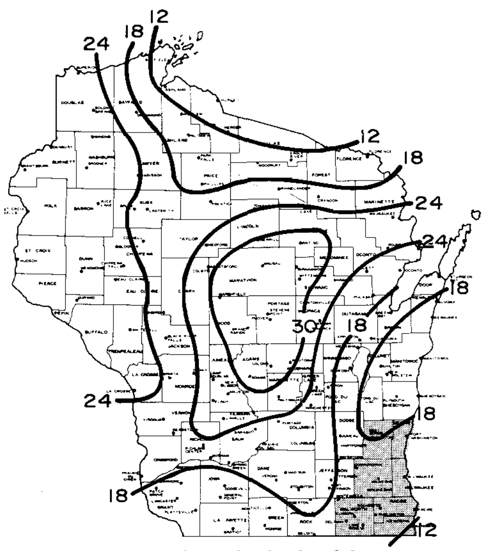
Lake Fog

The weather phenomena referred to as "lake fog" is a particular fog condition that occurs over land masses in proximity to large water surfaces, such as the eastern boundary of the Southeastern Wisconsin Region and Lake Michigan.

Fog caused by water vapor in the air condensing near the ground can result from cooling of the air near the ground or by an increase in the moisture content of the air above the saturation level. Advection fog is caused by air being cooled following horizontal movement, and is dependent on the surface over which it moves. There are two types of advection fog, that caused by cold air moving over a warmer water surface, and that caused by warm, moist air moving over a colder water surface. The first type, commonly called "stream fog," is usually very shallow. The second type, resulting from a temperature inversion, is a much denser fog, and is of considerable importance in some areas.

Figure 11

AVERAGE FROST DEPTHS IN THE REGION FOR FEBRUARY 28 BASED ON DATA FOR THE PERIOD 1961-1966[a]



[a] *This map was constructed on the basis of frost depths for cemeteries as reported by funeral directors and cemetery officials. Since cemeteries have soils that are overlain by an insulating layer of turf, the mapped frost depths should be considered as minimum values.*

Source: Wisconsin Statistical Reporting Service, National Weather Service, and SEWRPC.

With respect to the study area, lake fog is of this second type, caused by warm, moist air moving over the colder waters of Lake Michigan, and is more common in warmer months when the water is colder than the air. This type of fog is limited in its areal extent, normally being confined to the area over the water itself and up to a mile or two inland from the shoreline. Thus, lake fog becomes a problem in airport operation and siting only in a one- or two-mile strip along the shoreline or on the lake itself. On Lake Michigan, lake fog is fairly common during the daylight hours in the spring and early summer.

To evaluate more precisely the effect of lake fog, further analysis of available climatological data was undertaken to determine possible major reductions in ceiling and visibility at General Mitchell Field. The only adequate data for this investigation included recorded climatological observations for Madison Municipal Airport in Madison, Austin Straubel Field in Green Bay, and General Mitchell Field in Milwaukee.

Table 13 summarizes weather conditions by season and by day and night stratification for the "1,000'-3 miles" and the "200'-1/2 mile" ceiling and visibility categories. During the spring and summer, when lake fog could be a factor, Madison generally exhibits a smaller percentage of poor weather occurrence than Milwaukee in both of the ceiling and visibility categories. The difference between conditions existing at Milwaukee and Madison is greatest during spring days for the "1,000'-3 miles" category, with an approximately 9 percent occurrence

Table 13

ADVERSE CEILING AND VISIBILITY CONDITIONS AT GREEN BAY, MADISON, AND MILWAUKEE

		Ceiling and Visibility Conditions					
		Percent Occurrence					
		Milwaukee		Madison		Green Bay	
Season	Day or Night	1,000/3[a]	200/1/2[b]	1,000/3[a]	200/1/2[b]	1,000/3[a]	200/1/2[b]
Winter	Day	14.36	1.36	13.57	0.92	NA[c]	NA
	Night	12.97	1.66	12.36	1.75	NA	NA
Spring	Day	9.34	1.35	6.73	0.22	NA	NA
	Night	12.42	3.96	11.18	2.25	NA	NA
Summer	Day	3.91	0.26	3.37	0.11	NA	NA
	Night	7.67	1.39	9.08	1.88	NA	NA
Fall	Day	14.06	1.67	13.31	1.58	NA	NA
	Night	13.15	2.11	14.10	2.39	NA	NA
Annual	--	10.78	1.53	10.13	1.16	12.0	2.3

[a] *Ceiling less than 1,000' and visibility less than three miles.*

[b] *Ceiling less than 200' and visibility less than one-half mile.*

[c] *Not available.*

Source: National Climatic Center and R. Dixon Speas Associates, Inc.

at Milwaukee and an approximately 7 percent occurrence at Madison. On an annual basis, this ceiling and visibility category exists nearly equally at both locations, having an approximately 11 percent occurrence at Milwaukee and an approximately 10 percent occurrence at Madison. Both of these values are less than the 12 percent occurrence annually at Green Bay. In the more limiting "200-1/2 mile" ceiling-visibility category, the major difference occurs during the spring nights, with an approximately 4 percent occurrence at Milwaukee and an approximately 2 percent occurrence at Madison. The annual percentages for this category at both Milwaukee and Madison are again nearly equal, and less than the occurrence at Green Bay.

It is not possible to conclude from the available data that lake fog, in itself, is a major problem for aircraft operations at General Mitchell Field, even though this airport appears to exhibit somewhat higher percentages of low ceiling and visibility conditions. This airport apparently is located on the fringe of the inland penetration of the lake fog phenomena. It may be concluded that lake fog would be a major consideration only for new sites located within approximately two miles of the Lake Michigan shoreline, or for facilities located in the lake.

Daylight and Sky Cover

The annual variation in the time of sunrise and sunset and the daily hours of sunlight are presented in Figure 12. Sky cover information, in the form of expected percent of clear, partly cloudy, and cloudy days each month, is also summarized in Figure 12.

Daylight and sky cover data are another parameter to be considered in airport planning, design, construction, operation, and maintenance. For example, 34, or 74 percent, of the 46 airports located within the Region do not have runway lighting, which makes operations at these airports largely dependent upon clear daytime conditions. As illustrated in Figure 12, the annual variation in daylight ranges from a minimum of about nine hours on December 22, the winter solstice, to a maximum of about 15 hours on June 21, the summer solstice.

Mean monthly sky cover for the sunrise to sunset period varies somewhat during the year. The smallest amount of daytime sky cover may be expected to occur during the four-month July through October period when the mean monthly sky cover is at or slightly above 0.5. Clouds or other obscuring phenomena are most prevalent during the five-month November through March period, when the mean monthly daytime sky cover is about 0.7. The tendency for maximum annual sky cover in the winter and minimum annual sky cover in the summer is also illustrated by examining the expected relative number of days classified as clear, partly cloudy, and cloudy for months in each of these seasons. During the summer months, as shown in Figure 12, about one-third of the days may be expected to be categorized as clear, one-third as partly cloudy, and one-third as cloudy. Greater sky cover occurs in the winter, however, when over one-half of the days are classified as cloudy, with the remainder being approximately equally divided between partly cloudy and clear.

Ambient Air Quality

Air quality monitoring for gaseous pollutants was first initiated on a regular basis in the Southeastern Wisconsin Region in 1957 as part of the National Air Surveillance Network. The initial installation included a high volume air sampler located in downtown Milwaukee to collect suspended particulate samples on a twice monthly basis for analysis and interpretation at the U. S. Public Health Service Laboratories. In 1961, this sampler site was upgraded to include monitoring for sulfur dioxide and nitrogen dioxide, and in 1963, two additional similar stations were located above the Police Headquarters in the City of Racine and above the Municipal Building in the City of Kenosha. In 1967, Milwaukee County expanded its ambient air quality monitoring effort by securing 10 additional high-volume particulate samplers with instrumentation to monitor gaseous pollutant levels on a continuous basis. Presently, Milwaukee County operates high-volume samplers to measure suspended particulates at 16 locations, and uses a mobile van, operational since early 1969 and equipped to measure particulates, sulfur dioxide, nitrogen dioxide, ozone, carbon monoxide, and wind speed and direction, to monitor air quality at five sites throughout the county.

A network of ambient air quality monitoring stations is being established within the Region by the Wisconsin Department of Natural Resources to provide a continuous record of air quality levels. This network is to consist of nine monitoring sites, including seven in Milwaukee County, one in the City of Racine, and one in the City of Waukesha. Each station will continuously monitor the presence of particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, and ozone. In addition, several sites will be instrumented to measure methane and total hydrocarbons in the atmosphere. Meteorological instruments will eventually be located at all of the sites to provide important weather data. It is also proposed to outfit several mobile air monitoring laboratories to sample the ambient air in the vicinity of industrial concentrations, power plants, and major transportation terminals for particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, and ozone.

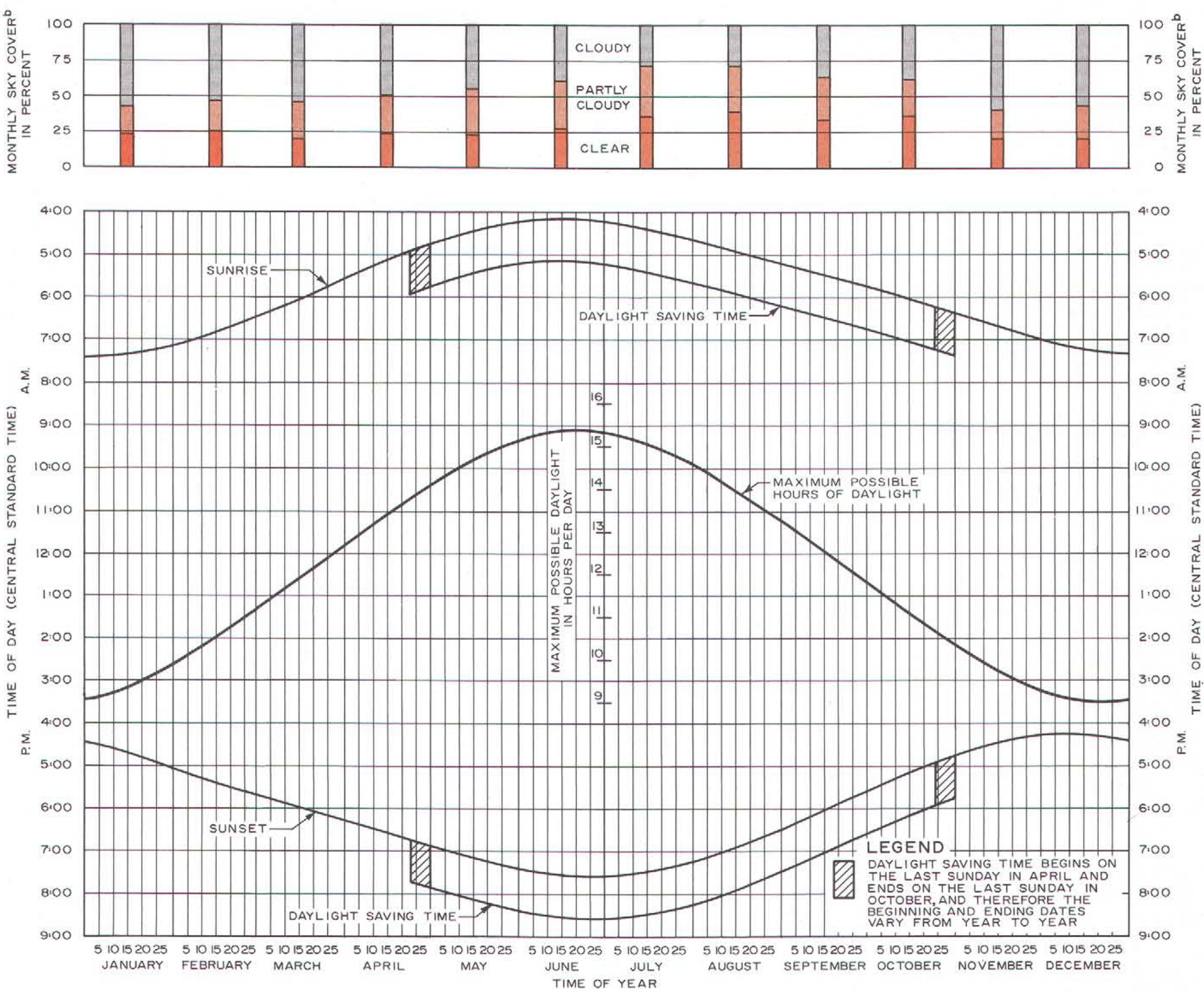
Although the ambient air quality monitoring programs conducted within the Region to date have provided a benchmark of valuable historical data, the data collection and reduction efforts must be considered minimal; have been uncoordinated on an areawide basis; and most importantly, were not designed within an analytical framework—as provided by a regional ambient air quality simulation model—validated by the most efficient use of existing data collection resources.

Under the Federal Clean Air Act, the U. S. Environmental Protection Agency (EPA) must promulgate minimum ambient air quality standards which must be met throughout the United States. To date the EPA has issued such standards for six pollutants: particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, photochemical oxidants (ozone), and hydrocarbons. These standards are summarized in Table 14. Two sets of standards are provided for each pollutant: a primary standard, specifying the pollutant level which should not be exceeded in order to protect human health; and a secondary standard, specifying the pollutant level which should not be exceeded in order to protect animal and plant life and property from damage, and thereby protect the public welfare from any known or anticipated adverse effects of an air pollutant.

As shown on Map 4, measured and estimated levels of particulate matter for 1973 within the Region exceed the primary standard (75 micrograms per cubic meter) and secondary standard (60 micrograms per cubic meter) on an annual average basis over very small areas of the Region. These areas include the central business district of Milwaukee, the Menomonee River Valley industrial area, and the adjacent intensely urbanized area of Milwaukee County; and the intensely urbanized and industrialized areas of eastern Racine and Kenosha Counties. On an annual average basis, levels of particulate matter

Figure 12

SUNRISE, SUNSET, AND SKY COVER AT MILWAUKEE[a]



[a]MILWAUKEE SKY COVER DATA ARE SIMILIAR TO THOSE OBSERVED AT MADISON AND AT GREEN BAY, WHICH SUGGESTS THAT THERE IS VERY LITTLE VARIATION IN THIS DATA FOR THE LARGE GEOGRAPHIC REGION, RELATIVE TO SOUTHEASTERN WISCONSIN, REPRESENTED BY THESE THREE NATIONAL WEATHER SERVICE STATIONS. THEREFORE, THE MILWAUKEE DAYLIGHT AND SKY COVER DATA MAY BE CONSIDERED APPLICABLE TO THE ENTIRE SEVEN-COUNTY REGION.

[b]SKY COVER CONSISTS OF CLOUDS OR OTHER OBSCURRING PHENOMENA AND IS EXPRESSED IN TENTHS. A DAY IS CLASSIFIED AS CLEAR IF THE SKY COVER DURING THE DAYLIGHT PERIOD IS 0-0.3, PARTLY CLOUDY IF THE SKY COVER IS 0.4-0.7, AND CLOUDY IF THE SKY COVER IS 0.8-1.0. MONTHLY SKY COVER INDICATES, BY MONTH, THE PERCENT OF THE DAYS THAT HAVE HISTORICALLY BEEN CLEAR, PARTLY CLOUDY, OR CLOUDY.

Source: Adapted by SEWRPC from National Weather Service and U. S. Naval Observatory data.

Table 14

NATIONAL AMBIENT AIR QUALITY STANDARDS
ISSUED APRIL 30, 1971 AND REVISED SEPTEMBER 14, 1973

Pollutant	Averaging Time	Primary Standards[a]	Secondary Standards[a]
Particulate matter (PM)	Annual (Geometric Mean) 24 hour	75 ug 260 ug[b]	60 ug[c] 150 ug[b]
Sulfur Oxides (SO_x) (measured as sulphur dioxide)	Annual (Arithmetic Mean) 24 hour 3 hour	80 ug (0.03 ppm) 365 ug (0.14 ppm)[b] --	 1300 ug (0.5 ppm)[b]
Carbon Monoxide (CO)	8 hour 1 hour	10 mg (9 ppm)[b] 40 mg (35 ppm)[b]	Same as Primary Same as Primary
Hydrocarbons (HC) (nonmethane measured as methane)	3 hour (6 to 9 a.m.)	160 ug (0.24 ppm)[b,d]	Same as Primary
Nitrogen Dioxide (NO_2)	Annual (Arithmetic Mean)	100 ug (0.05 ppm)	Same as Primary
Photochemical Oxidants (O_x) (measured as ozone)	1 hour	160 ug (0.08 ppm)[b]	Same as Primary

[a] *Concentration in weight per cubic meter (corrected to 25°C and 760 mm of Hg).*

[b] *Concentration not to be exceeded more than once per year.*

[c] *To be used as a guide in assessing implementation plans in achieving the 24-hour air quality standard.*

[d] *To be used as a guide in devising implementation plans to achieve oxidant standards.*

Source: 40 C.F.R. sec. 50.4 to 50.11.

as high as 242 micrograms per cubic meter have been recorded in the Milwaukee area, with maximum daily levels exceeding 700 micrograms per cubic meter. The primary pollutant origins of these excessive levels of particulate matter are industrial processes, power generation, and space heating.

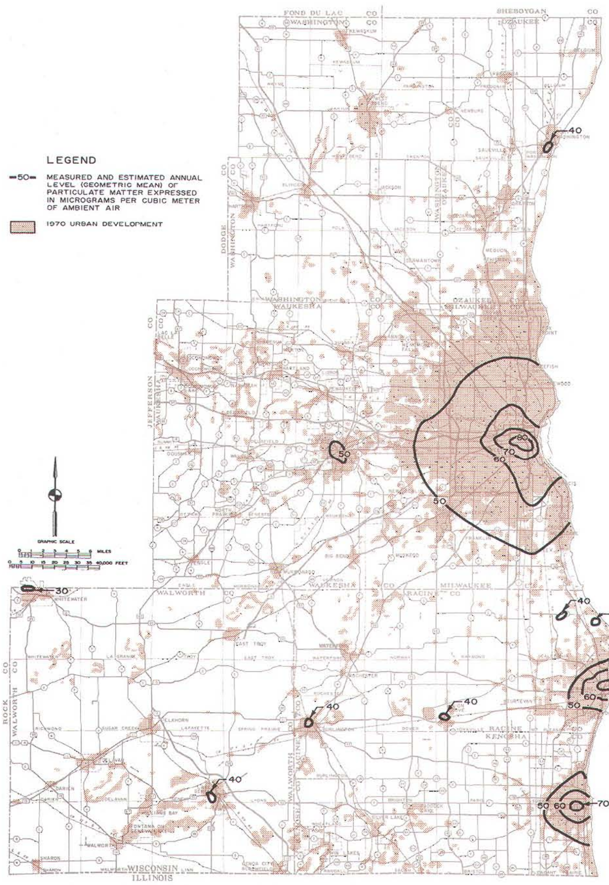
The adopted primary standard for sulfur dioxide specifies that the level of sulfur dioxide present in the atmosphere on the basis of the annual arithmetic mean shall not exceed 0.03 parts per million, or 80 micrograms per cubic meter, and on the basis of the second highest 24-hour average over a one-year period shall not exceed 0.14 parts per million, or 365 micrograms per cubic meter. As shown on Map 5, estimated levels of sulfur dioxide within the Region for 1970 approached the primary air quality standard on an average annual basis in the highly industrialized Menomonee River Valley of Milwaukee County. The primary sources of sulfur dioxide in the atmosphere are industrial processes, electric power generation, and space heating. Because of the currently limited facilities available to monitor ambient air quality within the Region, the currently available data and estimates derived from these data may not adequately represent the impact of the emissions from the major electric power generating plants located in Oak Creek in Milwaukee County and in Port Washington in Ozaukee County on the ambient air quality within the Region. Consequently, the established standards may be exceeded in other areas of the Region as well as in the Menomonee Valley area of Milwaukee County. The effects of unique meteorological conditions adjacent to the shoreline of Lake Michigan, within which the major electric power generation plants are located, may further aggravate the air pollution problem within the Region. On an annual average basis, maximum levels of sulfur dioxide approaching 0.04 parts per million have been recorded within the Region in and immediately adjacent to the highly industrialized Menomonee River Valley area of Milwaukee County. The highest value reported by the Wisconsin Department of Natural Resources as of July 1, 1974, of sulfur dioxide measured during 1973 in the Southeastern Wisconsin Region was an annual arithmetic mean value of 0.02 ppm.

With respect to carbon monoxide, the adopted primary and secondary national air quality standards specify that the second highest level of carbon monoxide over a one-year period shall not exceed nine parts per million (10 micrograms per cubic meter) over an eight-hour period, and 35 parts per million (40 micrograms per cubic meter) over a one-hour period. Only very limited ambient air quality monitoring data are available in the Region so as to permit a comparison of the carbon monoxide in the ambient air with the specified standards. A review of these limited data reveal that during a single eight-hour period in 1973 maximum levels of carbon monoxide in excess of 10 parts per million (11 micrograms per cubic meter) were measured in Milwaukee County, indicating a likelihood that the specified carbon monoxide standards may be exceeded within this portion of the Region. The primary sources of carbon monoxide are gasoline powered motor vehicles. It is estimated that in the Milwaukee area such vehicles account for over 90 percent of the carbon monoxide emissions.

The adopted primary and secondary standards for nitrogen dioxide specify that the level of nitrogen dioxide in the atmosphere shall not exceed 0.05 parts per million. On an annual average basis, maximum levels of this pollutant in excess of 0.05 parts per million have been measured in the central business district of Milwaukee. The primary sources of nitrogen dioxide are gasoline powered motor vehicles and industrial processes. Because

Map 4

ACTUAL MEASURED AND ESTIMATED GROUND-LEVEL CONCENTRATION OF SUSPENDED PARTICULATES IN THE REGION 1973

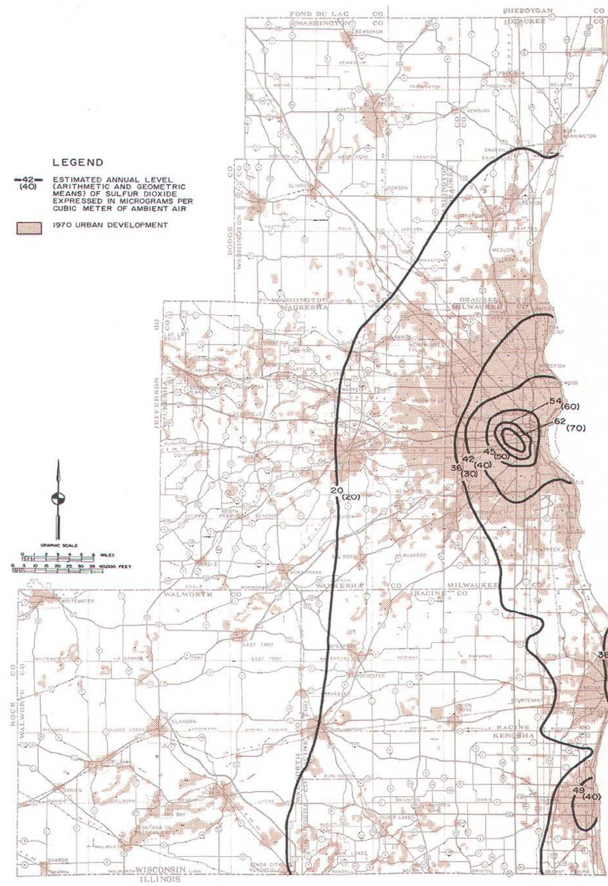


This recent map of particulate isopleths for the Region illustrates the correlation between the greatest concentrations of that pollutant and the highly industrialized areas of urban development within the Region. Actual and estimated levels of particulate matter exceed the primary ambient air quality standard (annual average (geometric mean) level of 75 micrograms per cubic meter) and the secondary ambient air quality standard (annual average (geometric mean) level of 60 micrograms per cubic meter) over the intensely developed portions of Kenosha, Milwaukee, and Racine Counties.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map 5

ESTIMATED GROUND-LEVEL CONCENTRATION OF SULFUR DIOXIDE IN THE REGION: 1970



The adopted primary air quality standard specifies that the annual average level of sulfur dioxide in the atmosphere, calculated on the basis of the arithmetic mean, shall not exceed 80 micrograms per cubic meter. As shown on the above map, the estimated levels of sulfur dioxide within the Region in 1970 approached the primary air quality standard on an average annual basis only in the highly industrialized Menomonee River Valley of Milwaukee County. Because of the limited facilities available to monitor ambient air quality, however, the data presented above may not adequately represent the impact of the emissions from the major electric power generating plants on ambient air quality within the Region.

Source: Wisconsin Department of Natural Resources and SEWRPC.

measured nitrogen dioxide concentrations within the Region exceed the established air quality standard by a small measure, and because a reduction in automotive emissions can be expected as federally established emission controls are met, pollution from nitrogen dioxide is not expected to become a serious problem within the Region.

The adopted primary and secondary standards for photochemical oxidants specify that the level of ozone in the atmosphere shall not exceed an average of 0.08 parts per million over a one-hour period. Average hourly levels of ozone as high as 0.19 parts per million have been measured in Milwaukee County. Yearly averages, as applied to other pollutants, are not good measures of ambient air quality with respect to oxidant pollution, because ozone concentrations will necessarily be at or near zero for most of the year, since weather conditions in the Region are usually not favorable to photochemical reactions. Photochemical oxidants result from a complex series of atmospheric reactions initiated by sunlight. When reactive organic substances and oxides of nitrogen accumulate in the atmosphere and are exposed to the ultraviolet components of sunlight, the formation of new compounds, including ozone and peroxyacyl nitrates, takes place. A primary source of reactive organic substances and oxides of nitrogen are gasoline powered motor vehicles, which emit unburned hydrocarbons, which in turn form ozone. Another major source of substances instrumental in the formulation of ozone are storage areas for motor fuels and certain commercial or industrial processes, including certain cleaning establishments.

Weather conditions are an important determining factor of the effect of pollutant emissions on air quality. The diffusive power of the atmosphere depends upon wind speed, surface conditions, and thermal stability. The topography of the Region is relatively uniform, with only a relatively small variation in elevation, and prevailing westerly winds generally provide effective dispersion of pollutants within the Region. During late spring and summer (April through June), however, the average temperature of the land rises above that of Lake Michigan, and the lake may influence weather and air quality conditions in a narrow band, approximately up to 15 miles wide, along the shoreline.

Meteorological conditions conducive to high air pollution levels are generally the result of two weather phenomena: 1) stationary high pressure weather systems (stagnating anticyclones), and 2) temperature inversions. Anticyclonic conditions generally extend over large areas of the earth's surface—areas much larger than the Region—and are readily apparent from a comparison of surface weather observations, especially observations of wind and barometric pressure. A stagnating anticyclone may remain over a region for periods of up to several days, and the accompanying stable, sunny, windless weather conditions permit air pollutants to accumulate to relatively high levels. The National Weather Service routinely issues air stagnation "advisories" when a large-scale, stagnant weather situation is forecast to occur, and the Wisconsin Department of Natural Resources may issue an alert, warning, or emergency warning pertaining to the potential pollution episode.

Temperature inversions occur when a "*ceiling*" of relatively warm air lies above a colder surface layer, trapping pollutants below this ceiling. The presence of an inversion can also result in a relatively stable atmospheric condition as well as limit the height within which pollutants can be mixed or dispersed. Inversion conditions may accompany stagnating, anticyclonic conditions, thereby further increasing the potential for a serious air pollution problem. Inversions can be detected by observations of atmospheric parameters, particularly of the vertical temperature gradient.

The effects of a third weather phenomenon occurring locally, the lake breeze, may accompany and aggravate the air pollution potential of either of the two aforementioned meteorological conditions. The lake breeze phenomenon occurs within the Region when westerly winds are light and the land mass has a higher temperature than that of the lake. The lake breeze influence will extend to the inversion level, which may approximate 2,500 feet, and above which a return flow of air toward the lake may occur. The onset of the lake breeze is usually after 8:00 a.m., and the breeze most often abates at sunset. Air pollutants may be trapped below the inversion layer and recirculated over the lake and the land until relatively high concentrations accumulate. These concentrations may be many times higher than the normal concentrations within the Region even though the pollutant emission rates in the area remain constant.

Information concerning meteorological conditions in the Region relative to air pollution dispersion is even sparser than information concerning ambient air quality and air pollution emission sources. The only first order National Weather Service Observation Station providing detailed meteorological data on a continuously recorded basis is maintained within the seven-county Southeastern Wisconsin Region at General Mitchell Field in Milwaukee County. Data with respect to upper air conditions are provided only by observations made at Green Bay, Wisconsin; Peoria, Illinois; and St. Cloud, Minnesota, and must be interpolated from these locations for use in the Region.

Although the present level of air pollution within the Region generally may not be as serious as it is in certain other regions of the United States, evidence exists that the national ambient air quality standards established by the U. S. Environmental Protection Agency for particulate matter, sulfur dioxide, and photochemical oxidants are presently being exceeded or have the potential for being exceeded during the next decade in certain areas of the Region. The regional air pollution problem is extremely complex, and for effective evaluation requires further comprehensive analysis of point, area, and line source emissions and meteorological phenomena. Studies and actions intended to fill many of the voids previously identified are currently underway by the Commission, acting in cooperation with the Wisconsin Departments of

Transportation and Natural Resources and the U. S. Environmental Protection Agency. Because of the limited data on ambient air quality and meteorological conditions in the Region, it is not possible to comprehensively evaluate the impact of airport systems upon regional air quality. However, a qualitative ranking of alternative plans was undertaken and the emissions of pollutants at the regional air-carrier airport were quantified.

Soils Capabilities

Soil forming factors, particularly topography and the nature of the parent glacial materials, exhibit wide spatial variations in southeastern Wisconsin, and therefore hundreds of different soil types exist within the Region which together form a very complex soil pattern. In order to assess the significance of these unusually diverse soil types and the resulting complex soil pattern to sound regional development, the Commission in 1963 negotiated a cooperative agreement with the U. S. Soil Conservation Service under which detailed operational soil surveys were completed for the entire Planning Region. The results of the soil surveys have been published in SEWRPC Planning Report, No. 8, Soils of Southeastern Wisconsin. The regional soil survey has not only resulted in the mapping of the soils within the Region in great detail and in the provision of data on the physical, chemical, and biological properties of the soils, but has also provided interpretations of the soil properties for planning, engineering, agricultural, and resource conservation purposes.

Soil suitability interpretations for certain types of development are particularly important to airport system planning. While knowledge of specific soil types and suitability for airport development is important and should be considered in evaluation of alternative site location and development, these soil suitability interpretations take on significant added meaning when related to the kinds and types of urban development that are generated in proximity to airports. Thus, detailed soil surveys and attendant interpretations are required not only to evaluate alternative airport site location and development proposals, but also to evaluate the costs and desirability of attendant potential urban development. There exist within the Region areas where the soils are generally well suited for both airport and urban development: soils having good drainage and foundation characteristics. Other parts of the Region have adverse soil conditions for airport development that can be overcome in the design and construction of airport facilities but that present substantial obstacles to the development of other urban land uses related to airport facilities.

Thus, the widespread occurrence of soils having questionable characteristics for not only specific airport facility development, but more importantly for the development of related urban land uses, coupled with highly complex soil relationships, indicates the need for considering soil relationships in the preparation and evaluation of airport plans. The information available will provide both broad airport site location guidelines and related land use plan design guidelines.

Further, soils are an important factor in the determination and delineation of the prime agricultural lands within the Region shown on Map 6. The Region's existing airports and elevations of selected locations within the Region are also shown on Map 6. If these agricultural lands are to be maintained for economic, environmental, and aesthetic reasons, careful attention will have to be given to the mutual adjustment of airport and related land use development and agricultural land preservation.

Other Natural Resource Base Elements

Certain other elements of the natural resource base are also significant to regional airport system planning and development. These elements are reviewed in the following paragraphs.

Physiography and Surface Water Resources: The 2,689 square mile Southeastern Wisconsin Region was once subjected to the influence of several stages of continental glaciation, the last of which, the Wisconsin stage, terminated about 11,000 years ago and largely determined the physiographic and topographic features of the entire Region. That glaciation provided southeastern Wisconsin with an interesting, varied, and attractive landscape exemplified by the Kettle Moraine area, a landscape which is still very much in evidence because of the predominantly rural, as opposed to urban, character of much of the existing land use pattern. Protection of the aesthetic quality, as well as the educational and recreational value, of the Region's glacial landscape is largely dependent on future public policy with regard to the development of urban land uses, including airport and airport related land uses.

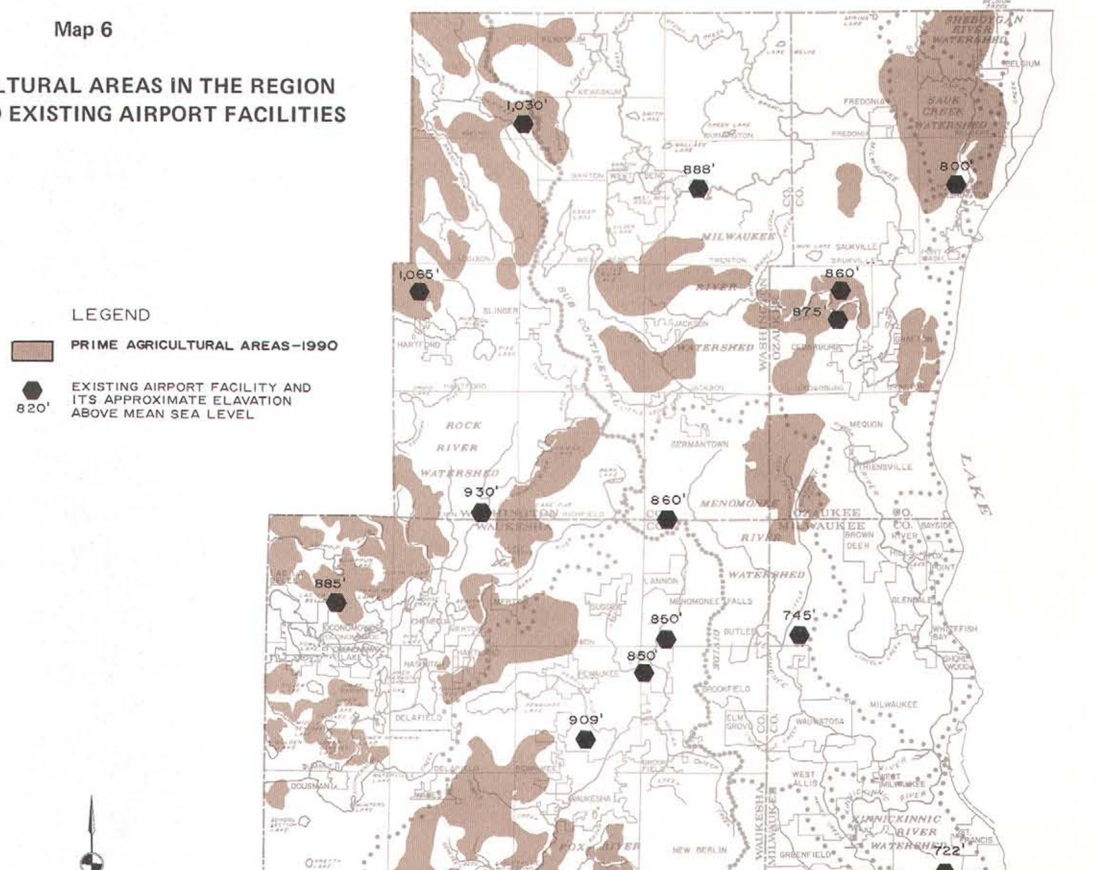
Regional surface drainage is characterized by a disordered dendritic pattern, primarily because of the heterogeneous nature of the glacial drift. There is a preponderance of ponds and lakes, and much of the Region is covered by wetlands, with many streams being mere threads of water through those wetlands. A major subcontinental divide which bisects the Planning Region such that 1,685 square miles, or 63 percent of the Region, drains toward the Mississippi River, while 1,004 square miles, or 37 percent of the Region, drains to the Great Lakes-St. Lawrence River drainage basin, determines the gross surface water drainage pattern.

Since the Commission has emphasized in-watershed solutions to water quality and flood control problems, in its water resource planning activities, the surface drainage pattern and location of watershed boundaries are important considerations in regional airport system planning. These watersheds are delineated on Map 7, which also shows the major lakes and streams within the Region and the Region's existing airports. Increased storm water runoff from airport and attendant urban development and water pollutants from airport operations must be considered in the development of a regional airport system plan.

Lakes, streams, and their associated undeveloped shorelands and floodlands probably constitute the singularly most important natural resource element of the Region.

Map 6

PRIME AGRICULTURAL AREAS IN THE REGION IN RELATION TO EXISTING AIRPORT FACILITIES

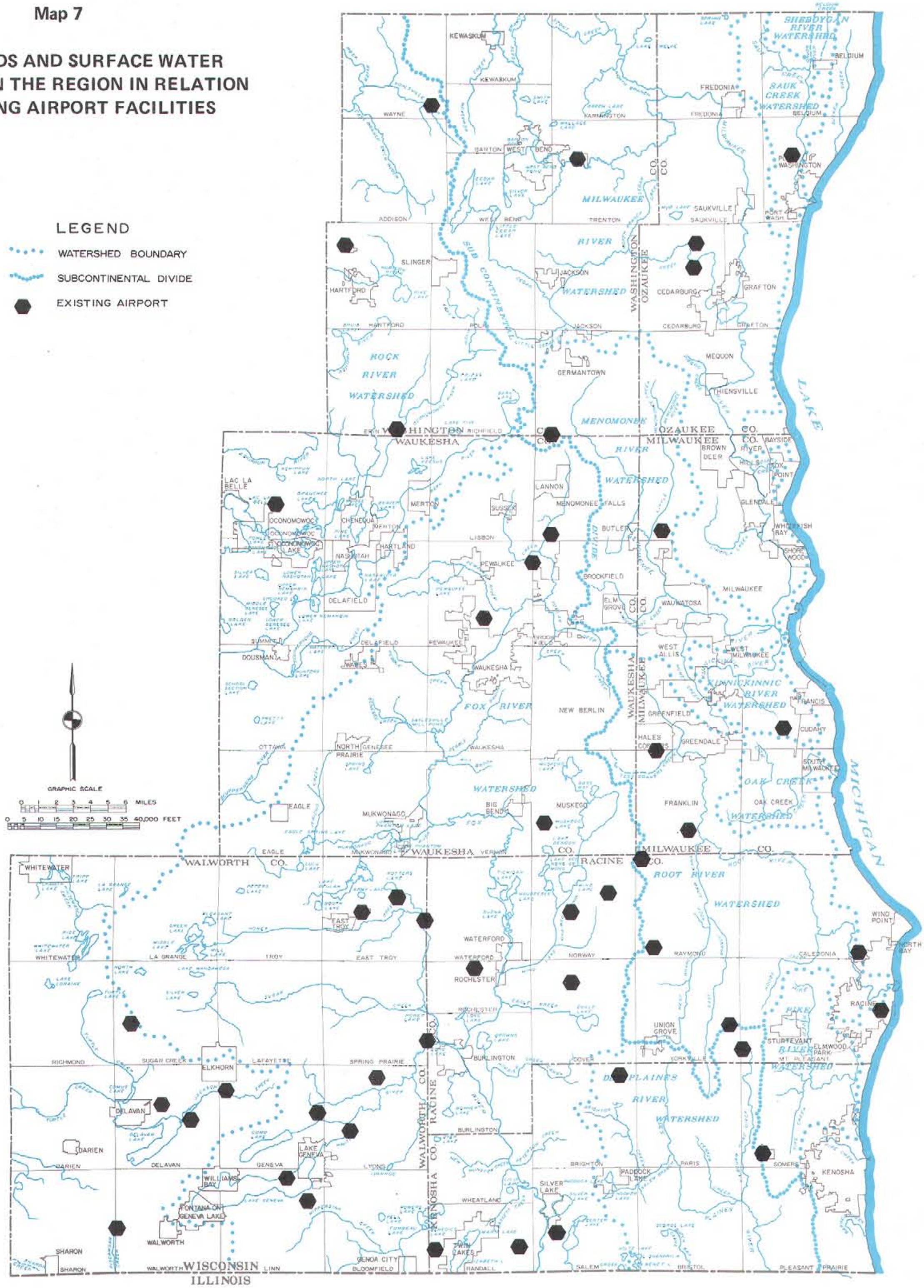


About 731 square miles, or nearly 27 percent of the area of the Region, have been identified in regional planning analyses as prime agricultural lands. The preservation of these lands in agricultural use will contribute significantly to the maintenance of a healthy ecological balance within the Region; provide for the production of certain food commodities within close proximity to the urban centers of the Region; provide open space to give form and structure to urban development; and contribute to the charm and beauty of the Region. To the extent practicable, airports should be planned so as to discourage urban development in these prime agricultural areas.

Source: SEWRPC.

Map 7

WATERSHEDS AND SURFACE WATER RESOURCES IN THE REGION IN RELATION TO EXISTING AIRPORT FACILITIES



A subcontinental divide traverses the Southeastern Wisconsin Region. That part of the Region lying east of this divide is tributary to the Great Lakes-St. Lawrence River drainage system, while that part of the Region lying west of this divide is tributary to the Mississippi River drainage system. The generally dendritic surface water drainage pattern of the Region, which is the result of the glacial land forms and features, divides the Region into 11 individual watersheds, three of which—the Des Plaines, Fox, and Rock River watersheds—lie west of the subcontinental divide. In addition to the 11 watersheds, there are numerous small catchment areas along the Lake Michigan shoreline that drain directly to the lake, which areas together may be considered to comprise a twelfth watershed.

Source: SEWRPC.

This is true because of the multifaceted functions which surface water resources must perform, including the support of numerous popular water-oriented recreation activities; provision of habitat for fish and wildlife; desirable sites for vacation homes and permanent residential developments; provision of water for domestic, municipal, and industrial use; waste assimilation; and storm water reception. The Region contains 1,148 lineal miles of major streams and 100 major lakes, the latter having a total surface area of 57 square miles, or about 2 percent of the area of the Region.

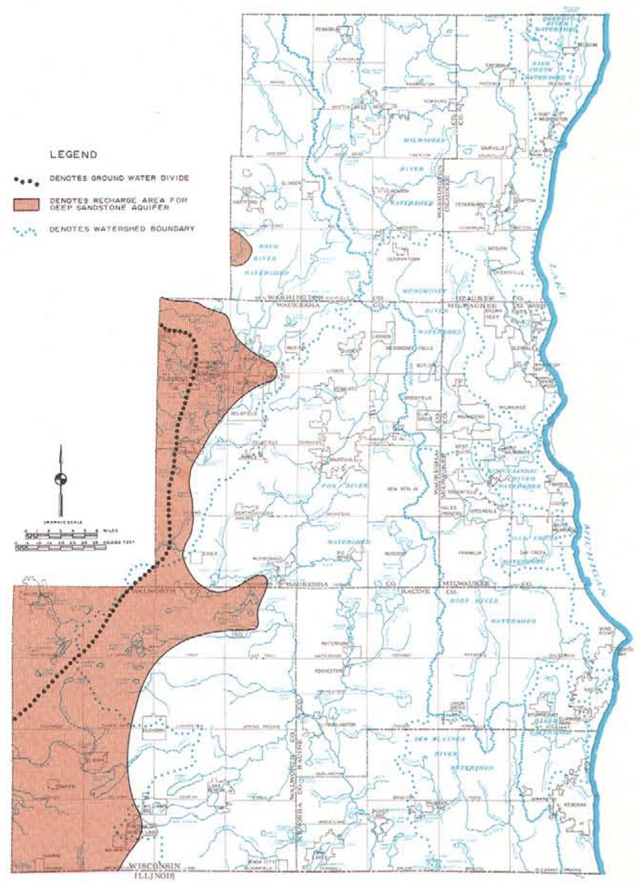
These surface water resources are vulnerable to man's activities in that their quality can easily degenerate as a result of excessive nutrient and organic waste loadup from malfunctioning or improperly placed private onsite sewage disposal systems, combined sewer and separate sanitary sewer overflows, inadequate waste treatment facilities, careless agricultural practices, and careless urban development practices.

At least 7 percent, or 188 square miles, of southeastern Wisconsin is estimated to lie within the inundation limits of a 100-year recurrence interval flood event. The 100-year recurrence interval floodplain has been delineated by the Commission for 558 lineal miles of major stream channel in the Root, Fox, Milwaukee, and Des Plaines River watersheds within the seven-county Region. This floodplain delineation serves to identify those areas of the Region poorly suited for urban and airport development because of flood hazards, high water tables, unsuitable soils, and high cost of public utility and related services, while at the same time identifying areas well suited for much needed outdoor recreation and open space uses. Regional land use policies in general, and airport system planning and development policies in particular, should direct airport and associated urban development to more suitable areas outside of the floodplains, thereby reserving the floodplains for open space uses consistent with the underlying flood water storage and conveyance functions of the floodplains.

Groundwater Resources: Groundwater is the principal source of water supply for much agricultural, residential, commercial, and industrial development in southeastern Wisconsin. Groundwater also sustains lake levels and provides the base flow of streams within the Region. The groundwater reservoir underlying the Region, which attains a combined thickness in excess of 1,500 feet in the easterly portions of the Region, may be subdivided into three distinct aquifers. In order, from land surface downward, these are: 1) the sand and gravel deposits of the glacial drift; 2) the interconnected shallow dolomite strata of the underlying bedrock; and 3) the deeper Cambrian and Ordovician Period strata composed of sandstone, dolomite, siltstone, and shale. Although regional groundwater is very hard, its quality is generally good, and therefore the invaluable groundwater reservoir and its recharge areas, and particularly the deep aquifer and its recharge area located in the Kettle Moraine area of the westerly portion of the Region, as shown on Map 8, must be protected. Such protection must extend to maintaining both the amount and the quality of the surface water runoff available for aquifer recharge.

Map 8

GROUNDWATER RECHARGE AREAS IN THE REGION



The declining water level of the deep sandstone aquifer provides a warning of the need for a sound groundwater resource management program. Careful attention must be paid to guard against contamination of this aquifer. The location of airports and attendant urban development must take into account their impact upon this major water supply resource.

Source: U. S. Geological Survey and SEWRPC.

Geology: The glacial drift of southeastern Wisconsin is underlain by bedrock formations of the Cambrian through Devonian Periods that dip gently down toward the east at a slope of about 20 feet per mile, and attain a thickness in excess of 1,500 feet beneath the eastern boundary of the Region. The bedrock of the seven-county Planning Region is, for the most part, covered by unconsolidated glacial deposits that are over 500 feet thick in some buried preglacial valleys. In contrast, there are approximately 150 square miles of southeastern Wisconsin, generally east of and parallel to the Kettle Moraine area, where bedrock lies within 20 feet of the ground surface, and a few localized areas where bedrock is actually exposed.

Sand and gravel, dolomite building stone known locally as lannon stone or limestone, and organic material are the three primary mineral and organic resources of southeastern Wisconsin that have commercial value as a result of their quantity, quality, and location. As a result of its glacial history, the Region has an abundant supply of sand and gravel deposits, the most productive of which are concentrated in the Kettle Moraine area and are important sources of concrete aggregate and of gravel for general construction purposes. Depending on the nature of the deposits, particularly their depth and areal extent and the size of the gravel and rocks, sand and gravel deposits may seriously hamper trenching, excavation, and tunneling work. Niagra dolomite is mined in open quarries, most of which are located in Waukesha County, and supplies high quality dimensional building stone and, when crushed, concrete aggregate and gravel for construction purposes. The presence of a quarrying operation in an area indicates relatively thin glacial deposits and proximity of bedrock to the ground surface and is, therefore, an important consideration in the planning and construction of airport facilities.

Organic deposits are widely distributed throughout the Region in small, scattered, low-lying, poorly drained areas, and form the basis for certain wetland wildlife habitat areas. Wetlands of all kinds, comprising 132,778 acres, or approximately 8 percent of the total land area of the Region in 1970, serve to attenuate peak flows, protect stream water quality by acting as sediment and nutrient traps, provide wildlife habitat, and have scenic and educational value. The wetlands within the Region are shown on Map 9. Some of these organic deposits also have potential commercial value in their ability to support certain specialized agricultural activities, including sod farming and peat mining. Organic deposits also identify areas having severe limitations for urban development of any kind, but particularly urban development with onsite sewage disposal facilities. These areas further complicate the construction of airport systems because of the poor engineering properties of organic soils and because of the difficulty of operating heavy equipment on, and of work with, organic deposits.

Vegetation: Historically, vegetational patterns in southeastern Wisconsin were determined by natural factors such as climate, glacial deposits, soil type, fire, topography, and drainage characteristics; but man, since his settlement of the Region, has increasingly influenced the quantity and quality of woodlands, wetlands, and aquatic vegetation. Woodlands, shown on Map 10, comprised approximately 8 percent of the total regional land area in 1963. In 1970, woodlands comprised approximately 7 percent of the total regional land area. These woodlands have, in addition to commercial value, significant ecological and scenic values, particularly when viewed in conjunction with the beauty of the Region's lakes, streams, and glacial land forms.

Environmental Corridors: One of the most important tasks completed by the Commission to date has been the identification and delineation of those areas of the Region in which concentrations of natural, scenic, recreational, and historic resources occur and which, therefore, should be preserved and protected in essentially natural open uses. Such areas normally include one or more of the following seven elements of the natural resource base which are essential to the maintenance of both the ecological balance and natural beauty of the Region:

1. Lakes, rivers, and streams and their associated undeveloped shorelands and floodlands.

2. Wetlands.

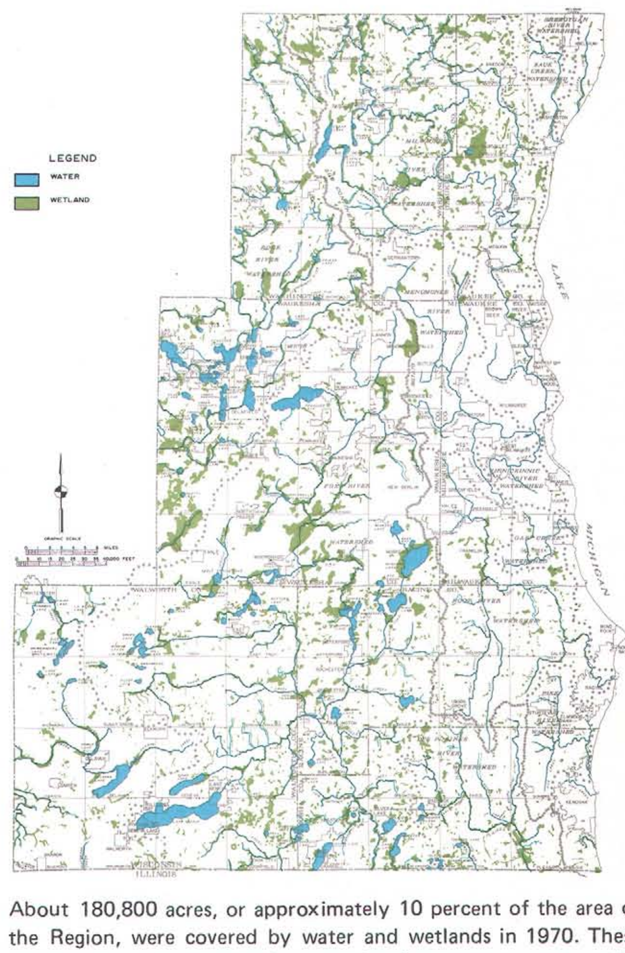
3. Woodlands.

4. Wildlife habitat areas.

5. Rugged terrain and high-relief topography.

Map 9

WETLAND AND WATER AREAS IN THE REGION: 1970



About 180,800 acres, or approximately 10 percent of the area of the Region, were covered by water and wetlands in 1970. These wetlands constitute a valuable recreational resource; support a wide variety of desirable forms of plant and animal life; and assist in reducing storm water runoff, stabilizing streamflows, and enhancing stream water quality by functioning as nutrient and sediment traps.

Source: Wisconsin Department of Natural Resources and SEWRPC.

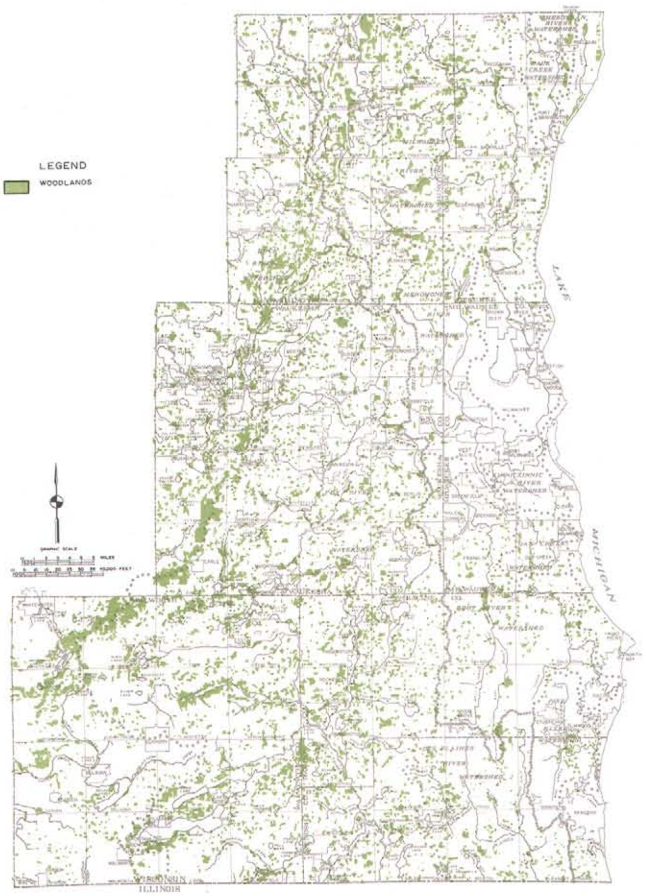
6. Significant geological formations and physiographic features.

7. Wet or poorly drained soils.

Although the foregoing elements comprise the integral parts of the natural resource base, there are four additional elements which, although not a part of the natural resource base per se, are closely related to or centered on that base and are a determining factor in identifying and delineating areas with scenic, recreational, and historic value. These additional elements are:

Map 10

WOODLANDS IN THE REGION: 1970



As of 1970, woodlands in the Region covered a total combined area of about 125,300 acres, or approximately 7 percent of the total southeastern Wisconsin area. These woodlands assist in maintaining a unique natural relationship between plants and animals; reduce storm water runoff; contribute to atmospheric oxygen and water supply; aid in reducing soil erosion and stream sedimentation; provide the resource base for the forest product industries; and provide valuable recreational opportunities, as well as a desirable aesthetic setting for attractive rural and planned urban development. Woodlands within the Region are presently being lost at the rate of approximately 730 acres per year.

Source: Wisconsin Department of Natural Resources and SEWRPC.

1. Existing outdoor recreational sites.

2. Potential outdoor recreation and related open space sites.

3. Historic sites and structures.

4. Significant scenic areas.

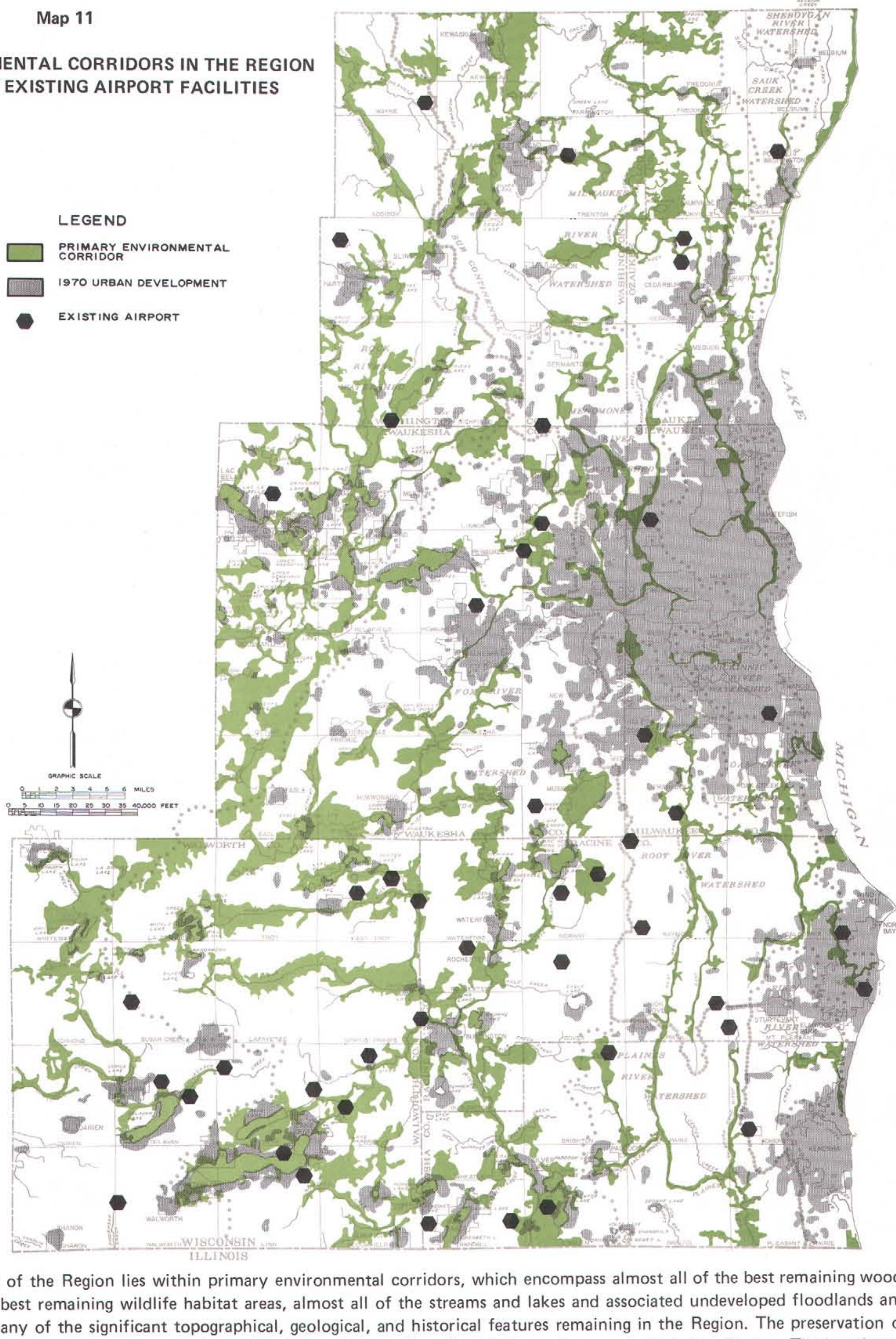
The delineation of these natural resource and natural resource-related elements produces an essentially lineal pattern encompassed in narrow, elongated areas which have been termed "environmental corridors" by the Southeastern Wisconsin Regional Planning Commission. These corridors and existing airport locations are shown on Map 11.

Although primary environmental corridors occupy only about 534 square miles, or about 20 percent of the Region, they contain almost all of the remaining high-value wildlife habitat areas; about one-half of all the remaining woodlands; about two-thirds of all the remaining wetlands; and about 85 percent of the remaining undeveloped lake and stream shorelines and associated floodlands within southeastern Wisconsin, as well as many significant physiographic features and historic sites. The primary environmental corridors are thus a composite of the best of the individual elements comprising the natural resource base of southeastern Wisconsin. The preservation of these primary environmental corridors in essentially natural open uses, including park and parkway and limited agricultural and country estate type uses, is essential to maintaining a high level of environmental quality in the Region and to the protection of its natural beauty; and, as such, is one of the principal objectives of the adopted regional land use plan upon which the regional airport system plan is based.

Recent trends within southeastern Wisconsin have resulted in the encroachment of urban development into the primary environmental corridors. Unfortunately, unplanned or poorly planned intrusions of urban development into these corridors not only tends to destroy the very resources and related amenities sought by development, but tends to create severe environmental problems having areawide effect. Airport system planning, involving as it does not only airport and airport facility development but also attendant urban development generated by the presence of airports, should take into account the presence and delineation of the environmental corridors so as to preserve and protect them from further degradation. With proper planning it should be possible to retain the environmental corridors in various open space areas related to airport development, or as buffer areas between the airport and other kinds of urban development. The potential impact upon the environmental corridors of water, air, and noise pollution associated with airport and related urban development must, however, be carefully evaluated in any airport site location or expansion proposals to ensure the preservation of the corridors in their natural state so that they can continue to contribute to the overall quality of the environment in the Region.

Map 11

PRIMARY ENVIRONMENTAL CORRIDORS IN THE REGION IN RELATION TO EXISTING AIRPORT FACILITIES



Approximately one-fifth of the Region lies within primary environmental corridors, which encompass almost all of the best remaining woodlands and wetlands, the best remaining wildlife habitat areas, almost all of the streams and lakes and associated undeveloped floodlands and shorelands, as well as many of the significant topographical, geological, and historical features remaining in the Region. The preservation of these corridors in compatible open uses is essential to maintaining the overall quality of the environment within the Region. The location of existing airports is shown relative to these corridors. New and expanded airports should be planned to be compatible with these environmental corridors and to discourage urban development in the primary environmental corridors.

Source: SEWRPC.

SOCIOECONOMIC BASE

Although a brief description of the Region's population growth and related urbanization was presented in Chapter I of this report as one of the factors contributing to the need for a regional airport system plan, additional details are offered in the sections that follow on the several socioeconomic bases of the Region: the demographic, economic, land use, public utility, and transportation bases.

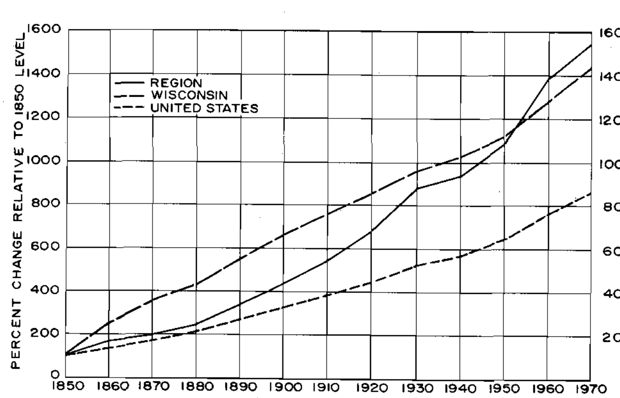
Demographic Base

Population Size: The population of the Region, which in 1970 totaled 1,756,100 persons, grew at the rate of about 18,000 persons per year from 1960 to 1970, a rate considerably lower than the approximately 33,000 persons per year growth rate experienced from 1950 to 1960. While the population of the Region increased by 182,000 persons from 1960 to 1970, the population of the central City of Milwaukee—the 12th largest city in the nation—followed national trends and actually decreased by more than 24,000 persons. Certain adjacent first-ring suburbs also showed population decreases, while large increases in population occurred in the newer outlying suburban areas, particularly in the rural-urban fringe areas. Population growth within the Region over the past century has generally occurred at a higher rate than for the state and nation (see Figure 13 and Table 15). Consequently, the regional share of the total national population increased from 0.49 percent in 1850 to 0.86 percent in 1970, while the regional share of the state population increased from about 37 percent in 1850 to nearly 40 percent in 1970.

Population Distribution: The Southeastern Wisconsin Region, like most metropolitan regions in the United States, is becoming increasingly urban. In 1850 the population of the Region was approximately 75 percent rural and 25 percent urban; by 1900 this relationship had nearly reversed to 30 percent rural and 70 percent urban; and by 1970 only 12 percent of the regional population was rural while 88 percent was urban. Moreover, of the 12 percent classified as rural, 10 percent was classified as rural nonfarm and only 2 percent as rural farm. The entire 120-year rural-urban population change is shown graphically in Figure 14. This trend to urbanization is one of the most significant distributional changes taking place within the Region, the state, and the nation today.

Figure 13

RELATIVE POPULATION GROWTH IN THE REGION, WISCONSIN, AND THE UNITED STATES: 1850-1970



Source: U. S. Bureau of the Census and SEWRPC.

Table 15

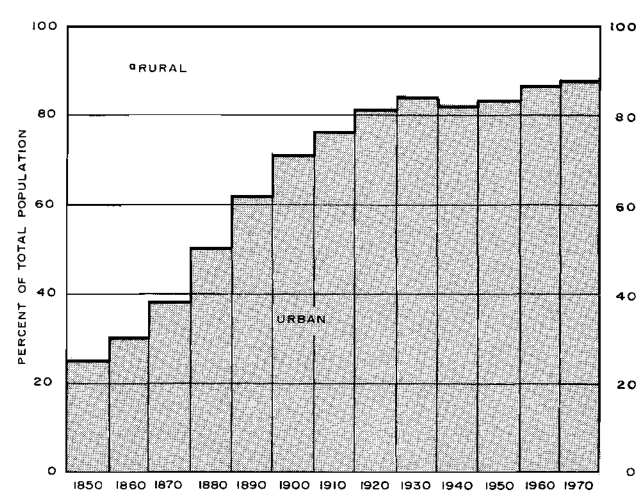
POPULATION TRENDS IN THE REGION, WISCONSIN, AND THE UNITED STATES SELECTED YEARS 1850-1970

Year	Population			Region Population as a Percent of	
	Region	Wisconsin	United States	United States	Wisconsin
1850	113,389	305,391	23,196,876	0.49	37.1
1860	190,409	775,881	31,443,321	0.61	24.5
1870	223,546	1,054,670	38,558,371	0.58	21.2
1880	277,119	1,315,497	50,155,783	0.55	21.0
1890	386,774	1,693,330	62,947,714	0.61	22.8
1900	501,808	2,069,042	75,994,575	0.66	24.2
1910	631,161	2,333,860	91,972,266	0.69	27.0
1920	783,681	2,632,067	105,710,620	0.74	29.7
1930	1,006,118	2,939,006	122,775,046	0.82	34.2
1940	1,067,699	3,137,587	131,669,270	0.81	34.0
1950	1,240,618	3,434,575	151,325,798	0.82	36.1
1960	1,573,620	3,952,771	179,323,175	0.88	39.8
1970	1,756,086	4,417,933	203,184,772	0.86	39.7

Source: U. S. Bureau of the Census.

Figure 14

DISTRIBUTION OF URBAN AND RURAL POPULATION IN THE REGION: 1850-1970



Source: U. S. Bureau of the Census and SEWRPC.

Population growth has not been uniform throughout the seven counties comprising the Region. During the 30-year period from 1900 to 1930, the highest rates of population increase occurred in urban Milwaukee, Racine, and Kenosha Counties. Urban decentralization over the last four decades, however, has reversed this trend, and the highest rates of population increase are presently occurring in certain outlying counties of the Region, notably Waukesha and Ozaukee Counties.

These varying rates of change in population growth have resulted in significant distributional shifts of population among the seven counties. As shown in Table 16, the most dramatic distributional changes over the 70-year period have occurred in Milwaukee and Waukesha Counties. The Milwaukee County proportion of the total regional population increased by about 6 percent from 1900 to 1930 and then decreased by more than 12 percent from 1930 to 1970. The proportion of the total regional population in Waukesha County decreased by about 2 percent from 1900 to 1930 and then increased by about 8 percent from 1930 to 1970. The result of the most recent changes in population distribution within the Region has been an areawide spread of population and urban development around the Milwaukee, Racine, and Kenosha urbanized areas. This diffusion of population and urban development has created many areawide developmental and environmental problems, including problems relating to changing land use and travel patterns. These changes in distribution are important considerations in the development of regional airport system plans which are, in part, designed to meet the needs of the existing and probable future resident population effectively while at the same time not adversely affecting the population being served.

Population Characteristics: The geographic distribution of the population by age throughout the Region is shown on Map 12. This map shows a concentration of children and younger people in suburban areas adjacent to the large central cities and of older people in many areas of the Cities of Milwaukee, Racine, and Kenosha. There is also a notable concentration of older persons in southern Ozaukee County, western Waukesha County, and southern Walworth County.

An important characteristic of the regional population is the number and size of the households in the Region. The number of households in the Region has been increasing at a higher rate than the total population since 1950 (see Table 17), and as a result the household size has been declining. The smaller average household sizes occur in the central cities and smaller outlying cities and villages. The larger average household sizes occur in two areas near the central business district of the City of Milwaukee, in suburban areas throughout the Region, and in rural farm areas.

Personal income in the Region has been increasing at a rapid rate, and in 1969 total personal income, measured in constant 1967 dollars, stood at 5.2 billion dollars (see Table 18). From 1949 to 1969, total personal income in the Region increased by nearly 2.9 billion dollars, or about 126 percent. This compares to a regional population increase over the same period of approximately 42 percent. Because the total amount of personal income in the Region has been increasing at a higher rate than the total population since 1949, per capita and per household incomes have increased markedly. Per capita incomes, again measured in constant 1967 dollars, increased over $1,100 from 1949 to 1969, from $1,858 to $2,954. Median per household incomes increased by more than $2,800 in the same period, from $5,743 to $8,563. The per household income increase reflects not only an increase in the earnings of the head of each household, but also the tendency for other household members, wives in particular, to supplement household incomes. The distribution of personal income on a per household basis throughout the Region is shown on Map 13. It is evident that the areas of highest average household income are presently located in northeastern and western Milwaukee County and in eastern Waukesha

Table 16

POPULATION DISTRIBUTION IN THE REGION BY COUNTY
1900, 1930, 1960, and 1970

County	1900		1930		1960		1970	
	Population	Percent of Region	Population	Percent of Region	Population	Percent of Region	Population	Percent of Region
Kenosha	21,707	4.3	63,277	6.3	100,615	6.4	117,917	6.7
Milwaukee . . .	330,017	65.8	725,263	72.1	1,036,047	65.8	1,054,249	60.0
Ozaukee	16,363	3.3	17,394	1.7	38,441	2.5	54,461	3.1
Racine	45,644	9.1	90,217	9.0	140,781	9.0	170,838	9.7
Walworth . . .	29,259	5.8	31,058	3.1	52,368	3.3	63,444	3.6
Washington . . .	23,589	4.7	26,430	2.6	46,119	2.9	63,839	3.7
Waukesha . . .	35,229	7.0	52,350	5.2	158,249	10.1	231,338	13.2
Region	501,808	100.0	1,005,989	100.0	1,573,620	100.0	1,756,086	100.0

Source: U. S. Bureau of the Census and SEWRPC.

County, and that the areas of lowest average household income are presently in the central Cities of Racine and Milwaukee. Since, income has been found to be a major factor in the level of air activity, the location of higher level income households represents a significant element of air service demand generation.

Economic Base

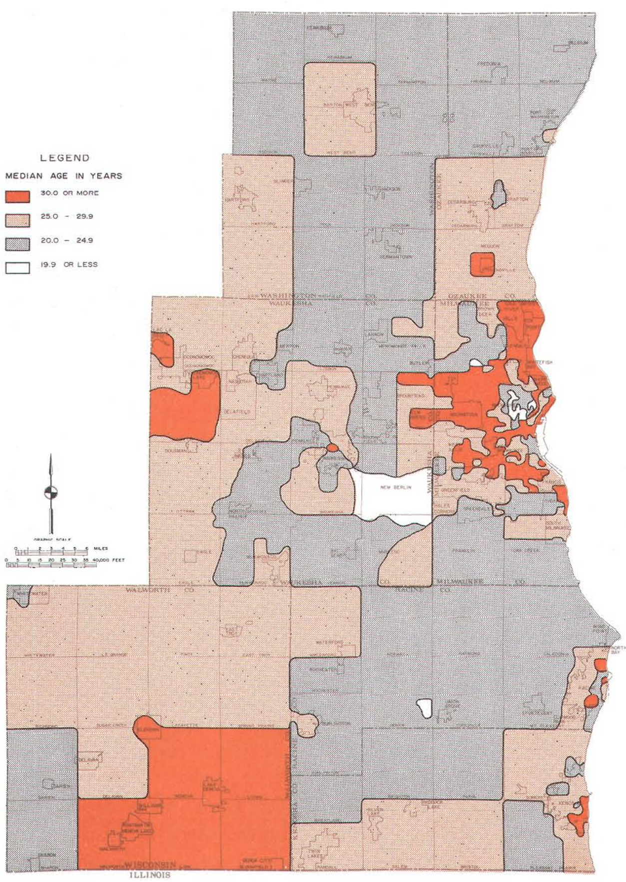
Changes in the population of an area are closely related to changes in the amount of economic activity in that area. This is true not only because much of the population migration into an area is dependent upon the availability of jobs in that area, but also because jobs must ultimately be available to hold the natural increase and prevent the out-migration of native young people entering the labor force. The rapid growth in the population of the Region may, therefore, be basically attributed to increasing economic activity in the Region.

Size of the Economy: One of the best measures of economic activity is the number of employment opportunities, or jobs, available within the planning area. The amount of economic activity in the Region, as measured by the number of jobs available, has increased at varying rates in the recent past. From 1954 to 1957 there was a rapid increase in the number of jobs available, followed by a sharp decline in 1958 corresponding with a general recession in the national economy. From 1958 to 1960, there was again a rapid increase, followed by another sharp decline in 1961, again corresponding with another national recession. Since 1961 there has been a more moderate but steady increase in jobs within the Region, reaching a total of 741,600 jobs in 1970. Figure 15 shows a comparison in the relative change in the number of employment opportunities within the Region, the State of Wisconsin, and the United States from 1950 to 1970.

Distribution of Economic Activity: Nearly 70 percent of the economic activity of the Region as measured by jobs was located in Milwaukee County in 1970, and another approximately 14 percent was located in Racine and Kenosha Counties combined. Approximately 83 percent of the regional jobs, therefore, were located in these three

Map 12

MEDIAN AGE DISTRIBUTION IN THE REGION: 1970



This map depicts the age distribution of the population of the Southeastern Wisconsin Region. The map indicates a high concentration of young persons in the near north side of Milwaukee County and in the New Berlin area of Waukesha County, areas inhabited by relatively large families. The map indicates concentrations of older median age levels occurring in both the older central city areas and in certain rural areas of the Region. In 1970 the median age of the regional population was 27.6 years, compared to 28.5 years in 1960.

Source: SEWRPC.

Table 17

NUMBER OF HOUSEHOLDS AND HOUSEHOLD POPULATION IN THE REGION: 1950, 1960, and 1970

Year	Number of Households	Household Population	Persons Per Household
1950	354,544	1,190,193	3.36
1960	465,913	1,537,235	3.30
1970	536,486	1,714,200	3.20
Percent Change 1950-1970	51.3	44.0	--

Source: U. S. Bureau of the Census and SEWRPC.

Table 18

PERSONAL INCOME TRENDS IN THE REGION 1949, 1959, and 1969

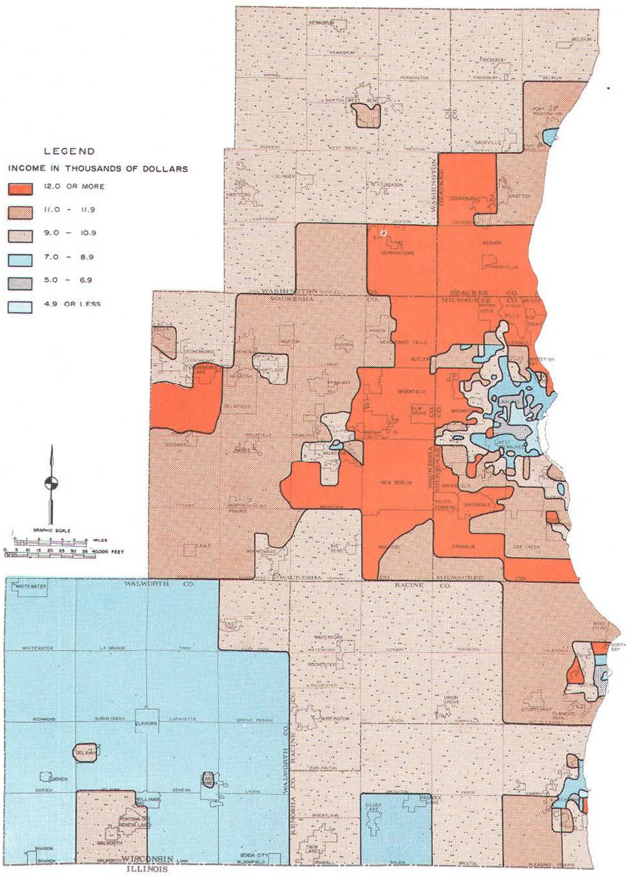
	Total Income (Millions of Dollars)		Median Per Household Income (Dollars)		Per Capita Income (Dollars)	
Year	Actual	Constant[a]	Actual	Constant[a]	Actual	Constant[a]
1949	1,660	2,299	4,145	5,743	1,338	1,858
1959	3,492	3,941	6,637	7,491	2,219	2,505
1969	6,029	5,189	9,950	8,563	3,433	2,954

[a]*Adjusted for price change; base year equals 1967.*

Source: U. S. Bureau of the Census and SEWRPC.

Map 13

MEDIAN HOUSEHOLD INCOME DISTRIBUTION IN THE REGION: 1969

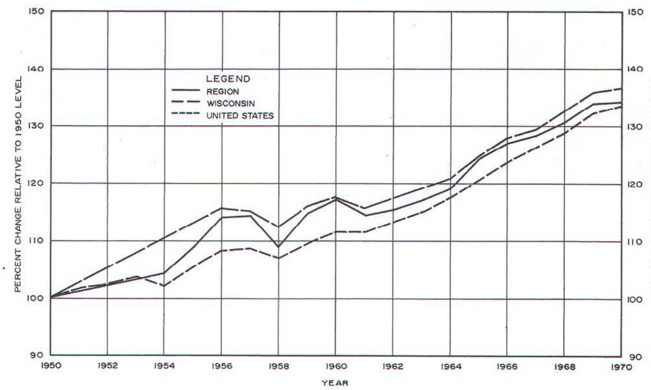


This map depicts the geographic distribution of household, or family, income in the Region. The lower income families are generally concentrated in the older central city areas and in the outlying predominantly rural areas of the Region. Concentrations of higher income families can be found in those newer communities that have been developed within the Region since 1950. It should be noted that the median household income for the Region as a whole increased from $5,743 in 1949 to $8,563 in 1969, measured in constant 1967 dollars.

Source: SEWRPC.

Figure 15

RELATIVE JOB GROWTH IN THE REGION, WISCONSIN, AND THE UNITED STATES 1950-1970



Source: U. S. Department of Labor; Wisconsin Department of Industry, Labor, and Human Relations; and SEWRPC.

counties. The remaining 17 percent of the regional jobs were distributed as follows: Waukesha County, 9 percent; Walworth County, 3 percent; Washington County, nearly 3 percent; and Ozaukee County, 2 percent (see Table 19).

The trend in the intraregional distribution of jobs is toward a decreasing concentration of jobs in Milwaukee County and an increasing concentration of jobs in the other six counties. Waukesha County has shown the largest increase in the proportion of total regional jobs since 1950, an increase from about 3 percent in 1950 to 9 percent in 1970. This increase is in direct contrast to Milwaukee County, where the proportion of total regional jobs decreased from nearly 79 percent to about 69 percent over the same period. These changes reflect a general historic trend toward decentralization of manufacturing, distribution, and service activities from highly urbanized areas to more suburban and rural-urban fringe areas. These shifts may be reflected in shifting air travel patterns in terms of the location-based corporate aircraft, business related flights, and cargo activities.

Structure of the Economy: The character of the regional economy can best be described in terms of its industrial structure, since the number of industries and types of industry directly affect land use and transportation needs. In this regard, economic activity within the Region can be classified into nine major industry groups: 1) agriculture; 2) mining; 3) construction; 4) manufacturing; 5) transportation, communication, and utilities; 6) trade; 7) finance, insurance, and real estate; 8) services; and 9) government.

Economic activity within the Region is heavily concentrated in manufacturing as shown in Figure 16, which compares the Region's economic activity to the national percentage distributions. In 1970, approximately 34 percent of the total jobs in the Region were in manufacturing, compared to more than 25 percent nationally. The proportion of economic activity in nearly all other industry groups within the Region, as measured by jobs, was less than the national averages.

The structure of economic activity within the regional manufacturing industry, which is so important in the regional economy, is also quite different from the structure of the manufacturing industry nationally, as shown in Figure 17. In contrast to the manufacturing industry of the United States, the manufacturing industry in the Region is more heavily concentrated in the production of durable goods, particularly machinery, electrical equip-

Table 19

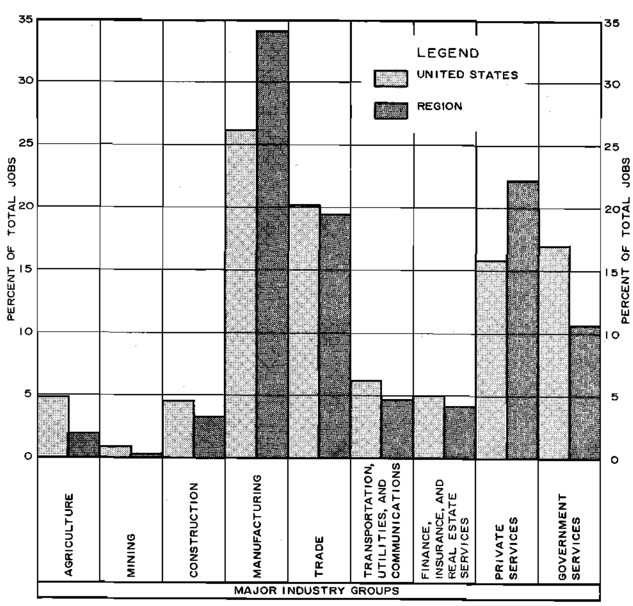
DISTRIBUTION OF JOBS IN THE REGION BY COUNTY
1950, 1955, 1960, 1965, and 1970

County	1950 Jobs	1950 Percent of Region	1955 Jobs	1955 Percent of Region	1960 Jobs	1960 Percent of Region	1965 Jobs	1965 Percent of Region	1970 Jobs	1970 Percent of Region
Kenosha . . .	27,700	5.0	35,600	6.3	40,100	6.2	42,100	6.1	39,200	5.3
Milwaukee . .	438,100	79.3	440,100	77.9	486,400	75.1	487,400	71.0	510,900	68.9
Ozaukee . . .	6,200	1.1	7,900	1.4	9,700	1.5	13,600	2.0	17,900	2.4
Racine . . .	43,200	7.8	44,600	7.9	49,500	7.6	58,900	8.6	61,900	8.3
Walworth . .	12,300	2.2	8,500	1.5	19,000	2.9	22,000	3.2	24,200	3.3
Washington . .	9,700	1.8	9,600	1.7	12,400	1.9	18,300	2.7	20,300	2.7
Waukesha . .	15,500	2.8	18,600	3.3	30,800	4.8	43,600	6.4	67,200	9.1
Region	552,700	100.0	564,900	100.0	647,900	100.0	685,900	100.0	741,600	100.0

Source: Wisconsin Department of Industry, Labor, and Human Relations and SEWRPC.

Figure 16

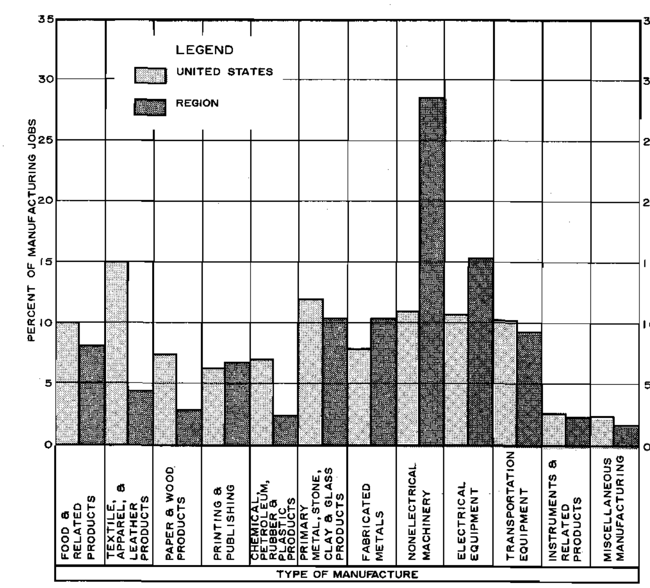
PERCENTAGE DISTRIBUTION OF TOTAL JOBS IN THE REGION AND THE UNITED STATES BY MAJOR INDUSTRY GROUP: 1970



Source: U. S. Department of Labor; Wisconsin Department of Industry, Labor, and Human Relations; and SEWRPC.

Figure 17

PERCENTAGE DISTRIBUTION OF MANUFACTURING JOBS IN THE REGION AND THE UNITED STATES BY TYPE OF MANUFACUTRE: 1970



Source: U. S. Department of Labor; Wisconsin Department of Industry, Labor, and Human Relations; and SEWRPC.

ment, and transportation equipment. In 1970, more than 52 percent of the total manufacturing jobs within the Region were in these industries, compared to less than 32 percent nationally. Compared to the national distribution, there is also a concentration of fabricated metal product manufacturing and printing and publishing activities. On the other hand, there is a relatively low concentration of activity associated with the production of nondurable goods, such as textile, apparel, leather, paper, wood, chemical, petroleum, rubber, and plastic products. The only nondurable goods manufacturing activity which has a proportion of manufacturing employment approximating that of the national economy, in addition to printing and publishing, is the production of food and beverage products. This is due primarily to the location of a number of large breweries in the Region.

Land Use Base

Land use is an important determinant of airport service areas, as well as an extremely important factor to be considered in the location and expansion of airport facilities, due not only to airport operational requirements but also to environmental influences. A detailed land use inventory was an integral part of the Commission's first land use-transportation study, and was used to prepare the comprehensive land use and transportation plans for the Region. These inventories, continuously monitored and updated as part of the Commission's continuing land use-transportation studies, reveal the existing amount, type, intensity, and spatial distribution of land use in sufficient depth and detail to enable the establishment of historic patterns and trends in land use development; to provide a basis for the preparation of general land use plans; and to provide a basis for the preparation of more detailed land use plans in the vicinity of existing and proposed airport facilities. Moreover, such an inventory, when coupled with a knowledge of historic development patterns, provides one of the best available bases for understanding urban activity and probable future land use patterns.

Historical Growth Patterns: The first permanent European settlement in the Region was established in 1795 as a trading post on the east side of the Milwaukee River, just north of what is now Wisconsin Avenue in the City of Milwaukee. The origins of most of the other major cities and villages within the Region can be traced to the establishment of such trading posts or to the establishment of certain types of agricultural services such as saw and grist mills. The location of these earliest urban activities was heavily influenced by water power and water transportation needs. The rapid settlement by Europeans of what is now the Southeastern Wisconsin Region had its beginning following the Indian cessions of 1829 and 1833, which transferred ownership of the lands that now comprise the State of Wisconsin south of the Fox River and west of the Wisconsin River to the federal government. Federal land surveyors, after the close of the Blackhawk War of 1832, began to survey, subdivide, and monument the federal lands. By 1836, the U. S. Public Land Surveys had been essentially completed in southeastern Wisconsin. Completion of the U. S. Public Land Survey in the Region and subsequent sale of the public lands brought many settlers from New England, Germany, Austria, and Scandinavia. Initial urban development occurred along the Lake Michigan shoreline at the ports of Milwaukee, Port Washington, Racine, and Southport (now Kenosha), since these settlements were more directly accessible to immigration from the East Coast through the Erie Canal-Great Lakes transportation route.

Changes in the amount of land devoted to urban use within the Region are indicated in Table 20. This historic urban growth pattern was graphically illustrated on Map 3 in Chapter I of this report. The amount of land devoted to urban development within the Region has increased steadily since 1850. From 1850 to 1950, urban development within the Region occurred in relatively tight, concentric rings outward from the established urban centers of the Region, a pattern resembling the annual growth rings of a tree. A dramatic change in the pattern of urban development within the Region, however, occurred about 1950. From 1950 to 1963, while the regional population increased by about 35 percent, or about 434,000 persons, the amount of land devoted to urban use increased by almost 150 percent, or by about 202 square miles. Urban development became discontinuous and highly diffused; the term "urban sprawl" being quite descriptive of this more recent pattern of urban development within the Region. This pattern continued from 1963 to 1970, during which an additional 57 square miles of land were actually

Table 20

POPULATION DENSITY TRENDS IN THE REGION SELECTED YEARS 1850-1970

Year	Population					Area (square miles)		Persons Per Square Mile	
	Urban		Rural						
	Number	Percent of Total	Number	Percent of Total	Total	Urban	Total	Urban	Total
1850	28,623	25.2	84,766	74.8	113,389	4	2,689	7,155.8	42.2
1880	139,509	50.3	137,610	49.7	277,119	18	2,689	7,750.5	103.1
1900	354,082	70.6	147,726	29.4	501,808	37	2,689	9,569.8	186.6
1920	635,376	81.1	148,305	18.9	783,681	56	2,689	11,346.0	291.4
1940[a]	991,535	92.9	76,164	7.1	1,067,699	90	2,689	11,017.1	397.1
1950[a]	1,179,084	95.0	61,534	5.0	1,240,618	138	2,689	8,544.1	461.4
1963[a]	1,634,200	97.6	40,100	2.4	1,674,300	340	2,689	4,806.5	622.6
1970[a]	1,728,949	98.5	27,137	1.5	1,756,086	397	2,689	4,355.0	653.1

[a] *The "rural-nonfarm" population is included in the urban total.*

Source: U. S. Bureau of the Census and SEWRPC.

converted from rural to urban use within the Region. If regional development trends continue as in the recent past, between 10 and 15 square miles of rural land may be expected to be converted to urban use each year within the Region. Under this type of urbanization, the entire seven-county Region is becoming a single mixed rural-urban complex. Many once isolated and independent communities are growing together, and urban development is spilling over the subcontinental divide which traverses the Region into the Fox-Illinois River Valley.

The influence of the amenities afforded by certain elements of the natural resource base upon the pattern of urban development within the Region was clearly indicated on Map 3 by the pattern of development that is ringing the shorelines of the many inland lakes within the Region, as well as the urban development bordering the shoreline of Lake Michigan. Although much of this lake-related development originally consisted of summer residences, most of these have been converted to year-round residences, and new lake-oriented development has been almost entirely of a year-round residential nature.

Historical Density Trends: The changes in population density within the Region from 1850 to 1970 are also shown in Table 20. During this period, the population of the Region increased nearly 15-fold, from 113,389 persons to 1,756,086 persons, while the amount of land devoted to urban land use increased almost 100 fold, from four square miles to 397 square miles. Overall population densities within the Region increased steadily from 42 persons per square mile in 1850 to 653 persons per square mile in 1970. Overall population densities within the developed urban areas of the Region, however, have exhibited quite a different trend. Such population densities increased steadily from 7,156 persons per square mile in 1850 to a peak of 11,346 persons per square mile in 1920. Urban population densities then began a steady decline to a level of 8,544 persons per square mile in 1950. After 1950, urban population densities declined even more sharply to about 4,800 persons per square mile in 1963, and continued to decline to 4,355 persons per square mile in 1970. This continued decline in urban population density has important implications for the provision of many urban facilities and services, including the provision of airport facilities and definitions of service areas.

Existing Land Use: The type and spatial distribution of land uses existing within the Region (April 1970) is shown on Map 14. This map provides a graphic summary of existing regional development at a given point in time, and its study can provide many valuable insights into an understanding of regional activity and development and of the areawide problems related thereto. The absolute and proportional areas presently devoted to each major land use category within the Region are summarized by county in Table 21.

Although southeastern Wisconsin is a highly urbanized region, less than 20 percent of its total area is presently devoted to urban type land uses. The largest land use category within the Region is still agriculture, which occupies about 60 percent of the total area of the Region. The next largest land use category is the water and wetland group, which occupies about 10 percent of the total area, and woodlands and open lands, which occupy another 10 percent of the total area. Therefore, more than 80 percent of the Region is presently devoted to agriculture, woodlands, and other open lands, or lies under water.

The urban type land use occupying the greatest area is residential, which presently accounts for about 9 percent of the total area of the Region. A close second is the use category of transportation, utilities, and communications, which accounts for about 6 percent of the total area. The small amount and proportion of land presently devoted to the urban economic activities, which are so important to the support of regional growth and development, are both surprising and significant. The total land area presently devoted to commercial, manufacturing, and wholesaling functions within the Region (minus onsite parking) amounts to only 16,556 acres, or 1 percent of the total land area, yet this small area provides the basis for more than 310,100 commercial, 251,000 manufacturing, and 32,000 wholesale jobs, or about 81 percent of all jobs within the Region.

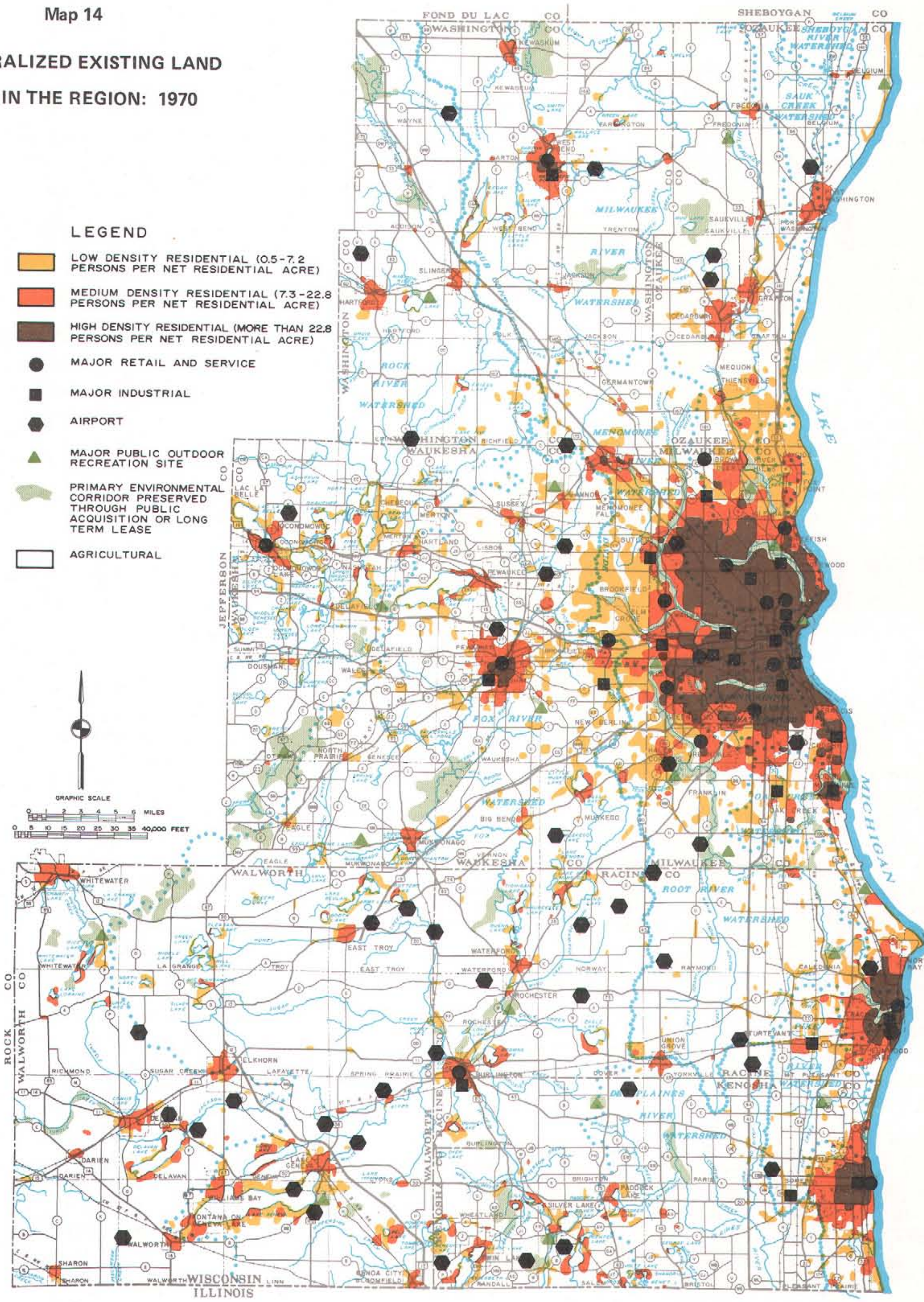
Residential: At the time of the 1970 land use inventory, there were 156,266 acres of residential land in the Region, or about 9 percent of the total regional land area. Table 22 details the amount and relative proportion of land devoted to the different types of residential use. The largest land consumer in this group is the single-family detached residence, which occupies about 78 percent of the total residential land area in the Region. Lands under residential development accounted for about 16 percent of the total, while two-family residences accounted for about 4 percent of the total. Mobile homes and multifamily residences combined consumed 2 percent of the total residential land in the Region.

For airport system planning, the significant element of residential land use is the geographic location of concentrated residential activity. The basic purpose of airport system development is to effectively provide air travel facilities with respect to those elements of the population and economy requiring the service. Residential and airport land uses are, however, basically incompatible. This is due primarily to the noise, air pollution, and traffic and safety hazards generated by airport operations. Therefore, current and probable future residential land use development patterns must be carefully considered in development of airport plans, not only with respect to desirable airport service areas, but also with respect to the adverse impact that airport facilities have upon residential land uses.

Commercial: The commercial land use category includes all retail and service commercial uses, including both local and regional shopping centers, highway-oriented commercial areas, and professional and executive offices, and excluding onsite parking of 10 or more spaces. There are presently 6,517 acres of land, or less than 1 percent of the regional total, devoted to this land use category.

Map 14

GENERALIZED EXISTING LAND USE IN THE REGION: 1970



The spatial distribution of land uses existing within the Region as of April 1970 is summarized on this map. Although southeastern Wisconsin is a highly urbanized Region, less than 20 percent of its total area is presently devoted to urban-type land uses. Agriculture, while declining in economic importance within the Region, still occupies 60 percent of the total land area within the Region, with the remaining 20 percent of the area occupied by water, wetlands, and woodlands. The diffusion of low-density urban development which has occurred within the Region since 1950 is evident from an examination of the map.

Source: SEWRPC.

Table 21

DISTRIBUTION OF LAND USE IN THE REGION BY COUNTY: 1970

County		Land Use Category[a]								Total
		Residential[b]	Commercial	Industrial[c]	Transportation[d]	Governmental[e]	Water and Wetlands	Open Lands[f]	Agricultural	
Kenosha	Acres. . .	13,477	504	811	8,927	3,996	19,445	17,010	113,930	178,100
	Percent . .	7.6	0.3	0.5	5.0	2.2	10.9	9.5	64.0	100.0
Milwaukee	Acres. . .	45,632	2,875	4,899	35,431	17,414	4,207	15,999	28,607	155,064
	Percent . .	29.4	1.9	3.2	22.9	11.2	2.7	10.3	18.4	100.0
Ozaukee	Acres. . .	12,321	330	444	8,054	2,597	14,879	10,897	100,491	150,013
	Percent . .	8.2	0.2	0.3	5.4	1.7	9.9	7.3	67.0	100.0
Racine	Acres. . .	16,625	575	1,099	12,442	4,329	17,712	17,572	147,207	217,561
	Percent . .	7.6	0.3	0.5	5.7	2.0	8.1	8.1	67.7	100.0
Walworth	Acres. . .	13,408	593	827	12,020	5,467	39,160	36,763	261,744	369,982
	Percent . .	3.6	0.2	0.2	3.3	1.5	10.6	9.9	70.7	100.0
Washington	Acres. . .	11,525	299	434	11,286	2,583	35,638	30,503	186,466	278,734
	Percent . .	4.1	0.1	0.2	4.1	0.9	12.8	10.9	66.9	100.0
Waukesha	Acres. . .	43,278	1,341	1,525	21,247	9,228	49,789	43,562	201,676	371,646
	Percent . .	11.6	0.4	0.4	5.7	2.5	13.4	11.7	54.3	100.0
Region	Acres. . .	156,266	6,517	10,039	109,407	45,614	180,830	172,306	1,040,121	1,721,100
	Percent . .	9.1	0.4	0.6	6.4	2.6	10.5	10.0	60.4	100.0

[a] *The nine major land use categories as inventoried were: residential, retail and service, wholesale and storage, manufacturing, transportation, institutional and governmental, recreational, agricultural, and open land and water. These categories have been rearranged for presentation and analysis purposes.*

[b] *Includes residential areas developed and under development.*

[c] *Includes all manufacturing, wholesaling, and storage.*

[d] *Includes utilities, communication facilities, and off-street parking of over 10 spaces.*

[e] *Includes institutional and active recreational areas.*

[f] *Includes woodlands, open pits, and quarries.*

Source: SEWRPC.

Table 22

RESIDENTIAL LAND USE IN THE REGION BY TYPE: 1970

Type of Residential Use	Acres	Percent of Total
Single-Family	122,507	78.4
Two-Family	5,573	3.6
Multifamily (less than 4 stories)	2,970	1.9
Multifamily (4 or more stories)	118	0.1
Mobile Homes	515	0.3
Residential Land Under Development . .	24,583	15.7
Total	156,266	100.0

Source: SEWRPC.

Several commercial land use categories represent land use developments compatible with airport developments. In fact, many major airport developments actually generate desirable commercial activities. These commercial land uses can be used as a buffer between airports and other less compatible and noncompatible urban developments.

Industrial: This land use category includes all manufacturing activities, wholesaling offices, warehouses, and storage yards, but excludes onsite parking of 10 or more spaces. There are presently 10,039 acres of land, or less than 1 percent of the regional total, devoted to this land use category.

Like commercial activities, many kinds of industrial activities can be generated or encouraged to develop as part of airport related urban activities. Many kinds of industries use air cargo facilities and wish to be located near aviation activity. As a result, airport environs are quite often major employee concentrations, and need to be recognized in development of urban services such as utilities and transportation links.

Transportation, Communication, and Utility: The transportation, communication, and utility land use category includes all street and highway rights-of-way; railroad rights-of-way and yards; airport, rail, ship, bus, and truck terminals; communications facilities, such as radio or television stations and transmission towers; utility rights-of-way; plants such as sewage disposal and water treatment and storage facilities; and all off-street parking areas containing more than 10 parking spaces. There are presently 109,407 acres of land, or about 6 percent of the regional total, devoted to this land use category.

Governmental, Institutional, and Recreational: The land areas devoted to governmental, institutional, and active recreational uses were classified in the land use inventory according to local or regional service orientation. If the service emphasis of a governmental or institutional use was oriented toward more than one community (minor civil division), it was classified as regional. If such service emphasis was oriented toward a single community or neighborhood, except for high schools in the City of Milwaukee, it was classified as local. Regional uses included universities and colleges, certain high schools, large central libraries, museums, zoological and botanical gardens, golf courses, bathing beaches, marinas, majoı athletic fields, hospitals, county courthouses, welfare agencies, and military installations. Local uses included elementary schools, certain high schools, churches, branch libraries, fire stations, all active park areas other than those classified as regional, and city, village, and town halls. All recreation facilities were further classified as public or nonpublic. The 1970 land use inventory reported a total of 45,614 acres of land in southeastern Wisconsin devoted to government, institutional, and recreational uses. Land devoted to government and institutional uses comprised about 16,618 acres, or 36 percent of this category. Approximately 11,139 acres, or 67 percent of all government and institutional land use in the Region, had a regional service orientation while the balance had a local service orientation.

The 1970 regional land use inventory further reported a total of 28,996 acres of active recreational land in southeastern Wisconsin. Public recreational land comprised 13,373 acres, or 46 percent of this total, while the balance consisted of private recreational land.

Many of these regional governmental institutional land uses generate a demand for air travel service and must be considered in terms of their impact on the regional airport system plan. Some of the open space, land consuming recreational activities may offer opportunities for airport development as adjacent compatible land uses.

Woodlands and Open Lands: This land use category includes all land areas presently containing trees or heavy brush; lands which are not presently devoted to urban use, cropped, or grazed; land areas presently devoted to such temporary uses as open pits for trash or garbage disposal; and quarries, either operating or nonoperating. There are presently 172,306 acres of land, or 10 percent of the regional total, devoted to this land use category. Approximately 73 percent of this area is devoted to woodlands, and 22 percent is in the open lands category. Only 5 percent, or 8,348 acres, are classified as quarries or pits.

Water and Wetlands: The water and wetland use category includes all inland lakes excluding Lake Michigan; all streams, rivers, and canals more than 50 feet in width; and open lands which are intermittently covered with water or which are wet due to a high water table. Presently there are 180,830 acres of water and wetland areas in the Region, or about 10 percent of the regional total.

Agricultural: The agricultural land use category includes all croplands, pasturelands, orchards, nurseries, and fowl and fur farms. Farm dwelling sites were classified as residential land and assigned a site area of 20,000 square feet. All other farm buildings were included in the agricultural land use. Agriculture is the largest land use in the Region, and about 60 percent of the total area of the Region, or 1,040,121 acres, is devoted to this use.

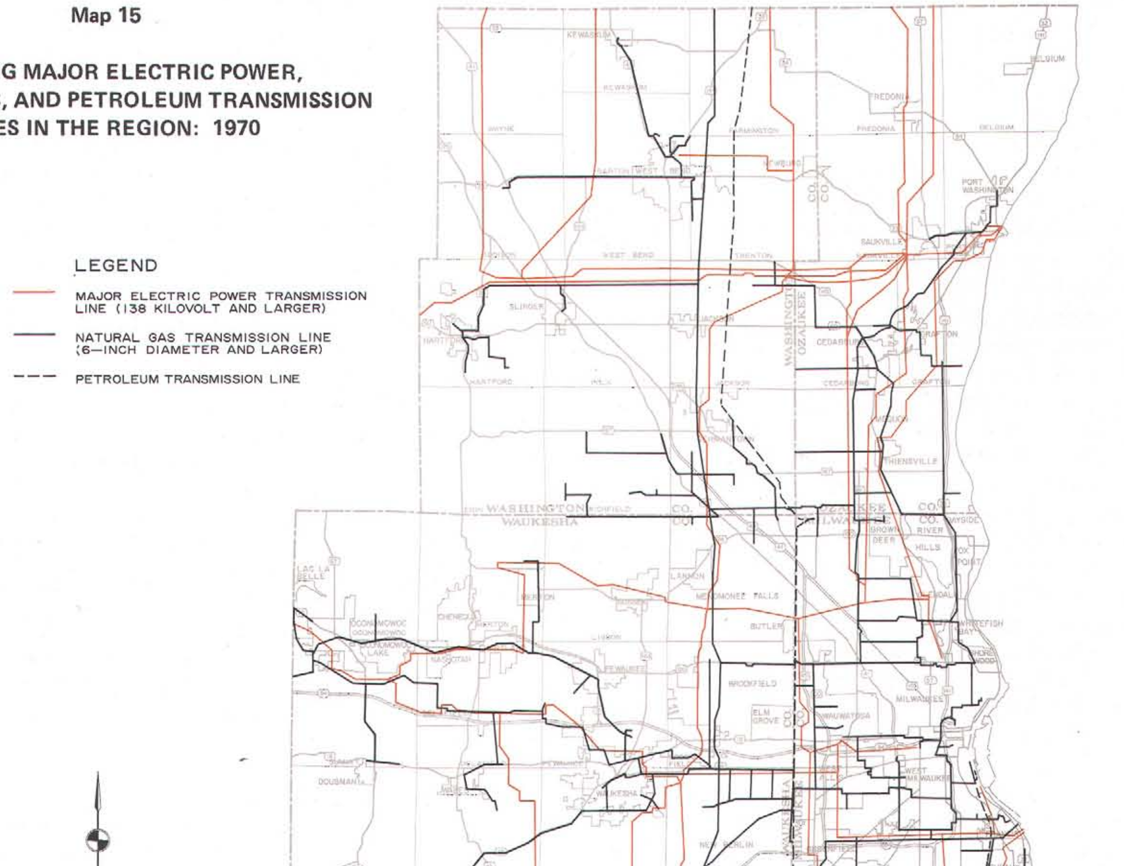
Public Utility Base

Public utility systems are one of the most important and permanent elements of urban growth and development. Urban and airport development today is highly dependent upon these utility systems, which provide the individual land uses with power, light, communication, heat, water, and sewerage. Power, gas, and communication facilities, although important to airport facility development, did not require specific inventory under the regional airport planning program because previous Commission studies have indicated that these utilities may be considered to be ubiquitous within the Region. Map 15 depicts the major electric power transmission and natural gas pipeline facilities in the Region that must be considered in airport site development or expansion. Water supply and sanitary sewerage utilities have a particularly important interrelationship. Water supply facilities bring potable water from its sources to the user, while sanitary sewerage facilities collect the used water, convey it to a treatment plant, and after treatment return it to the natural environment from which it came.

The majority of water and sewerage utilities in the Region are organized as water and sewerage departments of incorporated municipalities, and serve only those areas within the political boundaries of that municipality. Where sanitary districts have been organized, sewer and water service area limits may not be coterminous, although the individual service areas will often tend to approximate one another. Therefore, a general pattern of water and sewer service areas following political boundary lines rather than natural topographic boundaries, such as watershed boundaries, exists within the Region. The governing bodies of these existing utilities tend to be concerned

Map 15

EXISTING MAJOR ELECTRIC POWER, NATURAL GAS, AND PETROLEUM TRANSMISSION LINES IN THE REGION: 1970



Major utility transmission lines serve most areas of the Region, and thus are available to serve expanded or new airport locations. These lines must be considered in the location and design of new airports and the expansion of existing airports in order to minimize the cost of utility relocation and to eliminate obstructions to aircraft operation.

Source: SEWRPC.

primarily, if not solely, with the problems existing within the individual political subdivisions served, rather than with problems affecting the area as a whole and the individual political subdivisions in part.

Sanitary Sewerage Utilities: Virtually all sanitary sewer service within the Region is provided by publicly owned agencies. These agencies generally take the form of a commission in the case of utilities providing areawide service, a department in the case of utilities providing service to an incorporated municipality, or a town sanitary district in the case of a utility providing service to an unincorporated area. There are a total of 91 centralized public sanitary sewerage systems presently operated by utilities within the Region, serving a total area of about 309 square miles, or about 11 percent of the total area of the Region. Together these utilities serve a total population of 1.5 million persons, or about 85 percent of the total population of the Region. A total of 64 sewage treatment facilities are currently operated by the utilities owning, operating, and maintaining the 91 public sanitary sewerage systems, with many of the utilities contracting with adjacent utilities for sewage treatment purposes. In addition, there are 59 privately owned sewage treatment plants presently in operation within the Region. These generally serve isolated land use enclaves, mainly for industrial, commercial, and recreational enterprises.

The areas served by these existing sewerage systems and those proposed for service under recommendations of the regional sanitary sewerage system plan are delineated on Map 16. A total of 675 square miles, or about 25 percent of the total area of the Region, is served or has been proposed to be served by sanitary sewers.

Water Utilities: Most of the water supply service within the Region is provided by public water utilities. There are a total of 67 publicly owned water utilities within the Region. Of these 67 utilities, all but one—the North Shore Water Utility in Milwaukee County—provide retail water service to consumers. The North Shore Water Utility provides only wholesale water service to three other water utilities—the Glendale Water Utility, the Village of Whitefish Bay Water Utility, and the Water Utility of the Village of Fox Point. Together, these 67 publicly owned water utilities serve an area of about 259 square miles, or about 10 percent of the total area of the Region, and about 1.4 million persons, or about 80 percent of the total 1970 resident population of the Region. The existing (1970) service areas of these utilities are shown on Map 17.

In addition to the publicly owned water utilities, there are at least 59 private or cooperatively owned water systems throughout the Region. Many of these small water systems serve isolated residential enclaves, while some serve summer residents only and suspend operations during cold weather. Very few of these private systems have standby supply or storage facilities, and the great majority do not keep detailed records or file annual reports with state or regulatory bodies. It is anticipated that many of these systems will eventually be absorbed into publicly owned municipal water utilities.

All water supplied by the publicly owned water utilities is drawn either from Lake Michigan or from wells. The Region is not only rich in surface water resources but in groundwater resources, being underlain by two separate aquifers. Treated Lake Michigan water in an amount averaging 197 mgd (millions of gallons per day) was supplied in 1970 to an aggregate service area of about 199 square miles, or about 7 percent of the total area of the Region, and a population of about 1.2 million persons, or about 68 percent of the total population of the Region. Twenty-one of the 67 public utilities in the Region utilize Lake Michigan as a source of supply. Of these 21, seven own and operate water intake and treatment facilities, while 14 utilities purchase water on a wholesale basis. Generally, Lake Michigan offers an unusually good source of supply to those areas lying east of the subcontinental divide and within economic reach of this source of supply.

Well water in an amount averaging about 25 mgd was supplied in 1970 to an aggregate area of about 60 square miles, or about 2 percent of the total area of the Region, and a population of about 190,000 persons, or about 14 percent of the total resident population of the Region. Forty-six of the public utilities in the Region utilize the groundwater as a source of supply. In general, water service from a municipal utility is a matter of local policy furnished only to property within the municipal limits of that municipality. Only the Cities of Kenosha, Milwaukee, and Racine in the Region provide water service beyond their corporate limits in any substantial amounts.

Transportation Base

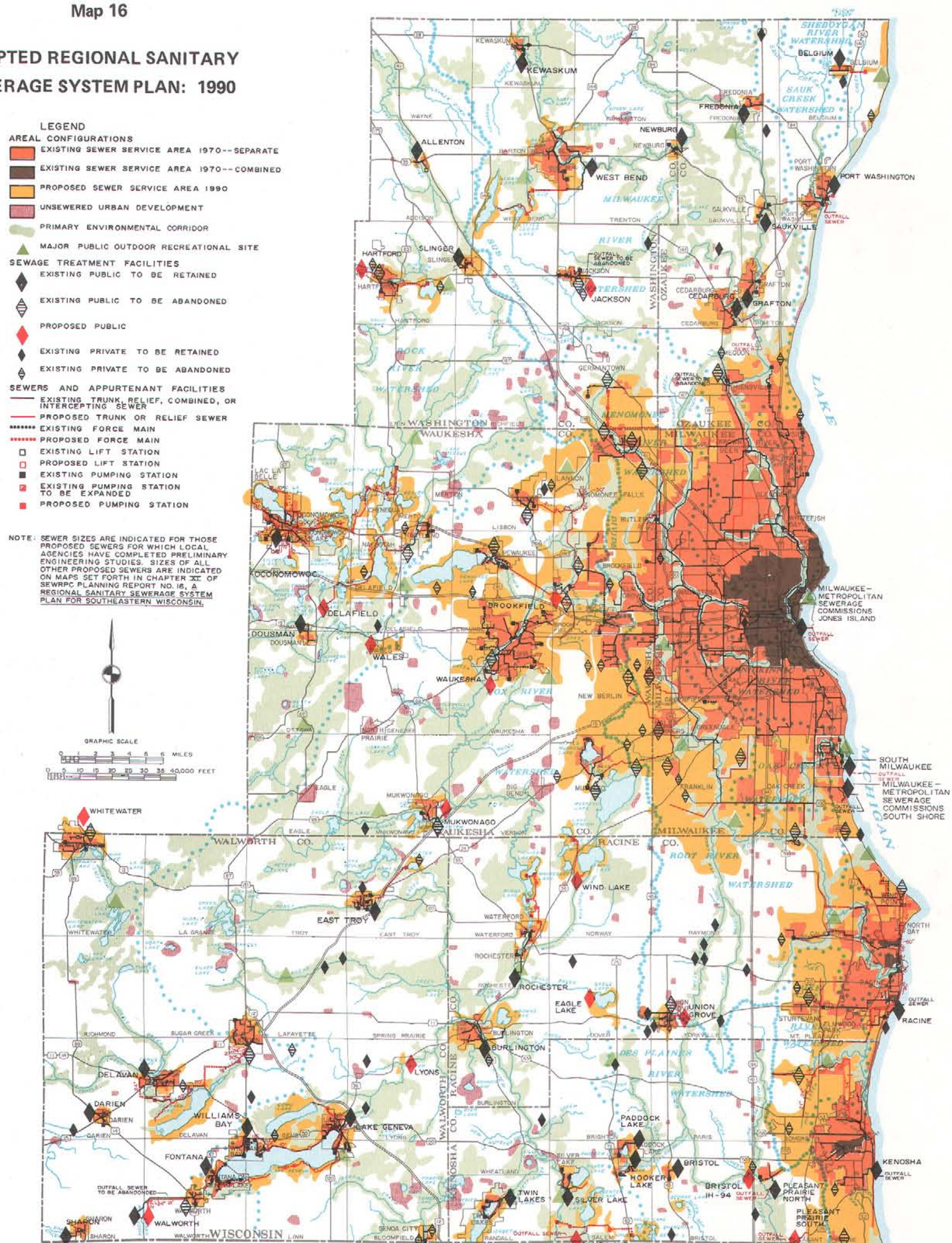
The regional surface transportation system, consisting primarily of an extensively developed all-weather high speed highway system serving the movement of people and goods, and to a much lesser degree a railway system serving primarily freight movements, but also limited passenger movements, has developed with the development of the Region. Although the transportation systems are a significant man-made feature of the Region and a major influence upon the socioeconomic structure of the Region, their impact upon airport system planning is so great that they will be discussed in greater detail in Chapter IV as one of the major air transportation inventory items. Since air travel is multimodal, with trips at either end requiring surface transportation, it is impossible to isolate the ground transportation system from the air transportation system. The existing (1972) arterial street and highway system in the Region is shown on Map 19.

SUMMARY

The seven-county Southeastern Wisconsin Region is an interrelated complex of natural and man-made features, which together form a rapidly changing environment for human life. The important man-made features of the Region include its land use pattern and its transportation and public utility networks. Together with the population residing in the Region and the economic activities taking place within the Region, these features may be

Map 16

ADOPTED REGIONAL SANITARY SEWERAGE SYSTEM PLAN: 1990



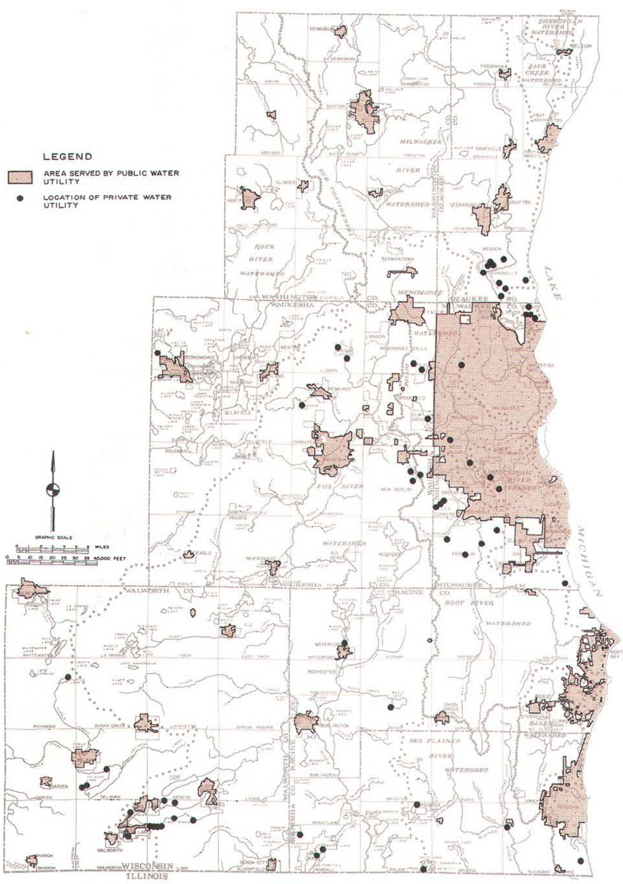
The areas served by existing sewerage systems and those areas proposed for service under recommendations of the adopted regional sanitary sewerage system plan are shown on this map. The provision of centralized sanitary sewer service to all of the areas designated for such service would result in service being provided to a total area of 675 square miles, or about 25 percent of the total area of the Region. There are a total of 91 centralized public sanitary sewerage systems presently operated by utilities within the Region, serving a total area of about 309 square miles, or about 11 percent of the total area of the Region.

Source: SEWRPC.

thought of as the socioeconomic base of the Region. The natural resource base is a primary determinant of the development potential of a region and of its ability to provide a pleasant and habitable environment for all forms of life. The principal elements of the natural resource base are climate, soils, physiography, water resources, geology, mineral and organic resources, vegetation, and fish and wildlife. An understanding of these two bases is essential to sound airport system planning, and to this end this chapter constitutes a description of

Map 17

WATER UTILITIES IN THE REGION: 1970



Most of the water supply service in the Region is provided by 67 publicly owned water utilities. The service areas of these 67 utilities are shown on this map. In addition, there are at least 59 private or cooperatively owned water supply systems in the Region which provide water service generally to individual subdivisions. The location of these private systems is also shown on this map. Lake Michigan is by far the most important source of water supply in the Region, with about 1.2 million persons, or 68 percent of the total Region population, currently being supplied from that source. An additional 190,000 persons, or about 14 percent of the total Region population, are supplied by public utilities relying on groundwater.

Source: SEWRPC.

the socioeconomic and natural resource bases of the Region. The more significant findings of the chapter are summarized below:

1. The Region has a continental type climate characterized primarily by a continuous progression of markedly different seasons and a large range of annual temperature, on which is superimposed frequent distinct changes in weather conditions which, particularly in the winter and spring, normally occur once every two or three days. Wind direction and velocity are important considerations in airport facility siting and orientation. Winds in southeastern Wisconsin may be expected to blow from the southwest and northwest each about 20 percent of the time and from the southeast and northeast each about 15 percent of the time. Runways oriented in these four directions will provide favorable wind coverage about 70 percent of the time. Wind velocities throughout the Region may be expected to be less than 4 knots about 12 percent of the time, between 4 and 14 knots about 62 percent of the time, and over 14 knots the remaining 26 percent of the time.

   Analysis of ceiling and visibility weather conditions indicates that, on an annual basis, weather conditions that permit aircraft operations under visual flight rules occur approximately 90 percent of the time, whereas it is necessary to operate under instrument flight rules the other 10 percent of the time. The most favorable visual flight rule weather occurs under summer daylight hours. Also, the higher wind velocities, exceeding 10 knots, occur predominantly during the visual flight rule weather.

   Temperature directly influences airport runway length. An increase in air temperature which makes the air less dense forces aircraft to require a longer take-off runway, a slower rate of climb, and a faster landing speed. Temperature in southeastern Wisconsin exhibits a large annual range which, based on monthly means for six geographically representative observation stations, extends from a January low of about 21°F to a July high of 71°F. Lake Michigan significantly affects temperatures of the Region during the winter to summer transitional periods of March, April, and May, during the summer months, and during the summer to winter transitional period. Markedly lower monthly mean and average daily maximum temperatures for land areas in close proximity to the lake as compared to those in inland areas are recorded. Further, Lake Michigan also affects summer temperatures by generating wind shifts on summer evenings that produce cooling lake breezes, resulting in abrupt daytime drops in summer shoreland temperatures.

   Precipitation within the Region takes the form of rain, sleet, hail, and snow, and ranges from showers to destructive thunderstorms as well as major rainfall-snowmelt events causing property and crop damage and inundation of poorly drained areas. The kind and amount of precipitation that may be expected to occur within the Region influences the nature of man's activities in general and particularly airport planning, design, construction, operation, and maintenance. Airport system problems created by various forms of precipitation include restricted visibility, atmospheric turbulence, slippery conditions on hard surface runways, nonuse of turf runways, decreased rate of climb for some aircraft, and congested terminal and air space created in and around airports because of various operational delays. The average annual total precipitation based on six geographically representative observation stations is 30.3 inches expressed as water equivalent, with monthly averages ranging from a February low of 1.32 inches to a high of 3.86 inches in June. The principal snowfall months are December, January, February, and March, during which 89 percent of the 43.2-inch average annual snowfall occurs. The maximum monthly precipitation measured in the Region of 13.17 inches occurred at West Bend in August 1924. The maximum monthly snowfall of 56.0 inches was recorded in Waukesha in January 1918. The maximum 24-hour precipitation recorded in southeastern Wisconsin occurred in the West Bend area on August 4, 1924, when 7.58 inches of rain fell, and the greatest 24-hour snowfall was 30.0 inches recorded in Racine in February 1898. With excessive quantities of freezing precipitation, operations at even air-carrier airports such as General Mitchell Field can become so unbalanced as to cause mass flight cancellations and delays, ferrying of aircraft, terminal confusion, and inconvenience to the traveling public.

Lake fog is a weather condition particularly affecting airports located in close proximity to large water surfaces. Lake fog, primarily caused by warm, moist air moving toward colder waters of Lake Michigan, is common in the warmer months along the shoreline of the Region. This type of fog is extremely limited in its areal extent, normally being confined to an area over the water itself and extending only a mile or two inland from the shoreline. Thus, within the Region, lake fog becomes a problem in airport operation and siting only in a one or two mile strip along the shoreline or on the lake itself.

2. Under the Federal Clean Air Act, the U. S. Environmental Protection Agency has prepared minimum ambient air quality standards, expressed in terms of six air quality indicators, which must be met throughout the United States. Monitoring of ambient air quality with respect to these indicators has been minimal within the Region, and necessary associated meteorological data relative to air pollution dispersion in even more sparse. Levels of particulate matter have been recorded in excess of minimum standards in Milwaukee County, and have been measured and calculated to exceed primary standards in the central areas of the Cities of Milwaukee, Kenosha, and Racine and in the Menomonee River Valley industrial area. Measured and calculated levels of sulfur dioxide within the Region apparently do not exceed the primary standards. Further, it is estimated that annual average levels of carbon monoxide within the Region presently do not exceed the primary and secondary standards. However, it is recognized that available data do not provide an adequate measure of ambient air quality conditions within the Region.

   Although the present level of air pollution within the Region generally may not be as serious as it is in some other regions of the United States, evidence exists that the national ambient air quality standards as adopted by the U. S. Environmental Protection Agency for particulate matter, sulfur dioxide, and photochemical oxidants are presently being exceeded or have the potential for being exceeded during the next decade in certain, primarily urban, areas of the Region. However, because of the limitations on both ambient air quality and the meteorological conditions within the Region, it will only be possible to qualitatively evaluate the impact of airport system plans on regional air quality. The regional air pollution problem is extremely complex and, for effective evaluation, requires further comprehensive analysis of point, area, and line source emissions and meteorological phenomena. Studies and actions intended to fill many of the voids are currently underway by the Commission, acting in cooperation with the Wisconsin Departments of Natural Resources and Transportation and the U. S. Environmental Protection Agency.

3. A wide variety of soil types has developed in southeastern Wisconsin as a result of the interaction of parent glacial deposits covering the Region, topography, climate, animals, and time. As a result of a detailed soil survey, all the diverse soil types of southeastern Wisconsin have been mapped; their physical, chemical, and biological properties identified; and interpretations made for planning purposes. The important characteristics of soils to be considered in airport planning are those that permit airport and attendant urban development, and those used to identify the primary agricultural lands on which airport development should be discouraged.

4. Because of the many functions which surface water resources must perform, including provision of water for domestic, municipal, and industrial use; waste assimilation; storm water reception; provision of habitat for fish and water life; desirable sites for vacation homes and permanent residential developments; and support of numerous popular water oriented recreational activities, sur-

face water resources consisting of lakes, streams, and their associated undeveloped shorelands and floodlands probably constitute the single most important natural resource element within the Region. The surface water resources are very vulnerable to man's activities in that their quality can easily degenerate as a result of careless agricultural and urban development practice. Regional land use policies in general, and airport system planning and development policies in particular, should direct airport and associated urban development, in consideration of these valuable surface water resources, to suitable areas located beyond the floodlands. Since emphasis has been placed by the Commission in its water resource planning activities upon in-watershed solutions to water quality and flood control problems, the surface drainage pattern and location of watershed boundaries are important considerations in regional airport system planning.

5. Groundwater is the principal source of water supply for varied residential, agricultural, commercial, and industrial development in southeastern Wisconsin, and also sustains lake levels and provides the base flow of streams within the Region. Regional development must be managed to protect the invaluable groundwater reservoir and its recharge areas, particularly the deep aquifer and its recharge area located in the Kettle Moraine area of the westerly portion of the Region. Airports and related urban development should be carefully located and designed with respect to these groundwater resources.

6. Delineation of those areas of the Region in which concentrations of natural, scenic, recreational, and historic resources occur produces an essentially lineal pattern encompassed in narrow, elongated areas which have been termed "environmental corridors." The primary environmental corridors occupy only about 534 square miles, or 20 percent of the Region, but contain all of the remaining high-value wildlife habitat areas, about half of the remaining woodlands, about two-thirds of the wetlands, and over three-fourths of the lakes and streams and associated floodlands, as well as many significant physiographic features and historic sites within southeastern Wisconsin. The primary environmental corridors comprise the best of the individual elements of the natural resource base of southeastern Wisconsin, and their preservation in a natural state or in park and related open space uses is essential to maintaining a high level of environmental quality within the Region and to the protection of its natural beauty and, as such, is one of the principal objectives of the adopted regional land use plan upon which the regional airport system plan is based.

   Airport system planning, involving as it does not only airport and airport facility development but also attendant urban development generated by the presence of the airport, should take into account the primary and secondary environmental corridors so as to preserve and protect them from further degradation. Airport sites can be developed to encompass environmental corridors within the open spaces associated with airport development and to use the environmental corridors as buffer areas between airports and other urban development. The potential impact upon the environmental corridors of the water, air, and noise pollution associated with airports and related urban development must also be carefully evaluated in airport development to ensure corridor preservation.

7. The population of the Region has been increasing at an average rate of about 18,000 persons per year from 1960 to 1970, and in 1970 totaled 1,756,100 persons. This rate of population growth, although higher than state and national growth rates, is considerably lower than the approximate 33,000 persons per year growth rate experienced within the Region from 1950 to 1960. The population growth within the Region has been occurring primarily in the newer outlying suburban, rural-urban fringe areas of the Region, while the populations of the older central cities and suburbs have remained relatively stable or have actually declined.

   Population growth has been accompanied by marked changes in certain characteristics of the population. The composition of the population is becoming increasingly urban, and at the present time, only about 12 percent of the total regional population is classified as rural. Moreover, of the total population, about 10 percent is classified as rural nonfarm and only 2 percent as rural farm.

8. Personal income has been increasing at a higher rate than the total population, so that per capita and per household incomes have increased markedly within the last two decades. From 1949 to 1969, total personal income in the Region, measured in constant 1967 dollars, increased nearly 2.9 billion dollars or about 126 percent. For this same period, per capita income increased from $1,858 to $2,954, and median per household income increased from $5,743 to $8,563. The areas of highest average household income are located in the most rapidly growing new suburban and rural-urban areas of the Region, presently located in northeastern and western Milwaukee County and eastern Waukesha County. Since income has been found to be a major determinant in the demand for air transportation services, the distribution of the higher income households is an important factor in airport system planning.

9. Employment opportunities in the Region have increased at a rate of approximately 9,370 jobs per year over the last decade to a current level of approximately 741,600 jobs. The economic

factors which promote population growth and urbanization of a Region are largely centered in or around the major urban centers of Milwaukee, Racine, and Kenosha. Although a diffusion of economic activity into the outlying areas is occurring, nearly 70 percent of the economic activity of the Region as measured by jobs was located in Milwaukee County in 1970. Another 14 percent was located in Racine and Kenosha Counties combined, and approximately 9 percent was located in Waukesha County, which has shown the largest increase in the proportion of total regional jobs since 1950.

10. Land within the Region has been undergoing a particularly rapid conversion from rural to urban use. Recent urban development within the Region has been discontinuous and highly diffused, consisting primarily of many scattered, low-density, isolated enclaves of residential development located away from established urban centers. Urban population densities within the Region, which peaked in 1920 at a level of about 11,300 persons per square mile, have steadily declined since then to about 4,400 persons per square mile in 1970. The highly diffused nature of recent urban development and the sharp decline in urban population density have intensified many longstanding environmental problems within the Region and have created new environmental and developmental problems of an unprecedented scale and complexity, including problems of airport system development. If regional development trends continue as in the past, between 10 and 15 square miles of rural land may be expected to be converted to urban use each year.

    The type and distribution of various land uses is another determinant of airport and related urban development. Airports provide support to some commercial, industrial, and institutional activities and are also capable of generating these compatible land uses. Although significant air service demands are generated by people living in the Region, residential and airport land uses are basically incompatible, due primarily to the noise, air pollution, and traffic and safety hazards generated by airport operations. Therefore, current and probable future land use development patterns must be carefully considered in the development of airport plans to effectively serve aviation demands while minimizing the adverse impact that airport facilities have upon residential land uses.

11. Existing and planned utility systems will serve as determinants for airport location. The impact of airport development and attendant urban development must also be considered in planning for expanded utilities systems. There are a total of 91 centralized public sanitary sewerage systems operated by utilities in the Region, presently serving a total of 309 square miles, or about 11 percent of the total area of the Region.

    The Region is unusually rich with respect to water resources. Urban development located east of the subcontinental divide which traverses the Region can utilize both Lake Michigan and two underlying aquifers as a source of supply. Urban development west of that divide must depend primarily upon the two groundwater aquifers. Public water supply system service areas have generally tended to follow public sanitary sewer service areas within the Region, although the extension of public water supply services has generally lagged behind the extension of sanitary sewer service. Gas and electric power services can be considered to be readily available throughout the Region, and therefore do not constitute a major constraint on the location or intensity of urban development within the Region.

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Chapter IV

EXISTING REGIONAL AIR TRANSPORTATION SYSTEM

INTRODUCTION

The existing air transportation system within the Southeastern Wisconsin Region consists basically of a combination of airport and airway facilities to accommodate the movement of people and goods into, within, and out of the Region. The ability of the system to perform its primary function depends to a considerable extent, however, upon the quality of the surface transportation facilities linking each airport, or transportation terminal, to its respective service area. Thus, the Region's air transportation system involves, more precisely, the aircraft landing areas, the airways and air navigation aids, and the ground access facilities.

The initial step in the technical planning phase of the airport system planning process is an inventory of existing air transportation facilities, which is necessary to establish the capacity, use, and level of service characteristics of the existing system. Inventory analysis also identifies deficiencies in the present system, and establishes the potential of each system component to accommodate additional demands.

This chapter summarizes the results of the inventory of the air transportation system presently serving southeastern Wisconsin conducted under the regional airport planning program. The chapter includes definitive data on the airports, airways, air navigation facilities, and related surface transportation facilities serving the Region, as well as present and probable future aircraft characteristics. The supplemental air vehicle inventory data are important to the planning process, since the physical characteristics of aircraft have a direct impact on system capacity requirements and facility needs.

The primary data sources for the inventory of existing airport facilities included Federal Aviation Administration (FAA) Airport Master Record Form 5010-1, the Wisconsin Division of Aeronautics, and an airport inventory survey. In the airport inventory survey, survey questionnaires enclosed with stamped, self-addressed envelopes were mailed to airport owners or managers in the Region, and were followed by personal visits with several airport managers and/or operators. The data were used to assess existing airport facilities and the capabilities for a regional airport system.

AIRPORTS

The present air transportation system in the Region is a complex network of airways and 46 publicly and privately owned airports, including one heliport and one seaplane base as shown on Map 2 and in Table 23. These airports fall into one of four major service categories—air carrier, general aviation, military, and special use. Publicly owned General Mitchell Field is the only air carrier airport in the Region. Air carrier airports are intended to accommodate primarily commercial airline service to the general public on a regularly scheduled basis. The air carrier airport, in effect, constitutes a major interregional transportation terminal handling relatively large volumes of passengers, mail, and cargo in large, high-performance aircraft.

The general aviation airports, including both public and privately owned facilities, are intended to serve smaller training, business, charter, agricultural, recreational, pleasure, and air taxi aircraft. In addition to General Mitchell Field, which provides general aviation as well as commercial air carrier service, there are 43 other active airport facilities for primary use by general aviation. All of these, however, are not open to unlimited public use, since some serve the personal requirements of the owners or cater strictly to specific aircraft types. The 25 general aviation public use airports, both publicly and privately owned, accommodate the majority of the business and pleasure aviation activity in the Region, accommodating about 79 percent of the based aircraft and over 72 percent of the aircraft operations in the Region in 1971, and thus are of primary interest in regional airport system planning. The 18 general aviation private, personal, or restricted use airports are of far lesser importance to the existing regional airport system. Since these airports may, however, affect the demand for, and use of, airspace and airports, the private use airports are identified herein.

Presently there are no exclusive military use airports within the Region. The Richard I. Bong Air Force Base complex, located in western Kenosha and southern Racine Counties, was abandoned before its completion in 1959, and the 5,532-acre site was relegated to surplus government property. Much of the air base property has already been converted to conservation, park, and recreational uses. Both General Mitchell Field in Milwaukee County and West Bend Municipal Airport in Washington County are joint use civil/military facilities providing military aviation service.

There are two landing areas in the Region that might be considered within the special use category, that is, facilities restricted to certain aircraft types. These include the Johnson Wax Heliport located in Racine, and the Edgewood Air Seaplane Base at Lake Geneva in Walworth County.

Airport Classification System

In order to systematically inventory and evaluate the various kinds and levels of airport facilities serving the Region, a method of classifying airports by functional

Table 23

OWNERSHIP, USE, PHYSICAL CHARACTERISTICS, AND CLASSIFICATION OF AIRPORTS IN THE REGION: 1971

County	Airport	Type of Ownership	Owner	Type of Use	Number of Based Aircraft			Estimated Number of Annual Operations[d]		Recommended FAA Classification[e] 10-Year	Recommended State Classification[f] 1990	Present Regional Airport Classification[g]	Number of Runways	Runway Surface	Physical Runway Length (Feet)	Effective Runway Length[h] (Feet)	Runway Lighting
					FAA[a]	Survey[b]	State[c]	Total	Itinerant								
Kenosha	Kenosha Municipal	Public	City of Kenosha	Public	86	82	75	64,500	23,000	GT	GT	GU	2	Asphalt	3,600	3,520	Yes
								(FAA, 4/71)						Asphalt	3,300	--	Yes
	Vincent	Private	John Vincent	Public	10	--	2	4,000	2,400	--	--	<BU-I	1	Turf	2,550	1,580	No
	Camp Lake	Private	Leon Sommers	Private	3	--	3	1,200	360	--	--	<BU-I	1	Turf	2,200	--	No
	Olson	Private	Rudolph Olson	Private	0	--	2	100	100	--	--	<BU-I	1	Turf	1,500	--	No
	Westosha	Private	Richard Davis	Private	16	24	7	500	100	--	--	<BU-I	2	Turf	2,600	--	No
								(Survey)						Turf	2,000	--	No
Milwaukee	General Mitchell Field	Public	Milwaukee County	Public	170	183	183	230,903	164,293	AZGT	AT	SAT	5	Concrete	9,916	--	Yes
								(FAA)						Concrete and Asphalt	5,868	--	Yes
														Concrete	8,011	--	Yes
														Concrete	4,182	--	Yes
														Asphalt	4,211	--	Yes
	Timmerman Field	Public	Milwaukee County	Public	163	160	147	143,900	62,066	BT	R	GU[i]	5	Asphalt	4,017	3,425	Yes
								(FAA)						Asphalt	3,200	--	Yes
														Turf	3,230	--	No
														Turf	2,980	--	No
														Turf	1,940	--	No
	Hales Corners	Private	L. Falk	Public	36	40	44	25,200	7,600	--	--	<BU-I	1	Turf	2,100	--	Yes
								(FAA, 4/71)									
	Rainbow	Private	Edward Rediske	Public	30	23	26	20,000	7,000	--	--	<BU-I	2	Asphalt	2,350	--	Yes
								(Survey)						Gravel	2,150	--	Yes
Ozaukee	Ozaukee	Private	Ray Karrels	Public	3	3	6	3,500	1,100	--	--	BU-I	2	Turf	3,000	2,080	No
								(Survey)						Turf	1,800	--	No
	Cedarbird Field	Private	Gernald Ohser	Private	2	--	3	800	240	--	--	<BU-I	1	Turf	1,900	--	No
	Grob	Private	Grob Inc.	Private	10	--	11	3,200	900	--	--	<BU-I	3	Turf	2,600	--	No
														Turf	1,500	--	No
														Turf	2,500	--	No
Racine	Burlington Municipal	Public	City of Burlington	Public	32	38	33	8,000	4,000	BT	BT	BU-II	2	Asphalt	3,600	3,010	Yes
								(Survey)	(FAA, 4/71)					Turf	2,600	--	No
	Fox River	Private	Jerry Mehlhaff	Public	6	8	10	3,200	1,900	--	--	<BU-I	1	Turf	2,600	1,420	No
	Hunt Field	Private	Stanley Hunt and Son	Public	2	--	1	800	240	--	--	<BU-I	1	Turf	1,800	840	No
	Racine Commercial	Private	Racine Commercial Airport Corporation	Public	44	34	43	35,000	10,500	--	--	BT	3	Asphalt	2,446	4,228	Yes
								(FAA, 4/71)						Asphalt	5,825	--	Yes
														Asphalt	4,890	--	Yes
	Sylvania	Private	Albert Koser	Public	30	38	32	12,000	3,600	--	--	<BU-I	1	Asphalt	2,250	1,540	Yes
								(Survey)									
	Valhalla	Private	Francis Moran	Public	2	2	1	200	40	--	--	<BU-I	2	Turf	2,600	1,920	Yes
								(Survey)						Turf	1,320	--	Yes
	Aero Estates	Private	C. J. Carriveau	Private	3	4	1	700	50	--	--	<BU-I	1	Turf	2,700	--	No
								(Survey)									
	Hill Valley	Private	William Dingel	Private	0	1	0	100	100	--	--	<BU-I	1	Turf	3,500	--	No
	Horner Farms	Private	Everett Horner	Private	1	--	--	400	120	--	--	<BU-I	2	Turf	2,075	--	Yes
														Turf	1,365	--	No
	Johnson Wax Heliport	Private	Johnson Air Interest Corporation	Private	0	0	0	--	--	--	--	Heliport	1	Asphalt	70	--	No
	Lewislynn Farm	Private	J. A. Lewis	Private	1	1	--	400	120	--	--	<BU-I	1	Turf	2,300	--	No
	University of Lawsonomy	Private	E. Bates	Private	0	--	0	100	100	--	--	<BU-I	1	Turf	1,650	--	No

Table 23 (continued)

County	Airport	Type of Ownership	Owner	Type of Use	Number of Based Aircraft: FAA[a]	Number of Based Aircraft: Survey[b]	Number of Based Aircraft: State[c]	Estimated Number of Annual Operations[d]: Total	Estimated Number of Annual Operations[d]: Itinerant	Recommended FAA Classification[e] 10-Year	Recommended State Classification[f] 1990	Present Regional Airport Classification[g]	Number of Runways	Runway Surface	Physical Runway Length (Feet)	Effective Runway Length[h] (Feet)	Runway Lighting
Walworth	East Troy Municipal . . .	Public	Village of East Troy	Public	14	18	20	5,700 (FAA, 4/71)	1,700	BT	R	<BU-I	1	Turf	2,075	1,725	Yes
	Big Foot	Private	John C. Ingalls	Public	9	--	8	1,000 (Survey)	300	--	--	BU-I	2	Turf Turf	2,300 3,050	2,520 --	No Yes
	Edgewood Air Seaplane Base	Private	Edgewood Air Inc.	Public	1	--	0	360 (Survey)	100	--	--	Seaport	2	Water Water	7 miles 2 miles	-- --	No No
	Gruenwald	Private	Linda Gruenwald	Public	4	4	4	1,600	480	--	--	BU-I	2	Turf Turf	3,000 2,600	2,380 --	No No
	Mt. Fuji	Private	Ed Meltzer	Public	0	--	0	100	100	--	--	<BU-I	1	Turf	2,200	--	No
	Playboy	Private	Playboy Club Inc.	Public	8	6	6	5,700 (FAA, 4/71)	1,700	--	--	BU-II	1	Asphalt	4,070	3,140	Yes
	Lake Lawn Lodge . . .	Private	Ramada Inn	Public	1	0	7	1,400 (Survey)	1,300	--	--	BU-II	1	Turf	3,200	2,960	No
	Heinrichs	Private	Robert M. Heinrichs	Private	1	--	0	400	120	--	--	<BU-I	1	Turf	1,600	--	No
	Swan	Private	J. P. Swan	Private	--	--	4	100	100	--	--	<BU-I	2	Turf Turf	2,200 2,000	-- --	No No
	Herbert Twist	Private	Herbert and Muriel Twist	Private	--	2	0	800	240	--	--	<BU-I	1	Turf	2,200	--	No
	Wag-Aero	Private	R. H. Wagner	Private	6	6	3	1,200 (Survey)	1,000	--	--	<BU-I	1	Turf	1,700	--	No
	Wal-Co-Wis Farms. . . .	Private	L. H. Whiting, Jr.	Private	2	2	0	800	240	--	--	<BU-I	1	Asphalt	2,000	--	No
Washington	Hartford Municipal . . .	Public	City of Hartford	Public	36	53	48	57,600 (Survey)	30,900	GU	GU	BU-I	2	Asphalt Turf	3,000 2,300	2,450 --	Yes No
	West Bend Municipal. . .	Public	City of West Bend	Public	99	92	82	90,540 (FAA, 6/71)	20,600	BT	BT	GU	2	Asphalt Asphalt	4,500 3,900	3,230 --	Yes Yes
	Hahn's Sky Ranch . . .	Public	Les Hahn	Public	7	--	2	1,000 (Survey)	300	--	--	<BU-I	2	Turf Turf	2,610 2,200	2,060 --	No No
	Doering Farms.	Private	Joseph Doering	Private	0	--	0	100	100	--	--	<BU-I	1	Turf	2,600	--	No
	Willow Creek	Private	Sheldon Pollow	Private	0	0	0	100	60	--	--	<BU-I	1	Turf	1,200	--	No
Waukesha	Waukesha County. . . .	Public	Waukesha County	Public	158	167	165	117,000 (FAA, 11/69)	35,100	GT	R	GU	3	Asphalt Asphalt Turf	4,200 3,600 2,170	3,475 -- --	Yes Yes No
	Aero Park	Private	Mrs. M. Stopar	Public	8	11	12	3,200 (FAA, 6/71)	1,000	--	--	<BU-I	3	Turf Turf Turf	2,200 2,400 1,500	-- -- --	No No No
	Capitol Drive	Private	Mrs. B. Zwrifel	Public	50	58	49	35,000 (FAA, 6/71)	10,500	--	--	<BU-I	3	Turf Turf Turf	2,000 1,700 1,560	1,325 -- --	No No No
	O'Leary Field	Private	Donald O'Leary	Public	2	--	1	800	240	--	--	<BU-I	1	Turf	1,300	--	No
	Oconomowoc	Private	R. E. Wessel	Private	3	--	2	1,200	360	--	--	<BU-I	1	Turf	1,400	--	No
Region	46	--	--	--	1,059	1,060	1,043	884,403	396,469	--	--	--	--	--	--	--	--

[a] *Federal Aviation Administration, Airport Master Record Form 5010-1.*

[b] *R. Dixon Speas Associates, Inc., Airport Inventory Survey.*

[c] *Wisconsin aircraft registration records.*

[d] *The estimated number of annual operations for certain airports, were derived, as noted, from FAA and airport inventory data. The number of annual operations at the remaining airports was estimated based on the FAA and inventory findings for similar airports, the number of based aircraft at the airport, and the relationship between the number of based aircraft and airport operations as shown by the FAA and survey findings for similar airports.*

[e] *1972 National Airport System Plan, U. S. Department of Transportation, Federal Aviation Administration.*

[f] *Interim Wisconsin Airport System Plan prepared by the Wisconsin Department of Transportation.*

[g] *The airport classification is based upon effective runway length.*

[h] *Effective runway length is the length of the airport's longest runway corrected for airport elevation, mean maximum temperature, and obstructions in the runway approach zone that may affect aircraft performance.*

[i] *Timmerman Field is presently restricted to use by non-turbojet powered aircraft.*

Source: U. S. Department of Transportation, Federal Aviation Administration; R. Dixon Speas Associates, Inc.; Wisconsin Department of Transportation, Division of Aeronautics; and SEWRPC.

and operational role was developed for use in the regional airport system planning program. This airport classification system is also used in defining each facility's role in the future airport system plan. The system permits division of existing and future airports into 10 categories, three of which are special categories.

Each of these airport classifications can be described functionally in terms of the geographic service area and population served, and operationally in terms of the types of aircraft served and the number of annual operations of critical aircraft. The physical capability of an airport to accommodate the various types of aircraft is extremely important to the operational function of the airport. The 10 airport classification categories used in the regional airport system planning program are shown in Table 24, as are the operational characteristics of each category. The airport classification system as well as the aeronautical service capabilities of each classification are shown in Table 25, while the number of airports in the Region according to airport classification and aeronautical service provided is shown in Table 26.

Due to the physical limitations of some existing airports in the Region, the "basic utility" classification shown in Table 24 was subdivided to properly classify those air-

Table 24

MAJOR OPERATIONAL CHARACTERISTICS OF THE AIRPORT CLASSIFICATIONS USED IN THE REGIONAL AIRPORT SYSTEM PLANNING PROGRAM

Airport Classification	Operational Characteristics	
	Aeronautical Service and Aircraft Limitations	Minimum Principal Runway Length[a] (Feet)
Scheduled Air Transport—Primary . . .	All certificated air carrier service and all levels of general aviation service that result in a minimum of 1,000,000 enplaning passengers annually.	5,500 to 11,500
Scheduled Air Transport—Secondary . .	Certificated air carrier service and all levels of general aviation service that result in a minimum of 50,000 to 1,000,000 enplaning passengers annually.	5,500 to 11,500
Scheduled Transport—Feeder	Certificated and noncertificated (third level) air carrier service and all levels of general aviation service that result in less than 50,000 enplaning passengers annually.	5,500 to 11,500
General Transport	General aviation service except service using aircraft over 175,000 pounds maximum gross takeoff weight.	5,000 to 8,500
Basic Transport	General aviation service except service using aircraft over 60,000 pounds maximum gross takeoff weight.	4,600
General Utility	General aviation service except service using aircraft over 12,500 pounds maximum gross takeoff weight or service using turbojet powered aircraft.	3,200
Basic Utility[b]	General aviation service using aircraft less than 8,000 pounds maximum gross takeoff weight except service using turbojet powered aircraft.	2,700
Heliport	Special aviation service provided by vertical takeoff and landing aircraft.	190 pad
STOLport	Certificated air carrier and general aviation service provided by aircraft having short takeoff and landing capabilities.	2,000
Seaplane Base	Special aviation service provided by aircraft having capabilities to land and take off from water.	3,500

[a] *Runway length must be corrected for airport elevation, mean maximum temperature, obstructions in the runway approach zone that may affect aircraft performance, and for transport airports, runway gradient.*

[b] *Basic utility or lower airports are subdivided into three categories—Basic Utility Stage II (BU-II), Basic Utility Stage I (BU-I), and less than Basic Utility Stage I (<BU-I). The Basic Utility Stage II airport has the operational characteristics shown in this table. The Basic Utility Stage I airport has a minimum effective runway length of 2,400 feet and therefore can accommodate only 90 percent of the general aviation fleet that can be accommodated at the Basic Utility Stage II airport. An airport classified as less than Basic Utility Stage I has a principal runway length of 2,400 feet or less and therefore can serve only up to 60 percent, the actual percentage dependent upon runway length, of the general aviation fleet that can be accommodated at a Basic Utility Stage II airport.*

Source: SEWRPC.

ports not fully capable of achieving minimum standards set forth for such airports. The type of aircraft that can be safely accommodated by an airport is dictated primarily by the runway length available for takeoff and landing operations. Since most aircraft engine performance is affected to some degree by altitude (airport elevation) and temperature, the physical runway length must be corrected to reflect standard conditions, that is, mean sea level and standard temperature (59°F).

In the Southeastern Wisconsin Region, airport elevations range from 727 feet to 1,065 feet, while average maximum temperatures range from 76°F to 84°F. The effect of these variables on aircraft performance, and the requirement to clear obstructions such as highways, railroads, and utility lines within the approach zone of each runway, may effectively reduce the physical runway length available for safe operations, and thus limit the types of aircraft that can operate from the shorter runway. Recognition of these operational limitations is critical with respect to basic utility airports.

Therefore, to account for these restrictions, it was necessary to divide basic utility airports into three categories in order to better define each airport's capability. These three categories are: Basic Utility Stage II—basic utility airports having a minimum effective runway length of 2,700 feet and therefore capable of accommodating 100 percent of the general aviation aircraft of less than 8,000 pounds gross weight; Basic Utility Stage I—basic utility airports having a minimum effective runway length of 2,400 feet and therefore capable of accommodating

Table 25

TYPE OF AERONAUTICAL SERVICE PROVIDED BY AIRPORTS
IN THE REGION ACCORDING TO AIRPORT CLASSIFICATION

Airport Classification	Aeronautical Service Category			
	Air Carrier	General Aviation	Military	Special Use
Scheduled Air Transport—Primary	X	X	X	--
Scheduled Air Transport—Secondary	X	X	X	--
Scheduled Air Transport—Feeder	X	X	X	--
General Transport	--	X	X	--
Basic Transport	--	X	X	--
General Utility	--	X	X	--
Basic Utility	--	X	X	--
Heliport	--	--	X	X
STOLport	--	--	X	X
Seaplane Base	--	--	X	X

Source: SEWRPC.

Table 26

NUMBER OF AIRPORTS IN THE REGION ACCORDING TO AIRPORT CLASSIFICATION
AND AERONAUTICAL SERVICE PROVIDED: 1971

Airport Classification	Aeronautical Service Category				
	Air Carrier	General Aviation	Special Service	Military	Total
Scheduled Air Transport—Primary	0	0	0	0	0
Scheduled Air Transport—Secondary	1	0	0	0	1
Scheduled Air Transport—Feeder	0	0	0	0	0
General Transport	0	0	0	0	0
Basic Transport	0	1	0	0	1
General Utility	0	4	0	0	4
Basic Utility	0	38	0	0	38
STOLport	0	0	0	0	0
Heliport	0	0	1	0	1
Seaplane Base	0	0	1	0	1
Total	1	43	2	0	46

Source: SEWRPC.

90 percent of the general aviation aircraft of less than 8,000 pounds gross weight; and less than Basic Utility Stage I—basic utility airports having an effective runway length of less than 2,400 feet and therefore capable of accommodating only up to 60 percent, the actual percentage dependent upon runway length, of the general aviation aircraft of less than 8,000 pounds gross weight.

This airport classification system provides ready assignment of all airports within the Region to one of these classifications. This classification system is also consistent with that being used in development of the Wisconsin statewide airport system plan. These operational standards, together with functional standards, are detailed in Chapter VII of this report, which sets forth the objectives, principles, and standards for the regional airport system plan.

A national airport classification system has been developed and is used by the Federal Aviation Administration (FAA). This system is based upon the number of annual enplaned passengers and aircraft operations at each airport, and consists of three distinct categories of airports differentiated by the levels of public service either provided or proposed to be provided by the airports. Each category is further classified into three levels of aeronautical activity. This FAA classification system is shown in Table 27. Comparison of this table with inventory data in this chapter indicates that only one airport in the Region—General Mitchell Field—would be classified higher than a feeder system airport under the national airport classification system. General Mitchell Field would be classified as a medium density, secondary system airport. The present classification of all existing public use airports in the Region under the regional airport system classification is set forth in Table 23, which also shows the recommended classification of existing airports under the state interim plan for 1990 and the National Airport System Plan for 1982.

Landing Area and Terminal Area Facilities

Assessing the capability of an existing airport system requires a determination of the capacity limitations of three distinct elements of individual airports: the airport landing area and airport terminal area, the airport related airspace and associated air navigation aids, and the airport related surface transportation facilities. Inventory data required to determine each of these capacity limitations were gathered for all 46 existing airports in the Region. The inventories relating to the airport landing and terminal areas are discussed in this section, while the findings of the inventories relating to airport related surface transportation facilities and airspace and related air navigation aids are discussed in subsequent sections of this chapter.

To determine airport landing area capacity, definitive knowledge of those factors affecting the ability of runways and taxiways to accept aircraft takeoff and landings is required. These factors include the number, length, and direction of runways; the number and location of taxiways; the size and location of apron facilities; and the types of air navigation aids. Similarly, definitive knowledge of individual elements of the terminal area is necessary to determine the area's overall capability to accept passengers, cargo, and aircraft. These elements include the number of airline and cargo gate positions, the size and location of airline and general aviation apron areas, the number of general aviation tie-down areas and the size and location of hangar facilities, the size and location of airline passenger and general aviation terminal

Table 27

FEDERAL AVIATION ADMINISTRATION AIRPORT CLASSIFICATION SYSTEM

Airport Category	Public Service Level (Number of Annual Enplaned Passengers)	Aeronautical Activity (Number of Annual Aircraft Operations)
Primary	More than 1,000,000	--
High Density	--	More than 350,000
Medium Density. . . .	--	250,000 to 350,000
Low Density	--	Less than 250,000
Secondary	50,000 to 1,000,000	--
High Density	--	More than 250,000
Medium Density. . . .	--	100,000 to 250,000
Low Density	--	Less than 100,000
Feeder	Less than 50,000	--
High Density	--	More than 100,000
Medium Density. . . .	--	20,000 to 100,000
Low Density	--	Less than 20,000

Source: U. S. Department of Transportation, Federal Aviation Administration.

and cargo buildings, the type and size of aircraft maintenance and support facilities, and the size and location of automobile parking facilities.

Some additional characteristics important to a proper assessment of airport facilities within the Region include airport ownership and acreage, the number of based aircraft, and annual air traffic volume. Airport ownership is significant in determining the number of future facilities. Historically, as a region urbanizes, privately owned airports have tended to be abandoned and converted to other urban land uses. Publicly owned airports, on the other hand, are usually maintained and improved, due primarily to the ability of municipalities and counties to provide the necessary funds as well as secure federal and state assistance for improvements. In most cases, airport size is directly related to the quality of the airport—the larger the acreage, the better the airport. This characteristic is important when determining the improvement or expansion potential of ground services and business activities at the airport. Protection from encroachment by residential and commercial development in the airport environs is also related to acreage. The number of based aircraft and the annual air traffic volume are other factors indicative of airport quality. Those airports providing only limited facilities and services normally have few based aircraft. Similarly, those limited airports will usually cater to predominantly local activity rather than itinerant and transient traffic.

As previously described, the 46 aviation facilities within the Region include one air carrier airport, 43 general aviation public and private or restricted use airports, one heliport, and one seaplane base. Of the 26 public use airports, including 25 general aviation airports and one seaplane base but excluding the Region's only air carrier airport, only seven are publicly owned and operated. There are presently no exclusive military use airports within the Region. These 46 landing areas are classified according to aeronautical service, ownership, and use in Table 28.

Air Carrier: General Mitchell Field, the only air carrier airport in the Region, is located in the City of Milwaukee approximately three miles south of the central business district. Owned by Milwaukee County, the 2,080-acre facility is served by five airlines: Eastern Air Lines, Inc.; North Central Airlines, Inc.; Northwest Airlines, Inc.; Ozark Air Lines, Inc.; and United Airlines, Inc., as well as other commuter services.[1] The airport is bounded on the north by E. Layton Avenue, on the east by the Chicago and Northwestern Railroad tracks, on the south by E. College and E. Rawson Avenues, and on the west by S. Howell Avenue and S. 6th Street.

Residential, commercial, and industrial development has almost completely surrounded the existing airport. As shown in Figure 18, the area is highly developed to the north with residential areas; to the west with commercial, industrial, and residential areas; and to the east with industrial and residential areas. To the south, development is still relatively sparse, and includes residential and farm land.

[1] *At the time of the 1971 enplaning passenger travel pattern survey, commuter service was provided by Air Michigan, Inc., which subsequently ceased operations at General Mitchell Field. Midstate Air Commuter, which is still operating, initiated service in 1972.*

Table 28

CLASSIFICATION OF AIRPORTS IN THE REGION ACCORDING TO AERONAUTICAL SERVICE, OWNERSHIP, AND USE: 1971

Aeronautical Service, Ownership, and Use	County							Region
	Kenosha	Milwaukee	Ozaukee	Racine	Walworth	Washington	Waukesha	
Air Carrier	0	1[a]	0	0	0	0	0	1
General Aviation								
Publicly Owned, Public Use	1	1	0	1	1	2[a]	1	7
Privately Owned, Public Use	1	2	1	5	5	1	3	18
Privately Owned, Private Use	3	0	2	5	5	2	1	18
Military	0	0	0	0	0	0	0	0
Special Use, Privately Owned								
Heliport-Private Use	0	0	0	1	0	0	0	1
Seaplane-Public Use	0	0	0	0	1	0	0	1
Total	5	4	3	12	12	5	5	46

[a] *General Mitchell Field and the West Bend Municipal Airport are joint use civil/military facilities.*

Source: SEWRPC.

Figure 18

GENERAL MITCHELL FIELD AND ENVIRONS—MILWAUKEE COUNTY÷1975

Source: SEWRPC.

Access to the main terminal area is from S. Howell Avenue. Access to peripheral general aviation and Wisconsin Air National Guard facilities is from E. Layton and E. College Avenues, with access to eastern facilities via the airport service road from E. Layton Avenue and via another entrance from E. Grange Avenue. Interstate highway 94 is located to the west and northwest of the airport. Plans are currently underway to construct a freeway spur, as recommended in the adopted regional transportation plan, to the main terminal area from an interchange with IH 94 south of W. Grange Avenue, directly west of the airport. This spur would replace S. Howell Avenue as the primary access route to the airport.

The airport's operational area consists of the five runways, described in Table 29. The primary north-south runway (IL-19R) has a Category II instrument landing system[2] for approaches from the south (IL) to assist aircraft under conditions down to a 100-foot ceiling and visibility of 1,200 feet.[3] The secondary runway (7R-25L) has a Category I instrument landing system for approaches from the southwest (7R) which permits landing operations down to a 200-foot ceiling and one-half mile visibility. Both runways have a 2,500-foot approach lighting system and both are equipped with high-intensity runway lights. Runway IL-19R also has a complete centerline lighting system. Instrument approaches to runway IL-19R from the north can be accomplished using the North Park nondirectional low-frequency radio beacon (NDB) located 6.4 miles north of the airport. Landing operations on this approach are permitted under conditions exceeding a 500-foot ceiling and one-mile visibility. Runway end identification lights (REIL) are available on runways IL and 7R, while visual approach slope indicators (VASI) are provided on runway ends IL and 13.

The passenger terminal, which is the only commercial airline passenger terminal serving the Region, has a total area of 246,900 square feet (see Table 30), and houses the operations of the five airlines, the other commuter services, the FAA Tower, and the Milwaukee County Airport offices and related concession facilities. Support areas near the passenger terminal include the FAA building, power house, cargo building, car rental areas, and related facilities.

[2]*A precision landing aid providing azimuth, elevation, and position guidance to the aircraft pilot.*

[3]*Minimum cloud cover and forward visibility.*

Table 30

CHARACTERISTICS OF THE TERMINAL AREA FACILITIES AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1971

Terminal Area Facility	Number or Size
Air Carrier Terminal	
Public, Administrative, and Mechanical Operations (Square Feet)	149,300
Concessions (Square Feet)	25,600
Airline Operations (Square Feet)	72,000
Total (Square Feet)	246,900
Public Parking (Number of Spaces)	1,450
Gates	
Passenger	21
Cargo	2
Apron	
Passenger (Square Yards)	151,400
Cargo (Square Yards)	7,500
General Aviation Areas	
Apron Area (Square Yards)	140,300
"T" Hangars	24
Conventional Hangar Areas (Square Yards)[a]	23,900
Paved Tie-downs	100

[a]*Excludes the five separate corporate hangar units.*

Source: R. Dixon Speas Associates, Inc.

Table 29

CHARACTERISTICS OF THE RUNWAY SYSTEM AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1971

Runway Orientation	Runway Length and Width (Feet)	Allowable Loadings (Pounds)		
		Single Wheel	Dual Wheel	Dual Tandem Wheels
North-South (IL-19R)	9,916 x 200	75,000	125,000	210,000
(IR-19L)	4,180 x 150	75,000	125,000	210,000
Northeast-Southwest (7R-25L)	8,011 x 150	75,000	110,000	185,000
(7L-25R)	4,211 x 100	41,000	53,000	80,000
Northwest-Southeast (13-31)	5,868 x 150	75,000	100,000	155,000

Source: General Mitchell Field Airport Layout Plan.

The present terminal is a two-level structure with ticket and baggage claim areas on either end of the lobby at the entrance level. Escalators lead to a second level lobby bridging a service court. This lobby, which contains most airport concessions, leads to the north, east, and south concourses as shown in Figure 19. The FAA Air Traffic Control Tower is located over this lobby section. The six-gate north concourse, the last of the original one-level concourses, is used by Ozark Air Lines. The two-level east concourse, built in 1967, has seven gates, five of which have enclosed aircraft loading bridges. Three of these gates (A1, A3, and A5) are used by United Airlines, and four (A2, A4, A6, and A7) are used by Northwest Airlines.

The banjo-shaped south concourse built in 1969 has eight gates. In addition to the six-gate (B14 to B19) rotunda at the end of the concourse which is used exclusively by North Central Airlines, two gates are located about midway along Concourse B. Gate B-12, leased by North Central Airlines, is normally subleased to other airlines on demand, while gate B-11 is used by Eastern Air Lines. Various airline operations areas and concession and support facilities are located at the apron level beneath the concourses and concession areas. Mechanical and storage areas are located at the basement level beneath the main lobby and concession areas.

Since the airport is predominantly a commercial airline airport, most services are supplied by or to the airlines and their passengers. Facilities and services include a restaurant, flight kitchen, snack bar, cocktail lounge, rental cars, cab service, public limousine service, valet parking, gift shop, and flight insurance counters.

Air cargo facilities at General Mitchell Field presently include two separate cargo buildings, each containing approximately 16,000 square feet of processing space. One building, owned by Mitchell Facilities, Inc., a freight forwarding firm, is located northwest of the passenger terminal along the main entrance to the airport. Since this building has no adjacent aircraft ramp and parking apron or cargo loading gates, cargo shipped from this location must be transferred by motor vehicle to an aircraft parking area located about 700 feet away at the north end of the passenger terminal aircraft parking apron.

The second cargo building, used by United Airlines, is located adjacent to S. Howell Avenue near the old Air National Guard building. Cargo from this building is trucked about one-half mile to the cargo aircraft apron north of the passenger terminal. There are two cargo loading positions in front of the old Air National Guard building, but these are seldom used.

General aviation services, which include aircraft sales and service, fuel sales, flight training, aircraft charters, hangar storage, tie-down storage, and major and minor airframe, engine, and radio repairs, are provided by Mitchell Aero, Inc., a fixed base operation, and by Aerodyne, Inc., an air taxi and fixed base operation.

There are 166 civilian aircraft, including 105 single-engine aircraft and 61 twin-engine aircraft, based at General Mitchell Field. Most are operated for business, commercial, or instructional purposes. Personal use of aircraft is small because the airport does not have low-cost tie-down areas; and hangar space, when available, is costly. In addition, there are 17 military aircraft based at General Mitchell Field, 11 by the Wisconsin Air National Guard and six by the Air Force Reserve.

At present there are four separate general aviation areas within General Mitchell Field, having a total of 140,000 square yards of apron area, 24 "T" hangars, and 100 paved tie-downs. In addition, there are two storage/maintenance hangars having approximately 23,900 square yards of space. There are also five privately owned hangars, each designed and used for a specific corporate business aircraft. These terminal area facilities are also summarized in Table 30.

An airport master plan prepared in 1968 by Arnold Thompson Associates[4] proposed extensive modifications to the existing General Mitchell Field passenger terminal complex. The plan, shown in Figure 20, included a crescent-shaped terminal to incorporate not only ticketing and baggage claim areas but also a large automobile parking structure. Aircraft boarding and servicing functions were to be accommodated in five concourse satellite structures. The proposed new facilities were to be built above and around the existing terminal, increasing the size of the complex to 696,000 square feet and 47 gates. All present aircraft, including the wide-bodied 747's, were considered in the terminal design.

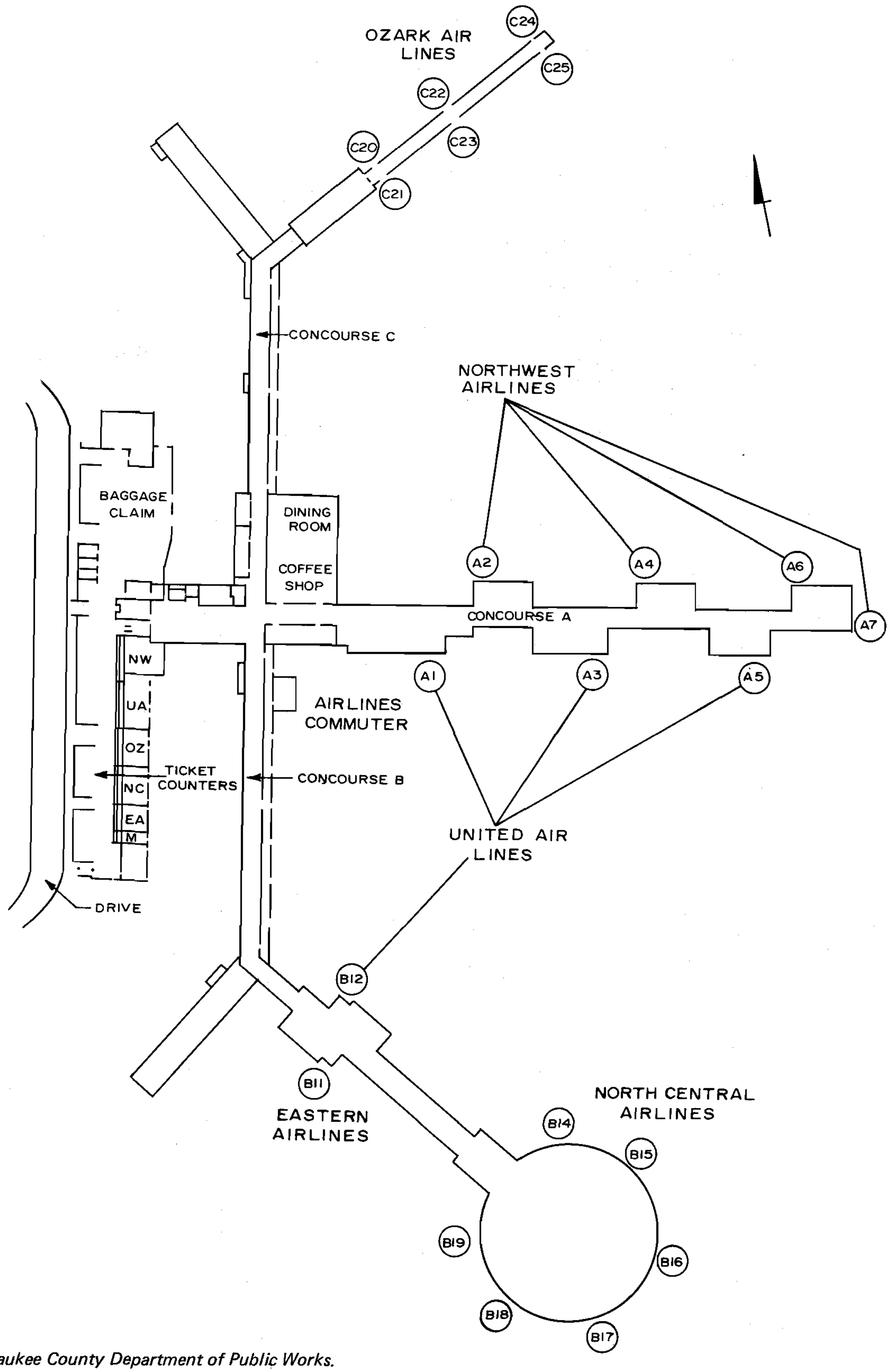
An airport master plan study for General Mitchell Field was initiated in 1973. From information developed under the study and the regional airport system planning program, the airport terminal plan was reviewed and revised. As recommended in a report prepared by the Milwaukee County Department of Public Works and Herbert H. Howell, Airport Consultant,[5] the terminal layout plan shown in Figure 21 is proposed to replace the one initially developed under the Thompson plan. In its final (1995) stage, the proposed terminal area would contain a terminal of 1,200,000 square feet with complete domestic and international facilities, providing for 52 aircraft parking gates, each designed to accommodate a variety of aircraft. Structural parking would also be provided for 6,000 cars, and remote parking would be provided for an additional 1,800 vehicles. The refined terminal plan is considered less expensive than the

[4]*General Mitchell Field, Passenger and Air Cargo Facilities Master Plan, Arnold Thompson Associates, Inc., Airport Facility Consultants, White Plains, New York, October 1968.*

[5]*Conceptual Plan for Terminal Area Development, General Mitchell Field, Milwaukee, Wisconsin, October 1974, Milwaukee County Department of Public Works and Herbert H. Howell, Airport Consultant.*

Figure 19

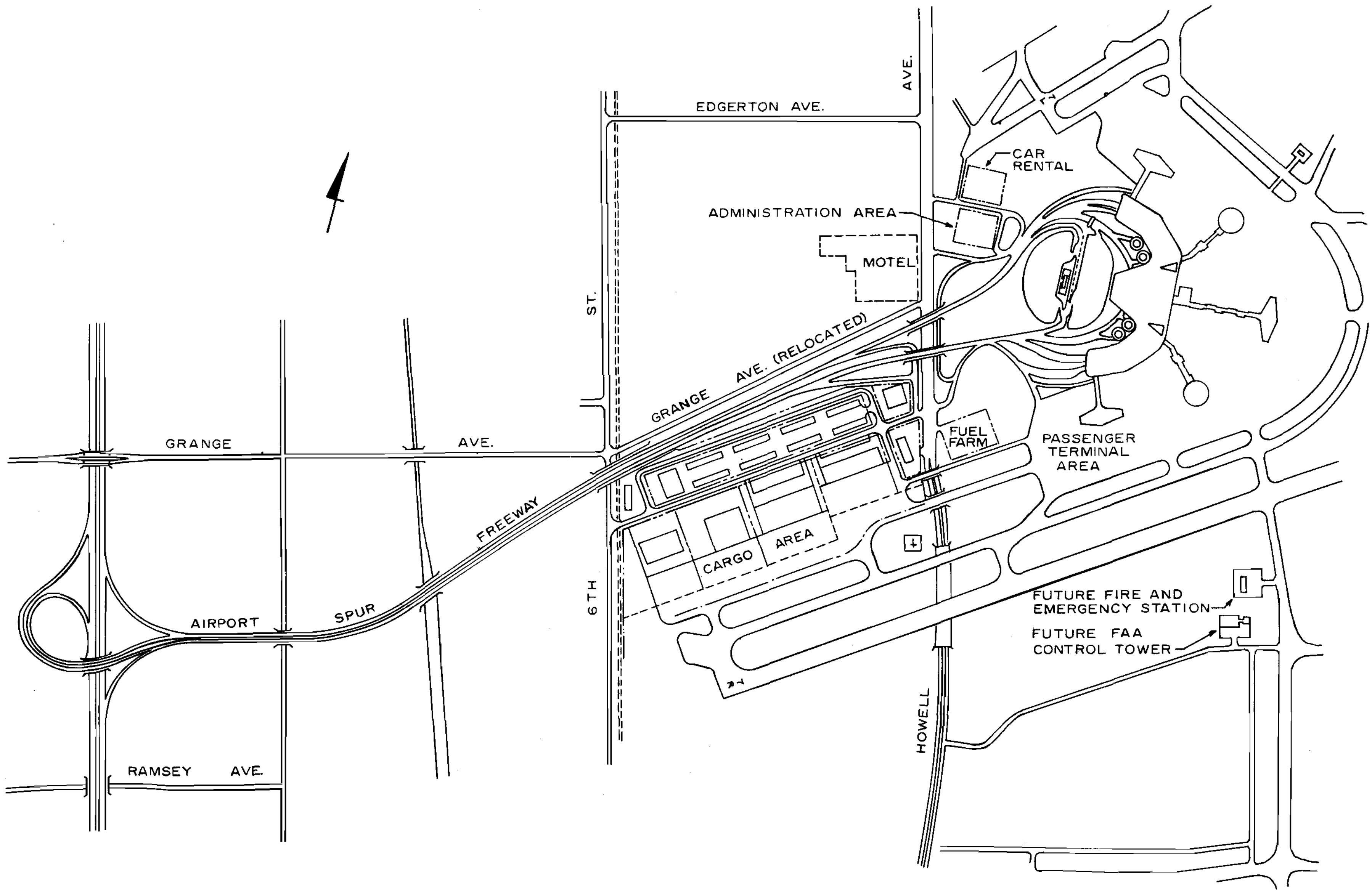
PASSENGER TERMINAL BUILDING LAYOUT FOR GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1971



Source: Milwaukee County Department of Public Works.

Figure 20

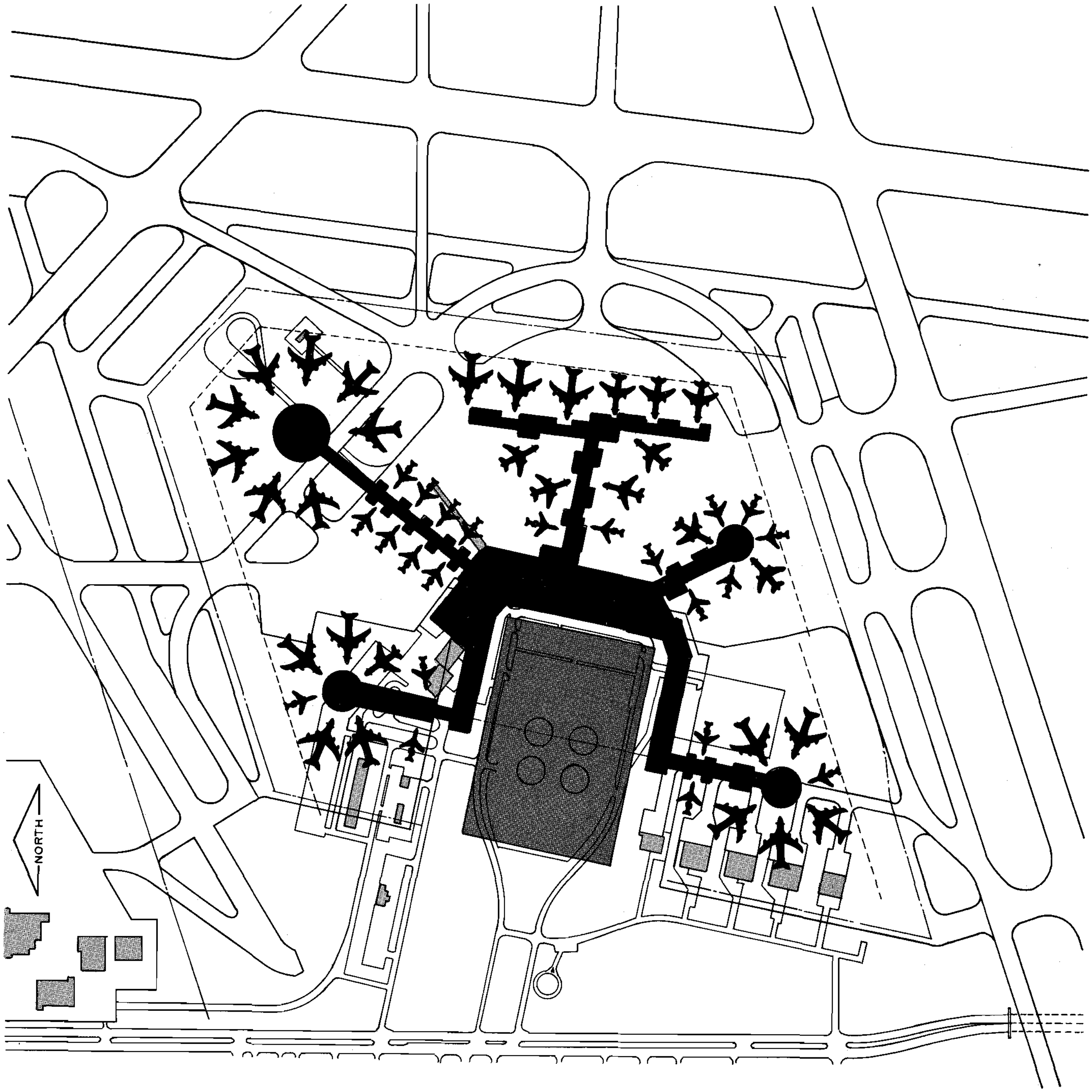
PROPOSED PASSENGER TERMINAL AND ACCESS ROADS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1968



Source: Arnold Thompson Associates, Inc.

Figure 21

REVISED TERMINAL LAYOUT PLAN FOR GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1974



Source: *Milwaukee County Department of Public Works and Herbert H. Howell, Airport Consultant.*

Thompson proposal, can be developed in stages as demand increases, and can be coordinated with other major elements of the Thompson proposal such as the airport access freeway and air freight facilities.

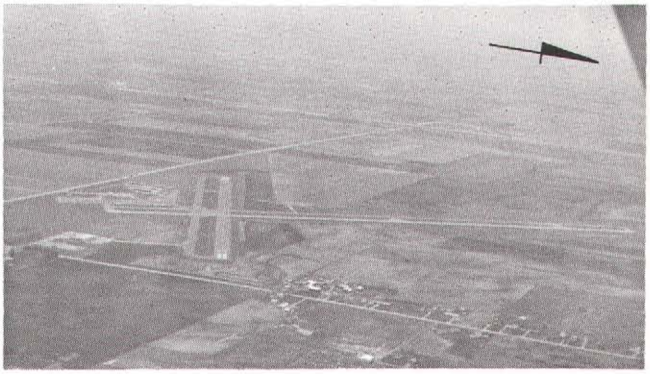
The Thompson master plan also proposed an air freight and cargo center to be located south of the new airport entrance freeway and north of runway 7R-25L between S. Howell Avenue and S. Sixth Street. The complex is to be divided into two distinct areas: air carrier cargo buildings and freight forwarder buildings. The air carrier cargo buildings are to occupy land which will accommodate up to 590,000 square feet of cargo facility space and allow up to 325 feet of building depth. The 115,000 square yards of paved aircraft apron south of the cargo buildings will provide 2,170 lineal feet of possible aircraft interface with the air carrier cargo buildings, and will have a minimum depth of 450 feet which will accommodate the wide-bodied 747 aircraft. The proposed freight forwarder buildings, to be located north of, and parallel to, the air carrier cargo facilities, are to be arranged in two parallel rows with a maximum length of 1,900 feet and a maximum depth of 85 feet, and will provide up to 323,000 square feet of available building area for the freight forwarders. The two rows of buildings are to be separated by 90 feet of paved area for use by trucks and other delivery vehicles.

General Aviation: The 25 publicly and privately owned general aviation public use airports within the Region are grouped by operational classification in Table 31. The availability of seven publicly owned general aviation airports in the Region provides a foundation for a regional air transportation system. Each county with the exception of Ozaukee has at least one county or municipally owned and operated general aviation airport. Of the seven publicly owned general aviation airports, Waukesha and Timmerman Field are county owned, while Kenosha, Burlington, East Troy, Hartford, and West Bend are municipally owned. At the time of the inventory, these seven airports accommodated nearly 68 percent, or 630, of the 933 aircraft based at general aviation airports in the study area. Of the 133 multi-engine aircraft based at general aviation airports within the Region, 82 percent, or 109, were based at these seven locations. Further, of the 640,940 annual aircraft operations at the 25 public use general aviation airports, 487,240 annual operations, or 72 percent, were accommodated at these seven airports. These 25 general aviation public use airports are shown in Figures 22 through 46.

The publicly owned and operated airports include four general utility and three basic utility airports. All of the publicly owned airports except East Troy Municipal in Walworth County provide year-round reliability with paved and lighted runways. Except for East Troy Municipal and Hartford Municipal in Washington County, all publicly owned airports provide some form of instrument

Figure 22

KENOSHA MUNICIPAL AIRPORT
CITY OF KENOSHA, KENOSHA COUNTY



SEWRPC Photo.

Table 31

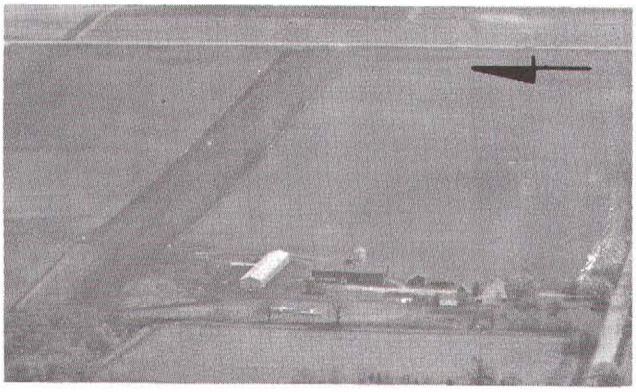
SUMMARY OF GENERAL AVIATION PUBLIC USE AIRPORTS IN THE REGION
ACCORDING TO AIRPORT CLASSIFICATION AND OWNERSHIP: 1971

County	Airport Classification and Ownership								Total	
	General Transport		Basic Transport		General Utility		Basic Utility			
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Kenosha	--	--	--	--	1	--	--	1	1	1
Milwaukee . . .	--	--	--	--	1	--	--	2	1	2
Ozaukee	--	--	--	--	--	--	--	1	--	1
Racine	--	--	--	1	--	--	--	4	1	5
Walworth . . .	--	--	--	--	--	--	1	5	1	5
Washington . . .	--	--	--	--	1	--	1	1	2	1
Waukesha . . .	--	--	--	--	1	--	--	3	1	3
Region	--	--	--	1	4	--	3	17	7	18

Source: SEWRPC.

Figure 23

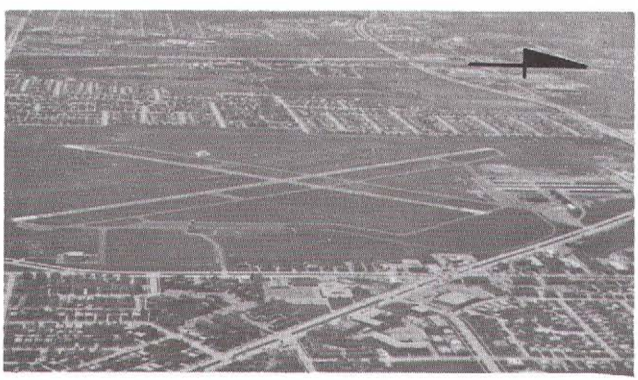
VINCENT AIRPORT
TOWN OF RANDALL, KENOSHA COUNTY



Wisconsin Department of Transportation Photo.

Figure 24

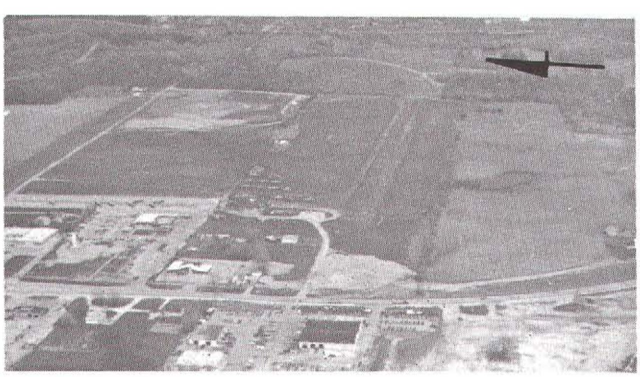
TIMMERMAN FIELD
CITY OF MILWAUKEE, MILWAUKEE COUNTY



SEWRPC Photo.

Figure 25

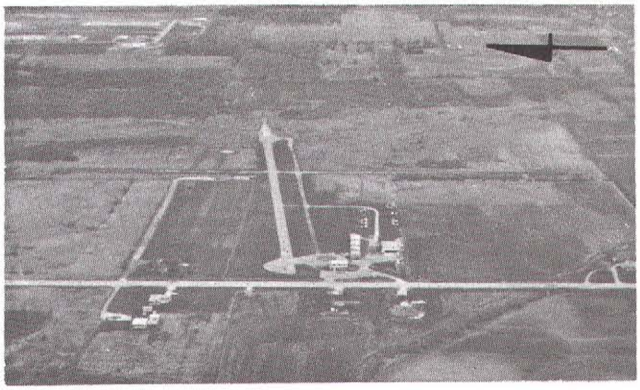
HALES CORNERS AIRPORT
VILLAGE OF HALES CORNERS AND CITY OF FRANKLIN
MILWAUKEE COUNTY



SEWRPC Photo.

Figure 26

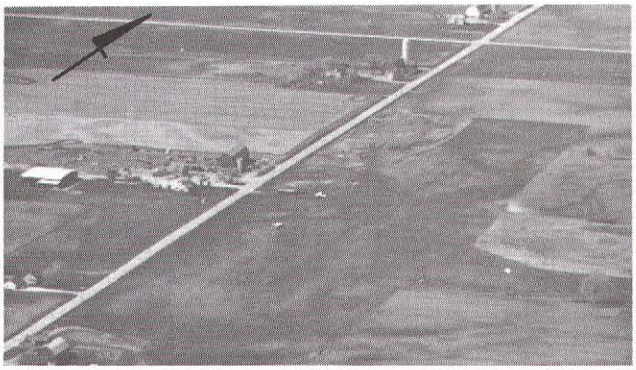
RAINBOW AIRPORT
CITY OF FRANKLIN, MILWAUKEE COUNTY



SEWRPC Photo.

Figure 27

OZAUKEE AIRPORT
TOWN OF PORT WASHINGTON, OZAUKEE COUNTY



Wisconsin Department of Transportation Photo.

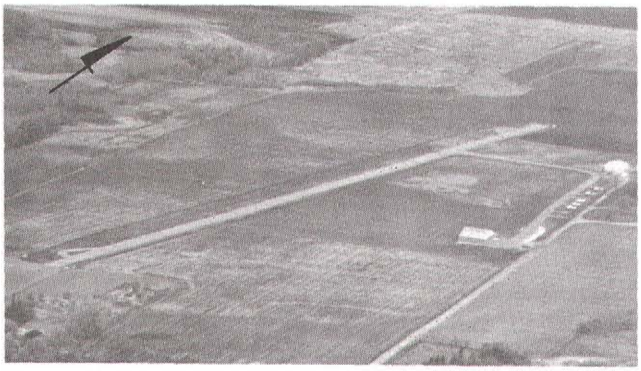
Figure 28

BURLINGTON MUNICIPAL AIRPORT
CITY OF BURLINGTON, RACINE COUNTY

SEWRPC Photo.

Figure 29

FOX RIVER AIRPORT
TOWN OF ROCHESTER, RACINE COUNTY



Wisconsin Department of Transportation Photo.

Figure 30

HUNT FIELD,
TOWN OF NORWAY, RACINE COUNTY

Wisconsin Department of Transportation Photo.

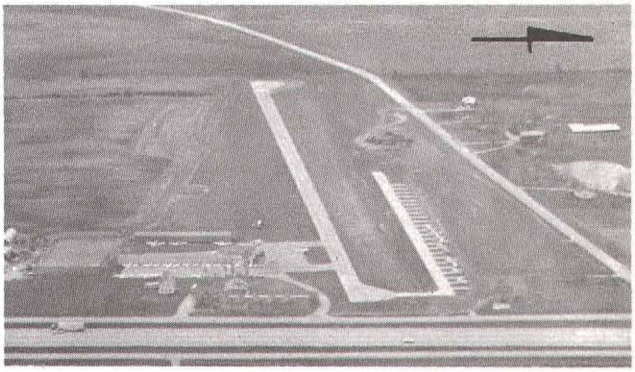
Figure 31

RACINE COMMERCIAL AIRPORT
TOWN OF CALEDONIA, RACINE COUNTY

SEWRPC Photo.

Figure 32

SYLVANIA AIRPORT
TOWN OF YORKVILLE, RACINE COUNTY



Wisconsin Department of Transportation Photo.

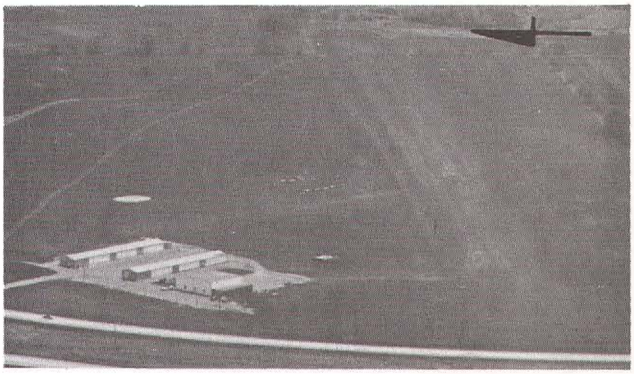
Figure 33

VALHALLA AIRPORT
TOWN OF RAYMOND, RACINE COUNTY

SEWRPC Photo.

Figure 34

EAST TROY MUNICIPAL AIRPORT
VILLAGE OF EAST TROY, WALWORTH COUNTY



Wisconsin Department of Transportation Photo.

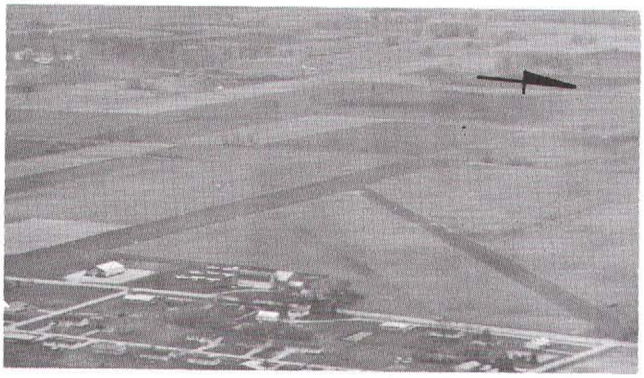
Figure 35

BIG FOOT AIRPORT
TOWN OF WALWORTH, WALWORTH COUNTY

SEWRPC Photo.

Figure 36

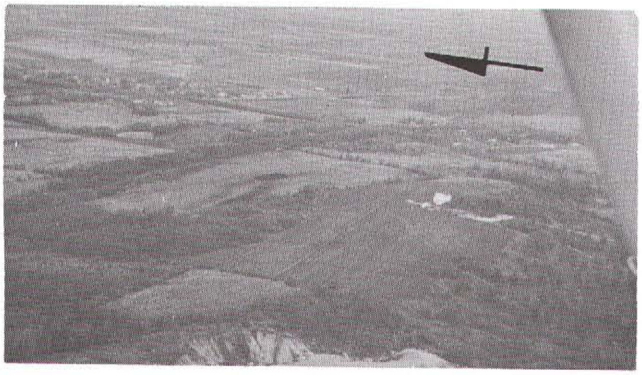
GRUENWALD AIRPORT
TOWN OF GENEVA, WALWORTH COUNTY



Wisconsin Department of Transportation Photo.

Figure 37

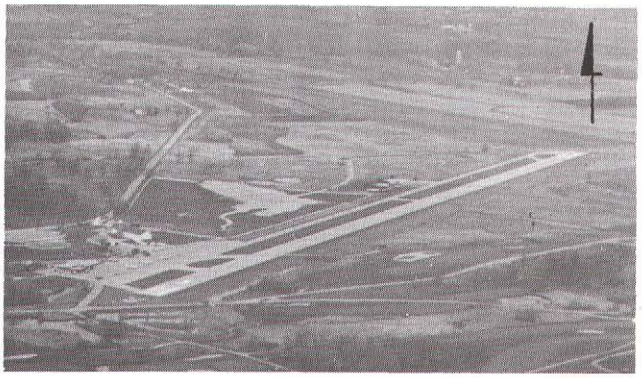
MT. FUJI AIRPORT
TOWN OF GENEVA, WALWORTH COUNTY



SEWRPC Photo.

Figure 38

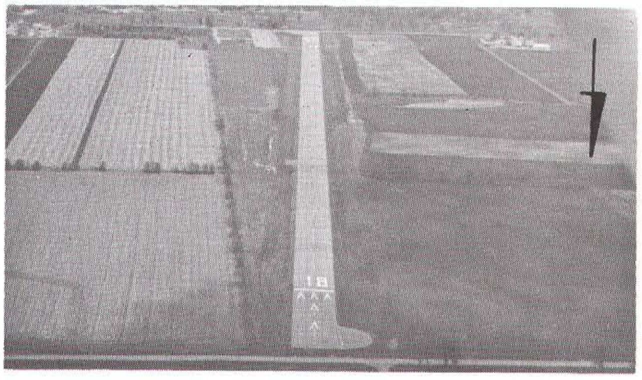
PLAYBOY AIRPORT
TOWN OF LYONS, WALWORTH COUNTY



Wisconsin Department of Transportation Photo.

Figure 39

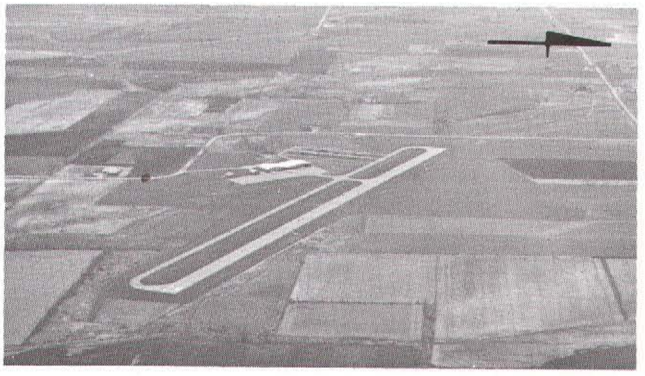
LAKE LAWN LODGE AIRPORT
TOWN OF DELAVAN, WALWORTH COUNTY



SEWRPC Photo.

Figure 40

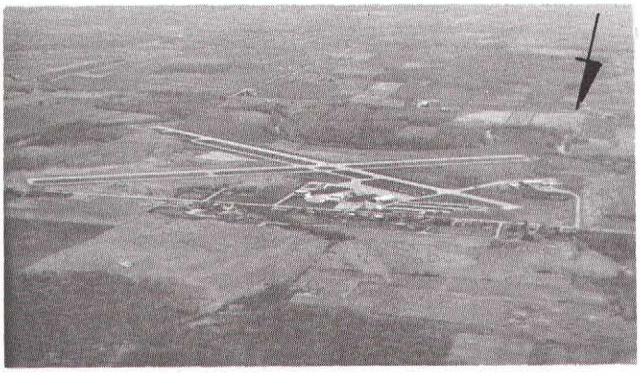
HARTFORD MUNICIPAL AIRPORT
CITY OF HARTFORD, WASHINGTON COUNTY



SEWRPC Photo.

Figure 41

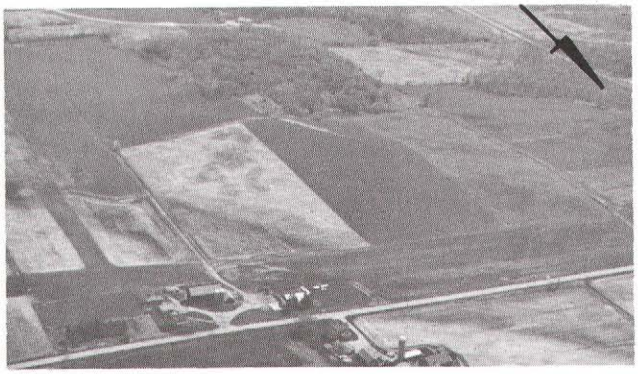
WEST BEND MUNICIPAL AIRPORT
CITY OF WEST BEND, WASHINGTON COUNTY



SEWRPC Photo.

Figure 42

HAHN'S SKY RANCH AIRPORT
TOWN OF WAYNE, WASHINGTON COUNTY



SEWRPC Photo.

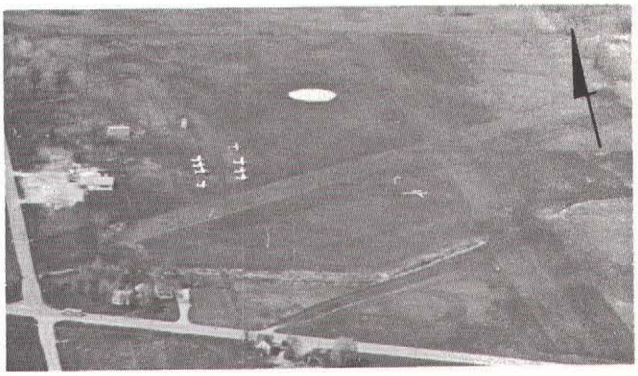
Figure 43

WAUKESHA COUNTY AIRPORT
TOWN OF PEWAUKEE, WAUKESHA COUNTY

SEWRPC Photo.

Figure 44

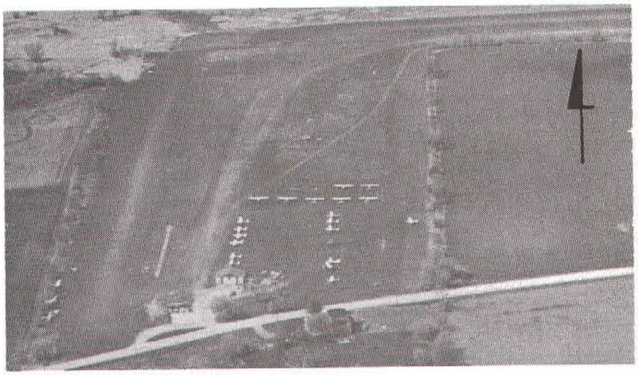
AERO PARK AIRPORT
VILLAGE OF MENOMONEE FALLS, WAUKESHA COUNTY



Wisconsin Department of Transportation Photo.

Figure 45

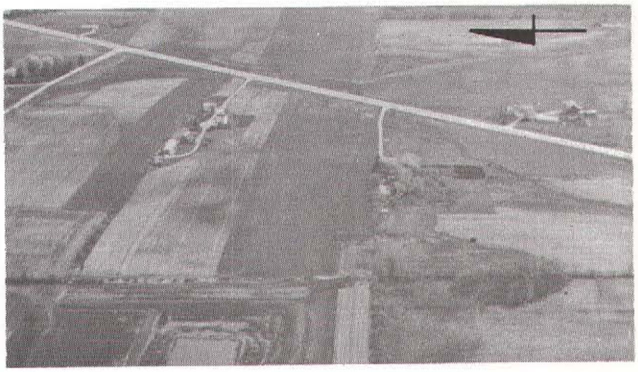
CAPITOL DRIVE AIRPORT
TOWN OF BROOKFIELD, WAUKESHA COUNTY



Wisconsin Department of Transportation Photo.

Figure 46

O'LEARY FIELD
CITY OF MUSKEGO, WAUKESHA COUNTY



SEWRPC Photo.

landing capability. Although Hartford Municipal provides a paved and lighted landing area, no FAA approved IFR procedure is available at the airport. Therefore, two of the eight public airports in the Region—East Troy Municipal and Hartford Municipal—can only be considered available for planes flying under VFR conditions. All privately owned, public use general aviation airports, except Racine Commercial Airport, are classified as basic utility airports. This airport, owned and operated by the Racine Commercial Airport Corporation, is a sophisticated airport facility, in contrast to the usual privately owned general aviation airport. It is classified as a basic transport airport, is capable of accommodating corporate jet aircraft, and has an FAA approved IFR approach. Racine Commercial accommodates 14 of the 24 multi-engine aircraft based at privately owned airports within the Region.

The 17 privately owned, public use, basic utility airports in the Region vary with respect to the extent and type of facilities and services available to the general aviation user. To further describe this range of facilities, the basic utility airports have been subclassified according to the following characteristics:

A-Paved runway 2,300-3,000 feet, nighttime airport aids,[6] runway lighting, attendant, fuel, and maintenance.

B-Unpaved runway 2,000-3,000 feet, daytime airport aids,[7] attendant, fuel.

C-Unpaved runway less than 2,000 feet, daytime or no airport aids, no attendant or irregularly attended.

Utilizing this subclassification system, the privately owned, public use basic utility airports include three Type A, eight Type B, and six Type C class airports.

A detailed compendium of all the general aviation airports, including the identification of those characteristics considered pertinent to system planning, is presented in Appendix C. Even though the public use airports are the primary concern of this study, this compendium includes both public and private use facilities.

Military: Although there are no exclusive military use airports within or immediately adjacent to the Region, a development decision related to a military facility which could significantly affect both land use and airport facility development within the Region must be made in the near future. This decision concerns the ultimate use of the abandoned Richard I. Bong Air Force Base in western Kenosha and southern Racine Counties.

In 1954 the U. S. Air Force selected, and the federal government acquired, a total of 5,532 acres of land in the Town of Brighton, Kenosha County, and in the Town of Burlington, Racine County, for development of a major military air base. After initiating construction, including work on a runway approximately 12,000 feet in length, the air base was abandoned in 1959, and the federal government declared the entire acreage and its improvements to be surplus property. In 1960, the Wisconsin Federal Surplus Property Development Commission was created pursuant to Section 15.995 of the Wisconsin Statutes for the purpose of acquiring the abandoned base in order that:

> "...federally owned land, improvements and appurtenances thereto which may be disposed of by the federal government may be acquired and integrated into the Wisconsin economy with the least amount of dislocation of economic, social and governmental institutions of the state, in order that the tax base may be enhanced, in order to assure effective zoning and land use development of such property...."

In 1961, the Surplus Property Development Commission in turn established a dummy corporation, the Wisconsin Federal Surplus Property Development Corporation (commonly referred to as the Bong Corporation), pursuant to Section 182.60 of the Wisconsin Statutes, to finance site acquisition and development. The State Department of Resource Development retained the firm of Max E. Anderson and Associates, Consulting Planners, Madison, Wisconsin, to prepare a preliminary plan for the development of the abandoned base. The preliminary plan, submitted to the Surplus Property Development Commission in October 1961, recommended the development of a new town on the abandoned air base surrounded by a greenbelt of park and wildlife conservancy areas.

Because neither the Surplus Property Development Commission nor the Bong Corporation had funds available, the Bong Corporation in 1964 entered into a contract with Herro and Associates which provided that the Herro group make available the funds needed to acquire certain portions of the abandoned air base from the federal government. In return, the Herro group acquired the right to purchase 977 acres of the site, of which 565 acres were to be used for industrial development and 412 acres for airport development; and a first right to purchase an additional 1,591 acres of the site at future market value for residential and other urban development, all in accordance with the preliminary development plan prepared for the Surplus Property Development Commission.

Pursuant to the agreement, the Herro group provided funds to the Bong Corporation, which in turn purchased 977 acres of the site from the General Services Administration for a total of $94,715. Of this total, $28,840 was paid for 412 acres intended to be used for airport purposes, and $65,875 for 565 acres intended to be used for industrial purposes. The Corporation agreed to pay $18,943 in cash to the federal government, and executed

[6] *Nighttime airport aids include a lighted wind cone and segmented circle.*

[7] *Daytime airport aids include a wind cone and segmented circle.*

notes secured by mortgages for the remaining $75,772. Pursuant to the agreement, the Herro group was given a trust deed securing the Bong Corporation's bond and a 10-year lease with option to purchase the 977 acres at cost.

The Wisconsin Conservation Commission, also acting pursuant to the preliminary development plan and the agreement, purchased 1,591 acres of the site from the federal government for $245,000, to hold for conservation purposes until such time as the Bong Corporation decided that these lands should be developed for urban purposes. The Herro group was given a first right to purchase these lands for such development.

The Bong Corporation and the Surplus Property Development Commission also assisted in securing transfer of the following parcels of the abandoned air base:

1. Approximately 1,980 acres to the Wisconsin Conservation Commission for permanent conservation use. These lands were conveyed by the federal government to the state as a grant on the condition that title would revert to the federal government should the lands ever be used for other than wildlife refuge purposes. The location of the lands included in this grant coincided with the greenbelt areas recommended on the preliminary development plan prepared for the Surplus Property Development Commission.

2. Approximately 360 acres (362 acres by survey) to Kenosha County for county park and golf course purposes. These lands were sold by the federal government to Kenosha County for $22,500.

3. Approximately 160 acres to the Salem Central Union High School District No. 1 as a grant for school forest purposes.

4. Approximately 160 acres to the Wilmot Union High School District as a grant for school forest purposes.

5. Approximately 160 acres to the Burlington Area Joint School District No. 1 as a grant for school forest purposes.

6. Approximately 24 acres to the Brighton Elementary School District No. 1 as a grant for school forest purposes.

7. Approximately 120 acres (133 acres by survey) to the Kenosha Unified School District No. 1 as a grant for school forest purposes.

All of the lands for school forest purposes were conveyed by the federal government to the local school districts as grants without condition.

In 1966, the State Legislature enacted Chapter 646, Laws of Wisconsin, 1965, which provided that all contracts entered into by the Surplus Property Development Commission were to be canceled, and title to the lands held by the Bong Corporation (977 acres) were to be transferred to the Wisconsin Conservation Commission. The Wisconsin Conservation Commission was further authorized to acquire all of the remaining lands within the abandoned base for recreation and conservation purposes. In 1966, the State Legislature also enacted Chapter 75, Laws of Wisconsin, 1967, which dissolved the Federal Surplus Property Development Commission. The Bong Corporation as a private corporation was not dissolved by this act of the Legislature.

The Herro group challenged the validity of this legislation by instituting legal proceedings which charged that the contract between the Herro group and the Bong Corporation had been breached by the enactment of Chapter 646, and this litigation advanced to the Wisconsin Supreme Court. That Court, in a decision dated April 1, 1969, held the legislative acts to be unconstitutional insofar as they affected the rights of the Herro group to the land of the abandoned air base, which rights the group had acquired through contract with the Bong Corporation and the Surplus Property Development Commission. Thus, the Court held that the contract between the Bong Corporation and the Herro group was valid and binding upon the state and the state agencies involved, and that the group had the right to demand specific performance of the contract. The Court indicated further that, if the state wanted to acquire the Herro group's rights in the abandoned Air Force base lands, it had the authority to do so either by negotiation for purchase or by instituting condemnation proceedings. In either event, the Herro group would be entitled to reasonable and just compensation for its contract and property rights. The state and certain of its agencies subsequently filed a motion for a rehearing with the Court.

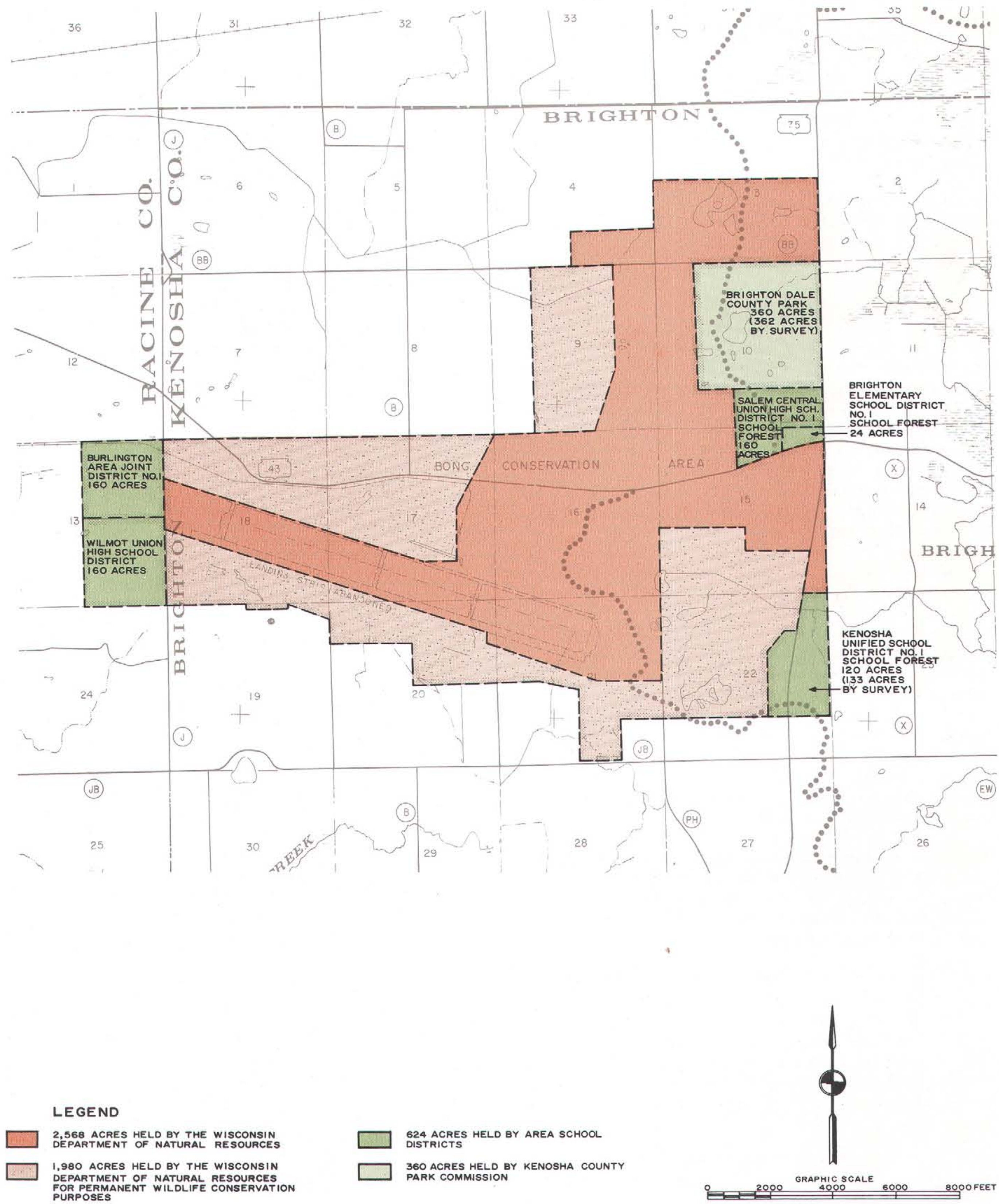
The results of the Court rehearing established that on July 1, 1970, legal title to the 977 acres be vested in the State of Wisconsin (Department of Natural Resources) without encumbrances. In addition, this same action removed the Herro and Associates vested rights to purchase the 1,591 acres held in title by the State of Wisconsin, Department of Natural Resources.

The present ownership of the original Richard I. Bong Air Force Base lands is summarized on Map 18. Of the original approximately 5,532 acres, title to approximately 984 acres has been transferred from the federal government to, and is held by, various local units of government for school, forest, and park purposes. Title to approximately 4,548 acres has been transferred from the federal government to, and is held by, the State of Wisconsin Department of Natural Resources, of which approximately 1,980 acres transferred to the Wisconsin Conservation Commission, now the Department of Natural Resources, are held for permanent conservation purposes.

Certain citizen groups in southeastern Wisconsin and northeastern Illinois have proposed that this abandoned Air Force base be developed as a major commercial air carrier airport serving the Chicago and Milwaukee metropolitan regions. Other groups have proposed that the

Map 18

PRESENT OWNERSHIP OF LANDS ORIGINALLY CONSTITUTING RICHARD I. BONG AIR FORCE BASE: JULY 1970



Source: SEWRPC.

abandoned base be used as a major air cargo terminal and as a military air base for reserve flying units. A sound decision concerning the future use of the Richard I. Bong Air Force Base as an airport facility, with its attendant major impacts on land use and surface transportation facility development within the Region, can be properly made only within the context of the comprehensive regional airport system plan, which not only identifies the long-range airport capacity deficiencies within the Region, but also relates any proposals for relief to a total system of airport facilities and to areawide land use and surface transportation system development.

Even though there are no military airports, military aviation activity is prevalent within the Region. Both General Mitchell Field in Milwaukee County and West Bend Municipal Airport in Washington County are joint use civil/military facilities. Also located at the Region's air carrier airport are the headquarters of the 128th Air Refueling Group of the Wisconsin Air National Guard (ANG) and the 440th Tactical Airlift Wing of the Air Force Reserve, and colocated at the West Bend Municipal Airport is the headquarters of the Army Aviation Support Facility of the Wisconsin Air National Guard (ANG). The 128th Air Refueling Group presently has 11 four-engine aircraft and the 440th Tactical Airlift Wing has six four-engine aircraft based at General Mitchell Field. The Army Aviation Support Facility of the Wisconsin Air National Guard presently has 14 helicopters based at West Bend Municipal Airport.

In addition, five of the Region's seven publicly owned general aviation airports, including Burlington, East Troy, Hartford, Kenosha, and Waukesha, provide military aircraft landing rights. These airports, although not considered joint use civil/military facilities[8] per se, do provide for both transient and training type military activity. No military aircraft are based at these locations.

Special Use: Two landing areas in the Region might well be considered within a special use category, that is, restricted to certain aircraft types. These include the Johnson Wax Heliport, located at Racine, and the Edgewood Air Seaplane Base at Lake Geneva.

The Johnson Wax Heliport is a private use landing pad restricted to use by S. C. Johnson & Son, Inc. Use of the heliport by others for purposes other than corporation associated business is subject to prior approval and authorization by the heliport owner.

The Edgewood Air Seaplane Base located on Lake Geneva provides access for float equipped aircraft to the Region's primary resort areas. This privately owned seaplane facility, the only designated water landing area in the Region, provides a sheltered anchorage, mooring buoys, a ramp, and docking facilities for public use between April and November. The seaplane base is attended daily.

Though not considered strictly "special use" facilities, three of the public use general aviation airports discussed in the preceding section warrant additional mention. Two airports, West Bend Municipal in Washington County and Aero Park in Waukesha County, accommodate considerable sport sailplane or glider activity. Rainbow Airport, located near Hales Corners in Milwaukee County, was a center for sport parachuting activity at the time of the inventory, but has since been purchased by Milwaukee County. At the time of the airport survey, West Bend Municipal Airport had 18 single place glider aircraft based on the airport, while Aero Park Airport had five based gliders.

Air Cargo Activity

Air cargo, which normally includes air freight, express, and mail, is accommodated at many of the airports in the Region. The center of air cargo activity is General Mitchell Field, which provides direct and indirect access to world markets. Several of the smaller general aviation airports supplement the overall air cargo distribution system.

Presently at General Mitchell Field, Northwest Airlines operates two all-cargo flights at least five days a week, providing direct access to both Minneapolis and New York. Supplementing these all-cargo flights are the passenger aircraft of all the airlines serving the airport, which carry a bulk of the Region's air cargo in their "belly hold" compartments.

During calendar year 1971, 37,000 tons of air cargo were processed (enplaned and deplaned) through General Mitchell Field. Of this total, 26,000 tons were air freight and express shipments, while the balance of 11,000 tons included mail. It is estimated that less than 10 percent of the total tonnage was, however, carried via the all-cargo flights.

The general aviation airport's role in air cargo distribution involves either direct, point-to-point shipments, such as corporate freight carried in corporate aircraft, or shipments to the central processing unit at General Mitchell Field for wider distribution via the scheduled airlines.

Quantifying air cargo movements by general aviation aircraft and through general aviation airports is, however, difficult. Historical data about cargo shipped via general aviation aircraft are extremely sparse. In an attempt to determine total air cargo activity levels in the Region, specific questions regarding the volume and type of air cargo handled at each public use airport within the Region were addressed to airport operators and users. Of the 16 airports that responded, only eight, in addition to General Mitchell Field, indicated any freight traffic. The responses from operators at these eight airports indicated the following annual freight volume: Kenosha Municipal Airport, 350 tons; Waukesha County Airport, seven tons; West Bend Municipal Airport, 15 tons; Playboy Airport, 10 tons; Rainbow and Sylvania Airports, "some"; and Burlington Municipal Airport and Timmerman Field, "negligible."

[8] *An official agreement between civil and military authorities does not exist with respect to sharing the operation and maintenance of the airport.*

The 16 airport operators responding to the air cargo questions further acknowledged use of their airport by local industry. The degree of use could not be estimated, however, since no records are kept. Of the 1,684 pilots interviewed during the Commission's surveys at public use airports, only 42, or 2 percent, indicated that they were carrying cargo. The cargo served by pilots weighed about five tons. Thus, the response from the airport operators and the pilots indicates that the amount of air cargo presently carried by general aviation aircraft is relatively limited.

AIRPORT RELATED SURFACE TRANSPORTATION FACILITIES

The surface transportation system is an important link in the development of an integrated regional airport system. Passenger and cargo service by air is basically multimodal, requiring surface movements at each end of the air travel portions of the trip. An extensive arterial street and highway system exists within the Region for movement of both passengers and freight by auto, truck, and inter- and intra-urban bus.

Arterial Streets and Highways

The extensively developed all-weather, high-speed highway system within the Region has markedly influenced the spatial location of urban development. This influence has been significantly modified by the location within the Region of such natural resources as lakes, streams, woodlands, and fertile farmlands. The 1972 arterial street and highway network within the Region, as shown on Map 19, consists of 3,119 miles of state, county, and local arterial streets and highways interconnecting the urban and rural areas of the Region.

The arterial street and highway system shown on Map 19 also services all airport facilities in the Region. Table 32 summarizes the type of arterial service provided to airports in the Region. As shown, the 1972 regional arterial street and highway system provided direct service to 22 airports, service within one mile to 15 airports, and service within two miles to nine airports. With the exception of Lake Lawn Lodge, which was serviced directly by STH 50, and Racine Commercial and Johnson Wax Heliport, which were serviced within one mile by STH 38, airports in the Region were served by arterials having adequate capacity to carry peak hour traffic.

Rail Service

Scheduled rail passenger service in 1971 was provided over about 97 route miles of rail line by two privately owned railroads—the Chicago, Milwaukee, St. Paul and Pacific Railroad Company (Milwaukee Road), and the Chicago and Northwestern Transportation Company (C & NW)—and by the quasi-public National Railroad Passenger Corporation (Amtrak). Rail passenger service was primarily oriented to and from the Chicago area and the Milwaukee urbanized area and points west and south of that urbanized area, with no service being provided to the southwest, northwest, or north.

Passenger service provided by the C & NW on a weekday basis consisted of the following trains: two trains in each direction between the Cities of Lake Geneva and Chicago, and nine trains in each direction between Kenosha and Chicago. Weekend passenger service is also provided by the C & NW between the Cities of Lake Geneva and Chicago and the Cities of Kenosha and Chicago. All of these trains provide Chicago-oriented commuter service. The Milwaukee Road provides one train daily in each direction between the Village of Walworth and the City of Chicago, and prior to July 1972, provided one train on weekdays in each direction between the Cities of Watertown and Milwaukee. The latter service, popularly known as the "Cannonball," was conceptually an intra-regional commuter service connecting the Milwaukee central business district with the communities of Watertown and Ixonia outside of the Region in Jefferson County, and Oconomowoc, Okauchee, Nashotah, Hartland, Pewaukee, Duplainville, Brookfield, Elm Grove, and Wauwatosa within the Region.[9]

Amtrak operates trains over Milwaukee Road trackage within the Region. Amtrak, which was created by an Act of Congress in 1970—the Rail Passenger Service Act—has assumed responsibility for operating almost all intercity railroad passenger service within the United States. Service provided by Amtrak within the Region has replaced former privately operated service, and consists of two trains daily in each direction between the Cities of Chicago and Minneapolis, with one of the trains proceeding west to the City of Seattle, both of which stop in the City of Milwaukee; two trains daily in each direction between the Cities of Milwaukee and St. Louis, with a stop in the City of Chicago; and three trains daily in each direction between the Cities of Milwaukee and Chicago. The combined service represents seven trains operating daily in both directions in the Chicago-Milwaukee corridor.

Interurban and Suburban Bus Service

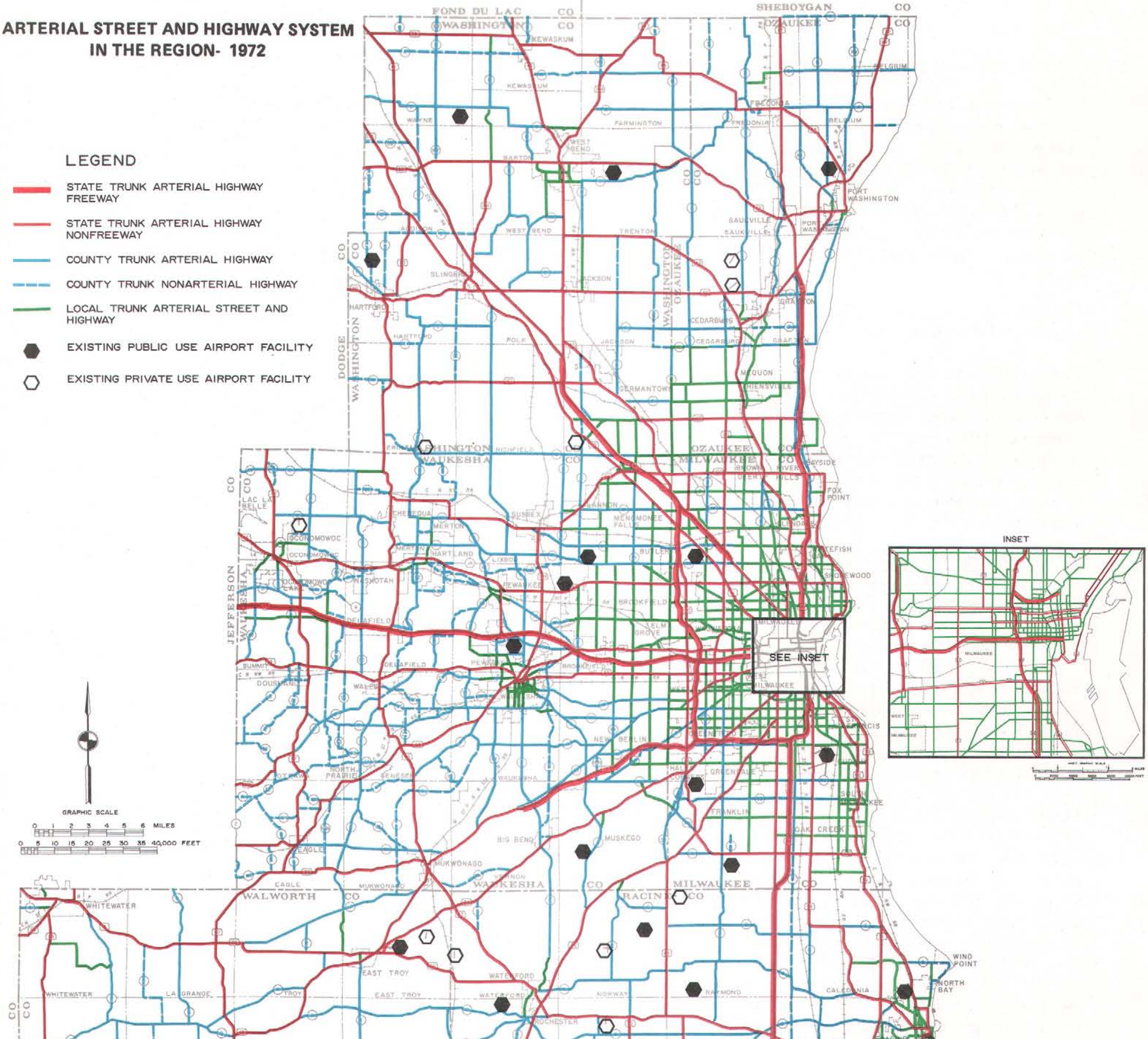
Interurban bus service was provided in 1971 by six private companies operating within the Region: Badger Coaches, Inc.; Greyhound Lines-West; Peoria-Rockford Bus Company; Tri-State Coach Lines, Inc.; Wisconsin Coach Lines, Inc.; and Wisconsin-Michigan Coaches, Inc. These six companies operated bus lines over a network of 500 miles of streets and highways, as shown on Map 20.

The level of service, as indicated by the number of daily round trips within each bus service corridor for 1971, is shown in Table 33. Bus service in the Milwaukee-Chicago travel corridor increased to 19 round trips daily in 1971. This growth reflects a concomitant decline in rail passenger service, as well as increasing use of O'Hare Field by residents of the Region. As noted in the table, seven daily round trips are provided by Tri-State Coach Lines between Milwaukee and Chicago's O'Hare Field. Conversely, intra-

[9] *After several unsuccessful attempts to abandon the "Cannonball," the Milwaukee Road was granted permission by the Wisconsin Public Service Commission to discontinue the service in July 1972, thus ending intra-regional rail commuter service in the Region. The "Cannonball" made its last run on July 31, 1972.*

Map 19

ARTERIAL STREET AND HIGHWAY SYSTEM IN THE REGION- 1972



In 1972, 3,119 miles of state, county, and local arterial streets and highways interconnected the urban and rural areas of the Region. This network of surface transportation facilities provides direct service to 22 airports, service within one mile to an additional 15 airports, and service within two miles to an additional nine airports. With the exception of Lake Lawn Lodge in Walworth County and Racine Commercial and Johnson Wax Heliport in Racine County, airports in the Region were served by arterials having adequate capacity to carry existing peak hour traffic.

Source: SEWRPC.

Table 32

TYPE OF ARTERIAL STREET AND HIGHWAY SERVICE PROVIDED TO AIRPORTS IN THE REGION: 1972

County	Airport	Arterial Service		
		Direct	Within One Mile	Within Two Miles
Kenosha	Public Use			
	Kenosha Municipal	X	--	--
	Vincent	--	X	--
	Private Use			
	Camp Lake	X	--	--
	Olson	--	--	X
	Westosha	X	--	--
Milwaukee	Public Use			
	General Mitchell Field	X	--	--
	Timmerman Field	X	--	--
	Hales Corners	X	--	--
	Rainbow	X	--	--
Ozaukee	Public Use			
	Ozaukee	--	X	--
	Private Use			
	Cedarbird Field	--	X	--
	Grob	X	--	--
Racine	Public Use			
	Burlington Municipal	--	X	--
	Fox River	X	--	--
	Hunt Field	--	--	X
	Racine Commercial	--	X[a]	--
	Sylvania	--	X	--
	Valhalla	--	--	X
	Private Use			
	Aero Estates	--	X	--
	Hill Valley	--	--	X
	Horner Farms	--	X	--
	Johnson Wax Heliport	--	X[a]	--
	Lewislynn Farm	--	X	--
	University of Lawsonomy	--	X	--
Walworth	Public Use			
	East Troy Municipal	X	--	--
	Big Foot	X	--	--
	Edgewood Air Seaplane Base	--	--	X
	Gruenwald	X	--	--
	Mt. Fuji	--	--	X
	Playboy	--	--	X
	Lake Lawn Lodge	X[a]	--	--
	Private Use			
	Heinrichs	--	X	--
	Swan	--	--	X
	Herbert Twist	--	X	--
	Wag-Aero	X	--	--
	Wal-Co-Wis Farms	X	--	--
Washington	Public Use			
	Hartford Municipal	--	--	X
	West Bend Municipal	X	--	--
	Hahn's Sky Ranch	X	--	--
	Private Use			
	Doering Farms	X	--	--
	Willow Creek	--	X	--
Waukesha	Public Use			
	Waukesha County	X	--	--
	Aero Park	X	--	--
	Capitol Drive	--	X	--
	O'Leary Field	X	--	--
	Private Use			
	Oconomowoc	X	--	--
Total	--	22	15	9

[a] *Arterial operating over capacity; peak hour service level D, E, or F as defined in the Highway Research Board Special Report 87, Highway Capacity Manual—1965.*

Source: SEWRPC.

Table 33

LEVEL OF SUBURBAN AND INTERCITY BUS SERVICE IN THE REGION: 1971

Bus Service Corridor	Number of Daily Round Trips
Milwaukee-Racine-Kenosha	12
Milwaukee-Waukesha	16
Milwaukee-Port Washington	9
Milwaukee-Lake Geneva-Rockford	2
Milwaukee-Whitewater-Rockford	2
Milwaukee-Oconomowoc	5
Milwaukee-Chicago Loop (Express)	19
Milwaukee-Chicago's O'Hare Field	7
Milwaukee-Green Bay	9
Milwaukee-Duluth	2
Milwaukee-Minneapolis	3
Milwaukee-Madison	11
Milwaukee-Marshfield	1
Milwaukee-Stevens Point	3
Madison-Whitewater-Lake Geneva-Chicago Loop	1

Source: Russell's Official National Motor Coach Guide, Vol. 44, No. 3, December 1971.

regional bus service has generally been declining. Nine of the 12 daily round trips in the Milwaukee-Racine-Kenosha corridor have scheduled stops at the S. Howell Avenue entrance to Milwaukee's General Mitchell Field.

Urban Bus Service

Urban bus service during 1971 was provided within Milwaukee County by the Milwaukee and Suburban Transport Corporation, within the City of Racine by Flash City Transit, within the City of Kenosha by the Kenosha Parking and Transit Commission, and within the City of Waukesha by Wisconsin Coach Lines, Inc. Together these four companies operate 560 miles of intraurban bus lines, as shown on Map 21.

The Milwaukee and Suburban Transport Corporation provides 32-minute bus service between General Mitchell Field's terminal building and Milwaukee's CBD. Buses operate Monday through Friday on 35-minute headways from 6 a.m. to 8 a.m. and 3 p.m. to 6 p.m.; Saturdays on 30-minute headways from 7 a.m. to 8:30 a.m. and 2:30 p.m. to 6:15 p.m.; and Sundays and holidays on 30-minute headways from 12:30 p.m. to 6 p.m. Daily bus service is also provided along the northern boundary of the airport on E. Layton Avenue between S. Howell and S. Pine Avenues from 5 a.m. to 2 a.m. on 15-minute headways, except Sundays and holidays, when buses operate on a 22- to 30-minute headway. The Milwaukee and Suburban Transport Corporation also operates three local bus routes in the vicinity of Timmerman Field, but none provide direct service to any of the airport facilities. These routes provide 40-minute headways from 5 a.m. to 6:30 p.m., and 60-minute headways from 6:30 p.m. to 12:30 a.m.

AIRSPACE ENVIRONMENT, SYSTEM, AND USE

The airspace system of the United States is a complex network of airways, air navigation aids, and air traffic control facilities designed to assist the movement of aircraft throughout the nation. The Federal Aviation Act of 1958 as amended, and Executive Order 10854, designate the navigable airspace as a limited national resource, and as such, specific rules and regulations have been established by the FAA to govern use of this system and thereby ensure safe and efficient air traffic flow.

The proximity of airports to one another, the relationship of runway alignments, and the nature of airport operations, such as those conducted during clear weather and poor weather conditions, are the principal interairport considerations which affect the capacity of the airspace available to a regional system of airports. It is not uncommon in a large metropolitan region, for example, to have major or secondary airports spaced so closely that they must share adjacent airspace. In such cases, there may be a reduction in the capacity of the airports involved during conditions requiring use of instrument flight rules (IFR) due to conflicting traffic movements in the same airspace. Aircraft operating in this environment must be sequenced with proper horizontal and vertical separation, which often results in delay, that is, a lesser number of aircraft served in a given period of time.

Although the complexity of the airspace environment precludes a simple explanation of the system, the following classification of airspace into its component parts is intended to provide a general understanding of the key elements of the airspace environment and the interaction of these elements as they may affect the air transportation system.

Airspace Environment

The total airspace may be divided basically into controlled and uncontrolled space. The controlled airspace consists of those areas within which some or all aircraft may be subject to air traffic control. The uncontrolled airspace consists of those areas within which no air traffic control is exercised.

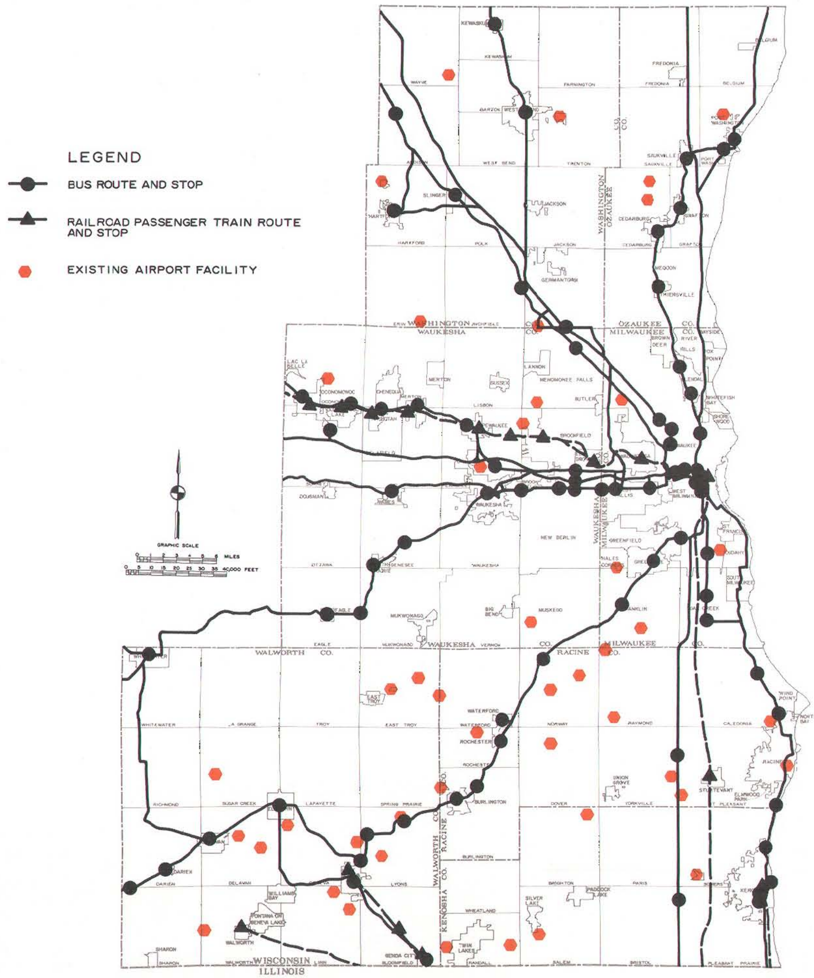
Controlled Airspace: The controlled airspace may be further divided into enroute and airport related airspace. The enroute controlled airspace may be further divided into continental control areas and control areas, while the airport related controlled airspace may be further divided into control zones, terminal control areas, airport traffic areas, and transition areas. Aircraft operations within controlled airspace are supported by ground/air communications, navigation aids, and related air traffic control services. The major subdivisions of airspace are shown schematically in Figure 47.

The enroute controlled airspace is composed of the following designated routes and related navigation systems over which aircraft can navigate without visual reference to the ground:

- Federal, or "Victor," airways, which extend from 1,200 feet above the ground surface level to 18,000 feet above mean sea level.

Map 20

INTERURBAN AND SUBURBAN BUS AND RAILROAD PASSENGER SERVICE IN THE REGION: 1971

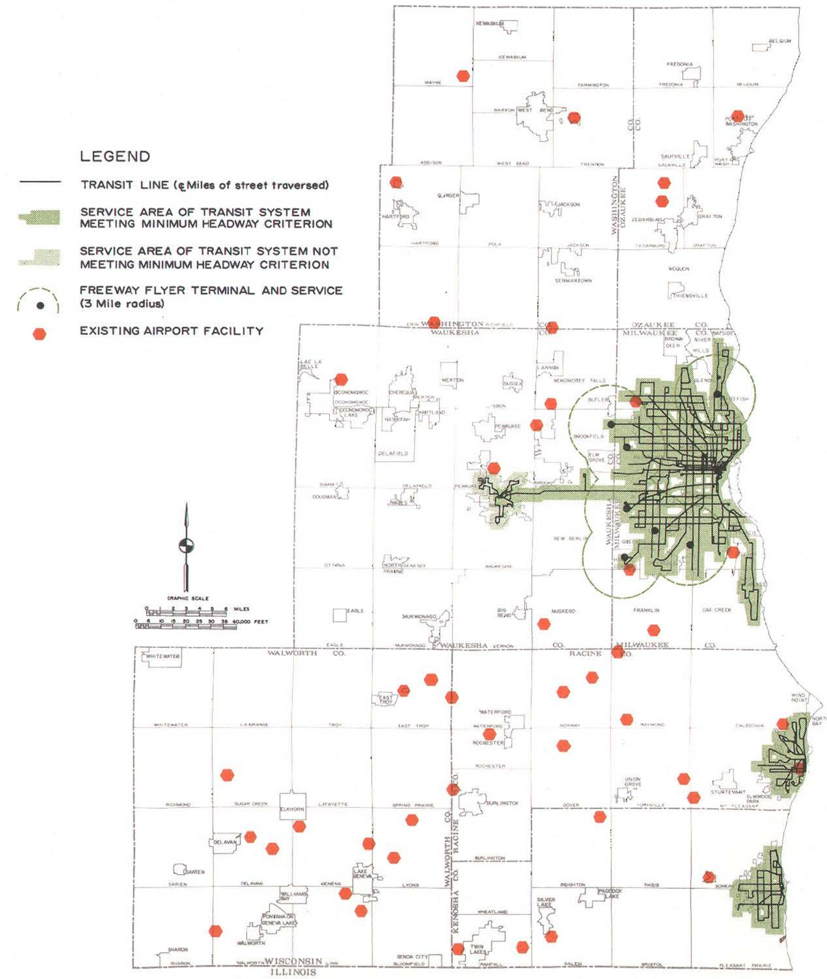


Interurban and suburban bus service in the Region in 1971 was provided by six private companies which operated bus lines over 500 miles of streets and highways. Scheduled rail passenger service in 1971 was provided over about 97 route miles of rail line by two privately owned railroads and by the quasi-public National Railroad Passenger Corporation (AMTRAK).

Source: SEWRPC.

Map 21

MASS TRANSIT LINES AND SERVICE AREAS IN THE REGION: 1971



Urban mass transit service is provided in four urban areas of the Region by three private corporations and a publicly owned mass transit system in the City of Kenosha. In 1971, these systems provided service over 560 route miles to about 77 percent of the total population of the urbanized areas of the Region within a quarter mile of the transit routes.

Source: SEWRPC.

- Jet routes, which extend from 18,000 feet above mean sea level to FL 450.[10] Operations above FL 450 may be conducted on a point-to-point basis, with navigational guidance provided on an area basis.

That portion of the enroute controlled airspace above 14,500 feet above mean sea level is designated as the continental control area. Controlled airspace above 18,000 feet above mean sea level is designated as the positive control area, wherein aircraft are required to be operated under instrument flight rules at all times regardless of weather conditions.

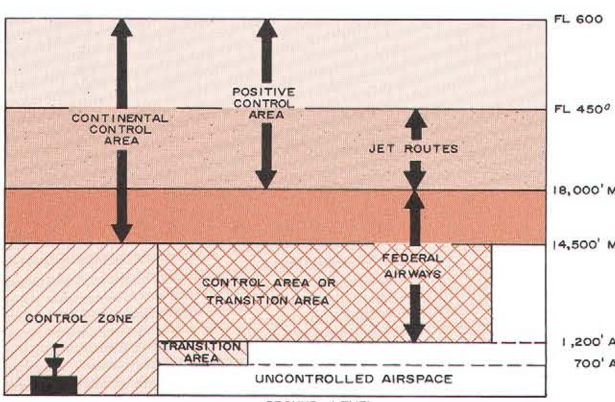
The airport related airspace includes the following controlled airspace areas and related air traffic control procedures designated to control aircraft arrival and departure at airports:

- Control zones, which extend upward from the ground surface and terminate at the base of the continental control area. Control zones that do not underlie the continental control area have no upper limit. A control zone may include one or more airports, and is normally a circular area having a five-statute-mile radius centered on an airport, with any extensions necessary to include aircraft instrument departure and arrival paths.

[10] *Flight level is defined by the Federal Aviation Administration as a level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each level is stated in three digits that represent hundreds of feet. For example, FL 250 represents a barometric altimeter indication of 25,000 feet; FL 255 indicates 25,500 feet.*

Figure 47

THE VERTICAL EXTENT OF AIRSPACE SEGMENTS



[a] *FL Indicates Flight Level*

[b] *MSL Indicates Mean Sea Level*

[c] *AGL Indicates Above Ground Level*

Source: R. Dixon Speas Associates, Inc.

- Transition areas, which extend upward from 700 feet above the ground surface when designated in conjunction with an airport for which an instrument approach procedure has been prescribed, or from 1,200 feet or more above the ground when designated in conjunction with an enroute airway. Unless specified otherwise, the upper elevation of transition areas is the base of the overlying enroute airway.

- Terminal control areas (TCA), which extend upward and outward from the nation's busier airports—as defined in terms of the number of aircraft operations and passengers carried—where it is necessary for safety reasons to maintain more stringent operating control. A TCA will have altitudes specified within which operation of all aircraft is subject to strict federally established operating rules.

- Airport traffic areas which, unless designated otherwise, extend within a horizontal radius of five miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of the airport.

Different air traffic control procedures apply to aircraft operating within these control areas based on the type of airport involved. The airspace around VFR airports is usually operated only under visual flight rules (VFR) conditions, normally defined as a visibility and ceiling equal to, or greater than, three miles and 1,000 feet, respectively. Some VFR airports can operate when weather conditions require instrument flight rules (IFR) operations if operations are limited to arrivals and departures under special prescribed conditions. For purposes of this report, all airports for which no instrument approach procedure has been published are classified as VFR airports. The airspace around IFR airports is operated under both VFR and IFR conditions. The sophistication of the air navigation aids used with, and obstruction clearance criteria associated with, each instrument approach establishes the extent of IFR capability. For purposes of this report, all airports for which FAA instrument approach procedures have been published are classified as IFR airports.

Uncontrolled Airspace: Uncontrolled airspace is that portion of the total airspace that has not been designated as part of either the enroute or airport related controlled airspace, and within which neither responsibility nor authority for exercising control over air traffic has been assigned to air traffic control agencies. Pilots operating in uncontrolled airspace normally operate according to visual flight rules, and have the responsibility to see and avoid other aircraft. Minimum weather conditions and minimum operating distances from clouds and obstructions are contained in these rules.

Airspace System

The significant elements of the airspace system affecting southeastern Wisconsin are the airport related controlled airspace, the air navigation aids, the air traffic control agencies, the control system operated by the control agencies, and the airports having published instrument flight procedures. The airport related controlled airspace, comprised of a control zone and transition areas, and the uncontrolled airspace within the Region are shown on Map 22. A discussion of the air navigation aids, air traffic control agencies, the air traffic control system, and operating practices at IFR airports, all of which serve to guide or control air traffic within southeastern Wisconsin, follows.

Air Navigation Aids: Air navigation aids are radio aids, installed as components of the United States National Airspace System (NAS), which provide navigational guidance to aircraft and define an airspace structure for monitoring and regulating such flights by a national air traffic control service. In the NAS system, navigational guidance in the enroute portion of aircraft flight is provided by very high frequency omnidirectional range beacons (VOR's), sometimes colocated with a tactical air navigation (TACAN) radio or provided with distance measuring equipment (DME) capabilities, which are identified as VORTAC or VOR(DME), respectively. In terminal areas, medium-range VOR's and low frequency, nondirectional radio beacons (NDB) are used to define terminal approach and departure procedures as independent facilities or in support of an instrument landing system (ILS). Control of traffic is maintained through use of these facilities, with supplemental, direct radio communication between air traffic controllers and pilots. Additionally, for the monitoring of air traffic control separation, long-range radar units (air route surveillance radar, or ARSR's), augment the enroute system, and terminal area radar (airport surveillance radar, or ASR) supports high-activity airport locations.

Supplementing the NAS navigational aids are military, local government, and privately owned facilities which meet federal electronic emission and flight inspection standards, and which are satisfactory for local use but are not considered part of the NAS system.

The enroute and terminal navigation aids located in southeastern Wisconsin are listed in Table 34. Information pertaining to the classification of each facility, its power output, and its primary use is included for additional reference.

Air Traffic Control Agencies: Control and regulation of air traffic is the responsibility of FAA air traffic control agencies located in airport traffic control towers and in air route traffic control centers (ARTCC). Air route traffic control centers are primarily responsible for aircraft operating under instrument flight rules, although air traffic advisories are provided to aircraft operating under visual flight rules when requested. Personnel in airport control towers control aircraft operating under visual flight rules in the vicinity of the airport. When a control tower is designated as an approach control facility, however, it controls arrival and departure traffic operating under instrument flight rules within its designated area of responsibility.

Primary responsibility for the control of IFR air traffic in southeastern Wisconsin is retained by FAA's Chicago air route traffic control center. In accordance with current FAA procedures, responsibility for control of IFR air traffic in transition between airports of the Region and the enroute airway system has been delegated to the FAA operated Milwaukee Control Tower, located at General Mitchell Field. Both the Chicago ARTCC and Milwaukee Tower rely upon radar facilities to expedite the flow of air traffic. An FAA airport traffic control tower located at Timmerman Field is responsible for VFR operations at that airport, and operates as an advisory agency to Milwaukee approach control to expedite the flow of Timmerman's IFR arrivals and departures.

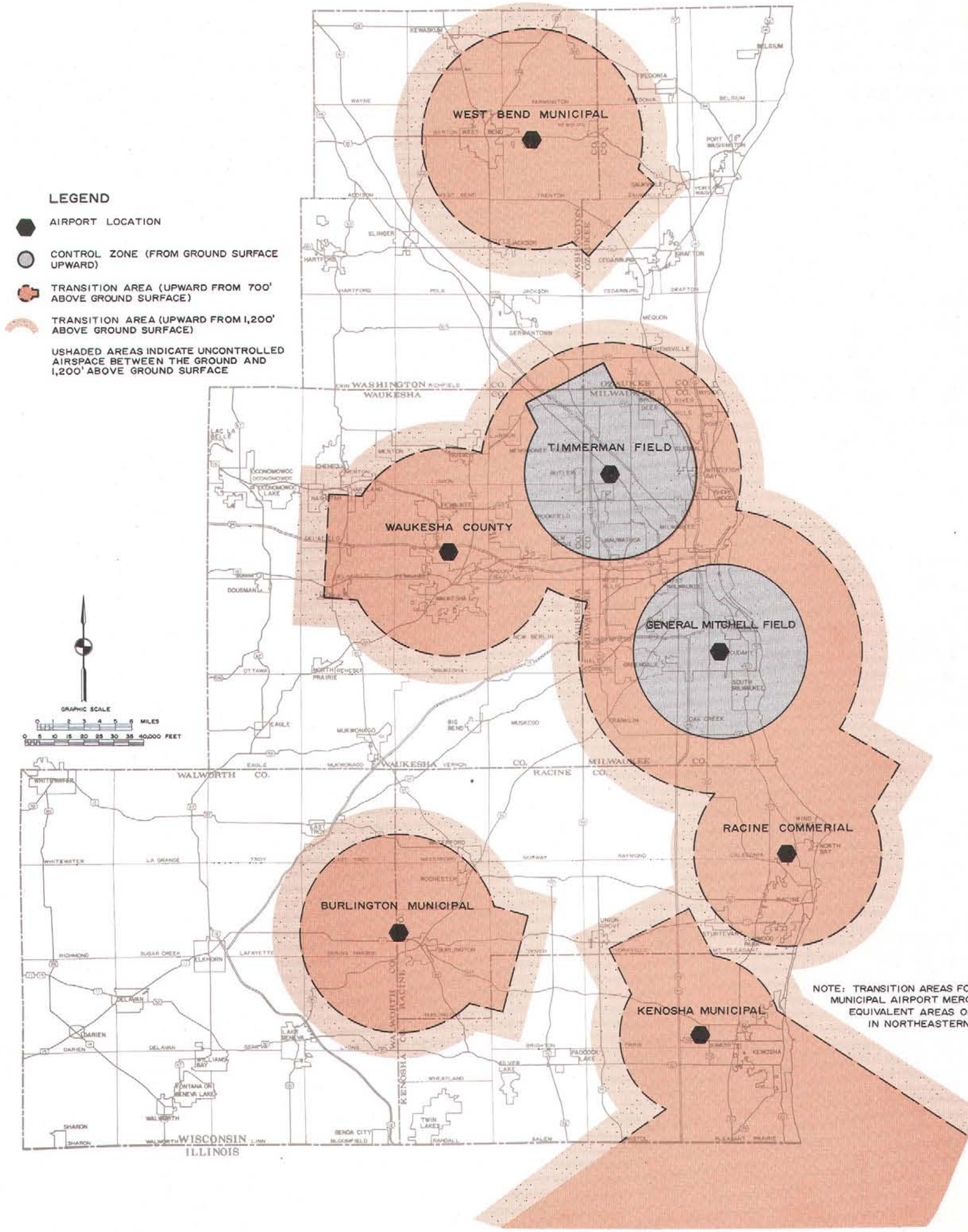
Air Traffic Control System: A "Letter of Agreement" has been developed between the Chicago ARTCC and the Milwaukee Tower which, among other things, describes the air traffic control system established, and defines the boundaries of each air traffic control agency. The information shown on Map 23, extracted from this Letter of Agreement, illustrates the low altitude controlled airways (those below an elevation 18,000 feet above mean sea level), and direct routings which have been established to provide inflight or "cockpit" guidance to aircraft operating in the vicinity of airports within the Region and the Chicago metropolitan area. The air traffic control boundaries of responsibility are also indicated. The high altitude controlled airways, those from an elevation 18,000 feet above mean sea level to the upper limits of controlled airspace, are not shown, since flights in this airspace are above that airspace which must be evaluated in development of the regional airport system plan. The regional airport system plan must consider operations in airport related airspace and the interface between the enroute and airport related airspace.

Responsibility for operations within the controlled airspace delegated to the Milwaukee Tower extends horizontally over approximately 90 percent of the airspace of the Region, and has vertical dimensions up to and including 6,000 feet. The irregular shape of the area is determined primarily by overlapping radar coverage of the Milwaukee (General Mitchell Field) and Chicago (O'Hare Field) Towers and the Chicago ARTCC, and the air traffic flow patterns of the Milwaukee and Chicago area airports. The routings and areas of responsibility depicted on Map 23 are subject to continuous review and are changed, as required, to improve route patterns. A recent procedural change which occasioned the "Letter of Agreement" that generated the information shown on Map 23 resulted in the activation of "Tower Enroute Service" between the Milwaukee and O'Hare Towers. The two towers, using a common boundary on the Wisconsin-Illinois state line, operate independently of the Chicago ARTCC, and control aircraft flying under instrument flight rule conditions at low altitudes (6,000 feet and below) between airports in their respective areas of responsibility.

IFR Airports: For the purpose of this study, IFR airports are defined as those regularly conducting operations in accordance with published instrument approach procedures. Generally, aircraft that will be operating under

Map 22

AIRPORT RELATED CONTROLLED AND UNCONTROLLED AIRSPACE IN AND ADJACENT TO THE REGION: 1971



The airport related controlled airspace, comprised of a control zone and transition areas within which some or all aircraft may be subject to air traffic control, as well as the uncontrolled airspace within and adjacent to the Region, are shown on this map. The airport related controlled airspace includes those designated areas around airports for which instrument approach procedures have been prescribed to control aircraft arrival and departure. The uncontrolled airspace consists of those areas within which no air traffic control is exercised.

Source: R. Dixon Speas Associates, Inc.

Table 34

AIR NAVIGATION AIDS IN THE REGION: 1971

Navigation Facility[a]			Radio Frequency	Radio Class	Use
Name	Type	Identifier			
Milwaukee	VORTAC	MIU	116.4	BVORTAC	Low and high altitude airway system guidance instrument approach procedure—Waukesha County Airport; missed approach procedures—Waukesha County Airport, Timmerman Field, and General Mitchell Field
Timmerman	VOR	MWC	108.6	(L)BVOR	VOR approach—Timmerman Field low and high altitude airway system guidance
Kenosha.	VOR	ENW	109.2	(T)VOR	VOR approach—Kenosha Municipal Airport
Southport	NDB	SOU	338	MHW	NDB approach—Kenosha Municipal Airport
Horlick	VOR	HRK	117.7	(T)VORW	VOR approach—Racine Commercial Airport
Racine	NDB	RAC	206	MHW	NDB approach—Racine Commercial Airport
West Bend	VOR	ETB	109.8	(T)VORW	VOR approach—West Bend Municipal Airport
Kettle Moraine	NDB	LLE	329	MHW	NDB approach—West Bend Municipal Airport
Waukesha	NDB	UES	359	MHW	NDB approach—Waukesha County Airport
General Mitchell Field . . .	ILS	I-MKE	110.3	ILS(CAT II)	ILS approach—runway IL, General Mitchell Field
	ILS	I-GMF	110.7	ILS(CAT I)	ILS approach—runway 7R, General Mitchell Field
North Park	NDB	ILW	260	MHW	NDB approach—General Mitchell Field
Golf	NDB	GM	242	H-SAB	NDB approach—ILS outer marker, runway 7R, General Mitchell Field; weather broadcast
Metro.	NDB	MK	410	LOM	NDB approach—ILS outer marker, runway 1L, General Mitchell Field
Burbun	VOR	BUU	114.5	(T)VORW	VOR approach—Burlington Municipal Airport and Playboy Airport

LEGEND

AB - Continuous automatic transcribed weather service

B - Scheduled weather broadcast

H - Nondirectional radio beacon (homing) with a broadcast power of 50 to less than 2,000 watts and an operating range of 50 nautical miles

(H) - Normal anticipated interference-free service range of 40 nautical miles below 18,000 feet

ILS - Instrument landing system

CAT I - Approach procedure that permits instrument operations to a decision height[b] of not less than 200 feet with a maximum visibility of one-half mile

CAT II - Approach procedure that permits instrument operations to a decision height[b] of not less than 100 feet with a 1,200-foot runway visual range (RVR); special aircrew and aircraft certification is required

L - Compass locator (component of ILS system) with a broadcast power of less than 25 watts, and an operating range of 15 nautical miles

(L) - Normal anticipated interference-free service range of 40 nautical miles at 18,000 feet

MH - Nondirectional radio beacon (homing) with a broadcast power of less than 50 watts and an operating range of 25 nautical miles

NDB - Nondirectional radio beacon

LOM - NDB colocated at ILS outer marker

S - Simultaneous range; homing and voice signals available

(T) - Normal anticipated interference-free service range of 25 nautical miles at 12,000 feet

TVOR - Terminal VOR, located on airport

VOR - Very high frequency omnidirectional range beacon

VORTAC - Combination VOR and TACAN

W - Without voice facilities

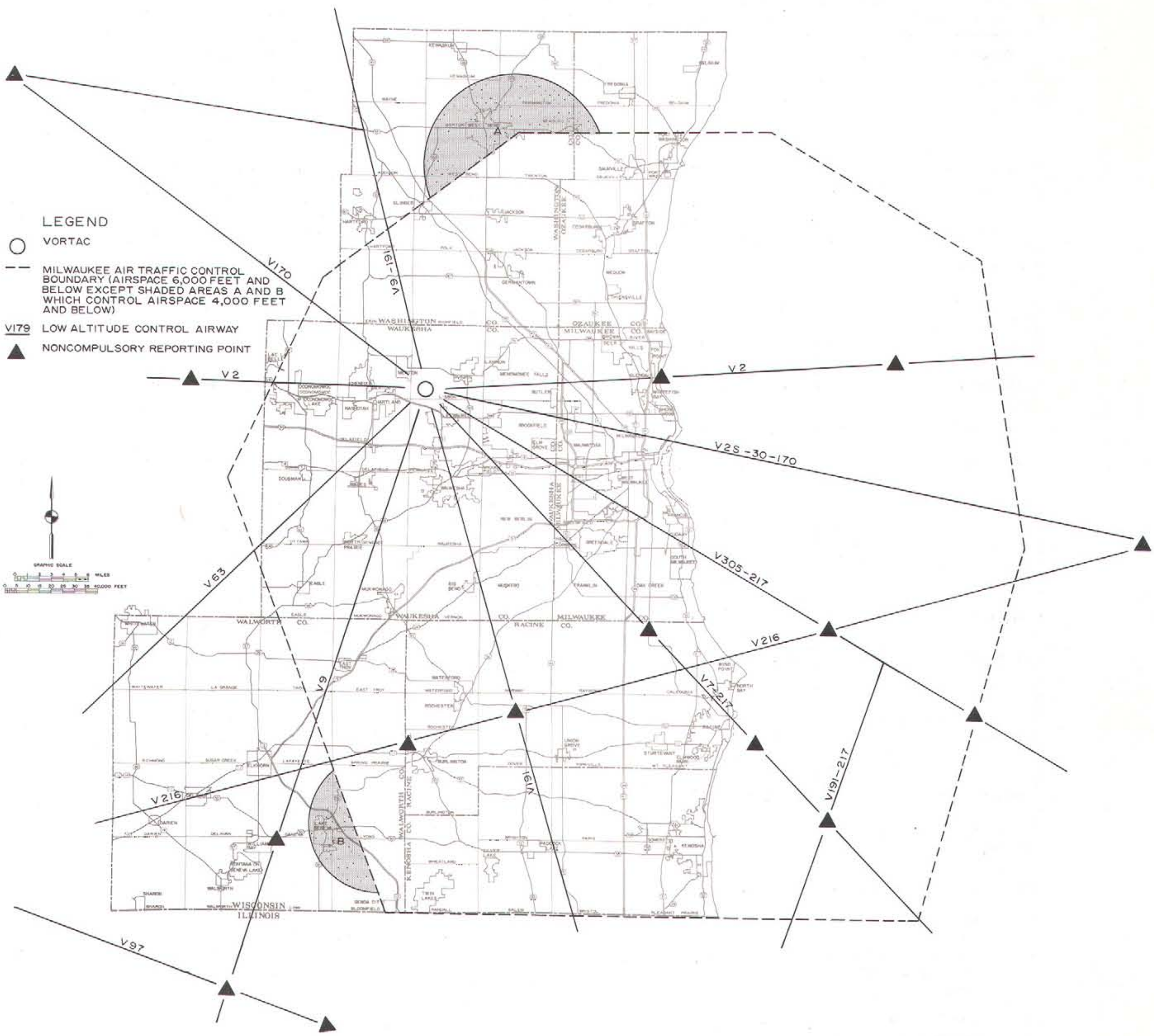
[a]*The location of these navigational facilities is shown on standard aerial navigation and approach charts.*

[b]*Decision height is an altitude, specified in feet above mean sea level, at which a missed approach shall be initiated when either visual reference has not been established with the runway environment, or the aircraft is not in a position to execute a normal landing.*

Source: R. Dixon Speas Associates, Inc., and selected U. S. flight information publications.

Map 23

MILWAUKEE AIR TRAFFIC CONTROL AREA: 1971



An agreement between the Chicago air route traffic control center and the Milwaukee Control Tower at General Mitchell Field defines the Milwaukee air traffic control boundary shown on this map. Responsibility for aircraft operations within this boundary, which encompasses airspace extending horizontally over about 90 percent of the Region and vertically to 6,000 feet, has been delegated to the Milwaukee Tower. The low altitude controlled airways (those below an elevation 18,000 feet above mean sea level) and direct routings which have been established to provide inflight guidance to aircraft in the vicinity of airports in the Region and the Chicago metropolitan area are also shown.

Source: Chicago Air Route Traffic Control Center/Milwaukee Tower Letter of Agreement of April 15, 1971; and Enroute Low Altitude Chart L11, L23, U. S. Government, Flight Information Publication 4, January 1973.

instrument flight rules but departing from non-IFR airports either take off under visual flight rules and request an IFR clearance enroute, or receive their IFR clearance before departure. Aircraft operating under instrument flight rules enroute to non-IFR airports utilize the enroute air route structure to a navigational aid adjacent to their destination as a point to terminate their IFR flight, and proceed under visual flight rules to the airport.

The airports within and adjacent to the Region having published IFR procedures are summarized in Table 35. The principal aeronautical activity, available instrument flight procedure, and allowable landing minimums are included for reference. IFR airports in adjacent counties are included because they represent a commitment of airspace that will affect airport planning within the Region. It is noteworthy that all IFR airports in the Region lie within the radar coverage of an air traffic control facility, and thus benefit from the added safety and expeditious air traffic handling that such service can provide. Radar advisory service is available on a workload-permitting basis to all aircraft departing from or enroute to VFR airports.

Airspace Use

The study of air traffic activity in the controlled airspace of southeastern Wisconsin focused upon the enroute airways and airport related airspace and attendant air traffic control systems to determine if air traffic patterns, air traffic loadings, or aircraft operational restrictions existed which could have an adverse effect upon the operation of the regional airports.

Enroute Controlled Airspace: The enroute airspace environment of southeastern Wisconsin is, in fact, only a portion of a larger "regional" airspace structure involving primarily service of the Chicago metropolitan area. Air traffic transitting the major air transportation hub at Chicago, that is, passing through it with or without a stop, comprises the predominant level of activity. Since data that describe only southeastern Wisconsin area traffic are limited, the discussion of activity within the enroute airway system is related to this larger regional level of activity, and is based upon statistical data compiled by the Chicago ARTCC.[11]

Air traffic activity on the peak activity day[12] in fiscal year 1969 controlled by the Chicago ARTCC is summarized in Table 36 by altitude and type of aeronautical

[11] *Enroute IFR Peak Day Charts, FY 1970, U. S. Department of Transportation, Federal Aviation Administration, Air Traffic Services, Washington, D. C., October 1970.*

[12] *The peak activity day is the day in any fiscal year in which the greatest number of IFR air traffic flights are handled by the Air Route Traffic Control Center.*

Table 35

AIRPORTS IN AND ADJACENT TO THE REGION HAVING PUBLISHED INSTRUMENT FLIGHT RULES PROCEDURES: 1971

Airport	Principal Aeronautical Activity	Available Instrument Flight Procedure					Allowable Landing Minimums	
		Radar Vector Service	ILS[a]	VOR[b]	NDB[c]	Control Tower	Ceiling (Feet)	Visibility (Miles)
General Mitchell Field . . .	Air Carrier	X	X	X	X	X	200[d]	1/2
Timmerman Field	General Aviation	X	--	X	--	X	500	1
Burlington Municipal . . .	General Aviation	X	--	X	--	--	700	1
Kenosha Municipal	General Aviation	X	--	X	X	--	700	1
Racine Commercial	General Aviation	X	--	X	X	--	500	1
Waukesha County.	General Aviation	X	--	X	X	--	600	1
West Bend Municipal. . . .	General Aviation	X	--	X	X	--	500	1
Playboy	General Aviation	X	--	X	--	--	600	1
Dodge County[e]	General Aviation	X	--	--	X	--	500	1
Waukegan, Illinois[e]	General Aviation	X	--	--	X	--	600	1

[a] *Instrument landing system—a precision landing aid.*

[b] *Very high frequency omnidirectional range beacon—nonprecision guidance.*

[c] *Nondirectional radio beacon—low frequency, nonprecision guidance.*

[d] *Category II ILS landing minimums available on runway 1L—100-foot ceiling and 1,200 feet visibility.*

[e] *Airport is located outside the Region.*

Source: R. Dixon Speas Associates, Inc., and selected U. S. flight information publications.

Table 36

NUMBER OF FLIGHTS IN ENROUTE AIRSPACE IN THE CHICAGO AIRSPACE REGION
PEAK DAY, FISCAL YEAR 1969

Altitude (Feet Above Mean Sea Level)	Type of Aeronautical Service						Total Flights	
	Air Carrier		General Aviation		Military			
	Number of Flights	Percent of Total	Number of Flights	Percent of Total	Number of Flights	Percent of Total	Number	Percent
0 - 9,999	603	43	755	54	46	3	1,404	48
10,000 - 17,999	353	76	96	21	16	3	465	16
18,000 - 29,999	495	87	37	7	35	6	567	20
30,000 - 34,999	200	86	21	9	12	5	233	8
35,000 and over	189	86	19	9	13	5	221	8
Total	1,840	64	928	32	122	4	2,890	100

Source: R. Dixon Speas Associates, Inc., and the Federal Aviation Administration Enroute IFR Air Traffic Survey, Peak Day FY 1969.

service. Since air traffic density at the lower altitudes (ground surface to 10,000 feet above mean sea level) is usually comprised of short-haul flights (those less than 200 nautical miles), activity at these levels can be considered to reflect the air traffic density in southeastern Wisconsin.

The hourly variation in peak day activity controlled by the Chicago ARTCC is illustrated in Figure 48. It can be seen that over 95 percent of the Chicago Center's air activity occurs during an 18-hour period from 6 a.m. to midnight. This distribution shows approximately the same pattern for each type of aeronautical service and for peak periods as that compiled at other U. S. Air traffic control centers.

Since the Milwaukee VORTAC, an electronic air navigation aid used as a point of airway intersection, is centrally located and is the focal point of airways above the Region, air traffic density over the facility was considered to be representative of the entire Region. Study of the activity records of flights using the Milwaukee VORTAC showed a total of 777 operations during the peak day in fiscal year 1969 in the low altitude airways and associated direct routings, and 388 operations in the high altitude airways and their direct routings. In recording peak day statistics, however, movement in both directions is recorded by the FAA, and thus an "overflight" is counted on both the inbound and outbound segments of its flight. To achieve a more realistic count, the activity recorded on the various converging and diverging routes to and from the facility was divided by two to obtain the number of "inbound," or "converging," aircraft. In this manner, air traffic density would be 388 operations in the low altitude levels and 169 at high altitude levels.

The foregoing data, supplemented by discussions with FAA officials manning the Milwaukee Tower and in the Chicago ARTCC, indicate that air traffic operating under instrument flight rules in the enroute airways over the Region is moderately heavy, and requires continual evaluation to ensure that saturation is not reached during heavy operational periods. Relief of traffic pressure can be achieved, if necessary, by restructuring the enroute airways system to provide bypass routes around the congested area.

In one effort to relieve such congestion around Milwaukee, the FAA, in May 1971, instituted a change to the low altitude airway structure by providing a VORTAC bypass routing. This change of airway structure and control procedure was designed to reduce operations in the airspace above Milwaukee, as well as to expedite the air traffic flow between Chicago and Milwaukee, Chicago and Green Bay, and Chicago and Oshkosh.

Airport Related Controlled Airspace: Airport related controlled airspace, or that controlled airspace normally associated with departure and arrival patterns of aircraft operating under both visual and instrument flight rules at those airports having approved and published instrument approach procedures within southeastern Wisconsin, was qualitatively analyzed to identify any airspace restrictions upon airport capacity which could be attributed to airspace interaction between the system's airports.

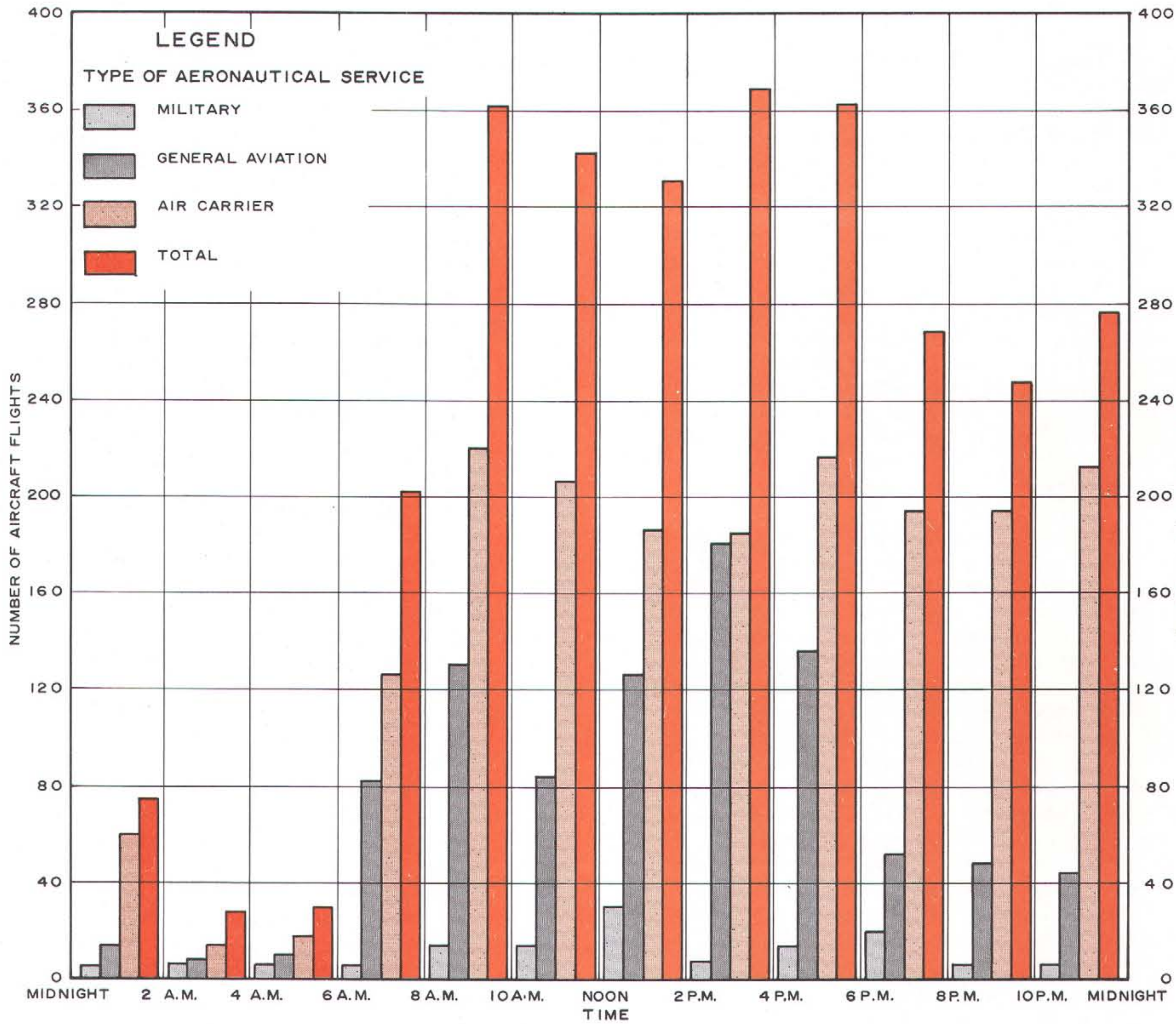
To undertake this analysis of airport related controlled airspace, it was necessary to make the following assumptions pertaining to airport runway instrumentation, air navigational aids, and air traffic control systems:

- Positive radar air traffic control would continue to be provided by a common air traffic control agency.

- All runways designated for instrument operations would be provided with an instrumented low approach path for a minimum of seven nautical miles, similar to existing ILS systems.

Figure 48

HOURLY DISTRIBUTION OF FLIGHTS IN ENROUTE AIRSPACE IN CHICAGO AIRSPACE REGION
PEAK DAY, FISCAL YEAR 1969



Source: R. Dixon Speas Associates, Inc., and U. S. Department of Transportation, Federal Aviation Administration Enroute IFR Air Traffic Survey, Fiscal Year 1969, Peak Day.

- During conditions requiring operations under instrument flight rules, all flights will operate in the same general direction.
- General Mitchell Field will operate primarily as an air carrier airport, using its present runway configuration and orientation.
- Departing aircraft, when necessary, will be tunneled under arrivals until clear of the inbound routes.
- Arrival aircraft will be given priority over departing aircraft in areas where arrival/departure conflicts occur.
- Lateral radar separation between aircraft of three nautical miles, or a vertical separation of 1,000 feet, will be maintained.

Two air traffic flow diagrams were prepared to depict close-in arrival and departure procedures of the seven IFR general aviation and one air carrier airport in the

Region, and the two general aviation airports in contiguous counties of Illinois and Wisconsin. Transition flight to and from the enroute system was not detailed, since the most critical area of operation for analysis of airport capacity is that airspace which is required for the final approach course and for separation of departures.

Each air traffic flow diagram is based upon present runway orientation and configuration. Although future planning may reduce some multi-runway airports to single, bi-directional runways, the assumption was made that each existing runway could be instrumented, and that the airport could achieve maximum capacity.

A final approach course of seven nautical miles was used to define a standard instrument approach procedure in which the first two nautical miles were allocated for flights on the runway-extended centerline prior to interception of a 3 degree glide slope (initiation of a controlled altitude descent) which begins five nautical miles out from the runway threshold. Radar vector areas[13] of six nautical miles are provided for each approach to General Mitchell Field, since that airport's runway-taxiway system is capable of supporting a continuous flow of arrivals with minimum intervals between aircraft.

Departure courses are indicated as diverging courses from the runway-extended centerline, which can begin at a point three miles from the runway. Although this distance may appear to be excessive, it is used to ensure that all classes of aircraft reach a minimum 1,000 feet above ground level before being required to turn. Three separate departure courses allow for minimum interval departure separation between aircraft, thereby ensuring attainment of maximum airport capacity.

During calm and low wind speed conditions, it is possible to expedite both departures and arrivals by using separate runways for arrivals and departures. Therefore, a bi-directional study of airport departure path interactions was made. When departure paths from one airport conflicted with those of another, departure paths were adjusted to provide as many paths as possible.

As indicated on Map 24, which shows arrival and departure paths from east to west, two airports within the Region—West Bend Municipal and Waukesha County—have independent arrival and departure paths, and thus are capable of unrestricted operations. The remaining airports have airspace restrictions to their operations due to interaction with operations at adjacent airports. The FAA controls aircraft operations in these areas of airspace restrictions, and, although there is no published rule specifying priority operations, air traffic controllers commonly give priority to arrival aircraft for safety reasons. These restrictions are further described below by airport.

- Timmerman Field—Unrestricted arrival paths to runways 33 and 22 can be provided by using altitude separation from the arrival paths to General Mitchell Field. Restrictions to departure paths from runways 33 and 22, identified as airspace conflict areas A and B on Map 24, are required to eliminate airspace conflicts with the arrival paths to the Waukesha County Airport. The restriction of left-hand turn departure paths is considered minor.

- General Mitchell Field—Unrestricted arrival paths, including radar vector spacing areas, to runways 19 and 25 can be provided by using altitude separation from the arrival paths to Timmerman Field. Restrictions to departure paths from runways 19 and 25, identified as airspace conflict areas C and D on Map 24, are required to eliminate airspace conflicts with the arrival paths to the Waukesha County Airport and with the departure paths from the Racine Commercial Airport. The restriction of right-hand turn departure paths—airspace conflict area C—is considered minor, but the restriction to a straight-ahead departure path—airspace conflict area D—is considered serious, not only because it reduces departure capacity, but because diversionary routings for aircraft having destinations to the south must be established. However, it is improbable that General Mitchell Field would operate to the south while Racine Commercial would operate to the northwest.

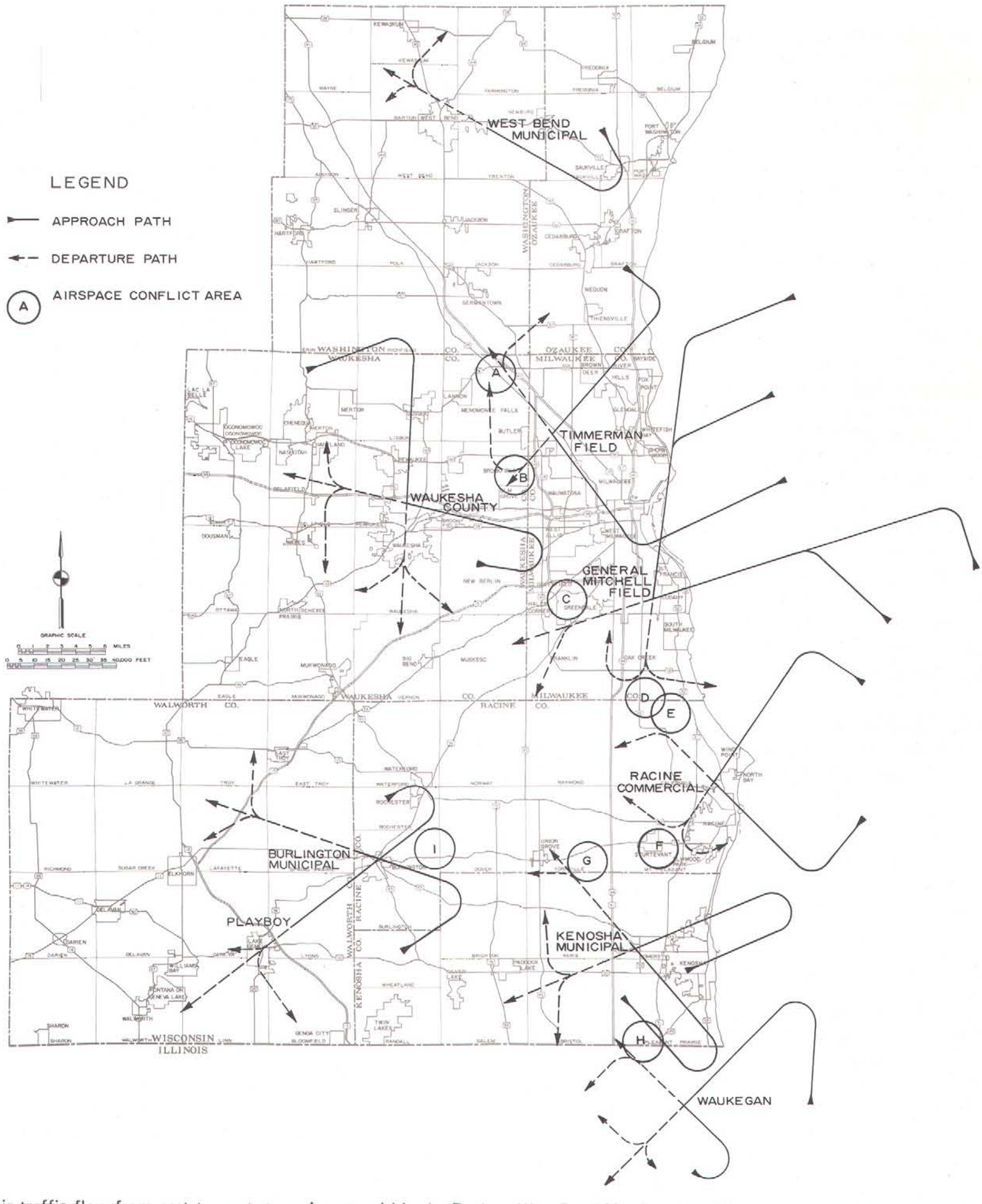
- Racine Commercial Airport—Unrestricted arrival paths to runways 22 and 32 can be provided. Restrictions to departure paths from runways 22 and 32, identified as airspace conflict areas E and F on Map 24, are required to eliminate airspace conflicts with the departure paths from General Mitchell Field and Kenosha Municipal. Although these restrictions are considered serious, the airspace conflicts depicted should occur only on rare occasions, since it is improbable that Racine Commercial would operate to the northwest while General Mitchell Field would operate to the south, or that Racine Commercial would operate to the southwest while Kenosha Municipal would operate to the northwest.

- Kenosha Municipal Airport—Unrestricted arrival paths to runways 24 and 32 can be provided by using altitude separation from the departure paths from Waukegan, Illinois. Unrestricted departure paths from runway 24 can also be provided. Restrictions to departure paths from runway 32, identified as airspace conflict area G on Map 24, are required to eliminate airspace conflicts with departure paths from the Racine Commercial Airport. Although the restriction of right-hand turn departures from Kenosha Municipal is considered minor, the conflict between the departure paths from Kenosha Municipal and Racine Commercial

[13] *Radar vector areas include that airspace within which a controller can "path-stretch" successive arrivals to their final approach course.*

Map 24

ARRIVAL AND DEPARTURE PATHS FROM EAST TO WEST AT AIRPORTS IN AND ADJACENT TO THE REGION CONDUCTING IFR OPERATIONS: 1971



With air traffic flow from east to west, two airports within the Region—West Bend Municipal and Waukesha County—have independent arrival and departure paths and thus are capable of unrestricted operations. The remaining airports require some restrictions on operations due to the interaction with operations at adjacent airports. Aircraft operations in areas of airspace restrictions are controlled by the FAA. Air traffic controllers commonly give priority to arriving aircraft for safety reasons, although there is no published rule specifying priority operations.

Source: R. Dixon Speas Associates, Inc.

would limit departures from both airports. However, as previously described, it is improbable that Kenosha Municipal would operate to the northwest while Racine Commercial would operate to the southwest.

- Burlington Municipal Airport—Arrival and departure paths to runway 29 are restricted because of the conflict, identified as airspace conflict area I on Map 24, with arrival paths to the Playboy Airport. To eliminate these airspace conflicts will require a one-to-one sharing of airspace; that is, an aircraft must depart or complete an approach to Burlington Municipal before an approach can be made to Playboy, or operations must be stopped at Burlington Municipal until a Playboy Airport approach clears the airspace at Burlington Municipal.

- Playboy Airport—Arrival paths to runway 23 are restricted because of the conflict, identified as airspace conflict area I on Map 24, with arrival and departure paths to Burlington Municipal. To eliminate this airspace conflict will require a one-to-one sharing of airspace. Unrestricted departure paths from runway 23 can be provided.

With air traffic flow west to east, as indicated on Map 25, one airport within the Region—West Bend Municipal—was found to have independent arrival and departure paths. As with traffic flow in the opposite direction, operations to and from the remaining area airports could experience some airspace restrictions due to interaction with adjacent airports, as described below:

- Timmerman Field—Unrestricted arrival paths to runways 4 and 15 can be provided. Unrestricted departure paths from runway 4 can also be provided. Restrictions to departure paths from runway 15, identified as airspace conflict area B on Map 25, are required to eliminate airspace conflicts with the departure paths from the Waukesha County Airport. The restriction of right-hand turn departure paths is considered minor.

- General Mitchell Field—Unrestricted arrival paths, including radar vector spacing areas, to runway 7R can be provided. Arrival paths to runway 1L are restricted because of the conflict, identified as airspace conflict area D on Map 25, with arrival paths to the Racine Commercial Airport. To eliminate this airspace conflict will require a one-to-one sharing of airspace, unless runway 14 at Racine Commercial is not in use. Unrestricted departure paths from runway 7R can be provided. Restrictions to departure paths from runway 1L, identified as airspace conflict area C on Map 25, are required to eliminate airspace conflicts with the departure paths from Timmerman Field. The restriction of left-hand turn departure paths is considered minor.

- Racine Commercial Airport—Arrival paths to runways 4 and 14 are restricted because of the conflicts, identified as airspace conflict areas D and F on Map 25, with arrival paths to General Mitchell Field and the Kenosha Municipal Airport. To eliminate these airspace conflicts will require a one-to-one sharing of airspace. It is improbable, however, that Racine Commercial would operate to the northeast while Kenosha Municipal would operate to the southeast. Unrestricted departure paths from runway 4 can be provided. Restrictions to departure paths from runway 14, identified as airspace conflict area E on Map 25, are required to eliminate airspace conflicts with the departure paths from the Kenosha Municipal Airport. The restriction of left-hand turn departure paths is considered minor.

- Kenosha Municipal Airport—Unrestricted arrival paths to runway 4 can be provided. Arrival paths to runway 14 are restricted because of the conflict, identified as airspace conflict area F on Map 25, with arrival paths to the Racine Commercial Airport. To eliminate this airspace conflict will require a one-to-one sharing of airspace. However, as mentioned earlier, it is improbable that Kenosha Municipal would operate to the southeast while Racine Commercial would operate to the northeast. Restrictions to the departure paths from runways 4 and 14, identified as airspace conflict areas G and H on Map 25, are required to eliminate airspace conflicts with the departure paths from the Racine Commercial and Waukegan, Illinois Airports. The restriction of left-hand turns from runway 4 and straight ahead movements from runway 14 is considered minor. It is also unlikely that Kenosha Municipal would operate to the southeast while Waukegan would operate to the northeast.

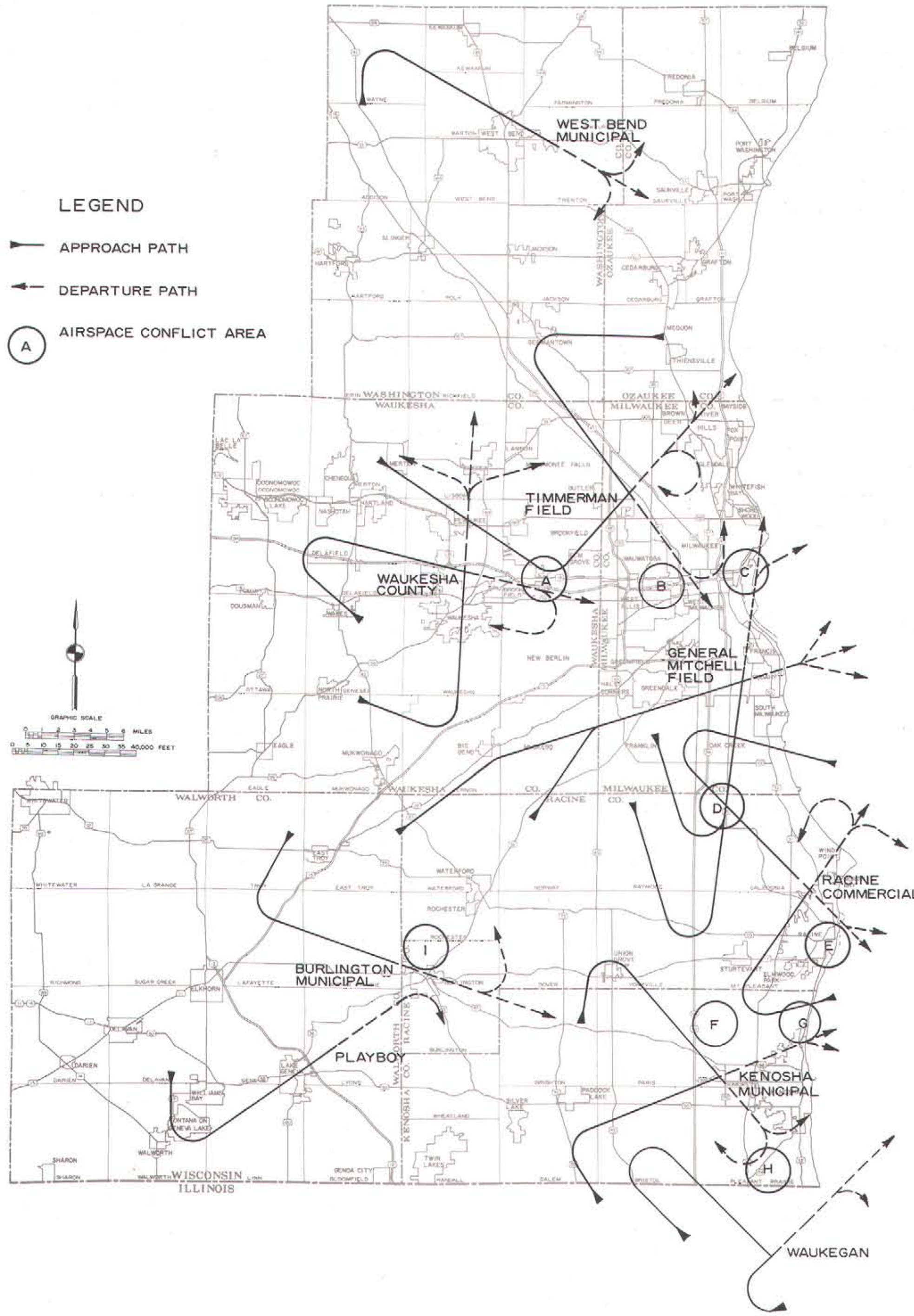
- Waukesha County Airport—Unrestricted arrival paths to runways 10 and 36 can be provided. Unrestricted departure paths from runway 36 can be provided, but restrictions to departure paths from runway 10, identified as airspace conflict area A on Map 25, are required to eliminate airspace conflicts with the arrival paths to Timmerman Field. The restriction of left-hand turn departure paths is considered minor.

- Burlington Municipal Airport—Unrestricted arrival paths to runway 11 can be provided. Restrictions to departure paths from runway 11, identified as airspace conflict area I on Map 25, are required to eliminate airspace conflicts with departure paths from the Playboy Airport. The restriction of right-hand turn departure paths is considered minor.

- Playboy Airport—Unrestricted arrival paths to runway 5 can be provided with the development of a missed approach procedure that turns aircraft away from Burlington Municipal airspace. Restric-

Map 25

ARRIVAL AND DEPARTURE PATHS FROM WEST TO EAST AT AIRPORTS IN AND ADJACENT TO THE REGION CONDUCTING IFR OPERATIONS: 1971



With air traffic flow from west to east, only one airport in the Region—West Bend Municipal—has independent arrival and departure paths and is thus capable of unrestricted operations. The remaining airports require some restrictions on operations due to interaction with operations at adjacent airports. Control of aircraft elevation, speed, and turning maneuvers is used to eliminate airspace conflicts upon approach to, and takeoff from, airports.

Source: R. Dixon Speas Associates, Inc.

tions to departure paths from runway 5, identified as airspace conflict area I on Map 25, are required to eliminate airspace conflicts with operations at Burlington Municipal Airport. Departure paths from Playboy Airport would be limited to right turns only.

The airport related airspace conditions of the eight airports in the Region currently conducting IFR operations are summarized in Table 37. Assuming that all airports in the Region are developed in accordance with their present runway orientation, and if air traffic density increases as forecast, some reduction in capacity may result at the Timmerman Field, General Mitchell Field, Racine Commercial, Burlington Municipal, Kenosha Municipal, and Playboy Airports. The Waukesha County and West Bend Municipal Airports have relatively unrestricted airspace available for increased operations.

Airspace restrictions which may affect airport capacity at these six airports can be attributed to conflicts between arrival-departure paths. It can be expected that some of the conflicts will be alleviated or modified through the development of variable geometry approach paths which change the final approach course and/or glide slope for both conventional-takeoff-and-landing (CTOL) and short-takeoff-and-landing (STOL) aircraft. The quantitative improvements expected from these

Table 37

SUMMARY OF AIRSPACE CONDITIONS AT AIRPORTS IN THE REGION CONDUCTING IFR OPERATIONS: 1971

Airport	Arrival Path		Departure Path		Remarks
	Runway	Operations	Runway	Operations	
West Bend Municipal. . .	31	Unrestricted	31	Unrestricted	No airspace conflict
	13	Unrestricted	13	Unrestricted	--
	6	Unrestricted	6	Unrestricted	--
	24	Unrestricted	24	Unrestricted	--
Timmerman Field . . .	4L- 4R	Unrestricted	4L- 4R	Unrestricted	--
	33L-33R	Unrestricted	33L-33R	Restricted	Departures limited to two paths
	22L-22R	Unrestricted	22L-22R	Restricted	Departures limited to two paths
	15L-15R	Unrestricted	15L-15R	Restricted	Departures limited to two paths
Waukesha County. . . .	10	Restricted	10	Restricted	Departures limited to two paths
	28	Unrestricted	28	Unrestricted	--
	36L-36R	Unrestricted	36L-36R	Unrestricted	--
	18R-18L	Unrestricted	18R-18L	Unrestricted	--
General Mitchell Field . .	1L	Restricted	1L	Restricted	Departures limited to two paths; arrivals 1 to 1 with Racine Commercial
	19R	Unrestricted	19R	Restricted	Departures limited to two paths
	7R	Unrestricted	7R	Unrestricted	--
	25L	Unrestricted	25L	Restricted	Departures limited to two paths
	31	Restricted	31	Restricted	Recommended for VFR use only, since both
	13	Restricted	13	Restricted	approach and departure paths would seriously conflict with, and reduce capacity at, Timmerman Field and Racine Commercial
Racine Commercial . . .	22	Unrestricted	22	Restricted	Departures limited to two paths
	32	Unrestricted	32	Restricted	Departures limited to one path
	4	Restricted	4	Unrestricted	Arrivals 1 to 1 with Kenosha
	14	Restricted	14	Restricted	Departures limited to two paths; arrivals 1 to 1 with General Mitchell Field
Burlington Municipal. . .	11	Unrestricted	11	Restricted	Departures limited to two paths
	29	Restricted	29	Restricted	Arrivals and departures 1 to 1 with Playboy arrivals
Kenosha Municipal . . .	24	Unrestricted	24	Unrestricted	--
	32	Unrestricted	32	Restricted	Departures limited to two paths
	6	Unrestricted	6	Restricted	Departures limited to two paths
	14	Restricted	14	Restricted	Departures limited to two paths; arrivals 1 to 1 with Racine Commercial
Playboy	5	Unrestricted	5	Restricted	Departures limited to one path
	23	Unrestricted	23	Restricted	Arrivals 1 to 1 with Burlington arrivals

Source: R. Dixon Speas Associates, Inc.

procedures, however, will not entirely eliminate the operational disadvantages inherent in a system of airports with conflicting terminal air traffic patterns.

An increase in air traffic density in low and high altitude enroute airspace will have little effect upon the system of airports within the Region, since the enroute structure can be adjusted to relieve any loading problems it may place upon airport related airspace.

Uncontrolled Airspace: Uncontrolled airspace, or that airspace between the ground surface and 1,200 feet above the ground surface exclusive of those areas designated as part of the controlled airspace environment over the Region, has been delineated on Map 22. Since it is permissible for general aviation aircraft to fly in uncontrolled airspace without filing a flight plan or otherwise notifying either a government agency or local airport operator of intent to do so, data regarding air activity operating in uncontrolled airspace are not maintained.

AIRCRAFT

The collection of technological data related to changes in aircraft design and performance is another important inventory element of airport planning. The physical characteristics of aircraft have both operational and economic significance for airport system planning. To provide efficient and safe use of facilities and airspace consistent with expected demands upon the airport and airspace system requires knowledge about the general dimensions and performance capabilities of current and future air carrier and general aviation aircraft types, and the composition of the aircraft fleets over time.

The basic physical characteristics that should be evaluated are aircraft size, capacity, and range. Aircraft size, particularly wingspan, fuselage length, empennage height, and aircraft weight, directly influences the size of parking aprons, hangars, and taxiway clearances. The capacity factors of fuel, passengers, and cargo have an important bearing upon fuel storage, fuel dispensing methods, fire fighting and rescue capabilities and operations, cargo handling facilities, and most importantly, passenger accommodations within and adjacent to the terminal complex. Aircraft range characteristics affect the number of arrival and departure operations, which in turn have an impact on runway capacities, gate positions, and traffic flows.

Performance characteristics, such as takeoff and landing distance, define runway length requirements and runway occupancy factors. Other factors of importance, including minimum clearances, passenger door heights, and parking area needs, are also necessary criteria for proper airport planning. Detailed physical and operational characteristics of several airline and general aviation aircraft currently in operation are provided in Appendix D. Most of the aircraft listed in this appendix operate within the Region, and will continue to do so for some time.

Aircraft Design and Performance Characteristics

In addition to examining the present aircraft fleet, consideration of new technological developments relative to "second" and "third" generation aircraft and their probable respective characteristics is required. Throughout the remainder of this decade, it is likely that the aircraft fleet serving commercial aviation needs will consist primarily of present day equipment and derivatives or modified versions (second generation) of today's aircraft. Experience in recent years has shown that many of the new aircraft presently operating are advanced versions of earlier, mid-1960 aircraft. For example, the Boeing 727-200 series three-engine jet aircraft is merely a stretched version of the original B-727. Similarly, the Douglas DC-8-61 and 63 series aircraft are stretched models of the DC-8-20 series aircraft, which entered commercial service in 1962. These stretched aircraft, however, have also been structurally improved, and have newer and more powerful engines.

All product line airplanes are studied by the manufacturer for possible size changes that might be required to fulfill future airline needs. A derivative airplane of a given model can encompass both decreases in linear dimensions and weight, as well as growth versions. The following summary is provided as representative of the plans or concepts for modifying certain aircraft types.

- DC-9—As the need arises, derivative versions of the DC-9 may be expected. These may include linear dimension changes up to approximately 45 percent. This could increase the body length up to 180 feet, the wingspan to 120 feet, and vertical tail height to nearly 37 feet. A total ramp weight on the order of 165,000 pounds is possible.

- DC-10—As the need arises, growth versions of the DC-10 may be expected to develop into an aircraft with a maximum gross weight of 600,000 pounds, a wingspan of 161 feet, and a total length of 231 feet. Two engine versions of the DC-10 are also being considered by the manufacturer.

- L-1011—Derivative versions of the L-1011 are currently planned by the manufacturer. Possible growth versions might include linear dimensional changes up to approximately 15 percent. This could stretch the body to 204 feet, the wingspan to 170 feet, and the tail height to nearly 56 feet. A total ramp weight of 550,000 pounds is possible.

- B-747—Possible growth versions of the 747 might include dimension changes up to about 20 percent. This could increase the length by up to 50 feet, the wingspan by up to 35 feet, and the tail height by up to 15 feet. A total ramp weight of 800,000 pounds is feasible.

Substantial improvements in the performance of civil aircraft flying today can be related to technical advances from research and development efforts conducted since 1945. For example, speed has increased from about 200 miles per hour to 600 miles per hour, range has increased from 2,000 miles to over 5,000 miles, aircraft productivity has increased from 1,450 ton-miles per aircraft hour to 42,000 ton-miles per aircraft hour, and unit direct operating costs have declined from about 2.5 cents per available seat mile to 0.9 cent per available seat mile. Significant advances in convenience and comfort have also been realized as a result of technological evolution.

Historically, military aviation has paced technological advances, with civil aviation as the beneficiary. More recently, however, little new technology applicable to civil aircraft has come from military programs, and much of the responsibility for such development has fallen upon the aircraft manufacturers, the airlines, and the U. S. Department of Transportation (DOT). The National Aeronautics and Space Administration (NASA), with the cooperation of the airlines, the manufacturers, and the DOT, has in recent times played an important role in organizing and implementing various research and development programs to meet the new urgency to look to the future of commercial aircraft transportation.

An assessment of the probable impact of the results of current research and development programs on aircraft characteristics is important to the regional airport system planning program. The major research and development areas of particular interest are directed toward advancing the short-haul aviation market, improving subsonic and low supersonic transports, and reducing aircraft noise at its source.

Since aviation already dominates the long-haul common-carrier market, future growth depends in part on achieving a greater share of the short-haul market. The short-haul aviation system, defined as an ensemble of airports, airways, and aircraft and attendant ground transport, provides point-to-point transportation between closely spaced urban centers or within urban centers. The most advanced equipment is available today for provision of medium- and long-haul transportation. With the first and second generation jets still relatively productive, the third generation wide-bodied transports are now entering service. The three new aircraft now available will soon be supplemented by the European twin-jet airbus and perhaps a U. S. counterpart. By 1980, even some of these aircraft will start being replaced, and the market will go to the best equipment then available. As presently envisioned, and as shown in Figure 49, this new equipment will fly about 15 percent faster, will be at least 10 EPNdB[14] quieter, and will have an equivalent direct operating cost that is about 10 percent lower. The aircraft will be considerably advanced in terms of integrated avionics and controls. Further, introduction of a million-pound aircraft with dual passenger/cargo roles in a day/night shift arrangement may be expected.

Aircraft Noise Control

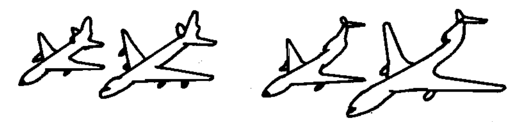
One primary technological constraint to the growth of air transportation is aircraft noise. As in the case of other pollutants, public awareness of aircraft noise is bringing about stringent measures to curtail and control it.

[14] *Effective perceived noise in decibels.*

Figure 49

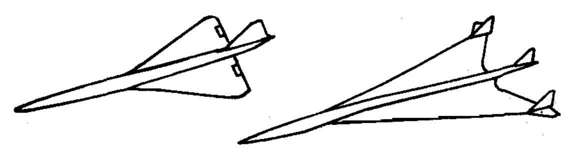
EXISTING AND FUTURE AIRCRAFT TYPES AND CAPABILITIES

ADVANCED TECHNOLOGY TRANSPORTS



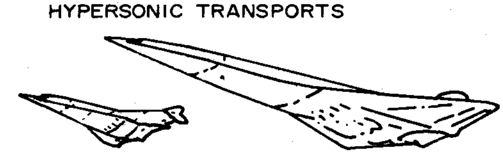
	CURRENT	1980'S
MACH NUMBER	0.85	0.9 TO 0.98
PASSENGERS	260 TO 370	200 TO 500
GROSS WEIGHT (POUNDS)	400,000 TO 750,000	240,000 TO 1,000,000+
RANGE (NAUTICAL MILES)	3,000 TO 5,500	3,000 TO 5,500
NOISE (EPNdB)	104 TO 108	90
DIRECT OPERATING COST (CENTS/SEAT-MILE)	0.75 TO 0.85	0.65 TO 0.80

SUPERSONIC TRANSPORTS



	CURRENT	1980 S.S.T.
MACH NUMBER	2.1	2.7
PASSENGERS	100+	350+
PAYLOAD RATIO	0.055	0.100
GROSS WEIGHT (POUNDS)	385,000	800,000
RANGE (NAUTICAL MILES)	3,200	5,000
NOISE (EPNdB)	111 TO 115	108
DIRECT OPERATING COST (CENTS/SEAT-MILE)	1.5	≈1.0

HYPERSONIC TRANSPORTS



	RESEARCH AIRPLANE	1995 TRANSPORT
MACH NUMBER	6 TO 12	7
GROSS WEIGHT (POUNDS)	80,000	450,000
PAYLOAD (POUNDS)	1,500 (EQUIPMENT)	62,000 (300 PASSENGERS)
RANGE (NAUTICAL MILES)	1,500	7,000
CRUISE BOOM (lb/ft^2)	---	<1
FUEL	LH_2	LH_2
PROPULSION	ROCKET/SCRAMJET	TURBO/SCAMJET
STRUCTURES	PASSIVE OR ACTIVE COOLING	ACTIVE COOLING (ALUMINUM OR TITANIUM)

Source: NASA Document SP 292, "Vehicle Technology for Civil Aviation, The Seventies and Beyond," prepared by Langley Research Center, November 1971.

Attempts to abate the aircraft noise problem have involved placing constraints on both airport and aircraft operations. These attempts, including the imposition of nighttime curfews on airport operation, limiting maximum flight ranges, and establishing noise monitoring programs, involve policy decisions on the part of the governmental authorities owning and operating airports. Until noise abatement is accomplished, airline operations will be increasingly restricted, and aircraft manufacturers will feel the effect in a loss of sales.

The issue of aircraft noise is being dealt with in three general ways: by decreasing it at the source, by aircraft operational changes, and by planning for land use compatibility.

The research programs of engine nacelle and duct treatment with sound absorbing materials, conducted by the National Aeronautics and Space Administration, have been somewhat successful in reducing the inlet and discharge duct noise components under airport approach conditions. Nacelle treatment is effective in reducing propagation of fan and engine noise from the ducts; however, the jet core noise is unaffected. In an effort to reduce jet core noise, NASA has made "quiet engine" research one of the large items in its recent aeronautics budgets. Figure 50 illustrates present aircraft noise conditions, while Figure 51 shows what NASA expects through 1985. The approach noise level of first generation jets can be reduced by retrofitting them with acoustically treated nacelles, and the second-generation wide-bodied jets are meeting FAR 36[15] today. In the mid-1970s, the quiet engine program of NASA is expected to demonstrate the technology available to produce engines about 10 EPNdB quieter than current engines, without major performance penalties. Still further engine improvements, including jet-noise suppression, may be expected. When quiet engines are combined with steep approaches, it should be possible to achieve noise levels at a point located beneath or in the immediate vicinity of the approach path of about 90 EPNdB in the 1980s for most subsonic transportation.

Reduction of the impact of aircraft noise upon airport environs can also be accomplished, in part, through adjustments in the manner in which the airport runways are used and adjustments in aircraft operations on takeoff and landing. The amount of noise reaching the ground from aircraft operating in and out of airports is greatly affected by the aircraft flight path and the throttle setting. One of the first noise control techniques applied was the use of preferential runways in order to direct traffic away from noise-sensitive areas. Under this technique, aircraft are assigned to takeoff or approach paths and runways by the control tower so that flight occurs over unpopulated or least populated areas surrounding the airport. These procedures, however, are applicable only when circumstances permit use of more than one runway or flight path. Other conditions, such as wind direction and intensity and individual aircraft operational capabilities, also influence the selection of runways during any 24-hour period.

Staggered hours of operation on a given set of runways so that no single flight path is used for more than a given period—for example, eight hours—may also prove useful. Reduction of the number of aircraft operations scheduled for peak periods would reduce noise concentrations during those periods. Limitations on jet aircraft operations to and from airports in the late evening or early morning periods also reduces adverse noise impacts. Although effective, these procedures may result in substantial loss of airport capacity and convenience, and, consequently, may contribute to the airport congestion problem.

Several operational procedures presently used or being seriously considered as interim noise abatement procedures are illustrated in Figure 52. These aircraft operational techniques can be used in takeoff and landing procedures to minimize the impact of aircraft noise on residential communities near airports. On approach, the normal glide path utilized by commercial airlines in the United States varies between 2.5 degrees and 3.0 degrees. Proposed modifications would increase this approach angle, thus maintaining aircraft at higher altitudes longer and thereby reducing noise exposure on the ground. Increasing the angle from 2.5 degrees to 3.0 degrees will result in a two to three EPNdB reduction. A greater reduction in noise exposure can be potentially attained with a "two-segment approach" procedure. Under this procedure, the aircraft would maintain a 6 degree approach slope up to three nautical miles from the runway threshold, and then intercept a 3 degree glide slope. This procedure is being fully evaluated by the FAA for compatibility with safety and other operating requirements. Three takeoff procedures that can be followed to minimize noise exposure include turns during takeoff; speed variations for steeper gradient climbing, more rapid transit over residential areas, or reduced rates of climb; and power reduction. Table 38 indicates the noise reduction at a point situated beneath the path of climb or in the immediate vicinity that can result from a power cutback for the different aircraft and engine types.

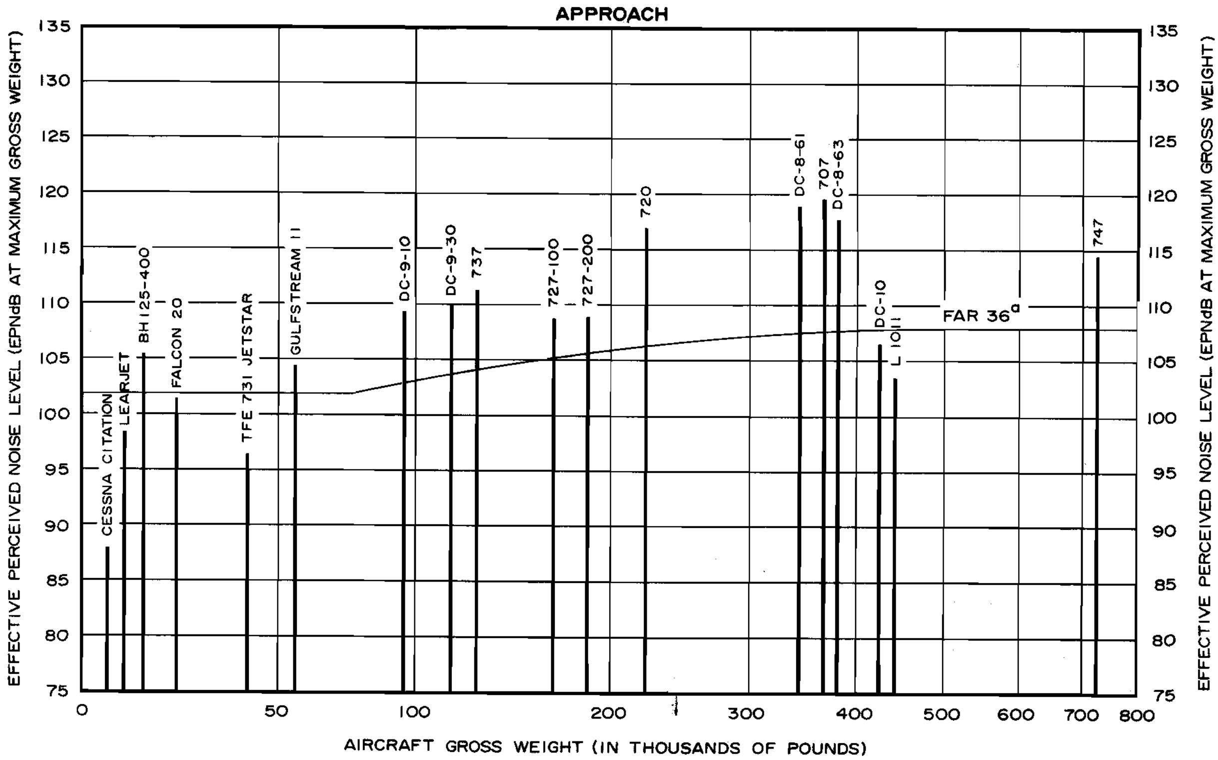
Even when advantage has been taken of all the procedures discussed previously, a residual noise problem may still exist. Consequently, the land use and activities of the airport environs subject to noise must be considered in the development of the airport system plan. Such consideration will include recommendations regarding development of compatible land uses around the airport, as well as the design and operation of airports to minimize the noise impact upon adjacent land uses.

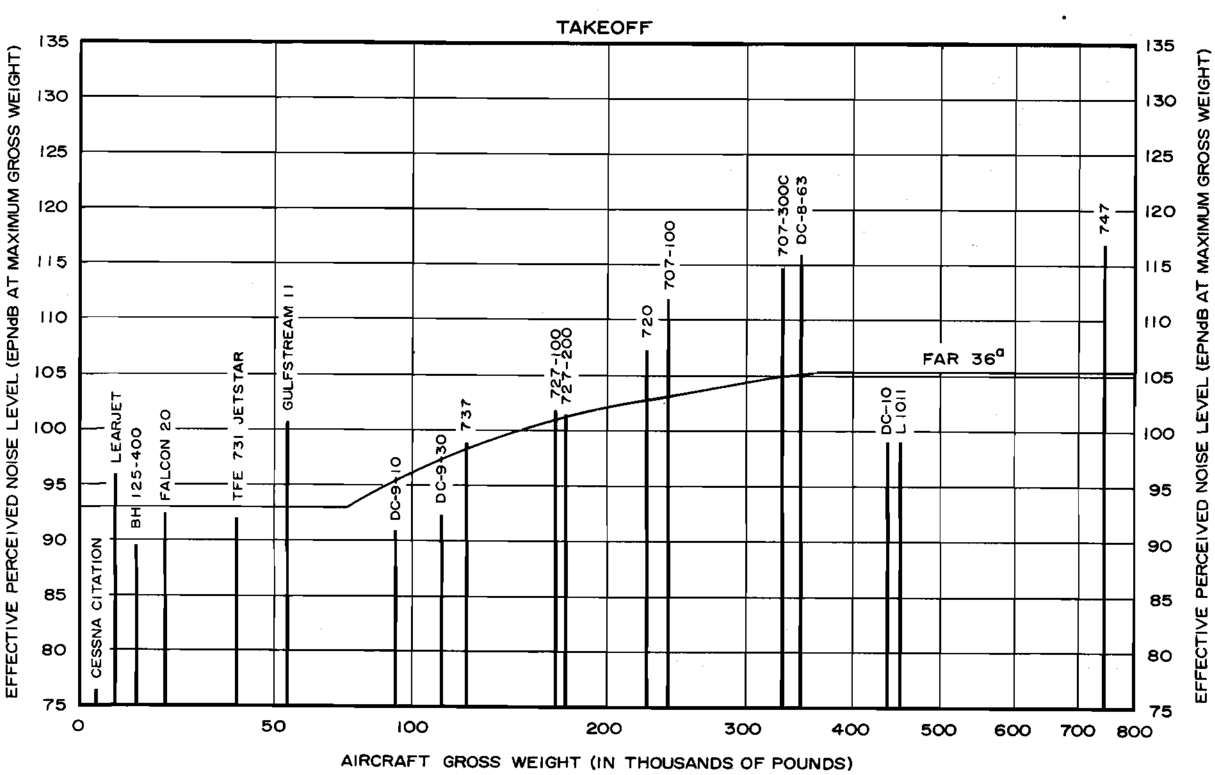
The Federal Aviation Administration has been involved in a series of continuing efforts to develop a suitable technique by which the contribution of aircraft sound to the environment in the vicinity of airports can be described. To satisfy the need for effective methods for

[15] *Federal Administration Regulations (FAR) Part 36—Noise Standards.*

Figure 50

COMPARATIVE NOISE LEVELS OF EXISTING AIRCRAFT: 1973



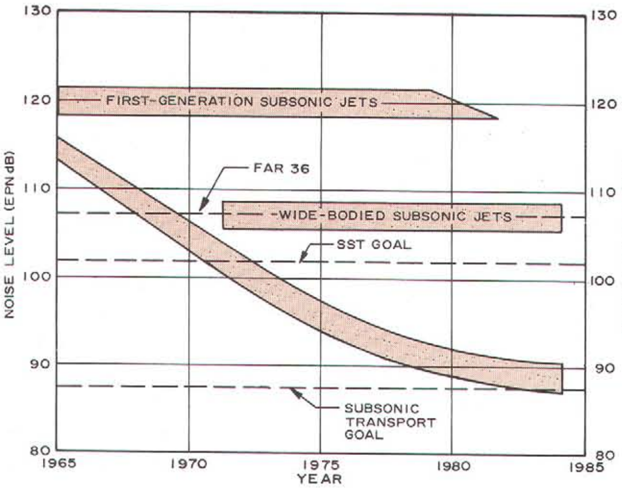


[a] *Federal Administration Regulations Part 36—Noise Standards.*

Source: Aircraft Manufacturers Data.

Figure 51

AIRCRAFT NOISE LEVELS ANTICIPATED FOR MULTI-ENGINE AIRCRAFT THROUGH 1985



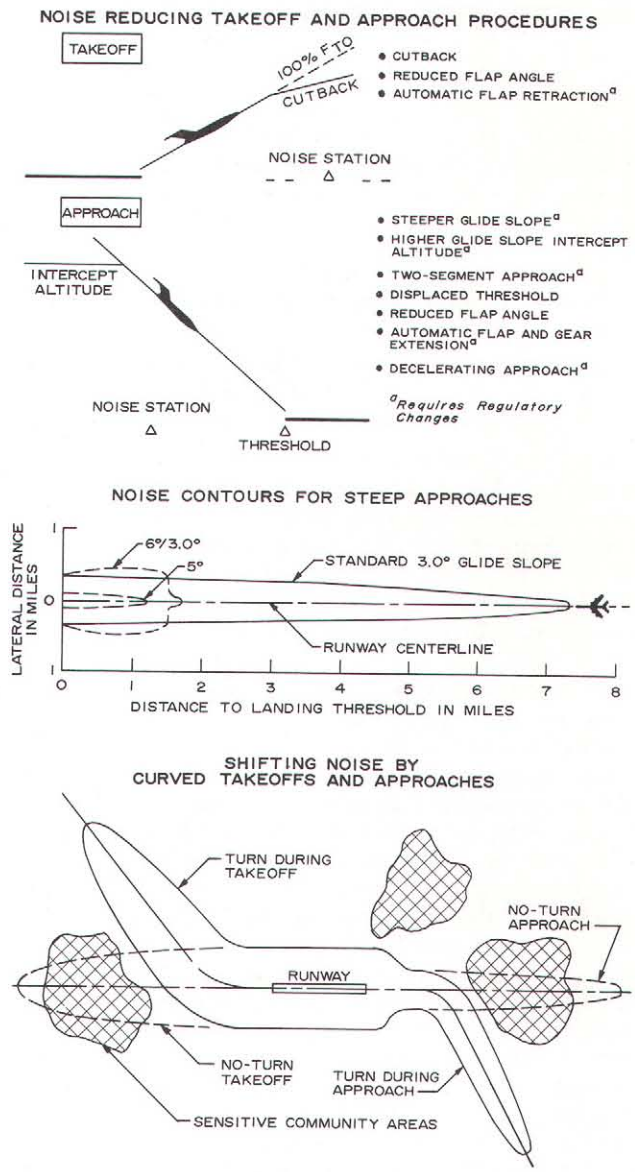
Source: NASA Document SP 292, "Vehicle Technology for Civil Aviation, The Seventies and Beyond," prepared by Langley Research Center, November 1971.

quantifying aircraft sound, the quantifying method must provide a technique for assessing the relative merits of describing and quantifying the noise climate around an airport resulting from aircraft operations under varying levels of aviation activity, and alternative procedures in aircraft approach and departure patterns. The quantification problem has received a considerable amount of attention, and has led to the development of noise exposure indices such as the composite noise rating (CNR)[16] in 1964, the noise exposure forecast (NEF)[17] in 1970, and the aircraft sound description system (ASDS)[18] in 1973.

The two noise exposure indices, CNR and NEF, result from techniques used to estimate community response to noise for identifying those areas around the airport where development of compatible land use may be undertaken to overcome undesirable noise impacts. From information generated by a noise analysis of the present and anticipated aircraft operations, and knowledge of

Figure 52

AIRCRAFT OPERATIONS DESIGNED TO REDUCE NOISE DURING TAKEOFF AND LANDING OPERATIONS



Source: Albert Barslow and William Alford, "Advanced Subsonic Transport Technology—an Overview," Astronautics and Aeronautics, August 1972, page 30.

land use categories that are considered compatible within specific ranges of NEF or CNR values determined from actual research and experience, recommendations for general land use can be provided for use in designing the regional airport system in accordance with the objectives and standards detailed in Chapter VII. The aircraft sound description system is an objective approach to describing aircraft sound levels for areas in the vicinity of airports. The ASDS states exposure to aircraft sound in terms of the amount of time that sound levels exceed a preselected threshold value, and as such, differs in four substantial ways from the other methodologies of dealing with

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[16] *Bolt, Beranek, and Newman, Inc., Land Use Planning Related to Aircraft Noise, October 1964.*

[17] *William J. Galloway and Dwight E. Bishop, Bolt, Beranek, and Newman, Inc., Noise Exposure Forecasts: Evolution, Evaluation, Extensions, and Land Use Interpretations, Report No. FAA-NO-70-9, prepared for the U. S. Department of Transportation, Federal Aviation Administration, August 1970.*

[18] *J. E. Cruz, U. S. Department of Transportation, Federal Aviation Administration, Aircraft Sound Description System Background and Application, Report No. FAA-EQ-73-3, March 1973.*

Table 38

REDUCTION IN AIRCRAFT NOISE RESULTING FROM ENGINE POWER CUTBACK

Number of Engines	Noise Reduction in Effective Perceived Noise Decibels (EPNdB)[a]		
	Turbojet	Turbofan (Low Bypass)	Turbofan (High Bypass)
2 . . .	6 to 9	5 to 6.5	3.5 to 5
4 . . .	1.5 to 6	2 to 3	1.5 to 3

[a] *Assumes gradient of climb after cutback is maintained at 4 percent.*

Source: Report of the Special Meeting on Aircraft Noise in the Vicinity of Aerodromes, Montreal, International Civil Aviation Organization, December 1969, pp. 4-8.

aircraft noise: it is a noise analysis oriented to using weighted sound pressure levels in decibels as used for many transportation and nontransportation noise sources, it states exposure in units of time, it has been oriented to describe noise in objective terms, and it yields information relative to a specific noise level.

The composite noise rating has been used to identify noise-sensitive areas around airports within the regional airport system for evaluation of alternative system plans, to guide recommendations for compatible land use development around the airports, and for airport runway orientation and aircraft operation. The CNR methodology is the most used, and at the time of preparing the noise analysis the only officially accepted method for identifying various levels of noise exposure. After July 1, 1974, the Federal Aviation Administration required that the ASDS methodology be used in airport planning studies. In using the CNR methodology, it should be recognized that the contours of noise equivalence plotted around the airports are calculated and shown generally rather than precisely, not only because the paths followed by the various types of aircraft are known to be far from precise and the levels of noise transmitted to the ground depend on various meteorological and other factors, but also because the plotting of index values may fail to match the annoyance that actually is felt.

The CNR methodology does provide a basis for development of land use plans that would be compatible with the airport environment, for evaluation of the impact of the airport plan on existing land uses, and for provision of a relative measure of the adverse noise impact among alternative airport system plans. Development of compatible land uses requires identification of the noise-sensitive areas and land uses and activities that will not be adversely affected by the aircraft noise. Designation of areas which are noise-sensitive to existing or forecast aircraft types and operations would be followed by zoning to encourage compatible development. Where the demand for additional land uses which would be compatible with airports does not exist, alternative procedures may be required to obtain acceptable compatibility between the airport and its neighbors. These activities may range from compensation for noise annoyance to soundproofing existing structures to purchasing noncompatible lands beyond the runways and clear zones. Use of zoning provides the best approach, since it not only establishes land availability for uses compatible with airports and airport operations, but it also discourages noncompatible uses that might be adversely affected by future aircraft operations.

Appropriate generalized land use planning recommendations will be outlined for each airport recommended in the regional airport system plan. These land use plan recommendations can be further detailed and refined under airport master plan studies required as an initial activity under regional plan implementation.

SUMMARY

The findings of the inventories of airport facilities, airspace and air control systems, and aircraft characteristics conducted under the regional airport planning program are summarized in this chapter. The 46 airports in southeastern Wisconsin have been classified into four aeronautical service categories and ten functional systems. Twenty-seven of the 46 airports are public use airports, and eight of these are publicly owned and operated, including the Region's only air carrier airport, General Mitchell Field in the City of Milwaukee. Two of the publicly owned airports, General Mitchell Field and West Bend Municipal, are joint civil and military use airports.

Assessing the capacity of the existing airport system requires defining the capacity limitations of three distinct elements: the landing area and terminal area, the airspace, and the surface access facilities. Inventory data related to each capacity limiting element and other information pertinent to airport system planning have been obtained, organized, and reported herein for each airport.

Data on the relationship of each airport to the Region's 1972 arterial street and highway system indicate that 22, or 48 percent, of the airports are directly served by the existing and proposed arterial street and highway system, and that an additional 15, or 33 percent, are located within one mile of this system. It was also found that only three arterial links serving as airport service roads are presently handling traffic volumes exceeding their design capacity. Upon implementation of the adopted regional transportation plan, with the attendant completion of the proposed freeway system and improvements to the surface arterial system, it is anticipated that these three arterial links will be operating within their respective design capacities. These links are USH 50 and STH 38 in Racine and Walworth Counties in the vicinity of the Lake Lawn Lodge, the Racine Commercial Airport, and the Johnson Wax Heliport. Public transportation is provided over the arterial street and highway system, and General Mitchell Field is served by both inter- and intra-urban bus service. There is also direct intercity bus service between the Region and Chicago's O'Hare Field.

This chapter also summarizes basic information regarding the regional airspace and air traffic control systems and the aircraft activities within this system. The study of air traffic activity in the controlled airspace of southeastern Wisconsin focused upon the enroute and airport related controlled airspace and air traffic control systems to determine if air traffic loadings or aircraft operational restrictions existed which could have an adverse effect on the operation of the Region's airports. The enroute airspace environment of southeastern Wisconsin is only a portion of a larger regional airspace structure involving primarily service of the Chicago metropolitan area. From analysis of the airspace structure of the Chicago region, it was concluded that enroute air traffic density in southeastern Wisconsin is moderately heavy and requires continual evaluation to assure that saturation is not reached during heavy operational periods. Traffic pressure can be relieved by restructuring the enroute system to provide bypass routes around the congested area.

Airport related controlled airspace, or that controlled airspace normally associated with arrival and departure patterns of aircraft operations under either visual flight rules (VFR) or instrument flight rules (IFR) within southeastern Wisconsin, was quantitatively analyzed to identify any airspace restrictions upon airport capacity which could be attributed to airspace interaction between the system's airports. Air traffic flow diagrams were prepared to depict close-in arrival and departure procedures of the seven IFR general aviation and one air carrier airport within the Region, plus the general aviation airports in two contiguous counties in Illinois and Wisconsin. Airport related airspace restrictions do exist, and some reduction in capacity may result, for Timmerman Field, General Mitchell Field, Racine Commercial, Burlington Municipal, Kenosha Municipal, and Playboy Airports. Airspace restrictions which may affect airport capacity of these six airports can be attributed to conflicts between arrival and departure paths. It can be expected that some of these conflicts will be alleviated or modified through the development of variable geometry approach paths which change the final approach course and/or guide slopes for both conventional takeoff and landing and short takeoff and landing aircraft. The quantitative improvements expected from these procedures, however, will not entirely eliminate the operational disadvantages inherent in a system of airports with conflicting terminal air traffic patterns.

Finally, this chapter described the results of the inventory of aircraft characteristics. The physical characteristics of aircraft have both operational and economical significance relative to airport system planning and development. To provide for maximum utilization and safety consistent with expected demands on the system, the dimensions and performance capabilities of current and future air carrier and general aviation aircraft types, and the composition of the aircraft fleets, must be considered. In addition to examining the present aircraft fleet, an assessment of the impact of current research and development programs is meaningful. The major research and development areas of particular concern include studies pertinent to the advancing short haul aviation market, the improvement of subsonic and supersonic transports, and aircraft noise reduction.

The discussion of aircraft of the future dealt with derivative airplanes, modified versions of today's aircraft, and advanced technology vehicles being researched and developed by the aircraft manufacturers, the airlines, and the National Aeronautics and Space Administration (NASA). NASA's Transport Technology Program is directed toward finding technological advances that would contribute to superior subsonic transport aircraft, advance short takeoff and landing aircraft for intercity use, and supersonic and eventually hypersonic aircraft.

One primary technological constraint to the growth of air transportation is aircraft noise. This problem is presently being dealt with in three general ways—by decreasing it at the source, by operational changes, and by planning for land use compatibility. Use of all of these techniques has been analyzed in development of the regional airport system plan.

This chapter has provided the basic inventory information upon which the regional airport system plan can be prepared. The present physical facilities and their abilities to handle air travel demands today have been inventoried and described. Analysis of the airspace capabilities has been undertaken and deficiencies identified. An inventory of current and future aircraft characteristics has been developed to provide input to the planning process. Together, these inventories represent the supply side of the air travel supply-demand equation existing within southeastern Wisconsin.

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Chapter V

EXISTING AIR AND AIR-RELATED TRAVEL HABITS AND PATTERNS

INTRODUCTION

One of the central concepts underlying all of the transportation planning efforts of the Commission, including the regional airport system planning program, is that travel is an orderly, regular, and measurable occurrence, evidenced by recognizable patterns. A complete and accurate inventory of existing air and related ground transportation movements within the Region is necessary to discover these patterns and disclose those aspects which demonstrate a high degree of repetitiveness. Such knowledge is necessary in order to understand the probable future demand for air transportation and related facilities. Accordingly, special travel inventories were conducted under the regional airport system planning program to determine existing habits and patterns of air travel and related surface travel within the Region. These surveys were the most complex of all the required inventories. In order to obtain a complete picture of the air travel habits and patterns within the Region, it was necessary to collect all pertinent existing data from governmental agencies and to conduct three types of personal interview travel surveys: a commercial enplaning passenger survey, a general aviation airport pilot survey, and a general aviation airport user survey. This chapter presents a brief description of the special travel inventories conducted under the regional airport system planning program; describes existing habits and patterns of air travel and related surface travel at airports within, or in close proximity to, the Region; and discusses the significant forces shaping the regional air and air related travel habits and patterns.

AIR CARRIER AIRPORT PASSENGER SURVEY

Passenger Traffic Volume

The basic sources of data used to determine the characteristics of air carrier passenger travel within the Region were governmental records, airline schedules, and personal interviews with air passengers. Public information regarding the origin and destination of air travelers is excellent. Through regulations of the Civil Aeronautics Board (CAB), certificated air carriers must annually report certain data for a 10 percent sampling of all commercial air passenger trips. Therefore, sample data are available on the travel habits and patterns of passengers who originate or terminate air trips at General Mitchell Field.

Table 39 summarizes passenger travel demand between Milwaukee and the 50 cities producing the highest volumes of trip interchange with Milwaukee as expanded from CAB sample data from 1959 to 1972. The cities are ranked in order of the 1971 volume of passengers going to or from Milwaukee, since 1971 was the base year chosen for the travel surveys. The passenger traffic volumes for each city listed represent the number of air passengers carried annually which originate at, or are destined for, airports serving those cities in flights to and from General Mitchell Field, and do not necessarily reflect the actual points of origin or ultimate destination at either end. An air traveler may, for example, travel by auto from Westport, Connecticut to the John F. Kennedy International Airport in New York City to enplane for Milwaukee, but is considered in Table 39 as originating in New York City.

Air Carriers Serving the Region Through General Mitchell Field

The five air carriers serving the Region through General Mitchell Field and holding a CAB Certificate of Public Convenience and Necessity authorizing the provision of scheduled air transportation over specified routes are Eastern Air Lines, Inc.; North Central Airlines, Inc.; Northwest Airlines, Inc.; Ozark Air Lines, Inc., and United Airlines, Inc. In terms of routes authorized and traffic carried, Northwest, North Central, and United are the most important carriers. Service by Ozark is limited so that traffic carried is about one-third to one-fourth that carried by United Air Lines, the third ranking of the three most important carriers. Maps of the airline routes for each major carrier serving Milwaukee, as authorized by the CAB, are presented in Appendix E. In addition to the certificated air carriers at General Mitchell Field, one commuter airline, Air Michigan, served the terminal in 1971.[1]

Airline service patterns are summarized on Map 26, which shows the pattern of direct, nonstop service provided as of January 1, 1971, and lists the cities with other direct service. Table 40 presents a summary of city pair service according to nonstop, one-stop, and other service. To develop a measure of the adequacy of airline service patterns, a service rating was developed for each city pair schedule, which took into account the important characteristics of airline service, specifically, the type of equipment used, the time of arrival and departure, the number of stops made, and whether the flight was an originating, terminating, or through flight. The following multiplier values were used for each flight characteristic in determining the service rating:

1. Equipment type:

   (a) Jet: 1.0
   (b) Non-Jet: 0.7

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[1] *Air Michigan ceased operation at General Mitchell Field on February 29, 1972.*

Table 39

PASSENGER TRAVEL DEMAND BETWEEN MILWAUKEE AND THE 50 U. S. CITIES WITH HIGHEST VOLUMES OF TRIP INTERCHANGE WITH MILWAUKEE: 1959-1972

City	Number of Passengers													
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
New York, N.Y.	95,500	89,560	87,700	93,980	96,760	114,190	130,750	123,470	154,950	147,950	174,050	169,860	167,560	167,290
Detroit, Mich.	69,740	69,500	63,800	65,750	63,170	72,490	83,950	81,560	98,210	101,120	117,140	115,780	99,340	95,730
Minneapolis, Minn.	54,650	51,990	52,390	52,350	55,710	60,820	75,670	72,150	102,160	97,070	106,950	104,410	89,020	91,180
Los Angeles, Calif.	18,810	16,990	17,380	21,480	23,500	29,370	33,840	45,820	56,670	67,320	69,550	64,190	64,190	65,980
Washington, D.C./ Baltimore, Md.	24,710	23,390	26,200	24,780	27,930	30,960	34,800	40,240	49,480	53,270	64,760	61,120	61,870	59,830
Cleveland, Ohio	31,960	29,200	30,420	31,250	31,660	33,130	37,500	42,450	47,780	53,670	57,690	55,170	53,650	51,320
Chicago, Ill.	35,670	32,030	28,450	31,860	41,940	47,900	58,310	68,740	74,080	66,460	55,170	53,810	46,520	51,730
San Francisco, Calif.	8,630	8,700	8,660	10,090	12,190	14,160	19,250	22,870	31,270	38,630	41,390	40,890	39,260	43,250
St. Louis, Mo.	13,250	12,590	11,740	12,950	13,330	13,780	18,920	22,590	27,230	35,530	38,300	37,140	38,720	38,750
Boston, Mass.	10,990	10,770	9,300	10,070	12,920	13,970	18,590	23,090	27,990	33,160	36,550	38,150	38,190	35,600
Philadelphia, Pa.	16,100	16,280	15,310	16,850	16,770	19,380	22,760	25,630	31,440	36,190	36,780	38,750	37,530	33,240
Miami, Fla.	18,670	15,920	11,160	11,450	13,090	13,580	19,490	25,230	35,210	30,560	34,300	31,830	36,420	39,770
Denver, Colo.	5,980	7,050	7,460	6,640	8,060	9,580	12,140	17,070	21,460	26,860	31,370	30,800	33,810	39,660
Tampa, Fla.	7,860	7,600	6,480	5,420	5,240	5,400	7,550	10,710	13,920	16,290	21,000	24,650	30,240	31,610
Las Vegas, Nev.	1,060	1,530	1,900	1,580	1,690	1,540	4,020	7,080	12,110	18,990	20,430	20,950	25,610	38,230
Pittsburgh, Pa.	12,130	11,050	11,270	11,480	12,310	12,900	16,570	16,920	23,120	25,770	26,860	25,510	23,100	24,470
Kansas City, Mo.	5,590	5,780	6,130	5,350	7,080	6,770	8,810	9,190	12,610	16,570	20,950	18,920	20,640	20,880
Atlanta, Ga.	2,730	3,330	3,570	3,560	4,160	3,970	5,080	6,340	7,800	12,190	15,550	15,740	20,040	26,320
Columbus, Ohio	4,750	5,020	4,150	4,070	4,930	4,990	6,370	7,150	7,830	9,160	8,020	15,460	18,820	19,720
Dallas/Fort Worth, Tex.	3,520	4,480	3,480	4,060	4,850	4,720	5,590	6,800	8,740	9,070	11,720	17,250	18,360	19,110
Cincinnati, Ohio	6,580	5,630	5,840	6,190	7,240	6,530	7,750	8,600	10,140	10,080	11,250	18,670	18,260	19,220
Indianapolis, Ind.	5,570	7,470	6,740	5,860	5,700	6,380	7,090	6,850	8,790	8,550	7,850	13,620	16,390	16,800
Dayton, Ohio	4,560	5,130	4,420	4,520	4,780	4,560	5,740	6,290	6,550	7,680	7,520	13,160	15,240	15,580
Grand Rapids, Mich.	13,100	11,410	8,880	10,620	12,570	12,100	11,450	11,810	15,200	17,830	16,900	15,820	14,870	15,910
Seattle, Wash.	4,450	3,170	4,620	6,780	3,660	3,990	5,290	6,990	10,260	11,600	13,470	16,060	14,580	11,350
Muskegon, Mich.	8,830	8,010	6,270	6,140	7,370	8,580	9,160	10,310	13,470	13,740	13,310	11,720	13,670	13,170
Fort Lauderdale, Fla.	30	--	--	--	--	--	--	--	--	5,730	7,870	14,770	13,060	16,130
Hartford, Conn.	3,950	3,350	3,670	4,120	5,310	4,790	5,440	6,260	7,700	10,300	10,480	10,990	11,830	13,390
San Diego, Calif.	2,020	1,800	1,670	1,950	2,880	4,270	5,930	7,370	7,910	10,880	11,880	11,190	11,500	12,230
Louisville, Ky.	2,440	3,720	3,630	3,190	3,780	4,290	4,650	4,610	5,410	6,380	6,900	9,750	11,150	12,560
Phoenix, Ariz.	2,680	2,600	1,890	2,570	2,540	2,730	3,830	4,720	6,420	6,140	7,530	8,300	10,990	14,980
Lansing, Mich.	2,200	1,930	1,980	3,850	4,300	4,980	6,210	8,440	8,220	10,340	9,540	9,040	10,020	10,490
Houston, Tex.	1,890	2,060	1,740	2,130	2,190	2,870	4,040	4,580	5,070	5,970	6,280	7,480	9,690	9,980
Omaha, Nebr.	3,770	3,530	3,720	4,040	4,430	4,310	5,390	5,460	5,770	6,440	7,840	8,440	9,360	10,050
New Orleans, La.	1,710	1,480	1,490	1,690	2,280	1,880	3,390	3,730	4,630	5,100	5,380	6,800	8,550	9,680
Buffalo, N.Y.	4,330	4,710	4,450	4,230	4,900	5,140	6,950	6,480	6,580	8,370	8,650	8,500	7,880	7,740
Duluth, Minn.	2,910	2,510	1,940	2,740	3,030	3,340	4,560	5,170	5,320	5,310	5,070	6,220	7,270	7,860
Memphis, Tenn.	1,560	1,360	1,740	1,570	1,360	1,620	1,830	2,770	3,910	4,140	4,640	5,340	6,590	7,260
San Antonio, Tex.	2,360	1,000	1,450	1,830	1,500	1,900	3,850	4,600	3,750	4,550	4,230	4,260	6,390	5,980
Des Moines, Iowa	4,760	4,650	4,170	4,930	4,920	5,710	5,970	7,080	7,170	8,760	8,450	5,570	6,350	6,680
Rochester, Minn.	6,840	5,350	4,040	4,580	5,140	5,810	7,260	6,040	9,470	8,780	8,130	5,540	6,020	5,370
Portland, Oreg.	1,790	1,660	1,150	1,590	1,750	2,120	2,990	3,190	3,580	4,740	5,250	6,250	5,820	7,040
Wausau, Wis.	2,620	1,880	1,560	2,560	3,180	3,030	3,080	3,150	3,400	2,980	4,570	3,840	5,570	5,580
Honolulu, Hawaii	--	--	--	--	--	--	--	--	--	4,210	5,310	5,880	5,520	5,520
Green Bay, Wis.	3,480	3,040	1,980	3,160	3,160	3,780	3,820	4,970	5,730	6,200	4,790	4,560	5,510	5,730
Syracuse, N.Y.	2,600	2,280	1,930	1,910	1,870	2,430	3,000	3,480	3,900	4,570	4,890	5,070	5,390	5,020
Cedar Rapids, Iowa	2,660	1,950	2,100	2,270	2,580	2,540	3,030	3,920	4,470	6,330	6,680	5,570	5,360	5,680
Rochester, N.Y.	2,170	2,350	1,900	2,270	2,850	2,490	2,830	4,320	4,450	4,500	4,670	4,740	4,760	5,230
Albany, N.Y.	2,070	1,890	1,540	2,010	1,910	1,610	2,260	2,470	2,710	3,400	3,770	4,170	4,210	5,580
Norfolk, Va.	2,470	2,250	2,470	2,720	2,620	2,720	2,400	2,540	3,220	4,080	3,890	4,100	3,940	4,590
Subtotal	548,700	520,930	495,920	527,040	567,090	630,100	759,150	831,300	1,027,260	1,113,510	1,215,520	1,235,800	1,238,630	1,286,050
Total	640,440	603,500	577,250	612,030	658,810	729,860	880,920	979,070	1,198,930	1,307,870	1,413,140	1,428,870	1,460,560	1,544,020
Percent of Total	85.7	86.3	85.9	86.1	86.1	86.3	86.2	84.9	85.7	85.1	86.0	86.5	84.8	83.3

Source: Civil Aeronautics Board, Domestic Origin-Destination Survey of Airline Passenger Traffic.

2. Type of flight:

   (a) Originating/Terminating: 1.0
   (b) Through: 0.8

3. Time of arrival/departure:

   (a) Prime time[2] adjusted for time zone: 1.0
   (b) Nonprime times adjusted for time zone: 0.7

4. Number of stops between Milwaukee and reference cities:

   (a) Nonstop: 1.0
   (b) One: 0.8
   (c) Two: 0.5
   (d) Three: 0.3
   (e) Four or more: 0.1

The flight schedules were evaluated by multiplying the values for each flight characteristic of each flight in a city pair. For example, a non-jet, through flight departure to Iron Mountain at 2 p.m. (nonprime time) would be assigned a value of 0.196, or (non-jet = 0.7) x (through

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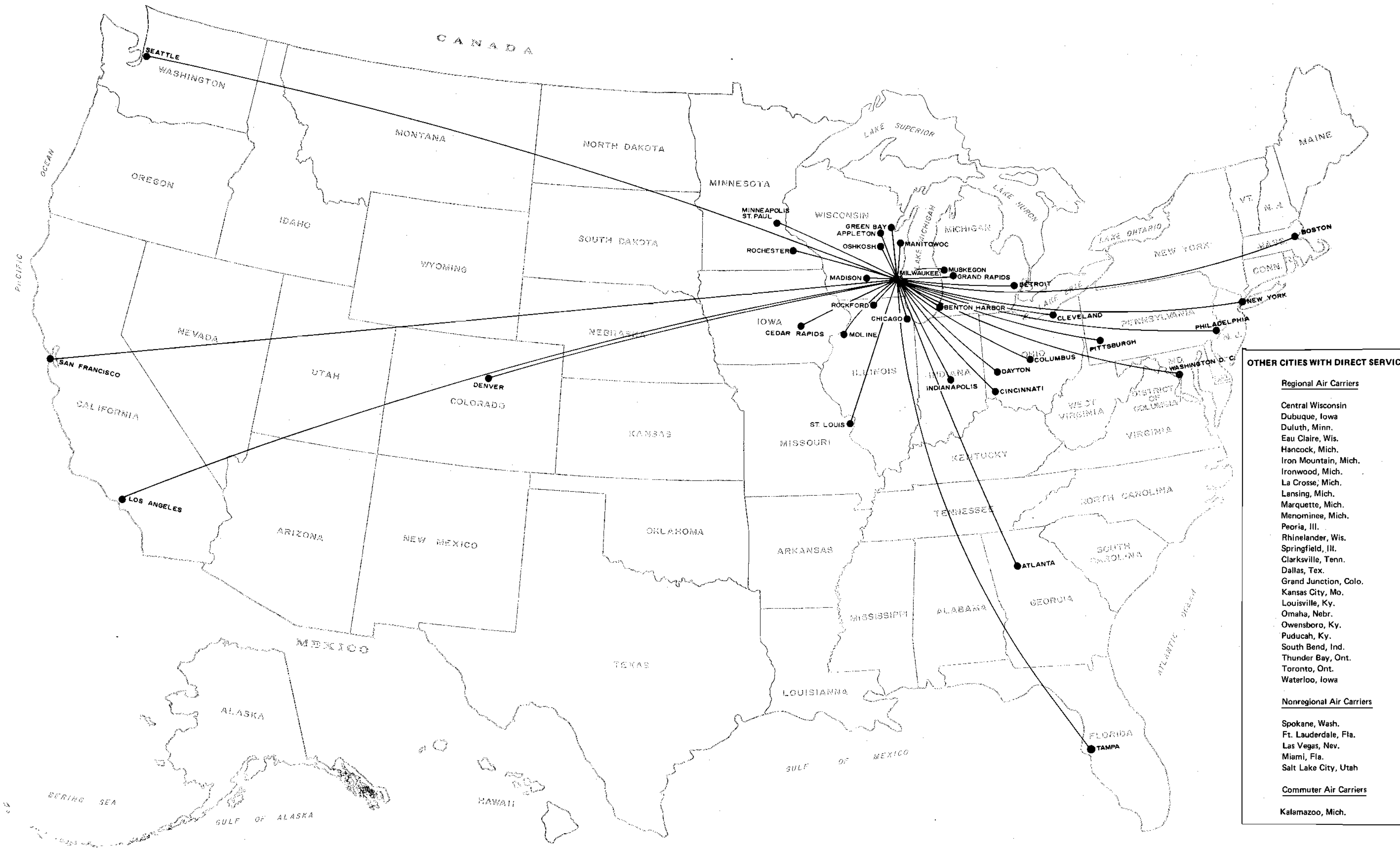
[2]*Prime time is defined as the hours between 5 p.m. and 7 p.m.*

Map 26

PATTERN OF DIRECT, NONSTOP COMMERCIAL AIR SERVICE TO MILWAUKEE: JANUARY 1971



Direct, nonstop commercial airline service was provided in 1971 to General Mitchell Field in Milwaukee from a total of 32 cities located throughout the United States. The majority of these cities are located in Wisconsin, Michigan, Ohio, Illinois, and Minnesota. Other cities are located primarily in states along the east and west coasts and in two southern states.

Source: R. Dixon Speas Associates, Inc.

Table 40

NUMBER OF DAILY FLIGHTS BETWEEN MILWAUKEE AND SELECTED CITIES IN THE UNITED STATES AND CANADA BY NUMBER OF STOPS MADE: JANUARY 1971

City or Geographic Area	Number of Daily Flights							
	To Milwaukee				From Milwaukee			
	Nonstop	1 Stop	2 or More Stops	Total	Nonstop	1 Stop	2 or More Stops	Total
Appleton, Wis.[a]	2	0	0	2	2	0	0	2
Atlanta, Ga.	2	0	0	2	1	0	0	1
Benton Harbor, Mich.	2	0	0	2	1	1	0	2
Boston, Mass.	1	2	0	3	1	2	0	3
Cedar Rapids/Iowa City, Iowa	1	0	0	1	1	0	0	1
Central Wisconsin	0	5	1	6	0	3	1	4
Chicago, Ill.	24	0	0	24	27	0	0	27
Cincinnati, Ohio	3	1	0	4	1	3	0	4
Clarksville, Tenn.	0	0	1	1	0	0	1	1
Cleveland, Ohio	3	0	2	5	3	0	2	5
Columbus, Ohio	1	2	0	3	3	0	0	3
Dallas/Fort Worth, Tex.	0	3	0	3	0	2	0	2
Dayton, Ohio	3	0	0	3	3	0	0	3
Denver, Colo.	2	0	0	2	2	0	0	2
Detroit, Mich.	9	1	4	14	8	1	5	14
Dubuque, Iowa	0	1	0	1	0	1	0	1
Duluth, Minn.	0	1	2	3	0	1	1	2
Eau Claire, Wis.	0	0	1	1	0	0	1	1
Fort Lauderdale, Fla.	0	1	1	2	0	2	2	4
Grand Junction, Colo.	0	1	0	1	--[b]	--[b]	--[b]	--[b]
Grand Rapids, Mich.	1	3	0	4	1	2	0	3
Green Bay, Wis.	1	6	0	7	2	5	0	7
Hancock, Mich.	0	0	2	2	0	0	1	1
Indianapolis, Ind.	3	0	0	3	3	0	0	3
Iron Mountain, Mich.	0	2	2	4	0	1	1	2
Ironwood, Mich.	0	0	2	2	0	0	1	1
Kalamazoo, Mich.	0	2	0	2	0	2	0	2
Kansas City, Mo.	0	1	0	1	0	1	0	1
LaCrosse, Wis.	0	2	0	2	0	2	0	2
Lansing, Mich.	0	1	2	3	0	2	2	4
Las Vegas, Nev.	0	0	1	1	0	1	0	1
Los Angeles, Calif.	2	0	0	2	2	0	0	2
Louisville, Ky.	0	2	0	2	0	2	0	2
Madison, Wis.	13	0	0	13	10	0	0	10
Manitowoc, Wis.	2	0	0	2	3	0	0	3
Marquette, Mich.	0	0	1	1	--[b]	--[b]	--[b]	--[b]
Menominee, Mich.	0	0	2	2	0	0	1	1
Miami, Fla.	0	2	1	3	1	1	2	4
Minneapolis/St. Paul, Minn.	11	4	3	18	13	3	4	20
Moline, Ill.	1	0	0	1	0	1	0	1
Muskegon, Mich.	4	0	0	4	4	0	0	4
New York, N.Y.	14	1	0	15	13	2	0	15
Omaha, Nebr.	0	1	1	2	0	1	1	2
Oshkosh, Wis.	5	0	0	5	5	0	0	5
Owensboro, Ky.	0	0	1	1	0	0	1	1
Paducah, Ky.	0	0	2	2	0	0	2	2
Peoria, Ill.	0	0	1	1	0	0	1	1
Philadelphia, Pa.	2	1	0	3	2	3	0	5
Pittsburgh, Pa.	1	1	0	2	1	0	0	1
Rhinelander, Wis.	0	1	1	2	0	0	1	1
Rochester, Minn.	2	1	0	3	2	1	0	3

Table 40 (continued)

City or Geographic Area	Number of Daily Flights							
	To Milwaukee				From Milwaukee			
	Nonstop	1 Stop	2 or More Stops	Total	Nonstop	1 Stop	2 or More Stops	Total
Rockford, Ill.	1	0	0	1	1	0	0	1
St. Louis, Mo.	3	0	0	3	3	0	0	3
Salt Lake City, Utah	0	1	0	1	--[b]	--[b]	--[b]	--[b]
San Francisco, Calif.	1	0	0	1	1	0	0	1
Seattle, Wash.	1	0	1	2	1	0	2	3
South Bend, Ind.	0	1	0	1	--[b]	--[b]	--[b]	--[b]
Spokane, Wash.	0	1	0	1	0	2	0	2
Springfield, Ill.	0	0	1	1	0	0	1	1
Tampa, Fla.	1	2	0	3	1	2	0	3
Thunder Bay, Ont.	0	1	0	1	--[b]	--[b]	--[b]	--[b]
Toronto, Ont.	0	2	1	3	0	2	0	2
Washington, D. C./Baltimore, Md.	3	2	1	6	4	1	1	6
Waterloo, Iowa	0	0	1	1	0	0	1	1

[a] *Service to Appleton was provided exclusively by a commuter airline (Air Wisconsin) which terminated service to Milwaukee December 31, 1970. Commuter airlines also served Central Wisconsin and Chicago, although in competition with certificated carriers.*

[b] *No direct service.*

Source: R. Dixon Speas Associates, Inc.

flight = 0.8) x (nonprime time = 0.7) x (two stops = 0.5); whereas a nonstop originating jet flight to Los Angeles leaving Milwaukee at 5 p.m. (prime time) would be assigned a value of 1.0, or (jet = 1.0) x (originating = 1.0) x (prime time = 1.0) x (nonstop = 1.0).

Each flight was rated in this manner, with the sum of the flight ratings providing the city pair service ratings. A comparison of the service rating and the traffic demand existing for each city is shown in Table 41. In such comparisons, service ratings appear low for service between Milwaukee and the Cities of Los Angeles, San Francisco, Pittsburgh, and Kansas City.

Enplaning Passenger Survey at General Mitchell Field Airline Terminal

A major work effort involved in establishing a data base for the regional airport system planning program was a personal interview survey of airline passengers at the General Mitchell Field airline terminal. In preparing the survey design, it was recognized that because airline passenger travel is highly reciprocal, it would be necessary to obtain airline passenger data in only one direction of travel. Accordingly, enplaning passengers only were interviewed during a three-day period from Thursday, September 16, through Saturday, September 18, 1971.

Specific information sought for each enplaning airline passenger included personal characteristics such as age, sex, race, annual household income, and home address; trip characteristic data relating to the geographic location, land use, and trip purpose at points of origin and destination; modes of travel used to reach the airline terminal; and the name of the airline boarded at the terminal. Information concerning the nature of business during their stay in the Region was also sought from nonresident passengers who were identified as having come to the Region for business purposes. A copy of the airport survey enplaning passenger questionnaire is contained in Appendix F. A similar survey was conducted by the Commission at General Mitchell Field on May 16, 1968, and permitted comparisons to be made between the findings of the two surveys.

Personal interviews were obtained with 7,406, or about 91 percent, of the 8,140 airline passengers enplaning at the airline terminal during the three-day survey. The remaining passengers either refused to be interviewed, or had pressing flight connections and were not able to be interviewed. Table 42 shows the total number of enplaning passengers and the total number and percentage of passengers interviewed, by airline, during the three-day survey period.

There were an average of 2,713 airline passengers per day enplaning at the airline terminal during the survey, or 64 passengers more than the average for 1971 and for the month of September. Each of these averages was 2,649 passengers. The number of passengers enplaning on the survey dates totaled 3,216 on Thursday, September 16; 3,009 on Friday, September 17; and 1,915 on Saturday, September 18, compared to the annual averages for such weekdays in September of 2,622, 2,684, and 1,627 passengers, respectively. In comparison, the

Table 41

COMPARISON OF AIR CARRIER SERVICE LEVEL AND PASSENGER TRAVEL DEMAND BETWEEN MILWAUKEE AND SELECTED CITIES IN THE UNITED STATES AND CANADA: 1971

City or Geographic Area	Service Level Between Milwaukee and Selected Cities		Ranking According to Passenger Travel Demand Between Milwaukee and Selected Cities[a]
	Rating	Rank	
Chicago, Ill.	26.64	1	7
New York, N.Y.	21.20	2	1
Minneapolis, Minn.	20.07	3	3
Detroit, Mich.	15.06	4	2
Madison, Wis.	13.05	5	--
Washington, D.C./Baltimore, Md.	8.00	6	5
Green Bay, Wis.	6.15	7	45
Philadelphia, Pa.	4.99	8	11
Cleveland, Ohio	4.81	9	6
Denver, Colo.	4.80	10	13
Oshkosh, Wis.	4.58	11	--
St. Louis, Mo.	4.50	12	9
Cincinnati, Ohio	4.33	13	21
Boston, Mass.	4.01	14	10
Muskegon, Mich.	3.94	15	26
Central Wisconsin	3.86	16	--
Dayton, Ohio	3.71	17	23
Columbus, Ohio	3.46	18	19
Tampa, Fla.	3.38	19	14
Fort Lauderdale, Fla.	3.22	20	27
Miami, Fla.	3.16	21	12
Indianapolis, Ind.	3.15	22	22
Rochester, Minn.	3.14	23	41
Los Angeles, Calif.	3.10	24	4
Dallas/Fort Worth, Tex.	2.80	25	20
Grand Rapids, Mich.	2.78	26	24
Toronto, Ont.	2.41	27	--
San Francisco, Calif.	2.36	28	8
Manitowoc, Wis.	2.34	29	--
LaCrosse, Wis.	2.30	30	--
Seattle, Wash.	2.20	31	25
Atlanta, Ga.	2.12	32	18
Pittsburgh, Pa.	2.00	33	16
Iron Mountain, Mich.	1.99	34	--
Appleton, Wis.	1.90	35	--
Louisville, Ky.	1.90	36	30
Lansing, Mich.	1.84	37	32
Kalamazoo, Mich.	1.81	38	--
Spokane, Wash.	1.73	39	--
Cedar Rapids, Iowa	1.70	40	47
Omaha, Nebr.	1.58	41	34
Duluth, Minn.	1.36	42	37
Moline, Ill.	1.19	43	--
Las Vegas, Nev.	1.15	44	15
Kansas City, Mo.	1.12	45	17
Rockford, Ill.	0.98	46	--
Rhinelander, Wis.	0.85	47	--
Salt Lake City, Utah	0.80	48	--
Dubuque, Iowa	0.78	49	--
Menominee, Mich.	0.76	50	--
Clarksville, Tenn.	0.70	51	--
Paducah, Ky.	0.66	52	--
Ironwood, Mich.	0.62	53	--
Peoria, Ill.	0.59	54	--
Grand Junction, Colo.	0.56	55	--
Owensboro, Ky.	0.56	56	--
Eau Claire, Wis.	0.48	57	--
Waterloo, Iowa	0.48	58	--
South Bend, Ind.	0.45	59	--
Thunder Bay, Ont.	0.31	60	--
Springfield, Ill.	0.30	61	--
Marquette, Mich.	0.28	62	--
Hancock, Mich.	0.16	63	--

[a] *The ranking of cities according to passenger travel demand corresponds to the ranking of the cities for 1971 shown in Table 39. A total of 29 cities or areas in this column do not have a ranking, either because they are not among the 50 cities with the highest volumes of trip interchange with Milwaukee as shown in Table 39, or because, in the case of Toronto and Thunder Bay, Ontario, they are nondomestic flights, which were not included in Table 39.*

Source: R. Dixon Speas Associates, Inc.

Table 42

TOTAL NUMBER OF ENPLANING PASSENGERS AND NUMBER AND PERCENTAGE OF PASSENGERS INTERVIEWED AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY BY AIRLINE: SEPTEMBER 16, 17, and 18, 1971

Airline	Enplaning Passengers											
	Thursday, September 16			Friday, September 17			Saturday, September 18			Total		
	Total	Number Interviewed	Number Interviewed as Percent of Total	Total	Number Interviewed	Number Interviewed as Percent of Total	Total	Number Interviewed	Number Interviewed as Percent of Total	Number	Number Interviewed	Number Interviewed as Percent of Total
North Central Airlines, Inc.	1,398	1,268	90.6	1,283	1,158	90.3	685	649	94.7	3,366	3,075	91.4
Northwest Airlines, Inc.	774	669	86.4	787	739	93.9	463	427	92.2	2,024	1,835	90.7
United Airlines, Inc.	587	580	98.8	642	485	75.5	477	450	94.3	1,706	1,515	88.8
Ozark Air Lines, Inc.	252	237	94.0	215	197	91.6	58	58	100.0	525	492	93.7
Eastern Air Lines, Inc.	68	63	92.6	69	57	82.6	52	48	92.3	189	168	88.9
Air Michigan	13	13	100.0	12	10	83.3	--	--	--	25	23	92.0
Charter—United Airlines, Inc.	76	76	100.0	--	--	--	--	--	--	76	76	100.0
Charter—Pan American World Airlines	--	--	--	--	--	--	169	162	95.9	169	162	95.9
Not Recorded	48	48	100.0	1	1	100.0	11	11	100.0	60	60	100.0
Total	3,216	2,954	91.9	3,009	2,647	88.0	1,915	1,805	94.3	8,140	7,406	91.0

Source: SEWRPC.

number of passengers enplaning at General Mitchell Field airline terminal on the one-day survey on Thursday, May 16, 1968, was 2,191.

Land Use at Enplaning Passenger Trip Origin: The majority of enplaning passengers (49 percent of the total interviewed) reached the airline terminal directly from residential land uses. Other important land uses generating enplaning passengers were hotels and motels (21 percent), commercial land uses (7 percent), and manufacturing land uses (7 percent). All other land uses accounted for 4 percent or less each of the total. The land uses at the origins of 10 percent of the trips were not recorded (see Table 43).

In the 1968 airport survey, rather similar distributions were indicated. Residential land uses accounted for 48 percent of the total; hotels and motels, 17 percent; commercial land uses, 16 percent; manufacturing land uses, 9 percent; and institutional and governmental land uses, 7 percent. All other land uses accounted for less than 1 percent each. The land use of 2 percent was not recorded.

Modes of Travel Used by Enplaning Passengers to Reach General Mitchell Field: The private automobile was the predominant mode of travel used by enplaning airline passengers to reach the airport, accounting for 55 percent of the total, according to findings of the 1971 airport survey. Of the other modes, aircraft transfers accounted for 17 percent; rental autos, 9 percent; taxicabs, 8 percent; and airport limousines, 4 percent. All other modes accounted for 2 percent or less each, and the mode of travel of 3 percent of the enplaning passengers was not recorded (see Table 44).

In the 1968 airport survey, in which aircraft transfers were not included in the summary and in which rental cars and courtesy cars were not distinguished from private autos, enplaning passenger travel by automobile totaled 77 percent; by taxi, 9 percent; by airport limousine, 11 percent; and by motor bus, 3 percent.

Table 43

DISTRIBUTION OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY BY LAND USE AT TRIP ORIGIN SEPTEMBER 16, 17, and 18, 1971

Land Use	Enplaning Passengers	
	Number	Percent of Total
Residential	3,656	49.4
Hotel/Motel	1,531	20.7
Commercial	541	7.3
Manufacturing	497	6.7
Institutional or Governmental	286	3.9
Transportation, Communication, Utility	117	1.6
Recreation	45	0.6
Open Land and Water	4	--[a]
Agricultural	1	--[a]
Not Recorded	728	9.8
Total	7,406	100.0

[a] *Less than one-tenth of 1 percent.*

Source: SEWRPC.

Travel Purposes of Enplaning Passengers: Information was obtained in the 1971 airport survey for each enplaning passenger concerning the purpose of travel at the points of origin and destination. The survey findings indicate that the large majority of such trips were comprised of those made from and to home (38 percent of origin and 41 percent at destination), work-connected business (21 percent at origin and 18 percent at destination), social-recreation activities (8 percent at origin and 27 percent at destination), and overnight accommodations (12 percent at origin and 0.1 percent at destination). All other purposes accounted for 4 percent or less of the total. The travel purposes of 10 percent at the origin and 3 percent at the destination points were not recorded (see Table 45).

The imbalance between the number of enplaning passengers (604) arriving at the Field from points of origin with social-recreation purposes and the number departing for such purposes (1,974) is probably explained by the tendency of travelers to begin recreational travel toward the end of a week to take full advantage of weekend days for their vacations or holidays rather than to end such travel at that time. The imbalance between the number of passengers coming to the airport from places of overnight accommodations (919) and the number destined for such accommodations (11) may be explained on the premise that a passenger arriving at an airport who just departed from overnight accommodations was fully conscious of that fact, but in considering the purpose at ultimate destination gave the principal purpose rather than this incidental purpose for the flight.

A better understanding and more accurate representation of the true purposes of air travel is obtained, however, by linking each trip by the purpose at origin with the purpose at destination, and substituting the origin purpose for the destination purpose of trips with a destination of "home." By such linking, it was found that work-connected flights comprised approximately 35 percent of the total; social-recreation, 32 percent; and overnight accommodations, 9 percent (see Table 45). All other purposes comprised 6 percent or less of the total each. The purpose of 7 percent of the air travel was not recorded.

Because the three-day survey at General Mitchell Field was conducted on Thursday, Friday, and Saturday and was therefore more heavily oriented to weekend rather than weekday travel, it appears that work-connected travel is understated and social recreation travel overstated as such volumes relate to an average 1971 weekday. This conclusion is drawn from the findings that work-connected travel decreased in the survey period from 1,411 flights on Thursday to 1,243 on Friday to 820 on Saturday, while social-recreation flights increased on those days from 638 flights to 861 and 1,079, respectively.

Table 44

DISTRIBUTION OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY BY MODE OF TRAVEL TO THE AIRPORT: SEPTEMBER 16, 17, and 18, 1971

Mode of Travel	Enplaning Passengers: Number	Enplaning Passengers: Percent of Total
Private Car	4,074	55.0
Rental Car	666	9.0
Hotel/Motel Courtesy Car	148	2.0
Airport Limousine	324	4.4
Taxicab	590	8.0
Motor Bus	85	1.1
Commercial Air Carrier	1,221	16.5
Other	44	0.6
Not Recorded	254	3.4
Total	7,406	100.0

Source: SEWRPC.

Table 45

DISTRIBUTION OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY BY ORIGIN, DESTINATION, AND AIR TRAVEL TRIP PURPOSE SEPTEMBER 16, 17, and 18, 1971

Trip Purpose	Origin: Number	Origin: Percent of Total	Destination: Number	Destination: Percent of Total	Air Travel: Number	Air Travel: Percent of Total
Home	2,835	38.3	3,064	41.4	--	--
Place of Work	135	1.8	50	0.7	70	1.0
Work-Connected Business	1,589	21.5	1,352	18.2	2,597	35.1
Personal Business	189	2.5	286	3.9	412	5.6
School	81	1.1	108	1.5	154	2.0
Social/Recreation	604	8.2	1,974	26.6	2,375	32.1
Military Duty or Leave	83	1.1	222	3.0	239	3.2
Convention/Seminar	145	2.0	91	1.2	214	2.9
Overnight Accommodations	919	12.4	11	0.1	691	9.3
Other	89	1.2	50	0.7	110	1.5
Not Recorded	737	9.9	198	2.7	544	7.3
Total	7,406	100.0	7,406	100.0	7,406	100.0

Source: SEWRPC.

Trip Origins of Enplaning Passengers: The origins of enplaning airline passengers at General Mitchell Field were found to extend not only into virtually every part of the Region, blanketing its most highly urbanized areas, but also into many other counties in Wisconsin as well as into other states. Of the 7,406 passengers interviewed, 5,204, or 70 percent, came to General Mitchell Field from points within the Region; 980, or 13 percent, came from elsewhere in Wisconsin; 974, or 13 percent, came from other states; and 27, or less than 1 percent, came from foreign countries. The points of origin of 221 passengers, or 3 percent, were not recorded. The major concentrations of passengers originating within the Region were found in the Central Business District of the City of Milwaukee. Minor concentrations were found in the area near General Mitchell Field, in major industrial and commercial areas in Milwaukee County, and in residential areas along Lake Michigan immediately north of the City of Milwaukee in Milwaukee County.

Of the 5,204 enplaning passengers originating from points within the Region, 5,109 passengers arrived at the airport by ground vehicle and six arrived by air travel. The mode of travel of 89 passengers was not recorded. Of the 980 enplaning passengers originating from points in 39 counties elsewhere in Wisconsin, 638 arrived by ground travel, 328 passengers arrived by air travel, and the mode of travel of 14 passengers was not recorded. Of the 974 enplaning passengers originating from points in other states, 101 arrived by ground travel, 854 arrived by air travel, and the mode of travel of 19 passengers was not recorded. Of the 27 enplaning passengers originating from points in other countries, all but one arrived by air travel. Because about 3 percent of the enplaning passengers did not provide information relating to the place of trip origin and/or the mode of travel used to reach General Mitchell Field, a precise estimate of originating passenger flights at the airport cannot be made. It is believed, however, that approximately 83 percent of total enplanements at General Mitchell Field originated there, while 17 percent originated elsewhere and transferred at the Field.

Trip Destinations of Enplaning Passengers: The ultimate destinations of the 7,406 enplaning airline passengers interviewed at General Mitchell Field during the three-day survey included every state in the Union and the District of Columbia; seven provinces in Canada; four countries in South America; Mexico; El Salvador; the Canal Zone; six Atlantic and Caribbean Island countries or possessions; Bermuda; 24 countries in Europe; five countries in Africa; five countries in Asia; the two Pacific Islands of Guam and Okinawa; the British Crown Colony of Hong Kong; New Zealand; and Australia.

Ultimate destinations within the United States were reported by 6,567 passengers, or 89 percent of the enplaning passengers; elsewhere within North America by 163 passengers, or 2 percent; in Europe by 506 passengers, or 7 percent; and on the continents of Asia, Africa, South America, and Australia combined, by 60 passengers or about 1 percent. The ultimate destinations of 110 enplaning passengers, or about 1 percent, were not recorded. By state, the largest concentrations of destinations were found to be in Michigan (865), Minnesota (620), Ohio (587), New York (539), California (531), and Wisconsin (528), as shown on Map 27.

City-pair demand rankings of air travel demand between Milwaukee and the 50 cities with the highest volumes of trip interchange with Milwaukee, as determined from the survey findings and from data compiled by the Civil Aeronautics Board, are compared in Table 46. Air passenger volumes shown for the survey rankings represent the number of enplaning passengers originating at General Mitchell Field during the three-day survey and destined for the 50 leading cities, but do not include the 17 percent of the passengers who transferred at the Field, or the 9 percent not able to be interviewed.

The comparison of the CAB and survey rankings indicates a good correlation. In both rankings, New York, Detroit, and Minneapolis are the three leading cities in order of importance. In addition, nine of the leading 10 cities, 23 of the leading 25 cities, and 41 of the leading 50 cities are common to both rankings.

Notable differences in the rankings are found for the Cities of Chicago, Philadelphia, and Miami, and particularly for the Cities of Dallas, Tampa, and Kansas City, in which substantially higher rankings are observed in the CAB ranking than in the survey rankings, and for the Cities of Indianapolis, Grand Rapids, and Columbus, in which substantially lower rankings are observed in the CAB ranking than in the survey rankings.

Departure Times of Enplaning Passengers: Distribution of enplaning passengers in the 1971 survey by flight time indicates that 8 a.m. to 9 a.m. and 5 p.m. to 6 p.m. represent the two peak hours of passenger activity at General Mitchell Field. Although the afternoon peak is not as predominant as the morning peak, the total passenger volume during the hours of 4 p.m. to 7 p.m. is greater than the passenger volume from 8 a.m. to 11 a.m. In total, afternoon volume far exceeds morning volume. Before 7 a.m. and after 7 p.m., passenger traffic is relatively insignificant. Figure 53 shows the distribution, according to departure time, of enplaning passengers interviewed between 6 a.m. and 12 a.m. during the three-day survey period.

Enplaning passenger volumes at General Mitchell Field were found to fluctuate rather widely by day, by week, by month, and by season of the year. Within the survey period, for example, enplaning passenger volumes ranged, by day, from a high of 3,216 passengers on Thursday, September 16, to a low of 1,915 passengers on the following Saturday, and by month, from approximately 92,800 passengers in August 1971 to approximately 62,300 passengers in February of that year. The purposes of air travel were also found to vary by day of week and by season, with social-recreational travel more pronounced on weekends than on weekdays, and more pronounced in summer months than in winter months. Thus, both the volumes of air travel and the purposes of air travel by time of day would tend to vary on a daily

Map 27

DESTINATIONS WITHIN THE UNITED STATES OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD–MILWAUKEE COUNTY: SEPTEMBER 16, 17, and 18, 1971

About 89 percent of the enplaning passengers at General Mitchell Field reported trip destinations within the United States, including every state in the Union and the District of Columbia. The largest concentrations of destinations were found to be in Michigan, Minnesota, Ohio, New York, California, and Wisconsin. The smallest concentrations were found to be in Wyoming, Vermont, Mississippi, Idaho, Arkansas, and Delaware.

Source: SEWRPC.

Table 46

COMPARISON OF PASSENGER TRAVEL DEMAND BETWEEN MILWAUKEE AND THE 50 U. S. CITIES WITH HIGHEST VOLUMES OF TRIP INTERCHANGE WITH MILWAUKEE: CIVIL AERONAUTICS BOARD RANKING AND ENPLANING PASSENGER SURVEY AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1971

City	CAB Ranking	1971 Survey Ranking	City	CAB Ranking	1971 Survey Ranking
New York, N. Y.	1	1	Louisville, Ky.	30	32
Detroit, Mich.	2	2	Phoenix, Ariz.	31	--[a]
Minneapolis, Minn.	3	3	Lansing, Mich.	32	25
Los Angeles, Calif.	4	5	Houston, Tex.	33	34
Washington, D.C./ Baltimore, Md.	5	4	Omaha, Nebr.	34	39
Cleveland, Ohio	6	6	New Orleans, La.	35	--[a]
Chicago, Ill.	7	12	Buffalo, N.Y.	36	43
San Francisco, Calif.	8	8	Duluth, Minn.	37	35
St. Louis, Mo.	9	7	Memphis, Tenn.	38	--[a]
Boston, Mass.	10	9	San Antonio, Tex.	39	46
Philadelphia, Pa.	11	19	Des Moines, Iowa	40	--[a]
Miami, Fla.	12	17	Rochester, Minn.	41	41
Denver, Colo.	13	10	Portland, Oreg.	42	40
Tampa, Fla.	14	24	Wausau, Wis.	43	--[a]
Las Vegas, Nev.	15	11	Honolulu, Hawaii	44	--[a]
Pittsburgh, Pa.	16	14	Green Bay, Wis.	45	33
Kansas City, Mo.	17	28	Syracuse, N.Y.	46	44
Atlanta, Ga.	18	18	Cedar Rapids, Iowa	47	--[a]
Columbus, Ohio	19	13	Rochester, N.Y.	48	--[a]
Dallas/Ft. Worth, Tex.	20	31	Albany, N.Y.	49	42
Cincinnati, Ohio	21	20	Norfolk, Va.	50	--[a]
Indianapolis, Ind.	22	15	Newark, N. J.	--[a]	22
Dayton, Ohio	23	21	Ft. Leonard Wood, Mo.	--[a]	26
Grand Rapids, Mich.	24	16	St. Paul, Minn.	--[a]	27
Seattle, Wash.	25	23	Peoria, Ill.	--[a]	37
Muskegon, Mich.	26	30	Bloomington, Minn.	--[a]	45
Fort Lauderdale, Fla.	27	38	Toledo, Ohio	--[a]	47
Hartford, Conn.	28	36	Akron, Ohio	--[a]	48
San Diego, Calif.	29	29	Birmingham, Mich.	--[a]	49
			La Crosse, Wis.	--[a]	50

[a]*City is not included in both rankings.*

Source: Civil Aeronautics Board, Domestic Origin-Destination Survey of Airline Passenger Traffic, and SEWRPC.

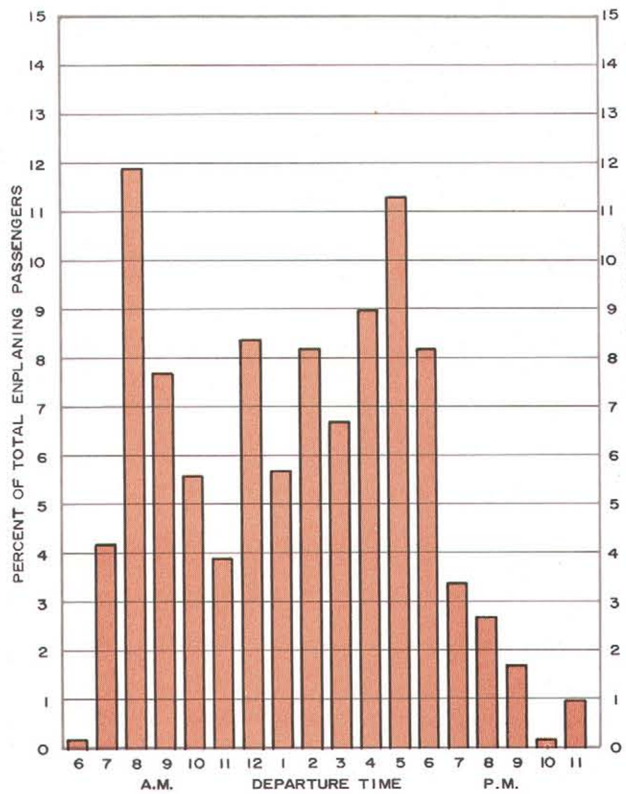
basis. In the 1968 airport survey, it was found that 2,191 passengers enplaned daily at General Mitchell Field compared to an average of 2,713 enplaning passengers daily in the three-day survey of 1971. In both 1968 and 1971, the major air carriers authorized to operate at General Mitchell Field were Eastern Air Lines, Inc.; North Central Airlines, Inc.; Northwest Airlines, Inc.; Ozark Air Lines, Inc.; and United Airlines, Inc. In 1968, two commuter airlines, Ong Airlines and Air Wisconsin, were authorized to operate at the Field, and in 1971 one commuter airline, Air Michigan, was authorized to operate at the Field.

The hourly distributional patterns of enplaning passengers at General Mitchell Field as determined in the 1968 and 1971 airport surveys were found to be quite similar. One exception is the morning peak, which occurred in the hour beginning at 7 a.m. in the 1968 survey and in the hour beginning at 8 a.m. in the 1971 survey. Another exception is the single largest peak, which occurred in a late afternoon hour in the 1968 survey and in an early morning hour in the 1971 survey. Following the peak hour in each survey, the distributional patterns were nearly identical, rising and falling alike in most instances in each succeeding hour (see Figures 53 and 54).

Time and Distance of Enplaning Passenger Travel Between Trip Origin Within Region and Airport: Survey findings indicate that of the total ground trips made to the airline terminal by enplaning airline passengers from points within the Region, the elapsed time was 10 minutes or less for approximately 11 percent of such trips, 20 minutes or less for about 45 percent, 30 minutes or less for about 78 percent, and 40 minutes or less for about 91 percent. The elapsed time of virtually all ground

Figure 53

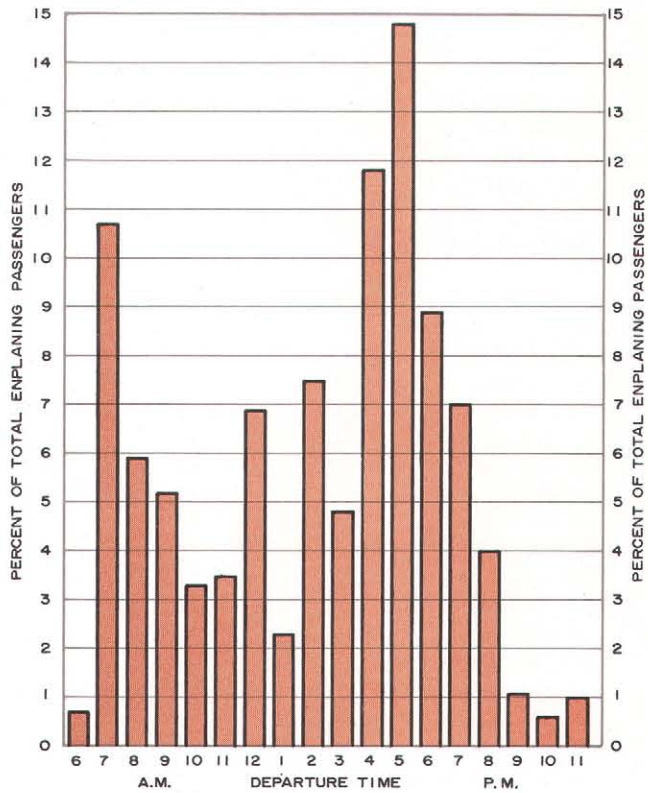
PERCENTAGE DISTRIBUTION OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD– MILWAUKEE COUNTY BY FLIGHT DEPARTURE TIME SEPTEMBER 16, 17, and 18, 1971



Source: SEWRPC.

Figure 54

PERCENTAGE DISTRIBUTION OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD– MILWAUKEE COUNTY BY FLIGHT DEPARTURE TIME May 16, 1968



Source: SEWRPC.

trips from points within the Region was 60 minutes or less. The average elapsed time of ground travel from points of origin within the Region to the airline terminal was approximately 23 minutes, while the median elapsed time was approximately 22 minutes (see Figure 55).

In terms of distance of such ground travel, approximately 52 percent of the enplaning passengers from within the Region originated at points within 10 miles of the airline terminal, 85 percent originated within 20 miles, 93 percent originated within 30 miles, and virtually all trips originated within 60 miles of the airline terminal. The average distance of ground travel from point of origin to the airline terminal was found to be approximately 12 miles, while the median distance was approximately nine miles (see Figure 56).

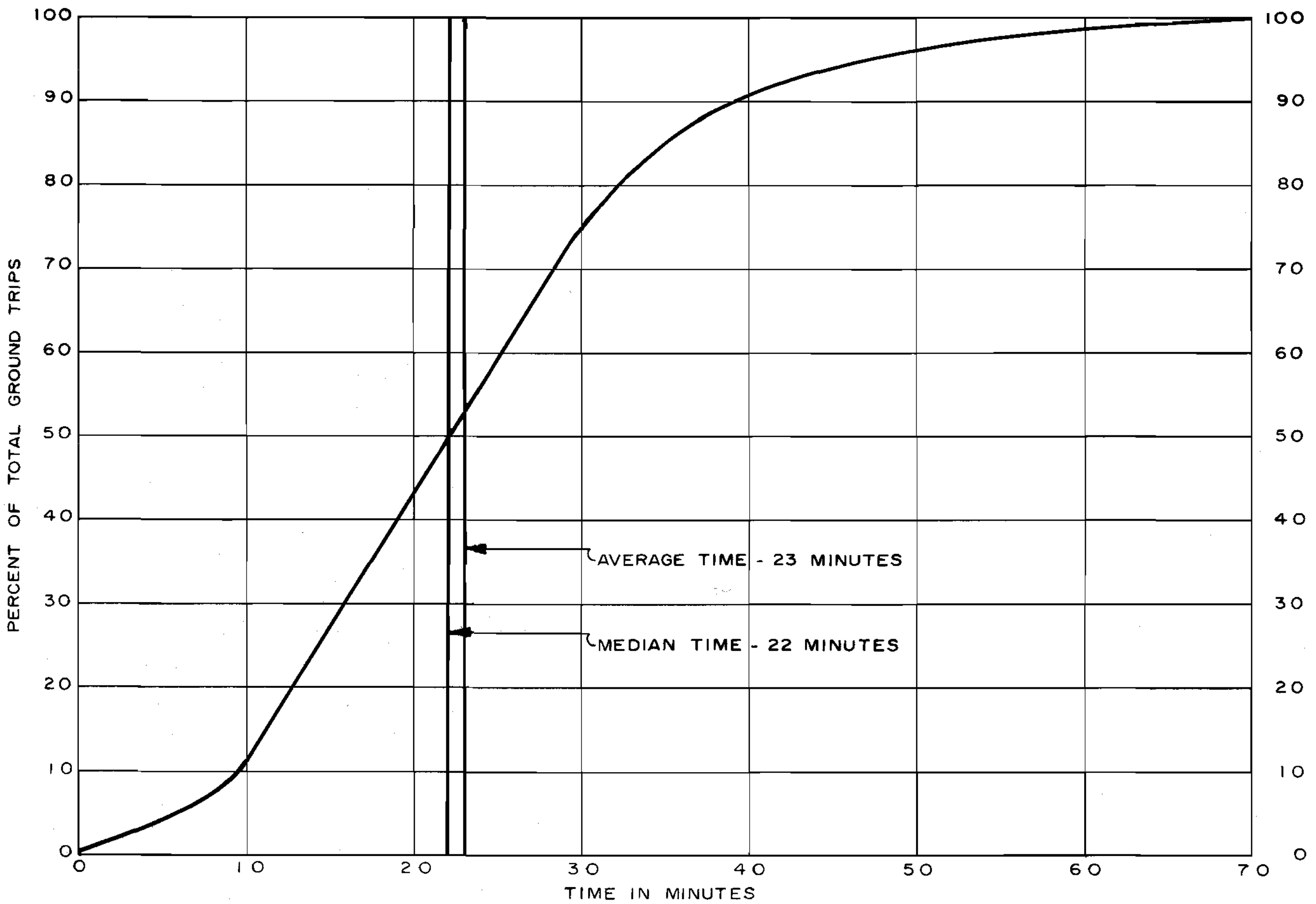
Nature of Business Conducted Within the Region by Nonresident Enplaning Passengers: A total of 2,158 nonresident passengers, or 49 percent of the total such passengers, indicated that the principal purpose of their trip to the Region was to transact business. Of these 2,158 nonresident passengers, 1,916 indicated the general nature of business conducted as follows: 33 percent of the total were involved in sales or marketing, 28 percent attended business conferences or meetings, 15 percent had administrative purposes, 9 percent were engaged in engineering work, 3 percent were involved in financial transactions, and the remaining 12 percent reported a variety of business activities not readily classified (see Table 47).

Socioeconomic Characteristics of Enplaning Passengers: The percentage distribution of enplaning passengers at General Mitchell Field according to various socioeconomic characteristics as indicated in the 1968 and 1971 surveys, as well as of the regional population as reported in the 1970 census, is shown in Table 48. Survey findings in 1971 indicated that male enplaning passengers (71 percent of total enplaning passengers) at General Mitchell Field outnumbered female enplaning passengers (29 percent of the total) by a ratio of nearly 2.5 to 1.0. By race, white passengers accounted for 97 percent of the total, black passengers for 2 percent, and other races combined, 1 percent.

By age group, enplaning passengers under 25 years of age comprised 14 percent of the total; passengers 25 through 44 years of age, 45 percent; passengers 45 through 64 years of age, 35 percent; and passengers

Figure 55

PERCENTAGE DISTRIBUTION OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY BY GROUND TRAVEL TIME FROM TRIP ORIGIN WITHIN THE REGION TO THE AIRLINE TERMINAL SEPTEMBER 16, 17, and 18, 1971



Source: SEWRPC.

65 and over, 6 percent. The median age of enplaning passengers was approximately 42 years, compared to approximately 41 years as estimated in the 1968 airport survey. By income group, enplaning passengers having an annual household income of less than $8,000 comprised 16 percent of the total; passengers with incomes between $8,000 and $15,999, 31 percent; passengers with incomes between $16,000 and $23,999, 29 percent; and passengers with incomes of $24,000 or more, 24 percent. The median annual household income of passengers in the 1971 survey was estimated at $16,650. The annual household income of passengers in the 1968 survey was not obtained.

Comparisons of the percentage distribution of the socio-economic characteristics of enplaning passengers as reported in the 1968 and 1971 surveys indicated only minor differences, while comparisons of these findings with the percentage distribution of such characteristics for the regional population as reported in the 1970 census indicated wide differences. The distribution of

Table 47

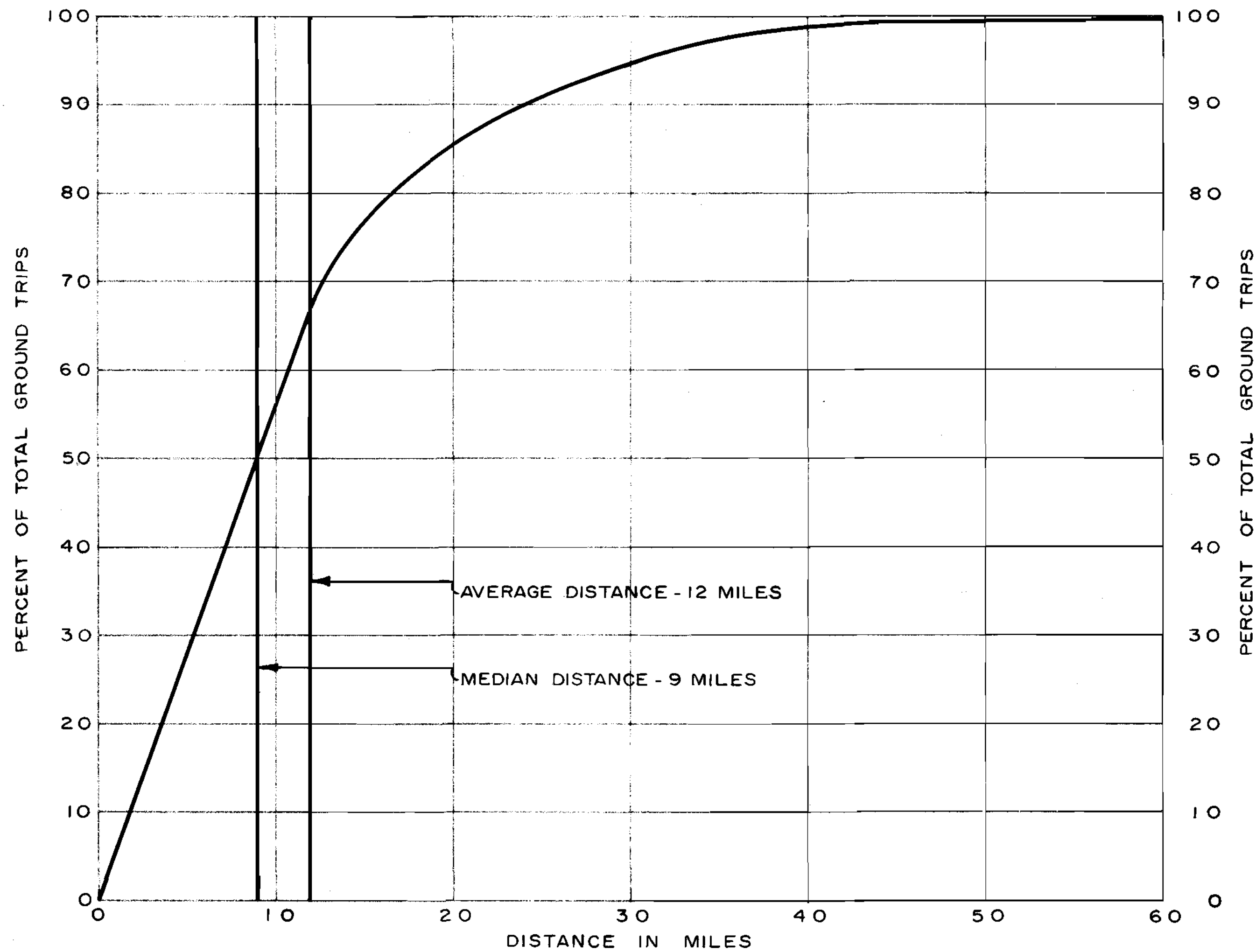
DISTRIBUTION OF NONRESIDENT ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY BY NATURE OF BUSINESS CONDUCTED IN THE REGION SEPTEMBER 16, 17, and 18, 1971

Nature of Business	Nonresident Enplaning Passengers: Number	Nonresident Enplaning Passengers: Percent of Total
Sales or Marketing	625	32.6
Administrative	290	15.1
Engineering	181	9.5
Financial	65	3.4
Conference/Meeting	531	27.7
Other	224	11.7
Total	1,916	100.0

Source: SEWRPC.

Figure 56

PERCENTAGE DISTRIBUTION OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD–MILWAUKEE COUNTY BY GROUND TRAVEL DISTANCE FROM TRIP ORIGIN WITHIN THE REGION TO THE AIRLINE TERMINAL SEPTEMBER 16, 17, and 18, 1971



Source: SEWRPC.

male passengers in the 1968 and 1971 surveys was found to be substantially higher, and the distribution of female passengers substantially lower, than in the 1970 census distribution of population for these categories. By race, the variation between the 1971 findings and the census findings was less conspicuous, with white passengers in the 1971 survey accounting for 97 percent of the total and black passengers accounting for 2 percent, compared to 92 percent and 7 percent, respectively, in the census findings (see Table 48).

The distribution of enplaning passengers in the youngest and oldest age groups in the 1968 and 1971 passenger surveys was found to be significantly lower than the census distribution, and significantly higher than the census distribution in the two middle categories. The median age of the 1970 regional population is estimated at approximately 28 years according to census figures, compared to approximately 42 years and 41 years, respectively, as found in the 1971 and 1968 passenger surveys.

With respect to income, the 1971 distribution in the two lower income groups was found to be substantially lower, and the distribution in the middle and upper income groups substantially higher, than the census distribution. The median annual household income of the 1970 regional population was estimated at approximately \$9,950, compared to approximately \$16,650 as estimated in the 1971 passenger survey. These contrasts indicate that enplaning passengers at General Mitchell Field are not representative of the total regional population, tending, in particular, to represent the more affluent, middle aged, and male segments of the population.

Table 48

PERCENTAGE DISTRIBUTION OF ENPLANING PASSENGERS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY AND OF THE POPULATION OF THE REGION BY SOCIOECONOMIC CHARACTERISTICS 1968 AND 1971 ENPLANING PASSENGER SURVEYS AND 1970 CENSUS

Socioeconomic Characteristic	Percent of Enplaning Passengers		Percent of 1970 Region Population
	1968	1971	
Sex			
Male	75.4	70.8	48.3
Female	24.6	29.2	51.7
Total	100.0	100.0	100.0
Race			
White	N/A[a]	97.4	92.6
Black	N/A[a]	1.6	6.8
Other	N/A[a]	1.0	0.6
Total	--	100.0	100.0
Age			
Under 25	14.7	13.9	46.6
25-44	51.7	45.0	23.5
45-64	31.8	35.3	20.2
65 and Over	1.8	5.8	9.7
Total	100.0	100.0	100.0
Median Age	41 Years	42 Years	28 Years
Annual Household Income			
Under $8,000	N/A[a]	15.7	37.5
$ 8,000 - 15,999	N/A[a]	31.6	43.5
16,000 - 23,999	N/A[a]	29.1	13.2
24,000 or More	N/A[a]	23.6	5.8
Total	--	100.0	100.0
Median Income	$ --	$16,650	$9,950
Total Enplaning Passengers	1,861	7,406	--
Total Region Population	--	--	1,756,086

[a]*Not available.*

Source: U. S. Bureau of the Census and SEWRPC.

GENERAL AVIATION AIRPORT PILOT AND USER SURVEYS

The collection of data relating to the characteristics and airport activities of all persons utilizing public use, general aviation airport facilities was another major inventory effort involved in establishing the data base for the regional airport system planning program. The general aviation airport survey consisted of an aircraft pilot survey and an airport user survey,[3] the latter consisting of all persons except pilots utilizing the surveyed airports.

[3]*Copies of both the general aviation airport pilot and user survey forms are included in Appendix F.*

A total of 25 general aviation airports within and adjacent to the Region, including the general aviation portion of General Mitchell Field, were included in the survey. Four additional public use general aviation airports located within the Region—Hunt Field, Valhalla, Vincent, and Mt. Fuji—were found to be so limited in terms of aircraft and ground travel that their inclusion in the survey was not believed to be warranted. In the period from September 9 through October 31, 1971, personal interviews were obtained at the survey airports with both aircraft pilots and airport users. In nearly every instance, the interviews continued at a given airport over a three-day period, with one of the survey dates including a Saturday or Sunday.

A total of 1,669 interviews were conducted with aircraft pilots, and 6,740 interviews were conducted with airport users. Table 49 indicates, for each airport surveyed, the number of vehicles entering and leaving; the number of aircraft landings, takeoffs, and touch and go operations; and the number of airport user and aircraft pilot interviews.

General Aviation Airport Pilot Survey

To obtain an understanding of the air and ground activities of general aviation aircraft pilots at the 25 general aviation airports selected for the study, a survey was undertaken of the characteristics and travel patterns of aircraft pilots utilizing these airports, of the cargoes carried, and of the aircraft involved. For the purpose of the survey, an aircraft pilot was defined as a person whose principal purpose at a surveyed airport was to arrive and/or depart as the pilot of an aircraft. Under this definition, a pilot did not include a licensed pilot who arrived or departed from an airport without making a flight. Such a person was considered as an airport user.

Specific information obtained in this survey included the personal characteristics of a pilot, such as age, sex, race, annual household income, and home address; as well as the characteristics of each pilot trip, such as the geographic location and land use at the points of origin and ultimate destination; purposes of the trip at the points of origin and ultimate destination and at the surveyed airport; modes of travel utilized to and from these airports; and the number of passengers carried. Data were also obtained regarding the type and weight of commodities carried and the geographic location of the origin and destination points of such cargoes; and regarding the

Table 49

GROUND AND AIR TRAFFIC ACTIVITIES AND NUMBER OF AIRPORT USER AND PILOT INTERVIEWS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION THREE-DAY SURVEY PERIOD—1971

Airport	Number of Ground Vehicles		Number of Aircraft Operations			Number of Interviews	
	Inbound	Outbound	Landings	Takeoffs	Touch and Go	Airport Users	Pilots
Aero Park	171	134	57	56	2	205	15
Big Foot	67	61	25	23	0	57	18
Burlington Municipal	143	147	72	77	24	202	45
Capitol Drive	160	159	95	93	8	172	54
East Troy Municipal	78	79	28	39	5	100	16
Fox River	37	34	38	38	15	32	18
General Mitchell Field	1,279	1,209	657	683	253	1,301	271
Grob	24	23	28	33	10	26	25
Gruenwald[a]	7	7	0	0	0	6	0
Hahn's Sky Ranch[a]	10	9	40	39	17	10	3
Hales Corners	209	191	126	129	30	246	75
Hartford Municipal	136	129	93	86	6	200	52
Kenosha Municipal	400	354	307	319	132	487	167
Lake Lawn Lodge[b]	41	41	21	18	0	73	17
O'Leary Field[a]	5	5	2	2	0	5	3
Ozaukee	16	14	23	27	10	23	10
Palmyra	58	55	41	39	1	66	20
Playboy	89	81	81	87	6	270	98
Racine Commercial	459	419	85	89	6	599	73
Rainbow	152	122	62	67	29	137	30
Sylvania	108	98	98	100	14	133	55
Timmerman Field	1,337	1,143	333	331	298	1,402	270
Watertown Municipal	108	96	40	40	14	106	33
Waukesha County	687	665	303	323	179	643	223
West Bend Municipal	196	164	184	214	33	239	78
Total	5,977	5,439	2,839	2,952	1,092	6,740	1,669

[a] *One-day survey.*

[b] *Two-day survey.*

Source: SEWRPC.

registration number, make, model, engine type, equipment type, and home base of each aircraft in use at the surveyed airports during the course of the survey.

Aircraft Operations at General Aviation Airports: Counts of aircraft operations at the general aviation airports surveyed indicated that 2,839 landing, 2,952 takeoff, and 1,092 touch and go operations[4] occurred at the 25 airports during the survey period. The four airports accommodating the largest number of general aviation aircraft operations were found to be General Mitchell Field, Timmerman Field, Waukesha County Airport, and Kenosha Municipal Airport, as shown in Table 49. Hour-group distribution of general aviation aircraft operations at these four airports, accounting together for about 60 percent of total aircraft operations at the 25 airports combined, indicates that the largest portion of aircraft operations was accommodated between 2 p.m. and 6 p.m. (1,482 operations) and between 10 a.m. and 2 p.m. (1,270 operations). It was also found that more takeoffs than landings occurred at each airport in the morning between 6 a.m. and 10 a.m., and that more landings than takeoffs occurred at each airport, with the exception of Kenosha Municipal Airport, in the evening between 6 p.m. and 10 p.m. Touch and go operations were found to occur more frequently between 10 a.m. and 6 p.m. than in the early morning and late evening hours at each of these airports (see Table 50). The 862 touch and go operations at these four airports accounted for approximately 79 percent of the total such operations at the 25 airports surveyed.

Local Flights at General Aviation Airports: Survey findings indicated that 30 percent, or 619, of the 2,034 flights recorded at the 25 general aviation airports during the survey period were local flights. Local flights are defined as flights having both takeoff and landing at the same airport. Of the airports surveyed, the four with the highest number of such flights were Waukesha County Airport (123), Timmerman Field (101), General Mitchell Field (77), and Kenosha Municipal Airport (74). Together, these four airports had 375 local flights, or 60 percent of all such flights made at the airports surveyed (see Table 51).

Local flights consisted chiefly of those for instruction or proficiency purposes (44 percent), for social-recreation purposes (38 percent), and for work-connected or work purposes (12 percent).

[4] *A touch and go operation is one in which an aircraft touches down at an airport and immediately takes off without stopping. Thus, the 1,092 touch and go operations given here in reality consist of 1,092 landings and 1,092 takeoffs.*

Table 50

GENERAL AVIATION AIRCRAFT OPERATIONS AT SELECTED AIRPORTS IN THE REGION BY HOUR-GROUP DISTRIBUTION THREE-DAY SURVEY PERIOD—1971

Airport	Aircraft Operation	Hour Group				Total
		6 a.m. to 10 a.m.	10 a.m. to 2 p.m.	2 p.m. to 6 p.m.	6 p.m. to 10 p.m.	
General Mitchell Field	Landings	109	186	188	174	657
	Takeoffs	154	196	215	118	683
	Touch and Go.	26	100	70	57	253
Kenosha Municipal	Landings	43	110	114	40	307
	Takeoffs	66	97	110	46	319
	Touch and Go.	18	51	51	12	132
Timmerman Field	Landings	34	98	134	67	333
	Takeoffs	59	89	135	48	331
	Touch and Go.	30	99	150	19	298
Waukesha County	Landings	34	92	131	46	303
	Takeoffs	66	105	117	35	323
	Touch and Go.	24	47	67	41	179
Total	Landings	220	486	567	327	1,600
	Takeoffs	345	487	577	247	1,656
	Touch and Go.	98	297	338	129	862

Source: SEWRPC.

Land Use at Pilot Trip Origins and Destinations: Residential and airport land uses were found to account about equally for the majority of aircraft pilot trip origins. Table 52 indicates that travel between the surveyed airports and residential land uses comprised 47 percent of the total trip origins and 40 percent of the total trip destinations; between surveyed airports and other airports, 40 percent of the trip origins and 46 percent of the destinations; between surveyed airports and commercial land uses, 6 percent of the trip origins and 4 percent of the trip destinations; and between surveyed airports and other land use categories, 3 percent or less each of either

Table 51

NUMBER OF LOCAL FLIGHTS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION THREE-DAY SURVEY PERIOD—1971

Airport	Number of Local Flights	Airport	Number of Local Flights
Aero Park	11	Lake Lawn Lodge[b]	2
Big Foot	5	O'Leary Field[a]	0
Burlington Municipal	17	Ozaukee	2
Capitol Drive	11	Palmyra	5
East Troy Municipal	9	Playboy	2
Fox River	12	Racine Commercial	18
General Mitchell Field	77	Rainbow	16
Grob	4	Sylvania	22
Gruenwald[a]	0	Timmerman Field	101
Hahn's Sky Ranch[a]	0	Watertown Municipal	6
Hales Corners	53	Waukesha County	123
Hartford Municipal	14	West Bend Municipal	35
Kenosha Municipal	74	Total	619

[a] *One-day survey.*

[b] *Two-day survey.*

Source: SEWRPC.

Table 52

DISTRIBUTION OF PILOT TRIPS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY LAND USE AT TRIP ORIGIN AND DESTINATION THREE-DAY SURVEY PERIOD—1971

Land Use	Aircraft Pilot Trips			
	Origin		Destination	
	Number	Percent of Total	Number	Percent of Total
Residential	777	46.5	663	39.7
Hotel/Motel	35	2.1	48	2.9
Commercial	96	5.8	65	3.9
Manufacturing	34	2.0	23	1.4
Airport	672	40.3	764	45.7
Institutional or Governmental	24	1.4	16	1.0
Recreational	6	0.4	13	0.8
Open Land and Water	2	0.1	2	0.1
Agricultural	0	--	1	0.1
Not Recorded	23	1.4	74	4.4
Total	1,669	100.0	1,669	100.0

Source: SEWRPC.

origins or destinations. The land uses of 1 percent of the trip origins and 4 percent of the trip destinations were not recorded.

Modes of Travel of Aircraft Pilots to and from General Aviation Airports: Aircraft pilots were found to travel to and from the surveyed airports largely by private automobile and private aircraft. Travel by private automobile comprised 55 percent of the trips to airports and 47 percent of the trips from airports, while travel by private aircraft comprised 38 percent of the trips to airports and 44 percent of the trips from airports. All other modes accounted for 3 percent or less each of travel to and from the airports. The travel mode of 1 percent of the trips to airports and 3 percent of the trips from airports was not recorded (see Table 53).

Trip Purposes of Aircraft Pilots at Airport: Trip purposes of aircraft pilots at the general aviation airports surveyed include both air and ground purposes. The most common purposes found in the survey were to change mode of travel between ground and air travel (35 percent), to engage in social/recreational activities (16 percent), and to improve flight proficiency through flight instruction and practice at the airports (15 percent). Less common purposes were to return to the base of operations (6 percent), to pick up or discharge air passengers (6 percent), to conduct work-connected business (4 percent), to service or refuel aircraft (4 percent), to work at the airports (2 percent), and to pick up or discharge air cargo (1 percent). The travel purposes of 6 percent of the aircraft pilots were not recorded (see Table 54).

Origin, Destination, and Air Travel Trip Purposes of Aircraft Pilots: Survey results indicate that of the total pilot trips generated at the general aviation airports surveyed, the largest category of trip purposes involved those made from home to the airports (45 percent) and from the airports to home (38 percent). The second largest category consisted of trips made to change mode of travel from ground to air (24 percent), and conversely from air to ground, including trips to return to the base of operations (22 percent). Trips made for other purposes comprised 10 percent or less of total trips both at the points of origin and destination (see Table 55).

The purposes given by aircraft pilots for trips at the trip origin, at the airport, and at the trip destination did not, however, make clear the purposes of pilot flights in all instances. By examining the interrelationship of the trip purposes and modes of travel reported by each pilot, the flight purposes were determined. Through this procedure it was found that generally aircraft pilot flights were made for social-recreational purposes (29 percent), improving flight proficiency (20 percent), picking up or discharging air passengers (16 percent), and for work or work-connected business (14 percent). Less common purposes included flights for servicing or refueling aircraft (9 percent) and conducting personal business (9 percent). All other purposes accounted for 3 percent or less each of the total (see Table 55).

Trip Origins and Destinations of Aircraft Pilots: Survey findings indicate that the majority of travel made by aircraft pilots to and from the surveyed general aviation airports originated at, or was destined for, points within the Region. Of the total aircraft pilot travel to the surveyed airports by ground and air, approximately 69 percent originated at points within the Region; 10 percent originated in 37 counties elsewhere in Wisconsin, 20 percent originated in 21 other states, and less than 1 percent originated in Canada. The origin of about 1.5 percent of the travel was not recorded (see Table 56). Of total aircraft pilot travel from the surveyed airports, approximately 62 percent was destined for points within the Region, 13 percent was destined for 43 other counties in

Table 53

DISTRIBUTION OF PILOT TRIPS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY MODE OF TRAVEL TO AND FROM THE AIRPORT THREE-DAY SURVEY PERIOD—1971

	Aircraft Pilot Trips			
	To Airport		From Airport	
Mode of Travel	Number	Percent of Total	Number	Percent of Total
Private Car	923	55.3	776	46.5
Hotel/Motel Courtesy Car	21	1.2	38	2.3
Taxicab	5	0.3	10	0.6
Air Taxi	16	1.0	20	1.2
Private Aircraft	634	38.0	738	44.2
Other	53	3.2	45	2.7
Not Recorded	17	1.0	42	2.5
Total	1,669	100.0	1,669	100.0

Source: SEWRPC.

Table 54

DISTRIBUTION OF PILOT TRIPS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY TRIP PURPOSE AT AIRPORT: THREE-DAY SURVEY PERIOD—1971

Airport	Trip Purpose												Total Pilot Trips
	Place of Work	Work Connected Business	Personal Business	Social-Recreational	Change Mode of Travel	Return to Base of Operations	Pick Up or Deliver Passengers	Pick Up or Deliver Cargo	Instruction/ Proficiency	Fuel or Service	Other	Not Recorded	
Aero Park	--	2	2	1	--	--	--	--	3	--	6	1	15
Big Foot	--	1	3	4	7	1	1	--	1	--	--	--	18
Burlington Municipal	1	1	5	15	5	2	2	--	5	8	--	1	45
Capitol Drive	1	--	1	3	41	1	1	--	3	3	--	--	54
East Troy Municipal	--	1	3	5	3	--	--	--	4	--	--	--	16
Fox River	--	--	--	4	4	--	--	--	10	--	--	--	18
General Mitchell Field	6	16	6	44	93	16	32	5	32	6	1	14	271
Grob	1	--	2	4	14	2	1	--	--	1	--	--	25
Gruenwald[a]	--	--	--	--	--	--	--	--	--	--	--	--	0
Hahn's Sky Ranch[a]	1	1	--	--	--	1	--	--	--	--	--	--	3
Hales Corners	2	6	--	21	28	7	--	--	11	--	--	--	75
Hartford Municipal	--	2	9	7	10	7	--	--	9	3	4	1	52
Kenosha Municipal	13	6	8	24	33	9	9	2	23	17	--	23	167
Lake Lawn Lodge[b]	--	2	--	9	2	--	3	--	1	--	--	--	17
O'Leary Field[a]	--	--	--	--	1	2	--	--	--	--	--	--	3
Ozaukee	--	1	2	--	4	--	--	--	2	1	--	--	10
Palmyra	--	1	1	5	8	1	1	--	--	3	--	--	20
Playboy	5	3	1	13	60	6	6	--	1	1	2	--	98
Racine Commercial	--	1	--	3	45	3	4	--	13	--	--	4	73
Rainbow	2	3	1	4	12	2	2	--	3	1	--	--	30
Sylvania	3	--	2	8	17	9	--	--	11	1	1	3	55
Timmerman Field	2	9	4	34	106	16	12	3	62	6	2	14	270
Watertown Municipal	--	1	1	6	11	5	--	--	6	3	--	--	33
Waukesha County	1	11	7	36	60	8	16	2	47	1	--	34	223
West Bend Municipal	2	2	3	25	19	4	5	--	7	10	--	1	78
Total	40	70	61	275	583	102	95	12	254	65	16	96	1,669
Percent of Total	2.4	4.2	3.6	16.5	34.9	6.1	5.7	0.7	15.2	3.9	1.0	5.8	100.0

[a] *One-day survey.*

[b] *Two-day survey.*

Source: SEWRPC.

Table 55

DISTRIBUTION OF PILOT TRIPS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY ORIGIN, DESTINATION, AND AIR TRAVEL TRIP PURPOSE: THREE-DAY SURVEY PERIOD—1971

Trip Purpose	Aircraft Pilot Trips: Origin Number	Origin Percent of Total	Destination Number	Destination Percent of Total	Air Travel Number	Air Travel Percent of Total
Home	751	45.0	627	37.6	--	--
Place of Work	106	6.4	46	2.7	45	2.7
Work-Connected Business	91	5.4	106	6.3	185	11.1
Personal Business	36	2.2	56	3.4	157	9.4
Social/Recreation	89	5.3	165	9.9	489	29.3
Change Model of Travel (Including Return to Base of Operations)	393	23.5	364	21.8	--	--
Pick Up or Deliver Passengers	70	4.2	87	5.2	266	15.9
Pick Up or Deliver Cargo	--	--	--	--	33	2.0
Instruction/Proficiency	20	1.2	37	2.2	329	19.7
Fuel or Service	19	1.1	16	1.0	147	8.8
Other	43	2.6	41	2.5	18	1.1
Not Recorded	51	3.1	124	7.4	--	--
Total	1,669	100.0	1,669	100.0	1,669	100.0

Source: SEWRPC.

Table 56

DISTRIBUTION OF PILOT TRIPS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY TRIP ORIGIN AND MODE OF TRAVEL: THREE-DAY SURVEY PERIOD—1971

Mode of Travel	Aircraft Pilot Trips: Origin: Region	Wisconsin Counties Outside Region	States Other Than Wisconsin	Canada	Not Recorded	Total	Percent of Total
Private Car	859	28	27	--	9	923	55.3
Rental Car	7	1	--	--	--	8	0.5
Hotel/Motel Courtesy Car	20	1	--	--	--	21	1.2
Airport Limousine	--	--	--	--	--	--	--
Taxicab	5	--	--	--	--	5	0.3
Motor Bus	--	--	--	--	1	1	0.1
Commercial Air Carrier	--	1	2	--	--	3	0.2
Air Taxi	3	4	9	--	--	16	0.9
Private Aircraft	210	127	283	6	8	634	38.0
Other	35	1	5	--	--	41	2.5
Not Recorded	8	1	1	--	7	17	1.0
Total	1,147	164	327	6	25	1,669	100.0
Percent of Total	68.7	9.8	19.6	0.4	1.5	--	100.0

Source: SEWRPC.

Wisconsin, 20 percent was destined for 23 other states and the District of Columbia, and less than 1 percent was destined for Canada. The destinations of 5 percent were not recorded, as shown in Table 57.

Of the total aircraft pilot arrivals at the surveyed airports, 60 percent were made by ground modes and 39 percent by air modes. The travel mode of 1 percent was not recorded. Of the pilot departures, 52 percent were made by ground travel, 46 percent were made by air travel, and the travel modes of 2 percent were not recorded. As might be expected, ground modes predominated in travel originating in or destined for points within the Region, and air travel predominated in travel originating in or destined for points beyond the Region (see Tables 56 and 57).

Time and Distance of Pilot Travel Between Trip Origin Within Region and Airports: For the ground trips made to the general aviation airports by aircraft pilots from points within the Region, the elapsed time was 10 minutes or less for about 39 percent of such trips, 20 minutes or less for about 68 percent, 30 minutes or less for about 85 percent, 40 minutes or less for about 95 percent, 50 minutes or less for about 97 percent, and 60 minutes or less for about 98 percent. Only about 2 percent of the trips had an elapsed time of one hour or more. The average elapsed time was about 16 minutes, and the median elapsed time was about 14 minutes, as shown in Figure 57.

In terms of distance from points of origin to the airports, it was found that approximately 63 percent of the trips originated within 10 miles of the airports, about 88 percent originated within 20 miles, about 93 percent originated within 30 miles, about 95 percent originated within 40 miles, and about 98 percent originated within 50 miles. The average distance of ground travel originating within the Region to the airports was about nine miles, and the median distance was about eight miles, as shown in Figure 58.

Pilot Licenses and Ratings: After arraying the responses of the pilots by home address, age, and sex, it was determined that 1,367 individual pilots made the 1,669 trips recorded in the general aviation pilot survey. Of these 1,367 pilots, 732, or 54 percent, held a private license only; 345, or 25 percent, held a commercial license only; 118, or 9 percent, held a student license only; 53, or 4 percent, held an air transport license only; 34, or 3 percent, held both private and commercial licenses; and 25, or 2 percent, held both commercial and air transport licenses. Eleven pilots, or slightly less than 1 percent, held other combinations of types of licenses. The type of licenses held by 49 pilots, or 4 percent, was not recorded (see Table 58).

Approximately 60 percent of the 1,367 pilots held no advanced ratings in conjunction with their licenses, as also shown in Table 58. The most common combination of advanced ratings was held by 145 pilots, or 11 percent, who had instrument, multi-engine, and instructor ratings. The second most common combination of advanced ratings was held by 125 pilots, or 9 percent, who had instrument and multi-engine ratings. The third most frequently

Table 57

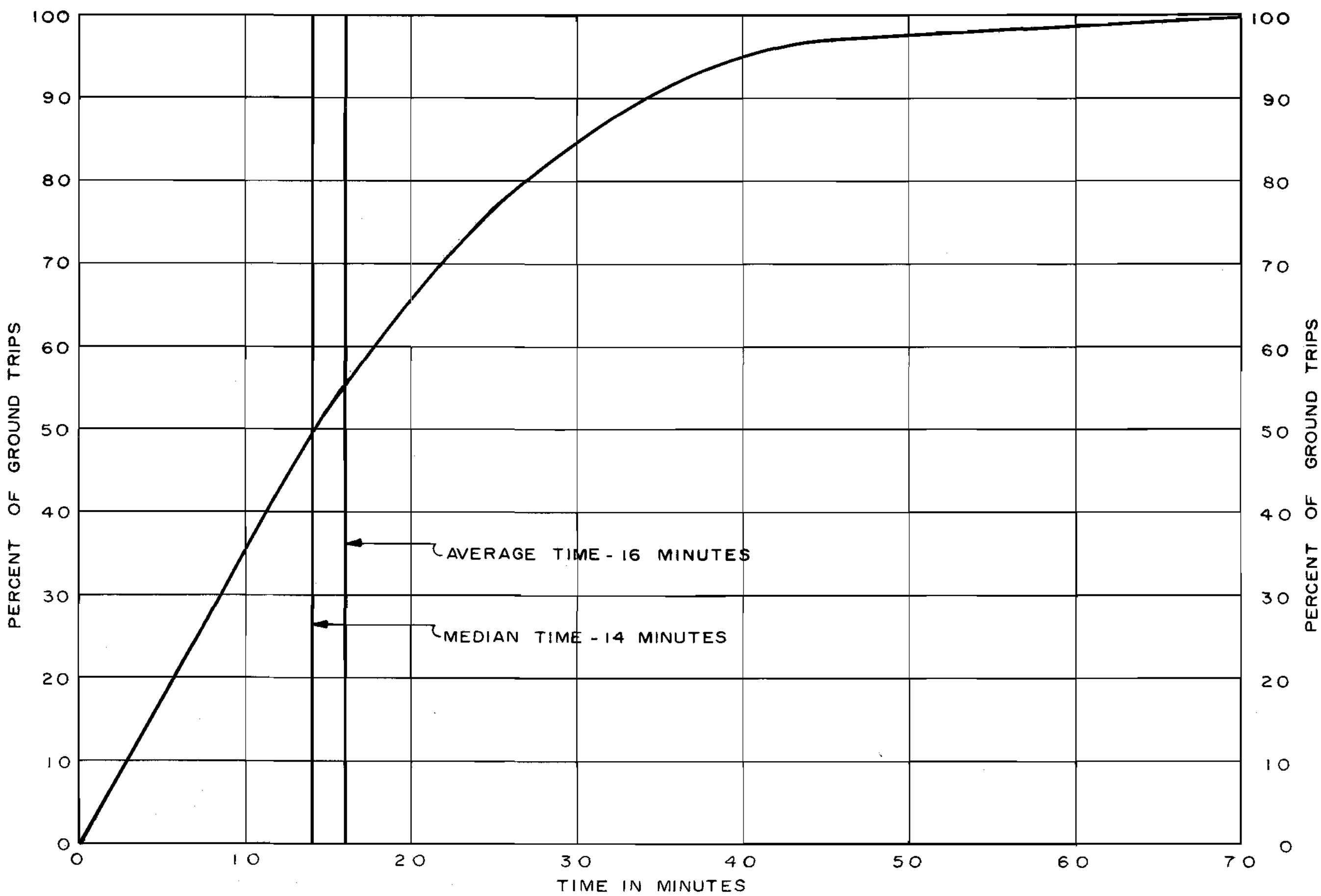
DISTRIBUTION OF PILOT TRIPS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY TRIP DESTINATION AND MODE OF TRAVEL: THREE-DAY SURVEY PERIOD—1971

Mode of Travel	Aircraft Pilot Trips						
	Destination						
	Region	Wisconsin Counties Outside Region	States Other Than Wisconsin	Canada	Not Recorded	Total	Percent of Total
Private Car	717	23	15	--	21	776	46.5
Rental Car	3	2	--	--	1	6	0.4
Hotel/Motel Courtesy Car	38	--	--	--	--	38	2.3
Airport Limousine	--	--	--	--	--	--	--
Taxicab	10	--	--	--	--	10	0.6
Motor Bus	--	--	--	--	--	--	--
Commercial Air Carrier	1	1	2	--	--	4	0.2
Air Taxi	1	7	12	--	--	20	1.2
Private Aircraft	222	181	301	5	29	738	44.2
Other	27	1	3	--	4	35	2.1
Not Recorded	10	2	--	--	30	42	2.5
Total	1,029	217	333	5	85	1,669	100.0
Percent of Total	61.6	13.0	20.0	0.3	5.1	--	100.0

Source: SEWRPC.

Figure 57

PERCENTAGE DISTRIBUTION OF PILOT TRIPS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY GROUND TRAVEL TIME FROM TRIP ORIGIN WITHIN THE REGION TO THE AIRPORT THREE-DAY SURVEY PERIOD—1971



Source: SEWRPC.

held advanced rating was an instrument rating only, which was held by 95 pilots, or 7 percent. It is notable that of the 732 pilots holding a private license only, approximately 82 percent held no advanced ratings, whereas of the 345 pilots holding commercial licenses only, approximately 81 percent held advanced ratings.

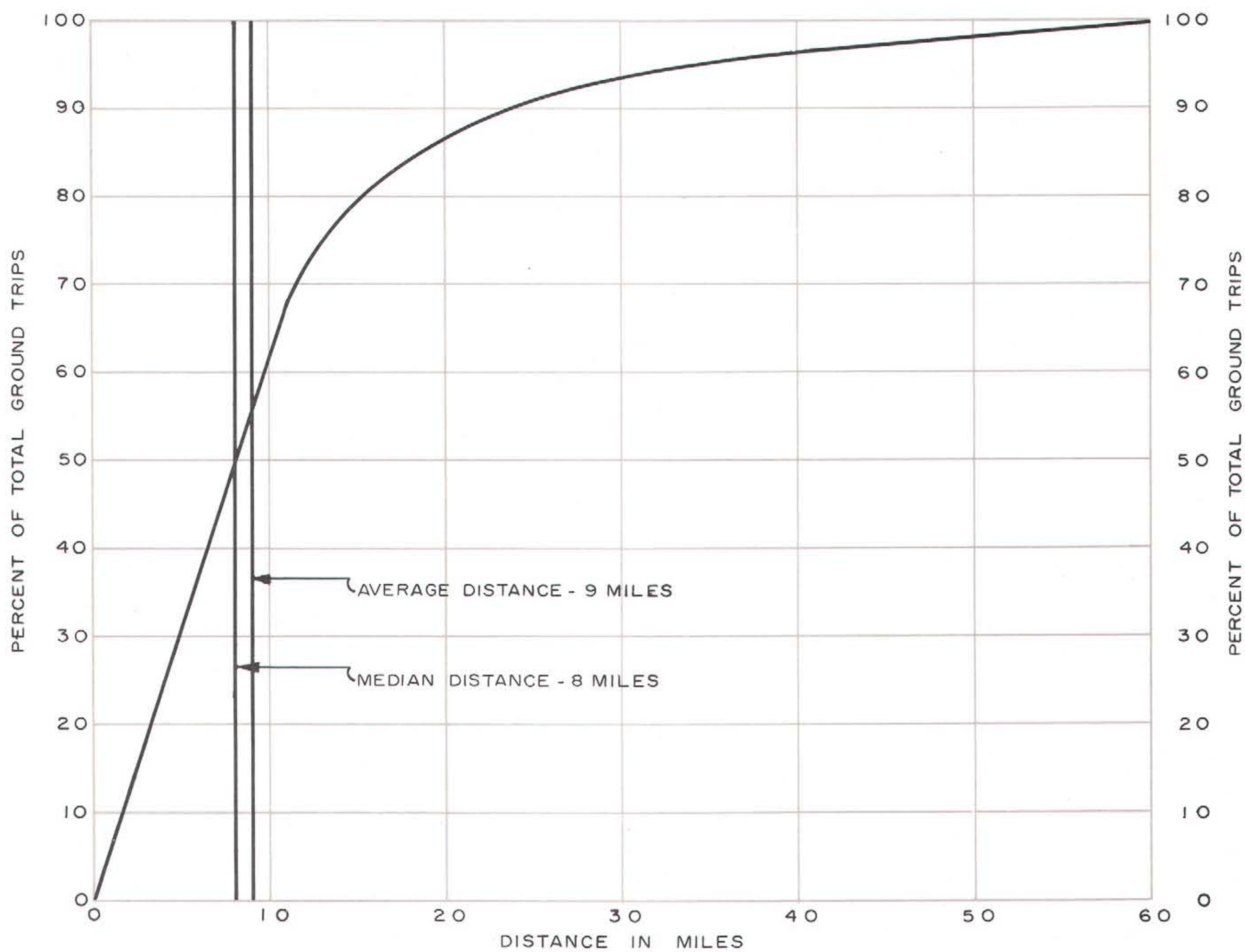
Aircraft Types and Equipment Used by General Aviation Aircraft Pilots: An analysis of known aircraft registration numbers indicated that 974 separate aircraft were used by the 1,367 pilots interviewed. By type, 925 aircraft, or 95 percent, were propeller driven; 15 aircraft, or 2 percent, were turboprops; 14 aircraft, or 1 percent, were jets; and nine aircraft, or 1 percent, were gliders. The engine types of 11 aircraft, or 1 percent, were not recorded. There were single engines on 787 of the aircraft surveyed, or 81 percent; twin engines on 159 aircraft, or 16 percent; and four engines on four aircraft, or less than one-half of 1 percent. There were no engines on nine aircraft, or 1 percent, which were gliders. The number of engines on 15 aircraft, or 2 percent, was not recorded.

It was found that of the 974 aircraft, 88 percent were equipped with VOR receivers, 84 percent with transceivers, 63 percent with VOR/LOC indicators, 56 percent with full IFR panels, 45 percent with marker beacon receivers, 45 percent with automatic direction finders, and 35 percent with transponders. The least common equipment found on the aircraft was deicing equipment (13 percent), flight directors (12 percent), and weather radar (8 percent). Two or more pieces of certain types of equipment were available on some of the aircraft. About 45 percent of the aircraft had two or more VOR receivers, 43 percent of the aircraft had two or more transceivers, and 31 percent of the aircraft had two or more VOR/LOC indicators, as shown in Table 59.

Socioeconomic Characteristics of General Aviation Aircraft Pilots: Survey findings indicated that the majority (98 percent) of aircraft pilots using the general aviation airports surveyed were males compared to 2 percent who were females. The findings also indicated that 99 percent of the pilots were of the white race and that the black

Figure 58

PERCENTAGE DISTRIBUTION OF PILOT TRIPS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY GROUND TRAVEL DISTANCE FROM TRIP ORIGIN WITHIN THE REGION TO THE AIRPORT
THREE-DAY SURVEY PERIOD—1971



Source: SEWRPC.

and other races accounted for less than 1 percent of the total, as shown in Table 60.

By age group, pilots under 25 years of age comprised 6 percent of the total; pilots 25 through 44 years of age, 59 percent; pilots 45 through 64 years of age, 34 percent; and pilots 65 years or older, 1 percent. The median age of pilots was estimated at 41 years of age. By income group, pilots having annual household incomes of less than $8,000 comprised 9 percent of the total; between $8,000 and $15,999, 43 percent; between $16,000 and $23,999, 29 percent; and $24,000 or over, 19 percent. The median annual household income was estimated at $15,738.

A comparison of the distribution of the socioeconomic characteristics of the pilots with a similar distribution of the regional population as reported in the 1970 census indicates major differences within most categories. For example, while nearly all aircraft pilots were found to be males, only 48 percent of the regional population was male, and while 99 percent of the pilots were of the white race, 93 percent of the regional population was white (see Table 60).

By age group, the proportion of aircraft pilots under 25 years of age and 65 years or older was considerably lower than the proportion of the regional population in those groups, while the proportion of pilots 25 through 44 years of age and 45 through 54 years of age was considerably higher than proportions for the regional population in those groups. The proportion of pilots having an annual household income of $8,000 or less was much lower than the proportion of the regional population in

Table 58

DISTRIBUTION OF PILOTS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY TYPE OF PILOT LICENSE HELD AND TYPE OF ADVANCED RATING: THREE-DAY SURVEY PERIOD—1971

	Pilot License									
Rating	Student Only	Private Only	Commercial Only	Air Transport Only	Private and Commercial	Commercial and Air Transport	Other Combinations	Not Recorded	Total Pilots	Percent of Total
No Rating	118	598	66	23	7	0	3	0	815	59.6
Instrument Only	0	65	30	0	0	0	0	0	95	7.0
Multi-engine Only	0	20	17	2	2	2	0	0	43	3.1
Instructor Only	0	3	8	2	2	3	0	0	18	1.3
Instrument and Multi-engine	0	37	74	0	6	6	2	0	125	9.1
Instrument and Instructor	0	2	33	0	3	0	0	0	38	2.8
Multi-engine and Instructor	0	1	12	1	1	0	0	0	15	1.1
Instrument, Multi-engine, and Instructor	0	2	93	20	10	14	6	0	145	10.6
Other Combinations	0	4	12	5	3	0	0	0	24	1.8
Not Recorded	0	0	0	0	0	0	0	49	49	3.6
Total	118	732	345	53	34	25	11	49	1,367	100.0
Percent of Total	8.6	53.6	25.2	3.9	2.5	1.8	0.8	3.6	--	100.0

Source: SEWRPC.

Table 59

DISTRIBUTION OF AIRCRAFT USED BY PILOTS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY NUMBER OF PIECES AND TYPE OF NAVIGATIONAL AND COMMUNICATION EQUIPMENT: THREE-DAY SURVEY PERIOD—1971

	Number of Pieces of Equipment												
	0		1		2		3		4		Not Recorded		
Equipment[a]	Number of Aircraft	Percent of Total Aircraft	Number of Aircraft	Percent of Total Aircraft	Number of Aircraft	Percent of Total Aircraft	Number of Aircraft	Percent of Total Aircraft	Number of Aircraft	Percent of Total Aircraft	Number of Aircraft	Percent of Total Aircraft	Total Aircraft
Transceiver	115	11.8	398	40.9	399	41.0	18	1.8	2	0.2	42	4.3	974
VOR Receiver	78	8.0	421	43.2	430	44.2	4	0.4	--	--	41	4.2	974
VOR/LOC Indicator	318	32.7	316	32.4	293	30.1	4	0.4	1	0.1	42	4.3	974
Full IFR Panel	387	39.7	543	55.8	2	0.2	--	--	1	0.1	41	4.2	974
Glide Slope Receiver	630	64.7	288	29.6	15	1.5	--	--	--	--	41	4.2	974
Marker Beacon Receiver	491	50.4	436	44.8	6	0.6	--	--	--	--	41	4.2	974
Flight Director	815	83.7	112	11.5	5	0.5	--	--	--	--	42	4.3	974
Automatic Direction Finder	492	50.5	435	44.7	6	0.6	--	--	--	--	41	4.2	974
Distance Measuring Equipment	716	73.5	21	21.8	5	0.5	--	--	--	--	41	4.2	974
Transponder	587	60.3	341	35.0	5	0.5	--	--	--	--	41	4.2	974
Weather Radar	854	87.7	78	8.0	1	0.1	--	--	--	--	41	4.2	974
Deicing Equipment	804	82.6	127	13.0	2	0.2	--	--	--	--	41	4.2	974
Automatic Pilot	664	68.2	267	27.4	2	0.2	--	--	--	--	41	4.2	974

[a] *The definition of each piece of equipment is contained in Appendix G.*

Source: SEWRPC.

that income range, while the proportion of pilots in the two income groups between $16,000 and $23,999 and $24,000 and over was significantly higher than the proportion of the regional population in those two groups. The proportions of aircraft pilots and of the regional population having a household income between $8,000 and $15,999 were similar.

Thus, it was found that the socioeconomic characteristics of aircraft pilots in the airport survey were not representative of the regional population, tending in particular to represent the more affluent, middle-aged and male segments of the population.

General Aviation Airport User Survey

Concurrently with the conduct of the general aviation aircraft pilot survey, a survey was undertaken which related to the characteristics and activities of other users of the 25 general aviation airports included in the study. For purposes of this study, airport users included both persons who made flights as passengers to and/or from the surveyed general aviation airports and those who did not. To better understand the travel and personal characteristics of each of these two types of airport users, and to determine differences between them, each user type is examined separately.

Table 60

PERCENTAGE DISTRIBUTION OF PILOTS AT GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION AND OF THE POPULATION OF THE REGION BY SOCIOECONOMIC CHARACTERISTICS 1971 THREE-DAY SURVEY PERIOD AND 1970 CENSUS

Socioeconomic Characteristic	Percent of Pilots Interviewed	Percent of 1970 Region Population
Sex		
Male	97.7	48.3
Female	2.3	51.7
Total	100.0	100.0
Race		
White	99.8	92.6
Black.	0.1	6.8
Other	0.1	0.6
Total	100.0	100.0
Age		
Under 25	6.4	46.6
25-44	59.1	23.5
45-54	26.4	11.2
55-64	7.3	9.0
65 and Older.	0.8	9.7
Total	100.0	100.0
Median Age	41 years	28 years
Annual Household Income		
Under $8,000	8.8	37.5
$ 8,000 - 15,999.	42.9	43.5
16,000 - 23,999.	29.2	13.2
24,000 or More	19.1	5.8
Total	100.0	100.0
Median Income	$15,738	$9,950
Total Pilots Interviewed	1,367	--
Total Region Population	--	1,756,086

Source: U. S. Bureau of the Census and SEWRPC.

Of the total 6,740 airport users interviewed at general aviation airports in the survey period, only 1,167, or about 17 percent, made flights to and/or from these airports in the survey period, while the remaining 5,573, or 83 percent, arrived at and departed from these airports by ground vehicle and did not make flights.

Information obtained in the survey for both flight-making and non-flight-making users included personal characteristic data such as age, sex, race, annual household income, and home address; and included trip characteristic data such as geographic location and land use at point of origin and destination; trip purpose at origin, at surveyed airport, and at ultimate destination; mode of travel utilized; and the time and date of arrival at a surveyed airport.

Land Use at Airport User Trip Origins and Destinations: Travel to and from the surveyed general aviation airports by flight-making airport users consisted of those who arrived by ground and departed by air, those who arrived by air and departed by ground, and those who arrived and departed by air.

The land use at the trip origin of those arriving at the airports by air and the land use at the destination of those departing by air were comprised principally of airports. The exceptions were three passengers who began or ended their flights in an open field. The land uses at the trip origin of those arriving at the airports by ground travel included the following: residential, 64 percent; hotels and motels, 18 percent; commercial, 7 percent; and manufacturing, 6 percent, with all other land uses at the trip origins accounting for 2 percent or less each of the total passengers. The land uses at the origins of 1 percent of the passengers were not recorded. The land uses at the destination of those departing from the airports by ground travel included residential, 44 percent; hotels and motels, 21 percent; commercial, 11 percent; manufacturing, 10 percent; recreational, 6 percent; and institutional or governmental, 4 percent. All other land uses at the destinations accounted for 2 percent or less each of the total passengers. The land uses at 3 percent of the trip destinations were not recorded (see Table 61).

Survey results indicate that of total trips made by non-flight-making airport users to and from the surveyed airports, residential land uses accounted for 68 percent of the trips at trip origin and 72 percent at trip destination; commercial land uses accounted for 13 percent at the trip origins and 11 percent at the trip destinations; and institutional or governmental land uses accounted for 5 percent at the trip origins and 3 percent at the trip destinations. All other uses accounted for 3 percent or less each of the total passengers. The land uses at 3 percent of the trip origins and 6 percent of the trip destinations were not recorded (see Table 62).

A comparison of the percentage distribution of land uses between flight-making and non-flight-making airport users indicates rather wide differences. The land uses at trip origins and destinations of flight-makers are heavily weighted by airport land use and to a lesser degree by residential land use, while the land uses at the origins and destinations of non-flight-making users are heavily weighted by residential land use and to a much lesser degree by commercial land uses. All other land uses in both user categories accounted for 8 percent or less each of the total.

Modes of Travel of Airport Users to and from General Aviation Airports: The modes of travel used by flight-making airport users in making trips to and from the surveyed general aviation airports consisted primarily of private aircraft and private automobiles. Private aircraft accounted for 52 percent of the total travel to

Table 61

DISTRIBUTION OF FLIGHT-MAKING USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY LAND USE AT TRIP ORIGIN AND DESTINATION: THREE-DAY SURVEY PERIOD—1971

Land Use	Flight-making Airport Users											
	Air Arrival/Ground Departure				Ground Arrival/Air Departure				Total			
	Origin		Destination		Origin		Destination		Origin		Destination	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Residential	--	--	188	43.6	335	63.5	--	--	335	28.7	188	16.1
Hotel/Motel	--	--	89	20.6	92	17.5	--	--	92	7.9	89	7.6
Commercial	--	--	46	10.7	39	7.4	--	--	39	3.4	46	3.9
Manufacturing	--	--	45	10.4	33	6.3	--	--	33	2.8	45	3.9
Airport	639	99.8	3	0.7	7	1.3	733	99.6	646	55.3	736	63.1
Institutional or Governmental	--	--	19	4.4	11	2.1	--	--	11	0.9	19	1.6
Recreational	--	--	24	5.6	1	0.2	--	--	1	0.1	24	2.1
Open Land and Water	1	0.2	2	0.5	2	0.4	2	0.3	3	0.3	4	0.3
Agricultural	--	--	--	--	--	--	--	--	--	--	--	--
Not Recorded	--	--	15	3.5	7	1.3	1	0.1	7	0.6	16	1.4
Total	640	100.0	431	100.0	527	100.0	736	100.0	1,167	100.0	1,167	100.0

Source: SEWRPC.

Table 62

DISTRIBUTION OF NON-FLIGHT-MAKING USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY LAND USE AT TRIP ORIGIN AND DESTINATION: THREE-DAY SURVEY PERIOD—1971

Land Use	Non-flight-making Airport Users			
	Origin		Destination	
	Number	Percent of Total	Number	Percent of Total
Residential	3,804	68.2	3,986	71.5
Hotel/Motel	138	2.5	138	2.5
Commercial	749	13.4	592	10.6
Manufacturing	157	2.8	121	2.2
Airport	166	3.0	162	2.9
Institutional or Governmental	282	5.1	194	3.4
Recreational	123	2.2	54	1.0
Open Land and Water	4	0.1	14	0.3
Agricultural	9	0.2	3	0.1
Not Recorded	141	2.5	309	5.5
Total	5,573	100.0	5,573	100.0

Source: SEWRPC.

the surveyed airports from points of origin; the private automobile accounted for 35 percent; hotel or motel courtesy cars, 4 percent; and rental cars, 3 percent. All other travel modes accounted for 2 percent or less each of the total. The travel mode of less than 1 percent was not recorded. Of the total travel from these airports to an ultimate destination, private aircraft accounted for 59 percent; private automobiles, 24 percent; and hotel or motel courtesy cars, 7 percent. All other modes accounted for 3 percent or less each of the total. The travel mode of 1 percent was not recorded, as shown in Table 63. Of total travel by all air and ground modes, air travel modes accounted for 55 percent from trip origins and 63 percent to trip destinations. Ground travel modes accounted for 44 percent from trip origins and 36 percent to trip destinations.

The private automobile was the predominant mode of travel utilized by non-flight-making airport users, accounting for 88 percent of travel to and 87 percent of travel from the surveyed airports. Other modes at both origin and destination included trucks (6 percent), motorcycles, bicycles, airport limousines, and walking modes combined in the "other" category (2 percent), and hotel-motel courtesy cars (1 percent). Rental cars, taxis, and motor buses each accounted for less than 1 percent at the origin and destination. The modes of 1 percent of the trips to and 3 percent of the trips from the surveyed airports were not recorded (see Table 64).

Comparisons of the percentage distributions of flight-making and non-flight-making airport users by mode of travel to and from the airports indicate that the principal modes of travel of flight-makers were private aircraft and private automobiles, while the principal mode of travel of non-flight-makers was the private automobile. All other modes of travel for both user types accounted for 7 percent or less in each direction.

Travel Purposes of Airport Users: Information was obtained in the general aviation airport survey for each flight-making user concerning the air or ground purposes of travel at the trip origin, at the surveyed airports, and at the ultimate destination.

Table 63

DISTRIBUTION OF FLIGHT-MAKING USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY MODE OF TRAVEL TO AND FROM THE AIRPORT: THREE-DAY SURVEY PERIOD—1971

Mode of Travel	Flight-making Airport Users			
	Origin		Destination	
	Number	Percent of Total	Number	Percent of Total
Private Car	412	35.3	277	23.7
Rental Car	33	2.8	13	1.1
Hotel/Motel Courtesy Car	46	4.0	79	6.8
Taxicab	19	1.6	27	2.3
Motor Bus	9	0.8	17	1.4
Commercial Air Carrier	6	0.5	7	0.6
Air Taxi	28	2.4	37	3.2
Private Aircraft	606	51.9	692	59.3
Two-Axle Truck	1	0.1	3	0.3
Other	5	0.4	2	0.2
Not Recorded	2	0.2	13	1.1
Total	1,167	100.0	1,167	100.0

Source: SEWRPC.

Table 64

DISTRIBUTION OF NON-FLIGHT-MAKING USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY MODE OF TRAVEL TO AND FROM THE AIRPORT: THREE-DAY SURVEY PERIOD—1971

Mode of Travel	Non-flight-making Airport Users			
	Origin		Destination	
	Number	Percent of Total	Number	Percent of Total
Private Car	4,899	87.9	4,830	86.7
Rental Car	20	0.4	20	0.4
Hotel/Motel Courtesy Car	86	1.5	81	1.4
Taxicab	34	0.6	34	0.6
Motor Bus	4	0.1	4	0.1
Two-Axle Truck	299	5.4	295	5.3
Multi-Axle Truck	30	0.5	29	0.5
Other	124	2.2	124	2.2
Not Recorded	77	1.4	156	2.8
Total	5,573	100.0	5,573	100.0

Source: SEWRPC.

The purposes of flight-making users at the trip origins consisted principally of changing mode of travel (44 percent), home (25 percent), and social-recreation (10 percent). All other purposes amounted to 5 percent or less each of the total. The purposes of such users at the surveyed airports consisted principally of changing mode of travel (82 percent) and social-recreation (10 percent). All other purposes amounted to 3 percent or less each of the total. The trip purposes at the destination consisted principally of changing mode of travel (40 percent), social-recreation (18 percent), work-connected business (14 percent), and home (14 percent). All other purposes amounted to 5 percent or less each of the total (see Table 65).

The responses given for such categories as "home," "change mode of travel," and "overnight accommodations," however, tended to mask the purpose of a given user flight. In order to better determine the real travel purposes of the flight-making users, the purposes at point of origin, at the surveyed airport, and at the destination, along with the modes of arrival and departure for that flight, were examined. It was found that flights to or from the airports for social-recreational purposes comprised nearly 49 percent of the total; for work and work-connected purposes, 29 percent; for personal business, 10 percent; for flight instruction, 8 percent; to serve a passenger, 2 percent; and other, 3 percent. Thus, passenger flights by airport users for social-recreational purposes were approximately equal to flights for all other purposes combined (see Table 65).

The purposes of non-flight-making users at the trip origins consisted principally of home (64 percent), work (12 percent), social-recreational (7 percent), work-connected business (5 percent), and personal business (4 percent). All other purposes equaled less than 2 percent each of the total. The purposes of 3 percent were not recorded.

The purposes of non-flight-making users at the airports consisted principally of social-recreation (34 percent), personal business (30 percent), place of work (11 percent), ground school instruction (8 percent), and work-connected business (7 percent). All other purposes accounted for 4 percent or less each of the total. The purposes of 3 percent were not recorded. The purposes of non-flight-making users at the trip destinations consisted principally of home (68 percent), place of work (8 percent), social-recreational (6 percent), work-connected business (5 percent), and personal business (4 percent). All other purposes accounted for 1 percent or less each of the total. The purposes of 6 percent were not recorded (see Table 66).

The reasons why flight-making and non-flight-making users travel to an airport can be determined to some degree by comparing their trip purposes at the airport. For flight-making users, the primary purpose at the airport is to change mode of travel from ground to air or vice versa (82 percent) and to a lesser degree for social-recreational purposes (11 percent). For non-flight-making users, the primary purposes at the airport are social-

Table 65

DISTRIBUTION OF FLIGHT-MAKING USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY TRIP PURPOSE THREE-DAY SURVEY PERIOD—1971

Trip Purpose	Flight-making Airport Users							
	Origin		Airport		Destination		Air Travel	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Home	291	24.9	--	--	161	13.8	--	--
Work	39	3.3	2	0.2	26	2.2	7	0.6
Work-Connected Business	59	5.1	20	1.7	164	14.1	332	28.4
Personal Business	17	1.5	34	2.9	28	2.4	117	10.0
School	--	--	--	--	3	0.3	--	--
Social-Recreation	120	10.3	123	10.5	213	18.2	568	48.7
Change Mode of Travel	517	44.3	956	81.9	468	40.1	--	--
Shopping	1	0.1	--	--	--	--	--	--
Overnight Accommodations	60	5.1	--	--	7	0.6	--	--
Pick up or Deliver Goods	--	--	--	--	--	--	--	--
Instruction/Proficiency	--	--	19	1.6	--	--	88	7.6
Serve Passenger	--	--	--	--	--	--	22	1.8
Other	35	3.0	4	0.4	61	5.2	33	2.9
Not Recorded	28	2.4	9	0.8	36	3.1	--	--
Total	1,167	100.0	1,167	100.0	1,167	100.0	1,167	100.0

Source: SEWRPC.

Table 66

DISTRIBUTION OF NON-FLIGHT-MAKING USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY TRIP PURPOSE: THREE-DAY SURVEY PERIOD—1971

Trip Purpose	Non-flight-making Airport Users					
	Origin		Airport		Destination	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
Home	3,578	64.2	--	--	3,772	67.7
Work.	639	11.5	614	11.0	433	7.8
Work-Connected Business	301	5.4	405	7.3	266	4.8
Personal Business.	206	3.7	1,683	30.1	197	3.5
School.	83	1.5	--	--	77	1.4
Social-Recreation	391	7.0	1,916	34.4	311	5.6
Change Mode of Travel.	12	0.2	42	0.8	20	0.4
Shopping.	54	1.0	--	--	41	0.7
Overnight Accommodations	27	0.5	--	--	29	0.5
Pick up or Deliver Goods	42	0.7	121	2.2	46	0.8
Instruction/Proficiency.	--	--	437	7.8	--	--
Other	60	1.1	192	3.5	61	1.1
Not Recorded.	180	3.2	163	2.9	320	5.7
Total	5,573	100.0	5,573	100.0	5,573	100.0

Source: SEWRPC.

recreational (34 percent) or personal business (30 percent), and to a lesser degree, work (11 percent). This would indicate that while flight-making users, constituting about 17 percent of total users, utilize the airport facility because of its function as a terminal, non-flight-making users, constituting about 83 percent of total users, utilize the airport facility primarily for social-recreational or personal business reasons, which are not necessarily directly related to the terminal function of the facility.

Socioeconomic Characteristics of Airport Users: Survey findings indicate that of the flight-making users at the general aviation airports, males accounted for about 75 percent of the total while females accounted for 25 percent, a ratio of 3 to 1. Members of the white race accounted for virtually all flight-making users (99 percent) while members of all other races combined accounted for 1 percent (see Table 67).

By age group, flight-making users under 25 accounted for approximately 13 percent of the total; those 25 through 44, for 52 percent; those 45 through 64 years, for 33 percent; and those 65 years and over, for 2 percent of the total. The median age of flight-making users was estimated at 41 years. By income group, flight-making users who were members of households having an annual household income of less than $8,000 comprised 8 percent of the total; between $8,000 and $15,999, 31 percent; between $16,000 and $23,999, 30 percent; and $24,000 or more, 31 percent. The median income of flight-making users was estimated at $18,649.

Survey findings indicate that 75 percent of the non-flight-making airport users were male and 25 percent were female, a ratio of 3 to 1. Virtually all such users were of the white race, with all other races combined accounting for only 1 percent.

By age group, non-flight-making users under 25 comprised 25 percent of the total; those 25 through 44, 49 percent; those 45 through 64, 24 percent; and users 65 years or older, 2 percent. The median age of non-flight-making users was estimated at 35 years.

By income group, non-flight-making users having an annual income of less than $8,000 accounted for 15 percent of the total; between $8,000 and $15,999, 53 percent; between $16,000 and $23,999, 22 percent; and $24,000 or more, 10 percent. The median income of non-flight-making users was estimated at $12,815.

Comparisons of the socioeconomic characteristics for these airport users and for residents of the Region as reported in the 1970 census indicate major differences in certain categories. For example, males comprised 75 percent and females 25 percent of both categories of airport users, compared to the census distribution of 48 percent males and 52 percent females. By race, members of the white race comprised 99 percent of the total in each user category, compared to 92 percent of the total in the census distribution, as shown in Table 67.

Table 67

PERCENTAGE DISTRIBUTION OF USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION AND OF THE POPULATION OF THE REGION BY SOCIOECONOMIC CHARACTERISTICS 1971 THREE-DAY SURVEY PERIOD AND 1970 CENSUS

Socioeconomic Characteristic	Percent of Airport Users		Percent of 1970 Region Population
	Flight-making	Non-flight-making	
Sex			
Male	74.8	75.0	48.3
Female	25.2	25.0	51.7
Total	100.0	100.0	100.0
Race			
White	99.7	99.2	92.6
Black	0.0	0.8	6.8
Other	0.3	0.0	0.6
Total	100.0	100.0	100.0
Age			
Under 25	12.8	24.7	46.6
25-44	52.0	49.1	23.5
45-64	33.3	24.5	20.2
65 and Over	1.9	1.7	9.7
Total	100.0	100.0	100.0
Median Age	41 years	35 years	28 Years
Annual Household Income			
Less than $8,000	8.3	14.7	37.5
$ 8,000 - 15,999	30.9	52.9	43.5
16,000 - 23,999	30.1	22.0	13.2
24,000 and Over	30.7	10.4	5.8
Total	100.0	100.0	100.0
Median Income	$18,649	$12,815	$9,950

Source: U. S. Bureau of the Census and SEWRPC.

By age group, the widest variance occurred in the distribution of flight-making users and the census distribution, with non-flight-making users falling between the two. The median age of flight-making users was 41 years, compared to 35 years for non-flight-making users and 28 years for the regional population.

By income group, substantial differences were also found between flight-making users and the regional population. The median annual household income of flight-making users was $18,649, compared to $12,815 for non-flight-making users and $9,950 for the regional population.

Thus, it was found that the socioeconomic characteristics of airport users were not representative of the regional population, tending in particular to represent the middle-aged and more affluent segments of the population.

Trip Origins and Destinations of Airport Users: Of the total flights made by airport users to and from the general aviation airports, 431, or 37 percent, were arrival flights; 527, or 45 percent, were departure flights; and 209, or 18 percent, were through flights.

About 19 percent of the arrival flights, including the arrival portion of through flights, originated at other surveyed or nonsurveyed airports within the Region, 14 percent originated in 30 counties elsewhere in Wisconsin, 64 percent originated in 21 other states, and 3 percent originated in Canada. The origins of less than 1 percent were not recorded, as shown in Table 68.

About 19 percent of the departure flights, including the departure portion of through flights, were destined for other surveyed or nonsurveyed airports within the Region, 22 percent were destined for 36 counties elsewhere in Wisconsin, 54 percent were destined for 22 other states and the District of Columbia, and 2 percent were destined for Canada. The destinations of 3 percent were not recorded, as also shown in Table 68.

Table 68

DISTRIBUTION OF USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY TRIP ORIGIN AND DESTINATION THREE-DAY SURVEY PERIOD—1971

Location	Flight-making Airport Users			
	Origin		Destination	
	Number	Percent of Total	Number	Percent of Total
Region	123	19.2	140	19.0
Wisconsin Counties Outside Region	89	13.9	164	22.3
States Other Than Wisconsin	407	63.6	397	53.9
Canada	18	2.8	12	1.7
Not Recorded	3	0.5	23	3.1
Total	640[a]	100.0	736[a]	100.0

[a] *The total number of flight-making users equals 1,376, 209 more than the total of 1,167 flight-making users, since the 209 through flights were counted twice.*

Source: SEWRPC.

User flights between the surveyed airports and counties elsewhere in Wisconsin were found to be more numerous in Dane, Brown, Jefferson, and Rock Counties than in other counties. User flights between the surveyed airports and other states were found to be more numerous in the State of Illinois, Michigan, Ohio, Indiana, and Minnesota than in other states.

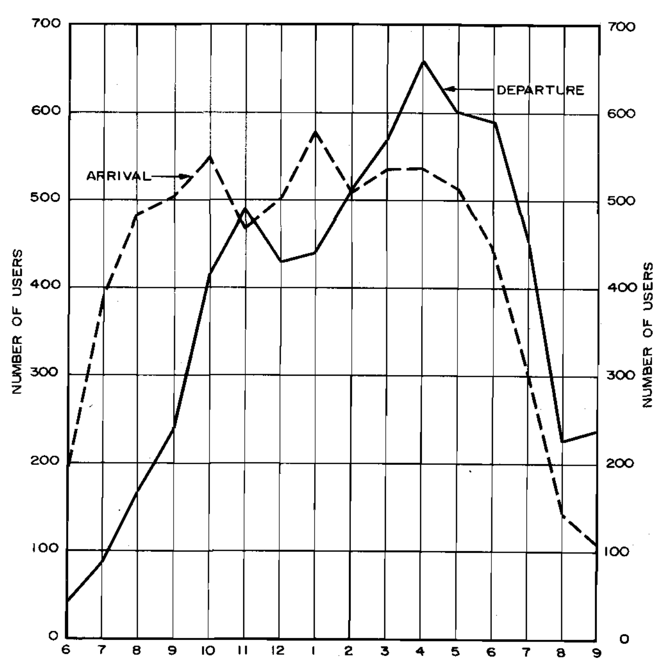
Arrival and Departure Times of Airport Users: Total user activity at general aviation airports increased sharply between 6 a.m. and 8 a.m., remained relatively steady between 8 a.m. and 6 p.m., and decreased sharply after 6 p.m. The peak hours for users entering the airports were 10 a.m and 1 p.m., whereas the peak hours of users leaving the airport occurred at 11 a.m. and 4 p.m.

Time and Distance of Airport User Between Travel Trip Origin Within the Region and Airport: Of the total airport user ground trips made to the general aviation airports surveyed, the elapsed time of ground travel from trip origin within the Region to the airport was 10 minutes or less for about 48 percent of the trips, 20 minutes or less for about 76 percent of the trips, 30 minutes or less for about 89 percent of the trips, 40 minutes or less for about 93 percent of the trips, and 60 minutes or less for virtually all trips. The average elapsed time ground travel was about 13 minutes, while the median elapsed time was about 11 minutes (see Figure 60).

In terms of distance from trip origins within the Region to the surveyed airports, about 78 percent of the trips originated within 10 miles; about 92 percent originated within 20 miles; about 98 percent originated within 40 miles; and virtually all trips originated within 60 miles of the surveyed airports. The average distance of ground travel was about eight miles, and the median distance was about seven miles, as shown in Figure 61.

Figure 59

DISTRIBUTION OF USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY ARRIVAL AND DEPARTURE TIMES THREE-DAY SURVEY PERIOD—1971



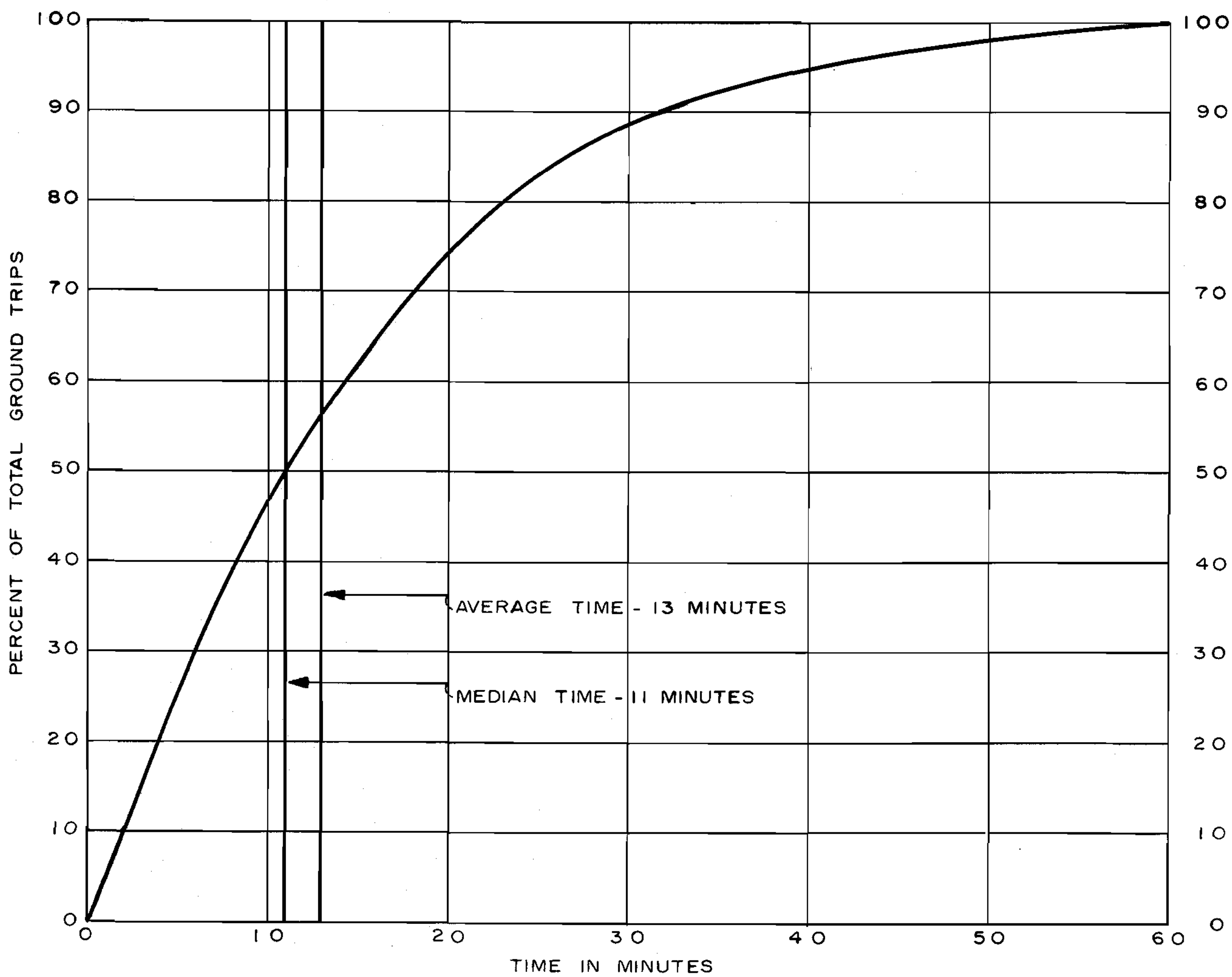
Source: SEWRPC.

SUMMARY

The major findings of the inventory of air and air-related ground travel conducted under the regional airport system planning program are summarized in this chapter.

Figure 60

PERCENTAGE DISTRIBUTION OF USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY GROUND TRAVEL TIME FROM TRIP ORIGIN WITHIN THE REGION TO THE AIRPORT THREE-DAY SURVEY PERIOD—1971



Source: SEWRPC.

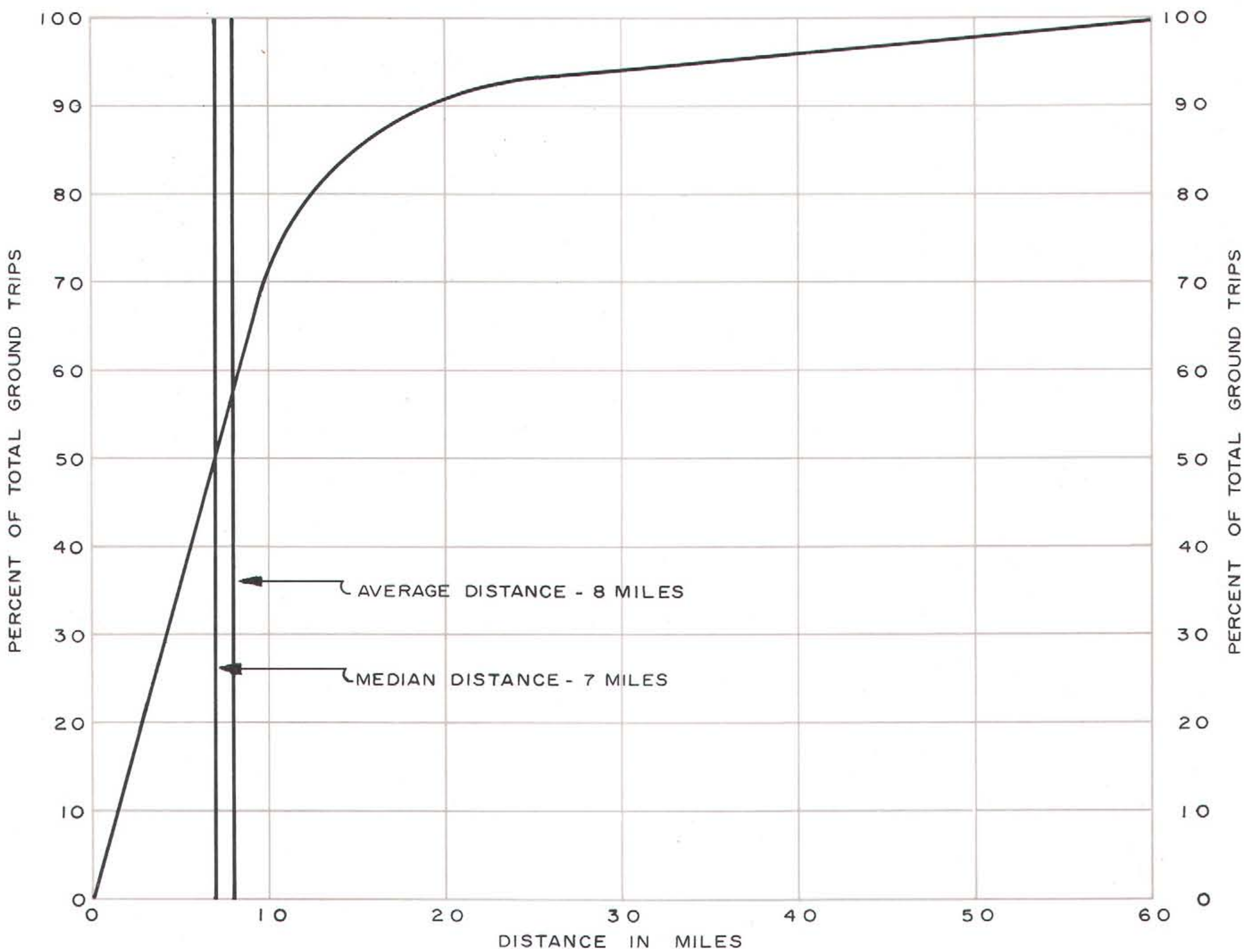
The inventories related to air carrier service and to the characteristics and travel patterns of enplaning airline passengers at General Mitchell Field, and to the characteristics and travel patterns of aircraft pilots and flight-making and non-flight-making airport users generated by 25 of the 29 general aviation airports located within or in close proximity to the Southeastern Wisconsin Region. The findings considered important for regional airport system planning include the following:

1. Five certificated air carriers served the Southeastern Wisconsin Region through General Mitchell Field in 1971. These included Eastern Air Lines, Inc.; North Central Airlines, Inc.; Northwest Airlines, Inc.; Ozark Air Lines, Inc.; and United Airlines, Inc. Of these, North Central, Northwest, and United were the most important carriers in terms of routes authorized and passenger traffic carried to and from General Mitchell Field. A comparison of air carrier service and passenger demand between cities served from General Mitchell Field indicated that the quality of service provided appeared to be low in comparison to demand between Milwaukee and the Cities of Kansas City, Los Angeles, Pittsburgh, and San Francisco.

2. Total aircraft operations at the 25 surveyed general aviation airports during a three-day survey period in 1971 included about 2,800 landings, 3,000 takeoffs, and 1,100 touch and go operations, which include both a landing and a takeoff. Four airports within the Region—General Mitchell Field and Timmerman Field in Milwaukee County,

Figure 61

PERCENTAGE DISTRIBUTION OF USERS OF GENERAL AVIATION AIRPORTS WITHIN AND ADJACENT TO THE REGION BY GROUND TRAVEL DISTANCE FROM TRIP ORIGIN WITHIN THE REGION TO THE AIRPORT
THREE-DAY SURVEY PERIOD—1971



Source: SEWRPC.

the Waukesha County Airport, and the Kenosha Municipal Airport—accounted for 56 percent of total landings and takeoffs, 79 percent of total touch and go operations, and 60 percent of the total local flights at these airports. The most heavily used airport within the Region in 1971, in terms of aircraft operations, was General Mitchell Field, with 657 landings, 683 takeoffs, and 253 touch and go operations. Timmerman Field had the highest number of touch and go operations with 298.

3. Approximately 70 percent of the 7,406 enplaning passengers interviewed and 1,669 general aviation pilot trips originated from points within the seven-county Region. An additional 13 percent of the enplaning passengers and 10 percent of the general aviation pilot trips originated elsewhere in Wisconsin. A significant number of enplaning general aviation passengers (64 percent) originated in other states. Approximately 19 percent originated within the Region, and an additional 14 percent originated within counties outside the Region.

4. Residential land uses are the primary origin and destination of air travelers within the Region. A majority of enplaning passengers (49 percent) reached the airline terminal directly from residential land uses. The other important land uses were hotels and motels (21 percent), commercial land uses (7 percent), and manufacturing land uses (7 percent). Residential and airport land uses together accounted for more than 85 percent

of the total land uses both at the origin and destination of pilot trips, with all other land uses accounting for 6 percent or less each of the total at both the origins and destinations. Land uses at the origin and destination of general aviation passengers consisted principally of airports (55 percent at origin and 63 percent at destination), residential uses (29 percent at origin and 16 percent at destination), and hotels and motels (8 percent both at origin and at destination). All other land uses accounted for 4 percent or less each of the total.

5. The predominant modes of travel used by enplaning passengers to reach General Mitchell Field were the private automobile (55 percent) and commercial aircraft (17 percent), with all other modes accounting for 10 percent or less each of the total. Travel modes of pilots to and from the surveyed airports were comprised largely of the private automobile (55 percent of the total to the airports and 47 percent from the airports), and private aircraft (38 percent to the airports and 44 percent from the airports), with all other modes amounting to 3 percent or less of the total travel to or from the airports. The most common modes of travel used by general aviation passengers to and from the surveyed airports were private aircraft (52 percent of the total from trip origin and 59 percent to the trip destination) and the private automobile (35 percent at the trip origin and 24 percent at the trip destination). All other modes accounted for 7 percent or less each of the total at origin and destination.

6. The ground travel time of enplaning passengers at General Mitchell Field averaged 23 minutes, with 78 percent of the originating passengers traveling 30 minutes or less and over 90 percent traveling 40 minutes or less to reach the airport. The average time that pilots spent in traveling on the ground to and from the general aviation airports was only 16 minutes, with 85 percent traveling 30 minutes or less to reach an airport. General aviation passengers were found to be within 13 minutes average ground travel time of the general aviation airports, and nearly 90 percent traveled 30 minutes or less. Over 90 percent of the general aviation airport users surveyed within the Region traveled 20 miles or less to reach the airport.

7. The primary purposes of air travel for enplaning air carrier passengers were work and work-connected business (35 percent) and social-recreational purposes (32 percent). For general aviation passengers, nearly 50 percent of the trips were for social-recreational purposes and less than 30 percent for work and work-connected business. About 14 percent of the pilot trips were made for work and work-connected business, about 29 percent for social-recreational purposes, and another 20 percent for instruction and proficiency.

8. The socioeconomic characteristics of commercial air passengers and the general aviation pilots and passengers were remarkably similar. Over 70 percent of the total enplaning passengers at General Mitchell Field were male, 75 percent of the passengers using general aviation transport were male, and 98 percent of the pilots were male. The median age of the enplaning passengers at General Mitchell Field was 42 years; of the passengers at the general aviation airports, 41 years; and of pilots of general aviation aircraft, 41 years. Eighty percent of the passengers using commercial air carriers and 85 percent of the general aviation passengers were between 25 and 65 years of age. About 14 percent of the air carrier and 13 percent of the general aviation passengers were under 25 years of age, and only 2 percent of the general aviation passengers and 6 percent of the air carrier passengers were 65 or older. Nearly 60 percent of the general aviation pilots were between 25 and 45 years of age. Over 90 percent were between ages 25 and 65. Only 6 percent were under 25, and only 1 percent were over 65. The median annual household income of the air transportation system users ranged from $15,700 for pilots to $16,650 for enplaning commercial airline passengers to $18,650 for general aviation passengers.

Geographic land use and socioeconomic factors together suggest that to effectively and efficiently serve air transportation needs and desires, which needs are generated primarily by residents of the Region, a system of airports closely related to residential land uses within the Region, located such that ground travel time and distance are kept within 30 minutes and 20 miles to maintain a service level that now accommodates approximately 85 percent of air transportation service users, will be required.

Further, these inventories have indicated that commercial air transportation is serving the needs of affluent men between 25 and 65 years of age, primarily for business and social-recreational purposes. The general aviation passenger is also affluent, male, and middle-aged, but travels primarily for social-recreational purposes and secondarily for work purposes. General aviation pilots, also affluent, male, and middle-aged, fly primarily for work and instruction/proficiency purposes. These geographic, land use, and socioeconomic factors have received consideration in the development of objectives and standards to guide and evaluate airport system plans, and in the allocation of public financial resources.

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Chapter VI

LEGAL, INSTITUTIONAL, AND PUBLIC FINANCIAL RESOURCE BASE CONSIDERATIONS IN REGIONAL AIRPORT SYSTEM PLANNING

INTRODUCTION

The current and probable future legal, institutional, and financial resources of the Region will, in large measure, dictate the extent and timing of regional airport system plan implementation. An inventory of these factors is necessary to fully appreciate their impact on plan implementation, and therefore on plan selection.

This chapter summarizes the inventory of the legal, institutional, and public financial resource factors affecting airport system plan implementation. The chapter describes federal, state, and local statutory authority and administrative rules affecting the development and operation of public airports, airport development programs, and related funding by various levels and agencies of government concerned. A history of public revenues from airport operation and expenditures for public airport facility development is also presented. The inventory of legal, institutional, and financial factors is intended to provide a basis for considering any needed legislative changes to effect implementation of the adopted regional airport system plan and preparation of administrative procedures and an organizational structure to administer, finance, and operate the recommended regional airport system. The legislative, administrative, and financial recommendations advanced will be conditioned by both the administrative and financing requirements of the recommended regional airport system, and a detailed analysis of inventory data relating to the existing public agencies responsible for operating airports in the Region, historical records of annual operating revenues and expenses of the airports in the Region, and federal, state, and local financial resources available to assist in the plan implementation.

LEGAL AND ADMINISTRATIVE BASIS FOR AIRPORT FACILITY DEVELOPMENT

Public airport development within the Region involves federal, state, and local units and agencies of government. Consequently, intergovernmental cooperation in airport facility development is essential. In Wisconsin, the local government owning an airport must look to the Wisconsin Department of Transportation, Division of Aeronautics, as well as to the Federal Aviation Administration for technical and financial assistance to develop and improve its airport. The following section summarizes the present legal framework and institutional structure for airport development at the federal, state, and local levels of government.

Federal Authority

Federal statutory authority for airport facility development is contained in the Airport and Airway Development Act of 1970 (Public Law 91-258) as amended. This Act mandates that the Federal Aviation Administration (FAA) administer the federal program through: 1) financial support of eligible capital improvement and land acquisition programs and of airport master plan and system plan studies; 2) technical assistance and advisory services on master and system planning, and the development of airport design, construction, and maintenance standards; and 3) federally sponsored research and development, and preparation and publication of the National Airport System Plan (NASP).

The federal airport development program as authorized by P.L. 91-258 is administered in accordance with the provisions of Federal Aviation Regulations (FAR) Part 152, Airport Aid Program. FAR Part 151 prescribes the policies and procedures for administering the Federal Aid Airport Program (FAAP) under the Federal Airport Act as amended (49 USC 1101 et seq.). Until the FAAP program is completely phased out, Part 151 will continue to govern federal grants made under that Act. For the purposes of this report, FAR Part 152 will be considered as the controlling federal administrative policy for airport facility development. Part 152 is organized into four major subparts as follows:

- Subpart A - prescribes general requirements applicable to projects under Part 152.
- Subpart B - prescribes rules and procedures for airport development projects under the Airport Development Aid Program (ADAP).
- Subpart C - prescribes project programming standards for airport development projects under the Airport Development Aid Program (ADAP).
- Subpart D - prescribes rules and procedures for conducting airport master planning and airport system planning projects under the Planning Grant Program (PGP).

The provisions of Part 152 which are pertinent to airport facility development within the context of a regional airport system plan concern the categories of airport development activities that are eligible for federal aid. These include land acquisition; site preparation; runway, taxiway, and apron improvements; airfield lighting; street and roadway work related to airport development; obstruction removal; fences; and navigational and landing aids. The development activities that are not eligible for federal aid, and which are also listed in Part 152, include land required for industrial and other nonairport purposes, maintenance work on runways, site preparation which is not a part of an overall site preparation project, lighting of public parking areas for passenger automobiles, and improvement of offsite roadways.

State Authority

The basic state statutory authority for airport development is Chapter 114 of the Wisconsin Statutes, entitled, "Aeronautics." Originally enacted in 1929, this Chapter has undergone several amendments, the last one occurring in 1967 with the reorganization of the state government and the creation of the Department of Transportation. The staffs of the predecessor Aeronautics Commission, Highway Commission, and Motor Vehicle Department became divisions in the new Department of Transportation. The Aeronautics Commission was abolished by this amendment, but its members were retained as a newly established Advisory Council on Aeronautics. All responsibilities and authority of the former Aeronautics Commission were transferred to the Secretary of the Department of Transportation.

Current provisions of the Wisconsin Statutes relative to airport facility development may be summarized as follows:

The Division of Aeronautics of the Department of Transportation is charged with laying out a comprehensive state system of airports to accommodate the aeronautical needs of the people of the state. This system must include every airport on the national system, at least one airport in each county, plus any other airports deemed necessary (Section 114.01). Receipts from the unrefunded portion of the tax on motor fuel used in aircraft, the airline property tax and the aircraft registration fees are allocated to the Secretary of Transportation for use to assist local airport sponsors in developing approved projects on the state airport system and to provide air-marking and air navigation facilities, and for the administration of the State Department of Transportation (Sections 114.35, 76.28, and 20.130).

Any county, city, village, town, or state agency may initiate and sponsor an airport project to be constructed with state and/or federal aid. A petition for state and federal funding must be filed with the Secretary of Transportation by the public sponsor. On receipt of the petition, the Secretary must hold a public hearing, after which he must issue a finding. A favorable finding must be submitted to the Governor, and only after approval by the Governor can state or federal airport funds be granted for airport construction projects (Section 114.33). No county, city, village, or town may submit a request for airport funds directly to the federal government. A local unit of government must designate the Secretary as its agent, who on its behalf will accept, receive and disburse federal funds (Section 114.32).

The costs of projects to be funded under the Federal Airport and Airway Development Act, in excess of the federal share, must be borne by the local sponsor and the state, except that the state shall not pay more than one-half of the nonfederal share nor more than $35,000 for the cost of a building project. The state cannot participate in the cost of constructing or improving hangars. For projects not funded under the Federal Airport and Airway Development Act, the state shall not pay more than one-half of the total project costs nor more than $35,000 of the cost of building projects nor participate in the cost of hangar construction or improvement (Section 114.34).

The local public sponsor has the power to protect aerial approaches to airports by a special-purpose "airport zoning ordinance" regulating, restricting, and determining the use, location, height, number of stories, and size of buildings and structures and objects of natural growth within three miles of the airport. This ordinance is effective even though the land affected may not be within the jurisdictional boundaries of the unit of government imposing the ordinance (Section 114.136). On lands not affected by such an ordinance, a permit must be obtained from the Secretary to erect any structure more than 500 feet above ground level within one mile of the airport, or 150 feet above ground level if it would be above the slope of one foot vertical for each 40 feet horizontal from the nearest airport boundary (Section 114.135).

The Wisconsin Statutes give full authority to counties, cities, towns, and villages to acquire, own, and operate airports. The power of condemnation for this purpose is expressly authorized, and cities and villages are allowed to bond themselves to provide airport facilities. In the operation of such facilities, municipalities are authorized to make reasonable rules and regulations and to charge fees to pay for operating costs (Chapters 59, 60, 61, 62, and Section 67.04).

Chapter 114 of the Wisconsin Statutes specifies the powers and duties of the Secretary of Transportation, including, among others, the administration of all aviation matters within the state. More specifically, Section 114.31 of the Statutes empowers the Secretary to provide general supervision of aeronautics in the state and to promote and foster the sound development of aviation; promote aviation education and training programs; safeguard the interests of those engaged in all phases of aviation; formulate, recommend, and promote reasonable regulations in the interests of safety; coordinate state aviation activities with those of other states and the federal government; and inform himself about all federal laws affecting aeronautics in the state, and pending legislation providing for a national airport system so that he may recommend measures to the Governor and the Legislature that will best enable the state to derive the maximum benefits from such legislation if and when it becomes effective. Section 114.31 also establishes a priority system for determining annual airport development projects. By July 1 of each even numbered year, the governing body of each county, city, village, or town that contemplates an airport development project in the next six years for which it proposes to request state or federal aid shall notify the Secretary of its intent and submit such information as he requires. The Secretary shall establish priorities for proposed projects in relation to the overall airport development plan, taking into account such factors as industrial, commercial, recreational and resource development and transportation needs. As part of his budget report, the Secretary shall submit a tentative priority list of projects he recommends for state aid in the following biennium.

AIRPORT FACILITY ADMINISTRATIVE STRUCTURE

Chapter 114 of the Wisconsin Statutes also delegates responsibility for the operation and maintenance of public airports to local units of government. Section 114.14 of the Act allows the governing body of a city, village, town, or county to adopt regulations and to establish fees or charges for the use of the airport or landing field, and to establish an airport commission with complete and exclusive control and management over the airport. The airport commission may employ a manager who may be a member of the commission.

Section 114.15 permits the governing body of a city, village, town, or county to annually appropriate and cause to be raised by taxation a sum sufficient to carry out the provisions of Chapter 114. Section 114.151 permits any two or more governing bodies of a city, village, town, or county to join together to acquire, equip, and operate airports or landing fields. Any governing body participating in the ownership or operation of a joint airport may at any time, by simple resolution, withdraw from such joint operation or control and thereby relinquish its interest in the airport.

The existing administrative structures of the eight publicly owned airports in the Region are as varied as the degree of facility development. The legal authority for the operation of all of these public airports, however, rests with Chapter 114 of the Wisconsin Statutes. Each of the airports was visited during the 1971 inventory to determine how each local unit of government administered its airport. A summary of the findings of the structured personal interviews conducted with the officials responsible for the operation and maintenance of each of these public airports follows.

Kenosha Municipal Airport[1]

The Kenosha Municipal Airport is owned, operated, and maintained by the City of Kenosha. A three-member Airport Commission, appointed by the Mayor and approved by the City Council of the City of Kenosha, provides policy direction. The Transportation Director of the City of Kenosha is responsible for managing the airport, harbor, and transit operations for the city. Fixed base operator service[2] is provided by Kenosha Aviation Service, Inc. under a nonexclusive 50-year lease agreement with the city having five-year review periods.

General Mitchell Field[3]

The only air carrier airport within the Region is owned, operated, and maintained by Milwaukee County. The Milwaukee County Board of Supervisors provides policy direction through its Transportation and Public Works Committee. The Airport Division of the Department of Public Works of Milwaukee County, in its role as airport manager, is responsible for all maintenance, operations, and crash, fire, and rescue services conducted on the airport grounds, and is responsible for the planning of airport and terminal expansion. The Milwaukee County Sheriff's Department provides general airport security services. The Federal Aviation Administration is responsible for the control of all aircraft movements at General Mitchell Field and for the installation, operation, and maintenance of all on- and off-airport navigational and runway approach aids. Milwaukee County is responsible for maintaining runway and taxiway lighting. To accommodate general aviation aircraft demands, Milwaukee County leases space to private corporations and the two fixed base operators, Aerodyne, Inc. and Mitchell Aero, Inc.

Timmerman Field[4]

The busiest general aviation airport within the Region is owned, operated, and maintained by Milwaukee County. The Airport Division of the Department of Public Works is responsible for management functions at Timmerman Field, and carries out policy direction from the Transportation and Public Works Committee of the Milwaukee County Board of Supervisors. The Federal Aviation Administration provides tower services 18 hours per day in space provided by Milwaukee County, and controls all aircraft movements at Timmerman Field. Gran-Aire, Inc. has a nonexclusive lease with Milwaukee County to provide fixed base operator services for the general aviation traffic using Timmerman Field.

Burlington Municipal Airport

The Burlington Municipal Airport is owned and maintained by the City of Burlington and managed by Burlington Airways, Inc., the fixed based operator, under

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[1] *At the time of the 1971 inventory, maintenance and management of the Kenosha Municipal Airport was provided by Kenosha Aviation Service, Inc., the fixed base operator.*

[2] *Fixed base operator (FBO) service is a commercial operation at an airport which provides services to general aviation, including aircraft fueling and maintenance, flight training, aircraft storage, aircraft and parts sales, pilot briefing, and restaurant facilities. Additional services of operating and maintaining the airport facility are sometimes included under contractual arrangements with the airport owner.*

[3] *At the time of the 1971 inventory, policy direction of operations at General Mitchell Field was provided by the Airport Committee of the Milwaukee County Board of Supervisors. The airport management, including security, was the responsibility of the then existing Milwaukee County Airport Department, and Midwest Airways, Inc. was a fixed base operator which was purchased by Aerodyne, Inc. in 1973.*

[4] *At the time of the 1971 inventory, policy direction of Timmerman Field operations was provided by the Airport Committee of the Milwaukee County Board of Supervisors. Airport management and routine maintenance were the responsibility of Gran-Aire, Inc., the fixed base operator, and major maintenance and capital improvements were the responsibility of the then existing Milwaukee County Airport Department.*

terms of a five-year renewable nonexclusive lease agreement with the city. The three-member Airport Committee of the Burlington Common Council provides airport policy direction.

East Troy Municipal Airport[5]
The East Troy Municipal Airport is owned by the Village of East Troy and managed by Milwaukee Executive Chapter and Air Freight, Inc., the fixed base operator, under terms of a nonexclusive 20-year lease agreement with the city. The Airport Committee of the Village Board provides airport policy direction. Airport maintenance is shared by the village and the fixed base operator.

Hartford Municipal Airport[6]
The Hartford Municipal Airport is owned by the City of Hartford and managed by Traggis Aviation Corporation, the fixed base operator, under the terms of a three-year management agreement with the city. Fixed base operator services are provided by Traggis Aviation Corporation under terms of a nonexclusive 25-year lease agreement with the city. The city provides policy direction through the Airport Committee of the City Council. Airport facility maintenance is provided by city forces under the supervision of the airport manager.

West Bend Municipal Airport
The West Bend Municipal Airport is owned and maintained by the City of West Bend and managed by West Bend Flying Service, Inc., the fixed base operator, under terms of a management agreement with the city that is subject to review every three years. The fixed base operator services are provided under terms of a 50-year lease agreement with the city. Airport policy direction is provided jointly by an Airport Committee, a standing committee of the Common Council consisting of four aldermen, and an Airport Board consisting of one alderman and five citizens.

Waukesha County Airport
The Waukesha County Airport is owned by Waukesha County and managed by Spring City Flying Service, Inc., the fixed base operator, under terms of a nonexclusive 10-year lease agreement with the county that will expire January 1, 1978. The Agricultural and Resource Committee of the Waukesha County Board of Supervisors is responsible for airport policy direction. The agri-business agent for the Waukesha County office of the University of Wisconsin-Extension, in consultation with university resource personnel, performs the staff functions of long-term planning, capital improvement budgeting, and liaison between the county and the fixed base operator. The county is responsible for major maintenance of the physical facilities, landing area system, buildings, and hangars, which are all owned by the county, while the fixed base operator is responsible for routine day-to-day airport maintenance functions. An aircraft tower was provided by and operated under county jurisdiction in 1974.

In summary, the inventory indicated that the existing administrative structures of the publicly owned airports within the Region are generally commensurate with the level of activity and revenue generated at each facility. The less busy general aviation airports are maintained by the Public Works Department of the owner agency, but the management is provided by the fixed base operator at the airport. By contrast, the two busiest airports—General Mitchell Field and Timmerman Field—are completely administered by Milwaukee County. The range of administrative procedures utilized by the local units of government is logical and generally consistent with approaches taken in other parts of the state and the United States.

ORDINANCES GOVERNING AIRPORT DEVELOPMENT

Federal, state, and local ordinances governing airport development, specifically with respect to land use near airports, clear zone protection, noise abatement, and air pollution abatement, constitute an area of legislation that needs more attention. Since the advent of turbine powered aircraft, much has been said about the need for compatible use of lands adjacent to airports, particularly in the approaches to runways. Model zoning ordinances limiting the height of aeronautical hazards in the vicinity of airports have been enacted by many states and local units of government concerned with the operation of airports. Federal Aviation Regulations (FAR) Part 77 specify the technical requirements for height zoning, and most ordinances are based upon these requirements. Clear zone protection requirements are also specified by FAR parts 77 and 152.

Although there is currently no federal requirement that airport operations conform to noise and air pollution standards, the U. S. Environmental Protection Agency is presently formulating standards of this type. No specific legislation or regulations requiring conformance have as yet been developed.

Recent policy changes by the Federal Aviation Administration in its administration of the Airport Development Aid Program (ADAP) and Planning Grant Program (PGP) provide financial incentives for communities and airport operators to voluntarily achieve a more compatible land use-airport relationship. Under the PGP, the funding of land use planning in communities adjacent to an airport is now eligible for federal aid. FAA Order 5100-17 Change 2 authorizes federal aid under ADAP for the purchase of incompatible land uses and development that has encroached on available land near an airport.

In July 1973, Wisconsin State Senator Reuben LaFave, at the request of the Wisconsin Department of Transportation, introduced Senate Bill 682 which, if adopted,

[5] *At the time of the 1971 inventory, the Village of East Troy retained an airport manager to manage and maintain airport facilities.*

[6] *At the time of the 1971 inventory, the fixed base operator at the Hartford Municipal Airport was Zivko Aviation.*

would permit municipal and county airport owners in counties having a population under 500,000 to enact land use zoning ordinances within a three-mile limit of the airport boundaries, subject to approval by the Secretary of the Department of Transportation, and to promote development of mutually compatible land uses and structures within the affected zoned areas around airports. The bill provides that the current zoning classification be retained in areas within three miles of airport boundaries until changes are effected under this new statute. The Department of Transportation would provide criteria and guidelines to the airport-owner unit of government to serve as minimum standards for establishment of acceptable zoning ordinances in the affected zoning area. Under this legislation, and if the municipal or county airport owner does not adopt reasonable and effective zoning ordinances for its affected zoning area within two years after designation of the area, the Secretary of the Department of Transportation shall adopt, as soon as possible after a public hearing, a reasonable and effective zoning ordinance. This proposed legislation was not adopted by the 1973 session of the Legislature and is being prepared for reintroduction to the 1975 session. In 1973, the proposed legislation was referred to the Committee on Transportation, which held one public hearing but took no further action.

Presently, the power to zone and control the use of land in the vicinity of airports is vested with the local units of government. Section 114.136 of the Wisconsin Statutes provides that any county, city, village, or town that is the owner of a site for an airport which has been approved for such purpose by the appropriate agencies of the state and federal government may protect the aerial approaches to the site by an ordinance regulating, restricting, and determining the use, location, height, number of stories, and size of buildings, structures, and objects of natural growth in the vicinity of the site. The ordinance shall be effective whether the site and lands affected are located within or without the limits of the pubic airport owner, and may be administered without the consent of any other governing body.

In addition to the zoning powers given to the public agency owner of an airport, the Wisconsin Statutes have also given land use zoning powers to the local units of government to regulate the use of land and water; the height, size, shape, and placement of structures; and the density of population. Enabling legislation in the State of Wisconsin which permits cities, villages, towns, and counties to make use of the zoning powers is found in the following sections of the Wisconsin Statutes (1961): city zoning—Section 62.23(7); village zoning—Section 61.35; town zoning—Sections 60.74 and 60.75; county zoning—Sections 59.97 and 59.99; and extraterritorial zoning—Sections 59.970(6), 62.23(7a), 66.052, and 114.136 (airport zoning).

The Regional Planning Commission has prepared Planning Guide No. 3, Zoning Guide, to explain the fundamentals of good zoning practice and to present a model zoning ordinance to be used as a guide in the formulation of local zoning ordinances, and thereby to assist the local units of government in achieving better zoning standards throughout the Region. This guide suggests that those communities with federal or state approved airport facilities prepare a special airport zoning ordinance pursuant to Section 114.136 of the Wisconsin Statutes rather than attempt to include provision of airport zoning in their general zoning ordinance. It should be expected that the airport zoning and comprehensive zoning would be made compatible in those instances where the same public agency is preparing the zoning legislation. For those airport sponsors developing airport zoning in areas under the comprehensive zoning control of other units of government, extensive interjurisdictional agency review and coordination should be achieved to develop an acceptable zoning plan for airports as well as other land uses.

A special inventory was undertaken to determine the current local ordinances covering zoning and land use controls for the eight publicly owned airports in the Region. Table 69 presents a summary of the results of this inventory. It was found that the airport zoning ordinances related to land use on the airport site and regulation of aircraft operations, and that the height control ordinances were the only off-airport land use control.

The control of land use development in the vicinity of privately owned airports is made possible through Section 114.135 of the Wisconsin Statutes. This section provides that the aerial approaches to any airport owned and operated by corporations organized to provide aeronautic facilities to the general public may be protected in the following manner: The owner of such airport shall prepare and file with the register of deeds plans and specifications showing the land affected; the owner of each parcel or interest therein, whether public or private; the regulations to be imposed on each parcel; and the structures, buildings, or other objects to be removed. The owner or managing body of the airport may negotiate and acquire from the owner of the various parcels or interest therein, by deeds, the protection privileges shown by the plans and specifications. Referring in the deed to the plans and specifications and briefly describing them shall be deemed sufficient legal description to convey the protection privileges set forth in the plans and specifications in the property of the grantor or grantors. If the airport owner is unable to obtain the desired protection privileges by negotiation, he may acquire them by eminent domain in the manner set forth in Chapter 32, except lands and buildings of railway companies which are necessary to, or are used in connection with, the operation of the railway. In case the protection privileges sought extend into more than one county, the plans and specifications shall be filed with the register of deeds of each county. In case any parcel of land lies in more than one county, eminent domain proceedings may be instituted in the circuit court of any county in which the parcel is situated, provided a certified copy of the final judgment with a description of the property involved is recorded with the register of deeds of all counties in which the parcel lies.

The extent to which owners of private airports open to the public have obtained protection privileges under this

Table 69

AIRPORT ZONING AND HEIGHT CONTROLS ADOPTED BY GOVERNMENTAL UNITS OWNING PUBLIC AIRPORTS IN THE REGION: 1971

Airport	Control Regulation: Airport Zoning	Control Regulation: Height Control	Statutory Authority[a]
Kenosha Municipal	Chapter 18, City of Kenosha Code of General Ordinances, "Kenosha Municipal Airport Operations and Regulations"	Chapter 18, City of Kenosha Code of General Ordinances, "Kenosha Municipal Airport Operations and Regulations"	Section 114.136
General Mitchell Field	None	Chapter 84, Milwaukee County Code of Ordinances, "Height Limitation at Airports"	Section 114.136
Timmerman Field	None	Chapter 84, Milwaukee County Code of Ordinances, "Height Limitation at Airports"	Section 114.136
Burlington Municipal	Chapter 19, City of Burlington Municipal Code, "Airport Zoning and Regulation"	None	Section 114.136
East Troy Municipal.	Chapter 17.14, Village of East Troy Zoning Code, "Airport Zoning"[b]	Chapter 17.14, Village of East Troy Zoning Code, "Airport Zoning"[b]	Section 114.136
Hartford Municipal	Chapter 9, City of Hartford Municipal Code, "Airport"	Chapter 9, City of Hartford Municipal Code, "Airport"	Section 114.136
West Bend Municipal	Chapter 13, City of West Bend Municipal Code, "Parks and Airports"	Chapter 13, City of West Bend Municipal Code, "Parks and Airports"	Section 114.136
Waukesha County	None	Waukesha County ordinance "regulating height of structures and trees and regulating use of property in the vicinity of the Waukesha County Airport." Adopted under Resolution No. 147.	Section 114.136

[a] *The statutory authority in each case is Section 114.136 of the Wisconsin Statutes.*

[b] *Inadvertently repealed in 1971 through adoption of a revised comprehensive zoning ordinance. Village officials are expected to take action to reincorporate the necessary zoning provision in the village zoning ordinances.*

Source: SEWRPC.

section of the Wisconsin Statutes was not inventoried. If any currently privately owned airports are recommended as an element of the regional system plan, the records of the County Register of Deeds will be reviewed to identify any restrictions that may exist.

AIRPORT DEVELOPMENT PROGRAMS

As previously noted, airport development within the Region must be achieved through a cooperative effort by concerned federal, state, and local units and agencies of government. This section reviews current governmental programs available for airport improvement, and presents a 10-year history of development investment at the eight publicly owned airports in the Region. The latter is intended to provide a basis for estimating the level of financial resources that would be available to support the implementation of a recommended regional airport system plan.

Federal Program

Since 1946, the federal government has provided financial assistance for the development of a publicly owned airport system throughout the United States. In 1946, the Congress enacted the Federal Airport Act, which provided funds for airport improvement appropriated annually from the general fund. In 1970, the Airport and Airway Development Act was enacted by Congress to replace the Federal Airport Act aid program. The new Act authorized federal aviation user charges to generate revenue for airport and airway development programs in order to reduce reliance on appropriations from the general fund. The revenues derived from the user charges are placed in a separate airport and airway trust fund, and Congress authorizes annual appropriations from this fund. The Act restricts the use of these funds to aviation purposes only.

The aviation user charges authorized by the Act include an 8 percent tax on domestic airline fares, a 5 percent tax on domestic air cargo tariffs, a $3 per passenger tax on all departing international flights, a seven-cent-per-gallon tax on aviation fuels purchased by noncommercial aviation, and a $25 annual tax on all civil aircraft (airline and general aviation), plus the following additional annual taxes: 3.5 cents per pound on all turbine powered aircraft, two cents per pound on all piston powered aircraft for each pound above 2,500 pounds maximum certificated takeoff weight, and excise taxes on aircraft tires and tubes (formerly deposited in the Highway Trust Fund).

The currently authorized level of federal funding for the fiscal 1974 ADAP Program is $310 million. A total of $275 million is apportioned to airports served by air carriers certificated by the Civil Aeronautics Board and to designated general aviation airports which "relieve congestion at airports having a high density of traffic and which serve all segments of civil aviation." The remaining $35 million is earmarked exclusively for airports serving general aviation. In addition to these ADAP funds, $15 million is provided for master plan and system plan planning grants under the PGP program.

The distribution of the $275 million for air carrier and "reliever" general aviation airports is made according to the following formula: $88,917,000 for distribution to states based upon an area/population ratio; $2,750,000 for Hawaii (35 percent), Puerto Rico (35 percent), Guam (15 percent), and the Virgin Islands (15 percent); $91,666,500 to individual airport sponsors based upon the ratio of enplaned passengers at airports served by air carriers to the total enplanements at all such airports; and $91,666,500 to be allocated at the discretion of the U. S. Secretary of Transportation. Of the $35 million for airports serving general aviation, $25,725,000 is apportioned to states based upon the area/population ratio; $525,000 is apportioned to airports in Hawaii, Guam, Puerto Rico, and the Virgin Islands; and $8,750,000 is to be allocated at the discretion of the Secretary.

The amounts apportioned to each state are available for a two-year period. Amounts designated for individual airport sponsors through the enplaned passenger formula are available for a three-year period. Funds not obligated by a grant agreement between FAA and an airport sponsor by the expiration date are added to the Secretary's discretionary fund for airport development without regard to geographical boundaries.

Applying these formulas to the authorized $310 million produces an estimated $4.4 million in federal aid available for airport development in Wisconsin in fiscal year 1974 for air carrier and reliever airports, and about $700,000 for general aviation airports. These totals include about 2 percent of the available discretionary funds, since the FAA does not have a formula for apportioning such funds. The estimated 2 percent used in the computation approximates the Wisconsin share of the nondiscretionary funds.

The Airport Development Acceleration Act of 1973 (Public Law 93-44) amended the Airport and Airway Development Act of 1970 by increasing the federal share of eligible project costs from 50 percent to 75 percent at all airports except large hub airports (there are no airports of this classification in the Region), and increasing the federal share of eligible fire fighting equipment and security equipment costs from 50 to 82 percent.

In summary, it can be anticipated that about $5.1 million in ADAP funds will be available annually for airport projects in Wisconsin if the present national level of ADAP funding is maintained. This compares with the actual federal aid expended in Wisconsin during the five-year period 1968 through 1972 of $7,542,078 from FAAP and ADAP. The total federal aid expended in Wisconsin during this period averaged about $1,660,000 per year, or less than one-third of the anticipated available federal aid at the present level of funding.

State Program

Wisconsin Statutes limit state financial aid on airport development projects to no more than 50 percent of the nonfederal share of the cost. Further limitations exclude state aid for hangars. Eligible building projects are restricted to a maximum of $35,000 in state funds. Prior to the enactment of the Airport Development Acceleration Act of 1973, (P.L. 93-44), the state share of the cost was restricted to 25 percent of the total project cost. During the ten-year period ending in 1971, actual state funds available for projects only averaged 12 percent of total project costs, or about 50 percent of the statutory limitation.

As already noted, under the provisions of P.L. 93-44 the federal share of all projects in Wisconsin will be 75 percent, leaving 25 percent to be funded equally by the state and airport sponsor. The state's share (12.5 percent) of the total cost compares closely with the ten-year historical experience of state aid. Although no formal policy exists concerning allocation of state aid to airport projects, long-term experience shows that about 51 percent has been expended on the 10 air carrier airports and the remaining 49 percent has been expended on the 57 publicly owned general aviation airports within Wisconsin. Of the state aid expended within the Region during the 1963-1972 period, about 72 percent has been expended at General Mitchell Field and 28 percent has been expended at the other seven publicly owned airports.

Between 1947 and 1953, state airport aid funds were obtained from the general fund. In 1953, the law was changed so that taxes collected on airline properties, unrefunded motor fuel taxes, and aircraft registration fees could be added to the funds appropriated from the general fund. Since 1961, only the latter tax funds have been available for airport development, since no funds were appropriated from the general fund after this date for this purpose. Since 1972, the unrefunded aviation fuel tax has not been separated from the highway motor fuel tax, and is now used to help finance the administrative costs of the Wisconsin Department of Transportation.

Table 70 sets forth the five-year history of dedicated aviation revenues collected and the amount of state airport aid funds available. The Wisconsin Department of Transportation estimates that about $41 million for airport aid will accrue during the period from 1973 to 1995 if the current growth trend of the dedicated revenue funds continues.

Local Programs

Locally generated revenues for airport development are most often appropriated from general funds on a pay-as-you-go basis. Occasionally, direct user benefit taxation is used at airports that have the capability of producing significant revenue from landing fees, building and general rentals, and concessions. It is difficult to predict the future levels of local funds that would be available for airport development. Local funds for airport development are not normally earmarked, and therefore vary from year to year and compete with funding requirements of other governmental activities. Since the sources of local funds are not discernibly related to general airport user variables such as fuel consumption and aircraft registrations, the Wisconsin Department of Transportation has estimated the availability of local funds based on an average of the last five-year history of local funds expended, assuming this average to be constant through 1995. This estimate amounts to about $46 million for the period between 1973 and 1995.

Table 71 presents data on local airport sponsor funds expended on federal and state aid program projects within the Region for the period 1963 to 1972. No record exists of local funds expended on airport projects not involving federal or state aid. Table 72 sets forth total expenditures for the 1963 to 1972 period for each of the publicly owned airports within the Region.

PUBLIC REVENUES AND EXPENDITURES FOR AIRPORT FACILITY DEVELOPMENT

The previous section dealt with the federal and state aid airport development programs, including the current level of funding available and estimates of funding levels that will be available through 1995. The section also presented

Table 70

AVIATION REVENUES COLLECTED AND STATE AIRPORT AID FUNDS AVAILABLE FOR AIRPORT DEVELOPMENT IN WISCONSIN: 1968-1972

Fiscal Year	Aviation Revenues					State Airport Aid Funds
	Unrefunded Gas Taxes	Airline Property Taxes	Aircraft Registration Fees	Miscellaneous[a]	Total	
1968	$176,229	$ 548,004	$ 75,233	$ --	$ 799,466	$ 434,044
1969	130,297	848,234	87,650	4,885	1,071,066	759,732
1970	127,801	1,117,398	90,598	6,301	1,342,098	924,633
1971	172,154	1,185,421	90,437	9,138	1,457,150	1,023,090
1972	--	1,153,034	96,636	--	1,249,670	929,294
Total	$606,481	$4,852,091	$440,554	$20,324	$5,919,450	$4,070,793

[a] *Charges for use of departmental aircraft.*

Source: Wisconsin Division of Aeronautics, Bureau of Finance.

the local funds expended on federal and state aid projects and the expected future level of expenditure. This section deals with the operating revenues and expenditures for each of the eight publicly owned airports, and statutory limitations on taxation and indebtedness imposed upon the local units of government.

During the inventory phase of the study, the annual operating revenues and expenditures at each of the eight publicly owned airports were obtained for the five-year period 1966 to 1970. Although it was intended to obtain the sources of revenues and expenditures, data were not uniformly available at that level of detail. Table 73 sets forth annual revenues and expenditures for each publicly owned airport within the Region. Only at General Mitchell Field and Timmerman Field did revenues exceed expenditures, providing an operating profit for Milwaukee County of some $4 million, while the other six airports had a cumulative operating deficit of almost $700,000 for the same period. It is anticipated that with county assumption of the management and maintenance of Timmerman Field, this airport will not continue to show revenues exceeding expenditures in the near future.

The Wisconsin Statutes place limitations on the fiscal powers of local units of government in terms of indebtedness and tax rate. Local funding for airport development must be raised within these state mandated constraints in addition to competing with other needed municipal capital improvements. To evaluate these constraints, the applicable Wisconsin Statutes, the status of the level of existing debt, and the tax levies that could be imposed by the local governments that now operate airports were identified.

The limit of indebtedness that any municipality in Wisconsin may incur is 5 percent of the equalized valuation of all taxable property located within the boundaries of the municipality (Section 69.03). As of 1971, all of the municipalities inventoried were below the statutory ceiling of funded debt. Table 74 summarizes the level of debt of each municipality. The eight units of government had a combined indebtedness of $206,191,372 compared to a statutory debt limit of $496,640,765 based on the equalized value of taxable property in 1971.

The ability of municipalities to raise funds through taxes is also controlled by the Wisconsin Statutes. Taxing powers differ for the various classes of municipal government as shown in Table 75. All taxes levied by a munici-

Table 71

EXPENDITURES FOR STATE AND FEDERAL AIRPORT AID PROJECTS IN THE REGION: 1963-1972

Year	Expenditure			
	Federal	State	Local	Total
1963	$ 585,659	$ 103,490	$ 613,814	$1,302,963
1964	912,670	173,434	363,903	1,450,007
1965	318,721	8,496	116,621	443,838
1966	345,068	62,010	- 109,359[a]	297,719
1967	349,460	36,349	- 111,479[a]	274,330
1968	349,494	73,532	- 28,644[a]	394,382
1969	273,340	230,431	536,164	1,039,935
1970	528,952	293,116	580,722	1,402,790
1971	285,020	193,440	294,095	772,555
1972	178,901	104,252	179,178	462,331
Total	$4,127,285	$1,278,550	$2,435,015	$7,840,850
Annual Average	$ 412,728	$ 127,855	$ 243,502	$ 784,085

[a] *The negative local share represents the transfer of previously reported expenditures from the local to the federal share.*

Source: *Wisconsin Department of Transportation.*

Table 72

EXPENDITURES FOR STATE AND FEDERAL AIRPORT AID PROJECTS FOR PUBLICLY OWNED AIRPORTS IN THE REGION 1963-1972

Airport	Expenditure			
	Federal	State	Local	Total
Kenosha Municipal	$ 117,312	$ 33,098	$ 72,608	$ 223,018
General Mitchell Field	3,322,797	926,524	1,830,029	6,079,350
Timmerman Field	280,824	19,998	- 112,707	188,115
Burlington Municipal	48,200	80,192	71,626	200,018
East Troy Municipal	--	--	--	--
Hartford Municipal	33,412	33,922	35,723	103,057
West Bend Municipal	104,350	75,932	231,356	411,638
Waukesha County	220,389	108,883	306,381	635,653
Total	$4,127,284	$1,278,549	$2,435,016	$7,840,849

Source: *Wisconsin Department of Transportation.*

Table 73

REVENUES AND EXPENDITURES FOR PUBLICLY OWNED AIRPORTS IN THE REGION: 1966-1970

Airport	1966		1967		1968		1969		1970		Annual Average		Ratio of Revenues to Expenditures
	Revenues[a]	Expenditures[b]	Revenues[a]	Expenditures[b]	Revenues[a]	Expenditures[b]	Revenues[a]	Expenditures[b]	Revenues[a]	Expenditures[b]	Revenues[a]	Expenditures[b]	
Kenosha Municipal	$ 3,601	$ 31,872	$ 4.455	$ 34,559	$ 7,981	$ 32,274	$ 1,219	$ 4,547	$ 7,895	$ 16,109	$ 5,030	$ 23,872	0.21
General Mitchell Field . .	1,229,126	897,931	1,439,788	890,995	1,914,452	1,051,622	2,181,253	1,167,402	2,422,738	1,247,790	1,837,471	1,051,148	1.75
Timmerman Field	22,754	3,687	23,359	4,053	22,292	8,869	22,735	53,398	23,754	9,988	22,979	15,999	1.44
Burlington Municipal . . .	--	2,753	--	10,550	2,000	62,513	2,000	38,788	3,500	2,667	1,500	23,454	0.06
East Troy Municipal. . . .	1,010	652	1,715	25,856	2,445	2,291	1,219	4,547	1,538	3,944	1,585	7,458	0.21
Hartford Municipal	--	--	2,802	7,500	3,738	9,700	3,210	6,116	3,223	6,660	2,595	5,995	0.43
West Bend Municipal . . .	10,905	17,051	7,109	13,025	10,656	18,979	10,811	32,673	10,601	152,952	10,016	46,936	0.21
Waukesha County	42,503	130,562	43,271	152,252	53,032	51,468	53,998	68,432	48,934	74,174	48,348	95,378	0.51
Region	$1,309,898	$1,084,508	$1,522,499	$1,138,790	$2,016,596	$1,237,716	$2,276,445	$1,375,903	$2,522,183	$1,514,284	$1,929,524	$1,270,240	1.52

[a] *Includes all revenues reported by both the owner and operator of the publicly owned airport.*

[b] *Includes operation, maintenance, and nonfederal and state supported capital expenditures reported by both the owner and operator of the publicly owned airport, but does not include allowance for depreciation of the capital investment.*

Source: SEWRPC.

Table 74

LEVELS AND LIMITS OF DEBT OF UNITS OF GOVERNMENT OWNING PUBLIC AIRPORTS IN THE REGION: 1971

Unit of Government	Debt Level		Debt Limit		Difference Between Debt Unit and Debt Level
	Amount	Percent of Equalized Value of Taxable Property	Amount	Percent of Equalized Value of Taxable Property	
City of Kenosha	$ 17,080,000	2.980	$ 28,599,850	5.0	$ 11,519,850
Milwaukee County.	178,126,000	2.020	440,630,800	5.0	262,504,800
City of Burlington	895,000	1.260	3,531,852	5.0	4,730,920
Village of East Troy. . . .	350,000	2.330	750,000	5.0	400,000
City of Hartford	352,640	0.587	3,202,530	5.0	2,849,890
City of West Bend	3,919,750	2.265	8,650,670	5.0	4,730,920
Waukesha County	5,467,982	2.380	11,474,447	5.0	6,006,465
Total	$206,191,372	--	$496,640,765	--	$290,449,393

Source: Wisconsin Department of Revenue, Bureau of Property Taxation; local units of government owning public airports in the Region; and SEWRPC.

Table 75

STATUTORY LIMITATIONS ON LOCAL TAXING POWERS

Unit of Government	Tax Limitation	Statutory Authority
County . . .	1% of equalized value of all taxable property	Section 70.62
City	3-1/2% of the assessed value of all taxable property	Section 62.12
Village. . . .	2% of the assessed value of all taxable property	Section 61.46
Town	1% of the assessed value of all taxable property	Section 60.18

Source: Wisconsin Statutes.

pality for the purpose of paying principal and interest on valid bonds or notes outstanding are exempt from these tax limitations. School taxes not exceeding eight mills per dollar of assessed value are specifically exempt from the statutory tax limitation of municipalities. Table 76 summarizes the status of tax levies and limitations for the local unit of government owning airports.

SUMMARY

The current and probable future legal, institutional, and financial resources of the Region provide one base for evaluating alternative airport system plans, and influence the extent and timing of recommended plan implementation. The existing legislative, administrative, and financial resource factors have been described in this chapter. The following are the significant findings of the inventory:

Table 76

TAX LEVY AND TAX LEVY LIMITS OF UNITS OF GOVERNMENT OWNING PUBLIC AIRPORTS IN THE REGION: 1971

Unit of Government	Tax Levy[a]		Tax Levy Limit		Amount That Tax Levy is Above or Below Tax Levy Limit
	Amount	Percent of Value[b]	Amount	Percent of Value[b]	
City of Kenosha	$ 6,506,418	1.3A	$17,610,131	3.5A	$-11,103,713
Milwaukee County.	105,762,876[c]	1.2E	88,126,160	1.0E	17,636,716
City of Burlington	662,920	0.9A	2,472,296	3.5A	- 1,809,376
Village of East Troy.	72,799	0.5A	316,249	2.0A	- 243,450
City of Hartford	350,649	0.7A	1,751,835	3.5A	- 1,401,186
City of West Bend	1,383,706	1.1A	4,444,128	3.5A	- 3,060,422
Waukesha County	10,750,953	0.5E	22,948,874	1.0E	-12,197,941

[a] *Includes only those taxes levied for general local purposes. These data exclude taxes levied for county and school purposes.*

[b] *A = Assessed Valuation of Taxable Property*
E = Equalized Valuation of Taxable Property

[c] *Includes over $18 million of taxes levied for the retirement of debt. Taxes levied for the purpose of debt retirement are excluded from the general tax levy limit.*

Source: Wisconsin Department of Revenue, Bureau of Property Taxation; local units of government owning public airports in the Region; and SEWRPC.

1. Public airport development in the Region involves federal, state, and local units and agencies of government, and therefore intergovernmental cooperation is essential. The local unit of government owning or desiring to sponsor airport facility development must look to the Wisconsin Department of Transportation, Division of Aeronautics and the Federal Aviation Administration for technical and financial assistance.

2. The basic statutory authority for public airport development in Wisconsin is Chapter 114 of the Wisconsin Statutes, which describes the responsibilities and authority of the Department of Transportation; the revenue sources available for providing the state's share of airport development; the limits of state participation in locally sponsored airport development projects; the provision for initiating and sponsoring airport facility projects with state or federal aid by a local sponsor, which can be either a county, city, village, town, or state agency acting alone or jointly with other units of government; and the power delegated to a local sponsor to protect aerial approaches to airports.

3. The Wisconsin Statutes also give full authority to counties, cities, towns, and villages to acquire, own, and operate airports; to use bond financing in development of airports; and to make reasonable rules and regulations and to charge fees to pay for operating costs.

4. Six of the eight publicly owned airports are under the direct control of committees comprised of elected public officials. These six airports are General Mitchell Field and Timmerman Field in Milwaukee County, Burlington Municipal Airport in Racine County, East Troy Municipal Airport in Walworth County, Hartford Municipal Airport in Washington County, and the Waukesha County Airport. The West Bend Municipal Airport in Washington County is governed by a committee comprised of elected officials and appointed citizens, and the City of Kenosha in Kenosha County has delegated airport activity responsibility to an Airport Commission appointed by the mayor and approved by the council. Three of the airports—Kenosha Municipal, General Mitchell Field, and Timmerman Field—are managed and maintained by governmental agencies, whereas the remaining five are managed by fixed base operators under terms of lease agreements with the units of government.

5. Federal authority for airport facility development is contained in the Airport and Airway Development Act of 1970, as amended. This Act mandates that the Federal Aviation Administration (FAA) provide financial support for eligible capital improvement and land acquisition programs and for airport master plan and system planning studies; technical assistance and advisory services on master and system planning and the development of airport design, construction, and

maintenance standards; and federally sponsored research and development and preparation and publication of the National Airport System Plan.

6. Legislation governing airport developments, specifically with respect to land use near airports, clear zone protection, noise abatement, and air pollution abatement, is limited. Model zoning ordinances limiting the height of aeronautical hazards in the vicinity of the airport have been enacted by most states and local units of government responsible for airport operations. All publicly owned airports within the Region control the height of structures through local ordinances. The FAA, under the airport development aid program, will participate in the cost of purchasing incompatible land uses and development adjacent to an airport within specified distances of runways, and will provide, under the planning grant program, financial incentives for communities and airport operators to voluntarily achieve a more compatible land use airport relationship through funding of land use planning of land adjacent to the airport.

7. The Airport and Airway Development Act of 1970, as amended, establishes a separate airport and airway trust fund for aviation improvements and establishes user charges to generate revenues. An estimated $4.4 million for facility development at air carrier and reliever airports and $700,000 for development at general aviation airports are available for Wisconsin during fiscal year 1974. This compares with the actual federal aid expenditures in Wisconsin from 1968 through 1972 of about $8.0 million, an average of $1.6 million per year, or less than one-third of the anticipated available federal aid at the present level of federal funding.

8. Although Wisconsin Statutes limit state financial aid on airport development projects to no more than 50 percent of the nonfederal share of the costs, actual state funds available for projects only averaged 12 percent of the total project costs during the ten-year period ending in 1971. During the five-year period 1968 through 1972, $4.07 million of state aid funds were expended on airport projects, and the Wisconsin Department of Transportation estimates that about $41 million for state airport aid will accrue from 1973 to 1995 if the current trend of dedicated revenue funds continues.

9. Although it is difficult to predict the future levels of local funds that would be available for airport development, since they are most often appropriated from general funds on a pay-as-you-go basis and are not related to general airport user variables such as fuel consumption or aircraft registration, the Wisconsin Department of Transportation has estimated the availability of local funds, based on an average of the last five-year history of local funds expended, to be $46 million for the period 1973 to 1995 for the State of Wisconsin, an average of $2.3 million per year.

10. The eight publicly owned airports in the Southeastern Wisconsin Region together expended an average of about $1.27 million annually for operation, maintenance, and the local share of capital expenditures during the five-year period 1966 through 1970, and received an average of about $1.93 million annually as revenue from their airport operations during the same period. The amounts expended do not include an allowance for depreciation of capital investments. Only at General Mitchell Field and Timmerman Field did revenues exceed expenditures as reported in the operating statements for this five-year period.

11. Airport development within the Region will depend upon a local sponsor to initiate expansion to an existing airport or development of a new airport in accordance with the recommendations of the regional airport system plan. Availability of local funds to share with state and federal funds available for airport development will depend upon the local sponsor's taxing and debt carrying capabilities and a willingness to fund airport projects in competition with other demands for public financing. Upon identification of appropriate sponsors for implementing recommended airport system plan elements, a detailed financial evaluation will be required to ensure that plan recommendations can be implemented within the funding capability of airport sponsors.

Chapter VII

REGIONAL AIRPORT SYSTEM DEVELOPMENT OBJECTIVES, PRINCIPLES, AND STANDARDS

INTRODUCTION

Planning may be defined as a rational process for formulating and meeting objectives. The formulation of objectives is, therefore, an essential task which must be undertaken before plans can be prepared. The formulation of objectives for organizations whose functions are directed primarily at a single purpose or interest, and are therefore direct and clear-cut, is a relatively easy task. The seven-county Southeastern Wisconsin Planning Region, however, is composed of many diverse and often divergent interests. Consequently, the formulation of objectives for the preparation of advisory comprehensive regional development plans is a very difficult task.

Soundly conceived regional development objectives should incorporate the knowledge of many people who are informed about the Region, and should be established by duly elected or appointed representatives legally assigned this task, rather than by planning technicians. This is particularly important because of the value system implications inherent in any set of development objectives. Active participation by duly elected or appointed public officials and by citizen leaders in the regional planning program is implicit in the structure and organization of the Southeastern Wisconsin Regional Planning Commission itself. Moreover, the Commission early in its existence recognized that the task of guiding the broad spectrum of related public and private development programs which would influence, and be influenced by, a comprehensive regional planning program would require an even broader opportunity for the active participation of public officials and private interest groups in the regional planning process. In light of this, the Commission provided for the establishment of advisory committees to assist the Commission and its staff in the conduct of the regional planning program.

The advisory committee structure created by the Commission for the regional airport planning study was described in Chapter I of this report. The use of such advisory committees appears to be the most practical and effective procedure available for involving officials, technicians, and citizens in the regional planning process and openly arriving at decisions and action programs which can shape the future physical development of the Region. Only by combining the knowledge and experience which the various advisory committee members possess about the Region can a meaningful expression of the desired direction, magnitude, and quality of future regional development be obtained. One of the major tasks of these committees, therefore, is to assist in the formulation of regional development objectives, supporting planning principles, and planning standards.

This chapter sets forth regional airport system development objectives, principles, and standards which can serve as a basis for airport planning within the Region. These objectives are consistent with both the general regional development objectives and the specific land use and surface transportation system (highway and transit) development objectives already established and adopted by the Commission. These general and specific development objectives, although set forth in other Commission reports, are summarized in this chapter to provide a proper context for the specific airport system development objectives, principles, and standards. The standards supporting the regional airport system development objectives are intended not only for use in regional airport system plan design, test, and evaluation, but also for use as guidelines in the more detailed engineering efforts required for implementation of the recommended airport system plan through airport facility construction.

BASIC CONCEPTS AND DEFINITIONS

The term "objective" is subject to a wide range of interpretation and application, and is closely linked to other terms often used in planning work which are also subject to a wide range of interpretation and application. Therefore, in order to provide a common frame of reference, the following definitions have been adopted for use in the regional planning efforts:

1. Objective—a goal or end toward the attainment of which plans and policies are directed.

2. Principle—a fundamental, primary, or generally accepted tenet used to support objectives and prepare standards and plans.

3. Standard—a criterion used as a basis of comparison to determine the adequacy of plan proposals to attain objectives.

4. Plan—a design which seeks to achieve agreed upon objectives.

5. Policy—a rule or course of action used to ensure plan implementation.

6. Program—a coordinated series of policies and actions to carry out a plan.

Although this chapter deals only with the first three of these terms, an understanding of the interrelationship between the foregoing definitions and the basic concepts which they represent is essential to the following discussion of objectives, principles, and standards.

OBJECTIVES

In order to be useful in the regional planning process, objectives must be sound logically and related in a demonstrable and measurable way to alternative physical development proposals. Only if the objectives are clearly related to physical development and only if they are subject to objective test can an intelligent choice be made among alternative plans to select the plan or combination of plans which best meets the agreed-upon objectives.

In any consideration of objectives, it must be recognized that various private and public interest groups within a Region as large and diverse as southeastern Wisconsin may have varying and at times conflicting objectives; that many of the objectives are of a qualitative nature and are, therefore, difficult to quantify; and that many objectives which may be held to be important by the various interest groups may not be related in a demonstrable manner to physical development plans. In light of these factors, the Commission has identified two basic types of objectives: general development objectives, which are by their nature either qualitative or difficult to relate directly to development plans; and specific development objectives, which can be directly related to physical development plans and at least crudely quantified.

General Objectives

The following general regional development objectives were adopted by the Commission after careful review and recommendation by the technical advisory and intergovernmental coordinating committees concerned:

1. Economic growth at a maximum rate, consistent with regional resources, and primary dependence on free enterprise in order to provide maximum employment opportunities for the expanding labor force of the Region.

2. A wide range of employment opportunities through a broad, diversified economic base.

3. Conservation and protection of desirable existing residential, commercial, industrial, and agricultural development in order to maintain desirable social and economic values; renewal of obsolete and deteriorating residential, commercial, and industrial areas in the rural as well as urban areas of the Region; and prevention of slums and blight.

4. A broad range of choice among housing designs, types, and costs, recognizing changing trends in age group composition, income, and family living habits.

5. An adequate and balanced level of community services and facilities.

6. An efficient and equitable allocation of fiscal resources within the public sector of the economy.

7. An attractive and healthful physical and social environment with ample opportunities for education, cultural activities, and outdoor recreation.

8. Protection, wise use, and sound development of the natural resource base.

9. Development of communities having distinctive individual character, based on physical conditions, historical factors, and local desires.

The foregoing general development objectives are proposed as goals which public policy within the Region should promote. They are all necessarily general, but nevertheless provide the broad framework within which regional planning can take place and the more specific goals of the various functional elements and component parts of the Region stated and pursued. The statement of these objectives is concerned entirely with ends and not with means, and the principal emphasis of these general objectives is on those aspects of regional development which relate either to the expenditure of public funds or to the effects of government actions and regulations. With respect to these general development objectives, it will be deemed sufficient to arrive at a consensus among the advisory committees and the Commission itself that the plan proposals do not conflict with the objectives. Such a consensus represents the most practical evaluation of the ability of the alternative plan proposals to meet the general development objectives.

Specific Development Objectives

Within the framework established by the general regional development objectives, a secondary set of more specific objectives has been postulated which can be directly related to physical development plans and can be at least crudely quantified. The quantification is facilitated by complementing each specific objective with a set of quantifiable planning standards which are in turn directly related to a planning principle which supports the chosen objective. The planning principles thus augment each specific objective by asserting its inherent validity as an objective.

In its planning efforts to date, the Commission has adopted, after careful review and recommendation by advisory and coordinating committees, eight specific regional land use development objectives and seven specific regional transportation system development objectives which, together with their supporting principles and standards, are set forth in full in SEWRPC Planning Report No. 7, Land Use-Transportation Study, Forecasts and Alternative Plans—1990, Volume II.

Land Use Development Objectives: The specific regional land use development objectives adopted by the Commission are concerned primarily with spatial allocation to and distribution of the various land uses, land use compatibility, resource protection, and accessibility. They are:

1. A balanced allocation of space to the various land use categories which meets the social, physical, and economic needs of the regional population.

2. A spatial distribution of the various land uses which will result in a compatible arrangement of land uses.

3. A spatial distribution of the various land uses which will result in the protection, wise use, and development of the natural resources of the Region: soils, inland lakes and streams, wetlands, woodlands, and wildlife.

4. A spatial distribution of the various land uses which is properly related to the supporting transportation, utility, and public facility systems in order to assure the economical provision of transportation, utility, and public facility services.

5. The development and conservation of residential areas within a physical environment that is healthy, safe, convenient, and attractive.

6. The preservation and provision of a variety of industrial and commercial sites suitable both in terms of physical characteristics and location.

7. The preservation and provision of open space to enhance the total quality of the regional environment, maximize essential natural resource availability, give form and structure to urban development, and facilitate the ultimate attainment of a balanced year-round outdoor recreational program providing a full range of facilities for all age groups.

8. The preservation of land areas for agricultural uses to provide for certain special types of agriculture, provide a reserve for future needs, and ensure the preservation of those rural areas which provide wildlife habitat and which are essential to shape and order urban development.

Transportation System Development Objectives: The specific regional surface transportation system development objectives adopted by the Commission are concerned primarily with the attainment of a balanced transportation system, alleviating traffic congestion, reducing travel times and accident exposure, and minimizing cost and disruptive effects upon communities and natural resources. The specific surface transportation system development objectives adopted by the Commission are:

1. An integrated transportation system which will effectively serve the existing regional land use pattern and promote the implementation of the regional land use plan, meeting the anticipated travel demand generated by the existing and proposed land uses.

2. A balanced transportation system providing the appropriate types of transportation service needed by the various subareas of the Region at an adequate level of service.

3. The alleviation of traffic congestion and the reduction of travel time between component parts of the Region.

4. The reduction of accident exposure and provision of increased travel safety.

5. A transportation system which is both economical and efficient, meeting all other objectives at the lowest cost possible.

6. The minimization of disruption of desirable existing neighborhood and community development and of deterioration or destruction of the natural resource base.

7. A high aesthetic quality in the transportation system with proper visual relation of the major transportation facilities to the landscape and cityscape.

Within the context of these specific surface transportation planning objectives, a more detailed set of objectives, principles, and standards concerned directly with transit system development has been established to provide guidance in the planning and design of a transit system and in carrying out the proposals of the adopted regional land use and transportation plan. The specific transit system development objectives adopted by the SEWRPC are:[1]

1. The transit facilities should be located and coordinated so as to effectively serve the existing land use pattern and promote the implementation of the adopted land use plan.

2. Transit facilities should be located and designed so as to preserve and enhance desirable existing community facilities and land use patterns and to promote efficient land use.

3. Transit facilities should promote total transportation flexibility, allowing transit service to be readily adapted to changes in the requirements of or the balance between private and mass transportation and to changes in transit technology.

4. Transit facilities should provide a means of access to areas of employment and essential services for all segments of the population, but especially for low- to middle-income families and others who do not or cannot operate an automobile.

5. Transit facilities should be located and designed to provide user convenience and comfort, thereby promoting transit utilization.

6. Transit facilities should be located and designed in relation to the urban environment so as to minimize any harmful effects they may have on the surrounding physical environment and to assist in the improvement of the design of the total urban environment.

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[1] *Transit System Development Objectives, Principles, and Standards, prepared for the Milwaukee County Mass Transit Technical Planning Study, SEWRPC, March 1969.*

7. The transit system should be economical and efficient, meeting all other objectives at the lowest possible cost.

AIRPORT SYSTEM DEVELOPMENT OBJECTIVES, PRINCIPLES, AND STANDARDS

Within the context of the foregoing specific land use and surface transportation development objectives, principles, and standards adopted by the Commission, a more detailed set of objectives, principles, and standards concerned directly with airport system development can be established to provide guidance in the preparation, test, and evaluation of alternative airport system plans, in the selection and adoption of a recommended regional airport system plan, and in the implementation of that recommended plan. Accordingly, the following airport system development objectives have been adopted by the Commission after careful review and recommendation by the Technical Coordinating and Advisory Committee on Regional Airport Planning:

1. An integrated regional airport system which will effectively serve the existing and probable future inter- and intra-regional air travel demand with appropriate types and adequate levels of service; alleviate air traffic congestion; and reduce travel times between the Region, its component parts, and other regions.

2. A regional airport system which will minimize accident exposure and provide increased travel safety.

3. A regional airport system which will be compatible with the existing land use patterns and adopted land use plans.

4. A regional airport system which will be properly related to the underlying and sustaining natural resource base and which will minimize the existing and potential adverse effects upon that natural resource base.

5. A regional airport system which will promote flexibility, allowing air transportation service to be readily adapted to changes in the demands for air transportation and to changes in aviation technology.

6. A regional airport system which will be properly related to and integrated with the supporting ground transportation systems.

7. A regional airport system which will be properly related to the regional public utility systems, permitting the efficient and economic provision of necessary public utility services to airport and airport-related land use development.

8. A regional airport system which will be located and designed to maintain a high aesthetic quality, with proper visual relation of the facilities to the landscape and cityscape.

9. A regional airport system which will be economical and efficient, meeting all other objectives at the lowest possible cost.

Complementing each of the foregoing specific airport development objectives is a planning principle and a set of planning standards, set forth in Table 77. Each set of standards is directly relatable to the planning principles as well as the objective, and serves to facilitate quantitative application of the objective in plan design, test, and evaluation. The planning principle, moreover, supports each specific objective by asserting its validity.

The planning standards adopted herein fall into two groups—comparative and absolute. The comparative standards, because of their nature, can be applied only through a comparison of alternative plan proposals. Absolute standards can be applied individually to each alternative plan proposal, since they are expressed in terms of maximum, minimum, or desirable values. The standards set forth herein should serve not only as aids in the development, test, and evaluation of regional airport system plans, but also in the development, test, and evaluation of specific airport facility improvement plans and in the development of plan implementation policies and programs.

OVERRIDING CONSIDERATIONS

In the application of the planning standards and in the preparation of the regional airport system plan, several overriding considerations—particularly legal and financial constraints—must be recognized. First, it must be recognized that an overall evaluation of the airport system plan must be made on the basis of cost. Such an analysis may show that the attainment of one or more of the objectives or supporting standards is beyond the economic capability of the Region and, therefore, that the objectives or standards cannot be met practically and must either be reduced or eliminated. Second, it must be recognized that it is unlikely that any one plan proposal will meet all of the objectives and standards completely, and the extent to which each objective and standard is met, exceeded, or violated must serve as a measure of the ability of each alternative plan proposal to achieve the specific objectives. Third, it must be recognized that certain objectives and standards may be in conflict, requiring resolution through compromise, and that meaningful plan evaluation may only take place through comprehensive assessment of each of the alternative plans against all of the objectives and standards.

Table 77

REGIONAL AIRPORT PLANNING OBJECTIVES, PRINCIPLES, AND STANDARDS

OBJECTIVE NO. 1

An integrated regional airport system which will effectively serve the existing and probable future inter- and intra-regional air travel demand with appropriate types and adequate levels of service; alleviate air traffic congestion; and reduce travel times between the Region, its component parts, and other regions.

PRINCIPLE

Air transportation represents an important modal element of a balanced regional transportation system. Aircraft offer a particularly effective means for meeting the need for relatively high-speed, long-distance movement of people and goods within and beyond the Region, and good air transportation is essential to inducing certain types of commercial, industrial, and recreational development. Airport facilities are necessary to provide an adequate level of transportation service to all segments of the population, to properly support certain essential economic and social activities, and to achieve economy and efficiency in the provision of transportation service. Air traffic congestion increases the cost of transportation, necessarily resulting in higher production costs, and decreases its productivity, which in turn adversely affects the relative market advantages of business, industrial, and recreational activities located within the Region. The development of a regional airport system should, therefore, seek to maximize economy and efficiency in the provision of air transportation services to the Region and its various subareas.

STANDARDS

1. All airports included in the regional airport system plan shall be classified in accordance with the following types of aeronautical service and airport service areas:

Airport Functional Classification	Aeronautical Service and Aircraft Limitations	Airport Service Area: Minimum Resident Population	Airport Service Area: Desirable Location
Scheduled Air Transport—Primary	All certificated air carrier service[a] and all levels of general aviation service[b] that result in a minimum of 1,000,000 enplaning passengers annually.	1,000,000	Maximize the proportion of the resident population within 60 minutes peak hour ground travel time.
Scheduled Air Transport—Secondary	Certificated air carrier service and all levels of general aviation service that result in a minimum of 50,000 - 1,000,000 enplaning passengers annually.	500,000	Maximize the proportion of the resident population within 45 minutes peak hour ground travel time or 30 miles of the airport.
Scheduled Air Transport—Feeder	Certificated and noncertificated (third level)[c] air carrier service and all levels of general aviation service that result in less than 50,000 enplaning passengers annually.	100,000	Maximize the proportion of the resident population within 30 minutes peak hour ground travel time or 15 miles of the airport.
General Transport	General aviation service except service using aircraft over 175,000 pounds maximum gross takeoff weight.	100,000	Maximize the proportion of the resident population within 45 minutes peak hour ground travel time or 30 miles of the airport.
Basic Transport	General aviation service except service using aircraft over 60,000 pounds maximum gross takeoff weight.	15,000	Maximize the proportion of the resident population within 30 minutes peak hour ground travel time or 15 miles of the airport.
General Utility	General aviation service except service using aircraft over 12,500 pounds maximum gross takeoff weight or service using turbojet powered aircraft.[d]	5,000	Maximize the proportion of the resident population within 30 minutes peak hour ground travel time or 15 miles of the airport.
Basic Utility	General aviation service using aircraft less than 8,000 pounds maximum gross takeoff weight or service using turbojet powered aircraft.	3,000	Maximize the proportion of the resident population within 30 minutes peak hour ground travel time or 15 miles of the airport.
STOLport	Certificated air carrier and general aviation service provided by aircraft having short takeoff and landing capabilities.	500,000	Maximize the proportion of the resident population within 10 minutes peak hour ground travel time or 5 miles of the airport.
Heliport	Special aviation service provided by vertical takeoff and landing aircraft.	Not Applicable	As needed to effectively serve special traffic generators.
Seaplane Base	Special aviation service provided by aircraft having capabilities to land and takeoff from water.	Not Applicable	As needed to effectively serve special traffic generators.

2. Airports of the functional type indicated should be provided when the forecast demand reaches the following threshold level:

Airport Functional Classification	Critical Aircraft Types[e] by Gross Weight Limits		Minimum Critical Aircraft Annual Itinerant Operations[f]
	Maximum Gross Weight Limit (Pounds)	Typical Aircraft	
Scheduled Air Transport—Primary	More than 175,000	B-747, B-707, DC-8, DC-10, L-1011	750
Scheduled Air Transport—Secondary	60,000 to 175,000	B-727-100, B-737, DC-9	1,100
Scheduled Air Transport—Feeder.	Less than 60,000	Jetstar, FH-227, Gulfstream II	500
General Transport	60,000 to 175,000	B-727-100, B-737, DC-9, L188, L100	1,100
Basic Transport.	12,500 to 60,000	Jetstar, FH-227, Gulfstream II, Learjet H5125, Falcon	500
General Utility	8,000 to 12,500	Beechcraft King Air, Turbo Commander, Piper PA-31P Navaho	500
Basic Utility	Less than 8,000	Cessna 150, Cessna 182, Cessna 310, Mooney M-20, Piper TA-28, Cherokee	Not Applicable
STOLport	Not Applicable	GAC-100, DHC-7	Not Applicable
Heliport.	Not Applicable	Helicopter	Not Applicable
Seaplane Base	Not Applicable	Seaplane	Not Applicable

Source: National Airport System Plan Handbook, FAA Document 5090.3, 1972.

Figure 62

B-747–SCHEDULED AIR TRANSPORT (PRIMARY) TYPE "AA" AIRCRAFT

Photo Source: R. Dixon Speas Associates, Inc.

Figure 63

DC-8–SCHEDULED AIR TRANSPORT (PRIMARY) AND GENERAL TRANSPORT TYPE "A" AIRCRAFT

Photo Source: R. Dixon Speas Associates, Inc.

Figure 64

DC-9–SCHEDULED AIR TRANSPORT (SECONDARY) AND GENERAL TRANSPORT TYPE "B" AIRCRAFT

Photo Source: R. Dixon Speas Associates, Inc.

Figure 65

GULFSTREAM II–SCHEDULED AIR TRANSPORT (FEEDER) AND BASIC TRANSPORT TYPE "C" AIRCRAFT

Photo Source: R. Dixon Speas Associates, Inc.

Figure 66

BEECHCRAFT KING AIR A100–GENERAL UTILITY TYPE "D" AIRCRAFT

Photo Source: R. Dixon Speas Associates, Inc.

Figure 67

CESSNA 150–BASIC UTILITY TYPE "E" AIRCRAFT

Photo Source: R. Dixon Speas Associates, Inc.

3. Each functional airport type included in the regional airport system plan should provide the following facilities and site area:

Airport Functional Classification	Principal Runway Length for Sea Level, Standard Temperature and 0 Wind, and 0 Percent Gradient	Secondary Runway Length[g] for Sea Level, Standard Temperature and 0 Wind, and 0 Percent Gradient	Taxiways	Minimum Land Acreage (excludes noise buffer area)	Minimum Airfield Lighting[h]	Minimum Terminal NAVAIDS[i]	Aprons[j]	Terminal Size	Auto Parking	Hangar Area	Tie-Downs[k]
Scheduled Air Transport. . .	5,500 to 11,500 feet depending on the critical aircraft	Minimum 80% of the principal runway	A parallel and exit taxiway system sufficient to eliminate all taxiing on active runways.	Primary–4,500 acres Secondary–1,500 acres Feeder–700 acres	HIRL on instrument runway, MIRL on all other runways for 95% wind coverage or capacity. MITL on turnarounds.	Primary–CAT II ILS; Secondary and Feeder–Cat I ILS; ALS, ASR; VASI-6 (3 bar); beacon; lighted wind cone.	Air carrier aircraft requirements based upon seating capacity (200+), 15,000 square yards; (120-199), 6,000 square yards; (75-119), 4,000 square yards; (55-74), 3,000 square yards; (54 or less), 3,000 square yards.	Air carrier, 242 square feet–typical peak hour passengers.	Air carrier, 1.5 spaces per typical peak hour passengers.		
General Transport. . .	5,000 to 8,500 feet depending on the critical aircraft.	Minimum 80% of the principal runway	Parallel taxiway on principal runway; exit and other parallel taxiways when required to increase capacity or for safety.	1,500 acres	HIRL on instrument runway, MIRL on all other runways for 95% wind coverage or capacity. MITL on turnarounds.	ILS or OM-LOC or TVOR, MALS, VASI-4; beacon, lighted wind cone.					
Basic Transport. . .	Minimum of 4,600 feet	Minimum 80% of the principal runway	Parallel taxiway on principal runway; exit and other parallel taxiways when required to increase capacity or for safety.	700 acres	HIRL on instrument runway, taxiway exit lights.	VOR or TVOR approach, MALS or REILS and/or VASI-4, beacon, lighted wind cone.				General aviation aircraft over 12,500 pounds require 500 square yards. General aviation aircraft between 8,000 and 12,500 pounds require 350 square yards. General aviation aircraft less than 8,000 pounds require 180 square yards.	General aviation aircraft over 12,500 pounds require 1,600 square yards. General aviation aircraft between 8,000 and 12,500 pounds require 625 square yards. General aviation aircraft less than 8,000 pounds require 300 square yards. Approximately 50% of based aircraft would require tie-downs.
General Utility	3,200 feet	Minimum 80% of the principal runway	Minimum of apron access taxiway; parallel taxiway when required for capacity and/or safety.	100 acres (based upon single runway of minimum length)	MIRL, taxiway exit lights.	VOR or TVOR or NDB approach, REILS and/or VASI-2, beacon, lighted wind cone.	General aviation aircraft requirements based upon aircraft gross weight. (12,500 pounds plus), 3,000 square yards; (Under 12,500 pounds), 350 square yards. Minimum requirement is whether area is capable of parking 5 typical aircraft at one time. A seaplane base requires addition of ramp.	General aviation, 24.5 square feet per peak hour pilots and passengers.	General aviation, 1.3 spaces per peak hour pilots and passengers.		
Basic Utility	2,700 feet	Minimum 80% of the principal runway	Apron access taxiway; parallel taxiway when required for capacity and/or safety.	60 acres (based upon single runway of minimum length)	MIRL	VASI-2, beacon, lighted wind cone, REILS.					
Heliport.	190 foot pad	190 foot pad	A pathway for hover training or ground training of helicopters, connecting the takeoff and landing area with a separate terminal or service area.	20 Acres	Perimeter lighting	VASI-4, lighted wind cone, beacon					
STOLport . . .	2,000 feet	2,000 feet	Parallel and exit taxiway system sufficient to eliminate all taxiing on active runways.	50 Acres	Threshold lights, runway edge lights (alternate white and yellow), and runway end lights.	VASI-2, REILS, ILS, beacon					
Seaplane Base	3,500 feet	3,500 feet	Not Applicable	Not Applicable	Not Applicable	Not Applicable					

Source: R. Dixon Speas Associates, Inc.

4. Adequate capacity should be provided at all airports to limit aircraft takeoff and landing delays. Acceptable delays are four minutes per aircraft at air carrier airports and two minutes per aircraft at general aviation facilities.

5. Scheduled commercial air transport service within the Region should provide the following maximum travel times[l] during the business day (7 a.m. to 7 p.m.) to reach any other city within the following service radius which also has air carrier service:

Air Travel Time (Hours-Minutes)	Air Miles
0:40	200
0:60	300
1:30	500
2:30	1,000

6. Either a general or basic transport or a general utility airport facility should be provided within 30 minutes ground travel time of all scheduled air transport facilities during peak travel hours to provide reliever general aviation service when the scheduled air transport airport is operating or forecast to operate at 60 percent of its runway system's practical annual capacity (PANCAP).[m]

OBJECTIVE NO. 2

A regional airport system which will minimize accident exposure and provide increased travel safety.

PRINCIPLE

Accidents involving aircraft take a heavy toll in lives, property damage, and human suffering. Accidents contribute substantially to overall transportation costs, and in turn increase public costs. Every attempt must be made to reduce both the incidence and severity of accidents. This requires, in addition to designing the airport system in accordance with the standards set forth herein, strict adherence to good rules and regulations of airport operation. The latter can only be achieved through effective airport and airway management.

STANDARDS

1. All public use airports in the regional airport system should conform to the airport planning design standards as defined in Objectives 1 and 5.

2. At the minimum, all applicable construction at public use airports in the regional airport system should conform to the U. S. Department of Transportation Federal Aviation Administration publication, "Standard Specifications for Construction of Airports" (AC 150/5370-1A), dated May 28, 1968, and any subsequent amendments thereto.

3. At a minimum, Federal Aviation Regulations Part 139, "Certification and Operations," and all subsequent parts regarding airport security measures and required airport certification procedures should be satisfied at all public use airports in the regional airport system.

4. Any structure to be constructed in the Region, and particularly in the vicinity of any airport, should conform to the minimum obstruction clearance standards established in Federal Aviation Regulations Part 77, "Objects Affecting Navigable Airspace."

5. Priority should always be given to maintaining and/or upgrading existing facilities to a safe condition before constructing new facilities.

6. Height restriction zoning ordinances that limit physical structural obstructions or the visual hazards they create should be adopted and enforced by the appropriate unit of government (local, county, state, or federal) at all public use airports in the regional airport system to ensure safe air traffic patterns and compatible land uses surrounding the airports.

7. Clear zones should be kept free from obstructions and not be utilized as sites for the placement of buildings and other structures. Clear zones may be used for such purposes as offstreet parking, outdoor storage, and roadways provided that the minimum obstruction clearance standards are maintained.

OBJECTIVE NO. 3

A regional airport system which will be compatible with the existing land use patterns and adopted land use plans.

PRINCIPLE

The proper allocation of uses of land can avoid or minimize hazards to health, safety, and welfare, and maximize amenities and convenience. Airport facilities should be located and designed so as to minimize the potential adverse effects of airport development and operation on the surrounding land uses, to encourage the development of land uses which benefit from locations in close proximity to airports, and discourage the development of land uses which conflict with airport development and operation.

STANDARDS

1. To reduce potential conflicts between land uses in the vicinity of airports and aircraft operations, to provide transition areas between airports and residential and other similar land use areas, and to prevent the further encroachment of incompatible land uses around airports, advance acquisition of the land at all publicly owned airports in the regional airport system considered necessary to carry out the recommended changes in physical characteristics of the airport or the recommended changes in airport operations through the planning period should be made by appropriate local, county, state, or federal governmental units.

2. Comprehensive land use controls should be enacted by appropriate units of government within a five mile radius of all public use airports in the regional airport system plan to control land uses in airport approach areas, control or remove incompatible and nonconforming land uses, and control excessive noise, hazards, or other nuisances.

3. Land uses and developments around airports shall be permitted or restricted in accordance with the following noise exposure forecast (NEF)[n] and composite noise rating (CNR)[n] criteria:

Type of Land Use and Development	Noise Zone[o]		
	30 NEF (100 CNR)	30-40 NEF (100-115 CNR)	40 NEF (115 CNR)
Residential	Yes	--[p]	No
Commercial	Yes	Yes	--[p]
Hotel, Motel	Yes	--[p]	No
Offices, Public Buildings	Yes	--[p]	No
Schools, Hospitals, Churches	--[p]	--[p]	No
Theaters, Auditoriums	--[p,q]	--[p]	No
Outdoor Amphitheaters, Theaters	--[q]	No	No
Outdoor Recreational (Nonspectator)	Yes	Yes	Yes
Industrial	Yes	Yes	--[p]
Agricultural, Open Land	Yes	Yes	Yes
Environmental Corridor	Yes	Yes	No

Source: Adapted by SEWRPC from Bolt, Beranek and Newman, Inc., Aircraft Noise and Airport Neighbor: A Study of Logan International Airport, Technical Report No. DOT/HUD IANAP-70-1, March 1970, p. 9.

4. Airports classified as general utility or larger, considered capable of generating airport related urban land development, should be located so as to minimize encroachment on proposed agricultural and open land uses, and to minimize requirements for extensive changes or additions to recommended urban service plan elements that are contained within adopted land use, transportation, and utility system plans.

OBJECTIVE NO. 4

A regional airport system which will be properly related to the underlying and sustaining natural resource base, and which minimizes the existing and potentially adverse effects upon that natural resource base.

PRINCIPLE

Natural resources of the Region are limited. Therefore, it is imperative that a balance be maintained between the activities of man and the underlying and sustaining natural resource base. Proper location and design of airport facilities can minimize the potentially harmful effects of such development upon the environment, and assist in preserving and protecting the natural resource base.

STANDARDS

1. Airport facilities and airport related land developed or proposed to be developed for urban uses without public sanitary sewer service should be located only on areas covered by soils determined in the regional soil surveys to be very good, good, or fair for urban development without sanitary sewer service.

2. Floodlands should not be allocated to any airport development which would cause or be subject to flood damage.

3. No airport development should be allowed to encroach upon and obstruct the flow of water in the perennial stream channels and floodways.

4. The destruction of wetlands by airport development should be minimized.

5. The destruction of woodlands by airport development should be minimized.

6. The natural habitat for fish and game can best be obtained by preserving or maintaining other resources, such as soil, air, water, wetlands, and woodlands, in a wholesome state. The standards for each of these other resources, if met, would ensure the preservation of a suitable wildlife habitat and population.

7. The regional airport system shall be structured such that the contribution to regional air pollution resulting from airport and aircraft operation will be minimized and will meet air pollution controls specified in Chapter NR 154 of the Wisconsin Administrative Code, "Air Pollution Control," as may be amended from time-to-time.

OBJECTIVE NO. 5

A regional airport system which will promote flexibility, allowing air transportation service to be readily adapted to changes in the demands for air transportation and to changes in aviation technology.

PRINCIPLE

Aviation technology is in a constant and rapid state of change as reflected in changing aircraft size and performance, advances in navigational aids, and decreases in the cost of air transportation. In order to assure maximum efficiency and benefits, the regional airport system should be so located and designed as to be adaptable to effectively serve potential changes in demand which may be brought about by changes in technology.

STANDARDS

1. Runways, taxiways, and aprons shall be sized so that the forecast activities will represent 60 percent of the landing area system's practical annual capacity.

2. Airport design, in accordance with the standards developed to meet Objective No. 1, will provide sufficient land area at each airport, except where noted, for provision of the kinds of landing area modifications and additions listed below that should be constructed when aviation activity reaches the level described.

Airport Development Item	Activity Level	Remarks
Runway (additional)	60 percent of the practical annual capacity.	Parallel preferred; same length and strength as primary if serving same aircraft; and additional land area for airport may be necessary to facilitate new runway—physical area dependent on new runway's location and length.
Short runway	75,000 total operations, including 30,000 or more transport type aircraft.	Small aircraft only; not necessarily parallel; and additional land area for airport may be necessary to facilitate new runway—physical area dependent on runway's location and length.
Runway extension	Number of annual operations by range of critical aircraft types as shown in Standard 2 of Objective 1.	Extension must be justified by change in critical aircraft requirements; and additional land area for airport may be necessary to facilitate extended runway—physical area dependent on runway's location and length.
Additional taxiways	60 percent of the practical annual capacity.	--
Additional exit taxiways	40 percent of the practical annual capacity.	--
Holding apron/by-pass taxiway.	75,000 total operations, 20,000 itinerant operations, or 30 peak hour operations.	Need dependent upon aircraft mix; consider effect on NAVAIDS; and limit holding apron to 4 positions.
Terminal aprons, aircraft loading aprons, parking aprons	60 percent of the practical annual capacity.	--

3. The site area provided for airport terminal facilities should be sized so that the forecast passenger and cargo demands will represent 60 percent of the airport terminal facility system's annual capacity in order to accommodate changing parking characteristics brought about by larger-capacity aircraft.

4. All airport facilities within the regional system should be constructed to the following minimum design standards for the respective airport classification:

Airport Dimensional Standards

Airport Facility Operational Characteristic	Item[a]	Utility Airport			Transport Airport									Runway Approach					
		Basic Utility		General Utility (Feet)	Basic Transport			General Transport		Scheduled Air Transport				Precision	Nonprecision		Visual		
		Minimum (Feet)	Maximum (Feet)		60/60[b] (Feet)	100/60[c] (Feet)	Precision Approach (Feet)	Nonprecision Approach (Feet)	Precision Approach (Feet)	Aircraft Type B[d] (Feet)	A[d] (Feet)	AA[d] (Feet)	Future (Feet)		Opposite Visual or Nonprecision	Opposite Precision	Opposite Visual	Opposite Precision	Opposite Nonprecision
Runway Length																			
As Required	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Width[b]																			
Runway	A	50	60	75	75	100	150	100	150	150	150	200	200	--	--	--	--	--	--
Runway Safety Area	B	100	120	150	150	300	500	300	500	500	500	700	700	--	--	--	--	--	--
Taxiway	C	20	30	40	40	40	40	40	50	50	75	100	125	--	--	--	--	--	--
Taxiway Safety Area	D	60	--	100	90	90	90	90	100	110	165	220	310	--	--	--	--	--	--
Runway Centerline To:																			
Parallel Runway Centerline	E	300	300	500	700	700	700	700	5,000[e]	5,000[e]	5,000[e]	5,000[e]	5,000[e]	--	--	--	--	--	--
Taxiway Centerline	F	150	150	200	200	200	400	300	400	400	400	600	1,000	--	--	--	--	--	--
Aircraft Parking Area	G	225	275	275	275	300	650	475	650	650	650	650	650	--	--	--	--	--	--
Airport Property Line	H	200	200	250	250	300	750	350	750	750	750	750	750	--	--	--	--	--	--
Building Restriction Line	J	250	250	300	250	300	750	350	750	750	750	750	750	--	--	--	--	--	--
Taxiway Centerline To:																			
Parallel Taxiway Centerline	K	--	--	--	150	150	300	200	300	200	300	300	400	--	--	--	--	--	--
Aircraft Parking Area	L	75	75	75	75	100	250	175	250	250	250	250	250	--	--	--	--	--	--
Building Restriction Line	M	50	50	50	50	75	200	100	200	200	200	200	200	--	--	--	--	--	--
Obstacle-Free Area Width																			
Runway Primary Surface	N	500	500	500	500	600	1,500	700	1,500	1,000	1,000	1,000	1,000	--	--	--	--	--	--
Taxiway and Apron Taxiway	P	100	100	100	100	150	400	200	400	210	285	365	470	--	--	--	--	--	--
Terminal Taxilane	Q	75	--	75	--	--	--	--	--	160	225	295	390	--	--	--	--	--	--
Approach Zone Requirements—Utility Airports																			
Approach Slope	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20:1	--	20:1	--	20:1
Runway Primary Surface	R	--	--	--	--	--	--	--	--	--	--	--	--	--	500	--	250	--	500
Clear Zone Length[f]	S	--	--	--	--	--	--	--	--	--	--	--	--	--	1,000	--	1,000	--	1,000
Clear Zone Width at End	T	--	--	--	--	--	--	--	--	--	--	--	--	--	800	--	450	--	650
Transport Airports																			
Approach Slope	--	--	--	--	--	--	--	--	--	--	--	--	--	50:1	34:1	34:1	20:1	20:1	20:1
Runway Primary Surface	R	--	--	--	--	--	--	--	--	--	--	--	--	1,000	500	1,000	500	1,000	500
Clear Zone Length[f]	S	--	--	--	--	--	--	--	--	--	--	--	--	2,500	1,700	1,700	1,000	1,000	1,000
Clear Zone Width at End	T	--	--	--	--	--	--	--	--	--	--	--	--	1,750	1,010	1,425	700	1,100	700

[a] *Letters refer to the letters on the accompanying figure.*

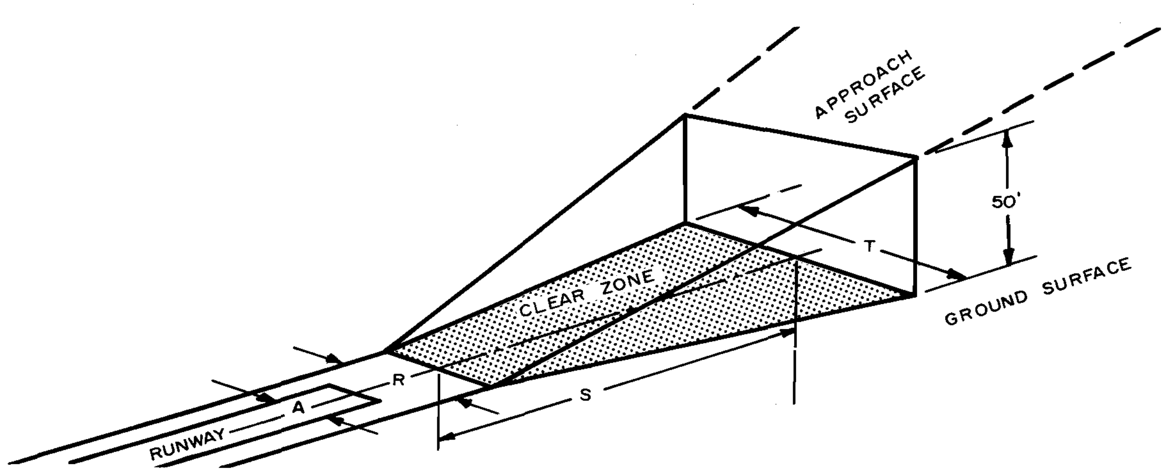
[b] *The airport is designed to satisfy the operational requirements of 60 percent of the general aviation fleet between 12,500 and 60,000 pounds at 60 percent of the net load capacity of such aircraft.*

[c] *The airport is designed to satisfy the operational requirements of 100 percent of the general aviation fleet between 12,500 and 60,000 pounds at 60 percent of the net load capacity of such aircraft.*

[d] *Characteristics of this aircraft type are presented in Appendix D.*

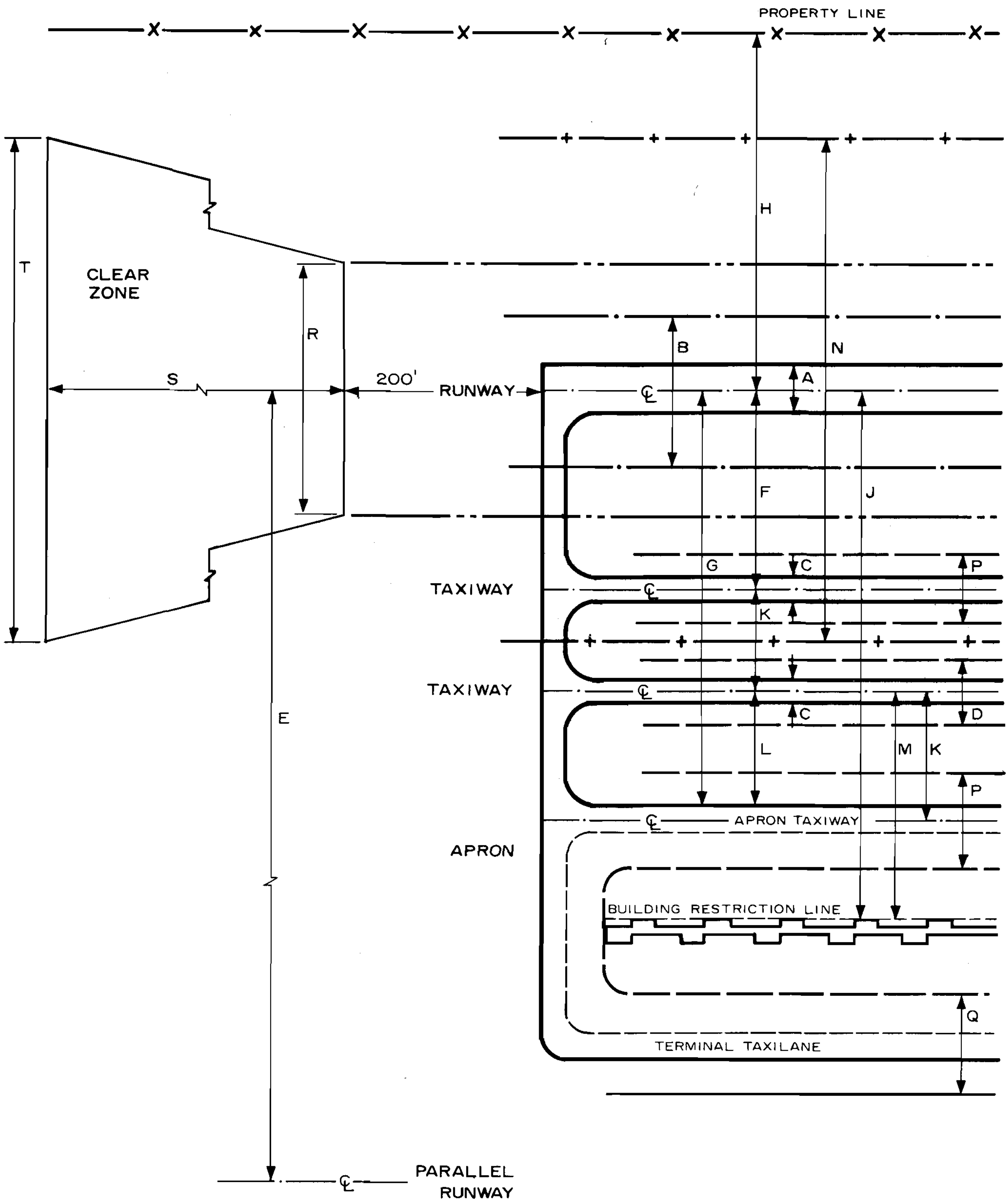
[e] *Refers to the load-bearing, hard surface area of the runway only.*

[f] *The distances indicated in this table for clear zone length(s) represent maximums. The precise length of a clear zone required at a given airport will depend upon site topography in the clear zone area. If the clear zone area is generally at or above the runway primary surface elevation, the clear zone length set forth in this table would apply. If the clear zone area is generally below the runway primary surface elevation, the clear zone length could be reduced to the location where the clear zone surface is 50 feet below the approach surface, as illustrated in the diagram below:*



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

BASIC AIRPORT DIMENSIONS–BASIC UTILITY, GENERAL UTILITY, BASIC TRANSPORT, GENERAL TRANSPORT, AND SCHEDULED AIR TRANSPORT AIRPORTS



OBJECTIVE NO. 6

A regional airport system which will be properly related to and integrated with the supporting ground transportation systems.

PRINCIPLE

Air transportation is particularly multimodal by nature, and almost all person trips and cargo movements made by air involve utilization of surface transportation facilities. Surface transportation facility and airport development are, therefore, highly interdependent, and the efficient movement of persons and goods between surface points of origin or destination and airports is essential to the attainment of good air transportation service within the Region. Surface transportation facilities are an important consideration in airport location and development. Airport development, in turn, may generate additional loadings on the surface transportation system and may require adjustments in that system.

STANDARDS

1. The main airport entrance road should be connected directly to, or served in the manner indicated by, the following surface transportation facilities:

Functional Classification	Ground Facility Connecting and/or Servicing the Airport
Scheduled Air Transport—Primary	Directly connected to a Type I freeway facility[r]
Scheduled Air Transport—Secondary	Served by a Type I freeway facility within two miles and directly connected to a Type I highway facility[s]
Scheduled Air Transport—Feeder	Directly connected to a Type I highway facility
General Transport	Served by a Type I highway facility within one mile and directly connected to a Type II highway facility[t]
Basic Transport	Served by a Type I highway facility within two miles and directly connected to a Type II highway facility
General Utility	Directly connected to a Type II highway facility
Basic Utility	Served by a Type II highway facility within one mile or directly connected to a Type III highway facility[u]
Heliport	Served by a Type I highway facility within one mile
STOLport	Served by a Type I highway facility within one mile
Seaplane Base	Served by a Type II highway facility within one mile or directly connected to a Type III highway facility

2. A scheduled air transport airport terminal and the principal or central business district of the airport service area shall be directly connected by Type II transit facilities.[v]

3. Average auto travel time between the principal, or central, business district of the airport service area and a scheduled air transport airport should not be more than 30 minutes during off-peak periods. Line haul travel time[w] by public transit[x] should not exceed off-peak auto travel time by more than 50 percent.

4. Auto travel time to a scheduled air transport facility or scheduled commercial airline service during off-peak periods shall be minimized.

5. General aviation airport service shall be provided to all residents of the Region within an auto travel time not exceeding 40 minutes during off-peak periods.

6. Off-peak ground travel time between 50 percent of the Region's major retail and service[y] and industrial[z] centers to an air cargo service facility[aa] shall not be more than 30 minutes.

OBJECTIVE NO. 7

A regional airport system which will be properly related to the regional public utility systems, permitting the efficient and economic provision of necessary public utility services to airport and airport-related land use development.

PRINCIPLE

Airport development and utility service development are interdependent in that utility services are essential to airport and airport-related land use development. Such development, in turn, generates an additional loading upon utility systems. Airport development should, therefore, be coordinated with utility system development to assure the economic provision of necessary public utility services, such as sewerage, water supply, power, and communication.

STANDARDS

1. Land developed or proposed to be developed for all transport, general utility, heliport, and STOLport classified airports should be located in areas servicable by an existing or proposed public sanitary sewerage system.

2. Land developed or proposed to be developed for all transport, general utility, heliport, and STOLport classified airports should be located in areas serviceable by an existing or proposed public water supply system.

OBJECTIVE NO. 8

A regional airport system which will be located and designed to maintain a high aesthetic quality, with proper visual relation of the facilities to the landscape and cityscape.

PRINCIPLE

Beauty in the physical environment is conducive to the physical and mental health and well-being of people. As a major feature of the landscape and cityscape, airport and airport-related facilities have an important impact on the aesthetic quality of the total environment. As such, the regional airport system should maintain a physical environment which has both aesthetic quality and a visual relationship to the surrounding landscape and cityscape.

STANDARDS

1. Airport facilities should be located to avoid destruction of visually pleasing buildings, structures, historical landmarks, and scenic features, and to avoid interference with vistas to such features.

2. Airport facility construction plans should be developed using good geometric, structural, architectural, and landscape design standards which consider the aesthetic quality of the airport facilities and the areas in which they are located.

OBJECTIVE NO. 9

A regional airport system which will be economical and efficient, meeting all other objectives at the lowest possible cost.

PRINCIPLE

The total resources of the Region are limited, and any undue investment in airport facilities and services must occur at the expense of other public and private investment. Therefore, the regional airport system should minimize the total capital and operating costs for the desired level of service.

STANDARDS

1. The sum of the airport facility operating and capital investment costs should be minimized.

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[a] *Certificated air carrier service is defined as air transportation service provided by any aircraft owned and operated by an air carrier holding a certificate of public convenience and necessity issued by the Civil Aeronautics Board to provide scheduled air transportation services over specified air routes.*

[b] *General aviation service is defined as air transportation service provided by any aircraft or aviation activity other than certificated air carrier and military activities.*

[c] *Noncertificated air carrier service (third level) is defined as air transportation service provided by any aircraft owned and operated by an air carrier operating under the authority of the FAA and CAB, but not subject to rigorous economic or route regulations, as long as it operates small aircraft with a seating capacity of 30 or less and less than 7,500 pounds of payload.*

[d] *Turbojet powered aircraft as defined herein are turbine engine powered aircraft, turbojet, and turbofan (pure jet powered) aircraft.*

[e] *Critical aircraft type is defined as that aircraft type whose operation at the airport establishes the minimum facility requirements.*

[f] *Itinerant operation is defined as an operation performed by an aircraft taking off from one airport and landing at another airport in the course of one air flight.*

[g] Secondary runway length equal to the length of the primary runway is presently eligible for federal aid participation; 80 percent of primary runway length is minimum length that should be considered.

[h] Airfield lighting:

HIRL	-	*High intensity runway lights.*
MIRL	-	*Medium intensity runway lights.*
MITL	-	*Medium intensity taxiway lights.*

[i] Minimum Terminal NAVAIDS (Aids to Air Navigation) if FAA minimum requirements are met.

ILS	-	*Instrument Landing System provides an approach path for exact alignment and descent of an aircraft on final approach to a runway. The system provides electronic guidance and range information as well as some visual reference information. CAT I ILS - Category I ILS provides capability for aircraft to operate down to a minimum of 200 feet decision height (ceiling) and 2,400 feet runway visual range (RVR) or one-half mile visibility. CAT II ILS - Category II ILS provides capability for aircraft to operate down to a minimum of 100 feet decision height (ceiling) and 1,200 feet runway visual range (RVR).*
ALS	-	*Approach Lighting System, normally a requirement when ILS is available.*
ASR	-	*Airport Surveillance Radar.*
VASI-6	-	*Visual Approach Slope Indicator: VASI provides a visual light path within the approach zone at a fixed plane which an approaching pilot can see and utilize for descent guidance. The - 6 indicates 3 light bar VASI used for technically sophisticated aircraft operations, such as air carrier; - 4 represents a 2 light bar VASI for use by less sophisticated aircraft such as corporate or business jets; and - 2 represents a light bar unit that is normally used in conjunction with smaller general aviation aircraft operations.*
Beacon	-	*Lighted beacon providing visual reference to airport location at night.*
Lighted Wind Cone	-	*Provides runway use information to the pilot day or night.*
OM-LOC	-	*Outer Markers and Localizer Components of ILS, which can be utilized separately as aids to air navigation and also as an approach aid to a specific runway.*
MALS	-	*Medium Intensity Approach Light System.*
VOR	-	*Very high frequency omnidirectional range beacon used as an aid to air navigation.*
TVOR	-	*Terminal VOR located in the immediate vicinity or within property limits of an airport, which provides greater flexibility as an approach aid than does a remotely located VOR.*
REILS	-	*Runway End Identification Light System.*
NDB	-	*Nondirectional radio range beacon used for air navigation.*

[j] Apron area requirements - Air carrier aircraft apron requirements are related to aircraft seating capacity. The number in parentheses is the range of seating capacity and is followed by the apron area in square yards. For example, (200) 15,000 refers to aircraft having seating capacity of 200 or more passengers and requiring 15,000 square yards of apron area, which includes parking and maneuvering area. Several general aviation aircraft apron requirements are related to aircraft gross weight. For example, (12,500)350 refers to aircraft having a gross weight of less than 12,500 pounds but requiring 350 square yards of apron area.

[k] The tie-down area includes that portion of the aisleway providing access and maneuvering area to tie-down space.

[l] Travel time is defined as the average length of time spent by all air passengers to travel the specified air mile distance.

[m] PANCAP - Practical Annual Capacity of a runway system.

[n] NEF - Noise Exposure Forecast is defined as a technique used for estimating community responses to aircraft noise based upon actual noise levels and their exposure frequency at an airport.

CNR - Composite Noise Rating is defined as a technique used for estimating community responses to aircraft noise based upon actual noise levels and their exposure frequency at an airport.

[o] A noise zone is an area around an airport runway, defined by NEF and CNR isopleths, in which the noise environment, depending on a person's activity or location, is objectionable.

[p] An analysis of building noise reduction requirements should be made, and needed noise control features should be included in the building design.

[q] A detailed noise analysis should be undertaken by qualified personnel for all indoor or outdoor music auditoriums and all outdoor theaters.

[r] *A Type I freeway facility is defined as a freeway on the state trunk highway system.*

[s] *A Type I highway facility is defined as a state trunk highway.*

[t] *A Type II highway facility is defined as a county trunk highway.*

[u] *A Type III highway facility is defined as a local trunk highway or arterial street.*

[v] *Type II, or intraurban, rapid, or modified rapid transit facilities are defined as facilities providing public passenger service over established routes within a single urban area on a regularly scheduled basis, with maximum headways of one hour during daylight hours (6 a.m. to 8 p.m.) by transit vehicles operating in a modified rapid transit service over freeways or in true rapid transit service over an exclusive right-of-way, or a combination thereof, for at least 50 percent of the trip distance.*

[w] *Line haul travel time is defined as the time spent in transit while aboard the vehicle.*

[x] *Public transit is defined as passenger service provided by a licensed operator over established routes on a regularly scheduled basis.*

[y] *A major retail and service center shall be defined as an existing or officially designated concentration of retail and service users having a minimum gross site of 60 acres, intended to serve areawide retail and service needs for a multicommunity population ranging from 75,000 to 150,000 persons located within a 10-mile radius. The term "officially designated," as applied to concentrations of various land uses, shall be defined as an area shown on adopted regional or local land use plans or recognized in local zoning district maps.*

[z] *A major regional industrial center shall be defined as an existing or officially designated concentration of manufacturing, wholesaling, and related-use establishments having a minimum gross site area of 640 acres or providing employment for over 5,000 persons.*

[aa] *An air cargo service facility is defined as a facility located either on or off the airport where freight, mail, and express packages are consolidated and/or dispatched for air shipment.*

SUMMARY

This chapter has presented the airport system development objectives, principles, and standards developed and adopted by the SEWRPC Technical Coordinating and Advisory Committee on Regional Airport Planning and the Commission itself to guide airport system plan design, test, evaluation, and implementation. The nine specific airport system development objectives have been developed in the context of specific regional land use and surface transportation (highway and transit) system development objectives, principles, and standards previously adopted by the Southeastern Wisconsin Regional Planning Commission, which have been summarized in this chapter to provide a proper context for the airport system development objectives, principles, and standards.

The standards which support the nine specific airport system development objectives also provide important guidelines for subsequent airport master plan preparation, facility design efforts, and related plan implementation efforts. This chapter thus documents the guiding objectives and supporting standards which the recommended regional airport system plan is intended to meet, and the criteria by which implementation policies and programs can be designed to carry out the recommended system plan and ensure compatibility and consistency between individual airport improvement efforts and the regional airport system plan.

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Chapter VIII

AIR TRANSPORTATION DEMAND FORECASTS

INTRODUCTION

Forecasts of aviation demand provide the basis for determining the extent of needs and scheduling of new facility components of a regional airport system. When future demands are compared with the capacity of the existing system components, deficiencies are identified and optimum scheduling of improvements and expansion can be determined.

Simply stated, the primary objective of this element of the regional airport study is to provide air travel forecasts for the period 1975-1990, by five-year increments, for the following items: commercial passengers, commercial cargo, air carrier aircraft operations, potential diversion of air traffic, general aviation activity, and military activity, which together comprise the regional demand for air transportation.

AIR CARRIER DEMAND

Air Carrier Projection Methodology

Perhaps the most important forecasts with respect to eventual facility requirements are those involving peak hour flows of activity, particularly air carrier aircraft operations. The total regional air carrier passenger traffic forecast is the important starting point for developing these basic forecasts. The passenger forecasts utilized in this study were developed by the use of two methods. First, total Region air trip originations were estimated for the period 1960 to 1970. Adjustments were made to account for trips where Region origin/destination passengers use airports outside the Region. Second, projections of future passenger originations were developed by using two models—a "top-down" model reflecting the Region's historical and future participation in total U. S. air travel demand, and a "bottom-up" econometric model correlating historical and future air travel demands with the Region's socioeconomic factors.

The first method involves an approach which has been used in other regional aviation system studies. Generally, there is a discernible trend in a city's percentage of total U. S. air carrier traffic, which can be projected based on an extension of historical trends. Total enplaning passenger traffic is comprised of originations (passengers beginning their air travel) and passengers making connections between flights. Since originations and connections can change independently, the analysis and projection is performed on each component of passenger traffic.

The basic approach of the top-down method is to project total U. S. air carrier traffic, and then, by standard statistical techniques, to project the Milwaukee share of the total such traffic. The trend in Milwaukee's share of the U. S. total has changed somewhat in the recent past. The future total U. S. air carrier traffic was estimated by application of equations previously developed by R. Dixon Speas Associates, Inc., and discussed later in this chapter.

The alternative approach uses an economic model to project future Region air trip originations. The model is based upon socioeconomic factors developed and forecast by SEWRPC under other planning programs. These factors and forecasts are discussed at length in another section of this report.

Historical Air Carrier Passenger Activity

Air carrier passenger traffic in the U. S. and at Milwaukee has been growing at dynamic rates for as long as the industry has existed. Among the causes of this growth are diversion from other modes of travel, numerous product improvements, lower costs of air travel, and significant increases in personal income and in the levels of business activity.

Diversion from other modes of travel to air has been significant, especially from intercity transportation by rail. Rail passenger routes have shrunk to a minimum, and the number of trains operating over these routes continues to decrease. With reduced schedules, the convenience of railroad passenger train service has deteriorated significantly, particularly at places between the primary system cities.

Tremendous improvements have occurred in air travel. It is instructive to recall the low altitude, nonpressurized flying which characterized early service. Today, the jet traveler's comfort and well-being are usually determined by the quality of airline catering, and in some cases, the quality of on-board entertainment. Further, average aircraft speed has increased significantly from the early days of aviation. The speed factor is in large part responsible for many changes in both business and personal travel patterns. Today, one can fly 1,000 miles, conduct a day's business, and return 1,000 miles in the same day. This method of doing business is substantially different from the methods of 1950 or even 1960. People take weekend air trips involving thousands of miles that were not possible previously.

One of the important air traffic product improvements is the cost of air travel. The efficiency of jet transportation, the mass marketing of travel, and overall productivity improvements have combined to make air transportation available at decreasing costs. Although recent air fare increases have been highly publicized, these increases are not much different from other price increases brought on by inflation. Comparing air fares in constant dollars, it is far less expensive to travel by air today than it was in the early decades of commercial air travel. There are also many more discounts available to allow people to travel at lower-than-normal rates during periods of off-peak air travel demand.

Increases in personal income and in the level of business activity have also been an important stimulus to airline traffic activity at Milwaukee as well as in the nation as a whole.

Anticipated Growth and Change in the Region

In any planning effort, forecasts are required of all future events and conditions which are outside the scope of the plan but which affect either the plan design or implementation. Changes in the population size and composition; in employment, income, and public revenue; and in land use requirements are all inevitable. Forecasts of several important socioeconomic characteristics have been prepared by the Commission to the year 1990. These forecasts of the direction and magnitude of anticipated change and the methodologies used to prepare these forecasts have been developed and described in Commission reports.[1] These forecasts were prepared in 1963 under the initial regional land use-transportation study and have been used for many of the Commission's planning activities. With the availability of the 1970 census information, and as an important element of the Commission's continuing planning activities, population and economic forecasts were reevaluated. Because this reevaluation was underway at the same time as the regional airport system planning program, the results of any new forecasts were not available. Therefore, the previously developed socioeconomic forecasts have been used in forecasting aviation characteristics. The impact of new population and economic forecasts on airport system planning will be evaluated as part of the continuing regional airport planning process.

In the past, population growth in the Region has generally paralleled that of other large metropolitan areas in the United States. Absolute population increases have been large, and growth rates have been higher than comparable state or national increases. The population of the Region has increased by about 515,000 persons within the last 20 years, compared to a total increase of only one million in the preceding 100 years. In terms of rate of increase, the population of the Region has been growing faster than that of either the United States or the State of Wisconsin. As a result, the Region's share of the U. S. population from 1950 to 1970 has increased from 0.81 percent to 0.86 percent. The Region's share of the state population has increased from 36 percent to nearly 40 percent.

Household formation is another population characteristic important for planning purposes. A household is defined as an individual or family occupying a separate dwelling unit as opposed to persons occupying group quarters, such as dormitories, boarding houses, or institutions. Between 1950 and 1963, the number of households in the Region increased from 355,000 to 482,000, resulting in the formation of about 10,000 new households per year.

The population of the Region is forecast to continue to increase, and as indicated in Table 78, to reach approximately 2,678,000 persons by 1990. This represents an increase of slightly more than one million persons over the estimated 1963 level of 1,674,000 persons. Approximately 55 percent of this increase is forecast to take place by 1980, and the other 45 percent in the 1980 to 1990 decade. The population forecast by county is also shown in Table 78.

[1] *See Chapter III of SEWRPC Planning Report No. 7, Volume 2, Forecasts and Alternative Plans—1990, for discussion of the assumptions and techniques used in the economic and demographic forecasts. In addition, SEWRPC Planning Report No. 3, The Economy of Southeastern Wisconsin, and SEWRPC Planning Report No. 4, The Population of Southeastern Wisconsin, each contain descriptions of the economic activity and population forecasting techniques used by the Commission.*

Table 78

ACTUAL AND FORECAST POPULATION OF THE REGION BY COUNTY: SELECTED YEARS 1960-1990

County	Year							Percent Change 1960-1990
	1960	1965	1970	1975	1980	1985	1990	
Kenosha	100,600	112,000	125,000	139,000	157,000	177,000	202,000	100.7
Milwaukee	1,036,000	1,103,000	1,170,000	1,236,000	1,305,000	1,375,000	1,446,000	39.5
Ozaukee	38,400	46,000	54,000	64,000	75,000	89,000	106,000	176.0
Racine	141,800	156,000	173,000	193,000	217,000	247,000	283,000	99.5
Walworth	52,400	57,000	62,000	67,000	73,000	80,000	87,000	66.0
Washington	46,100	52,000	58,000	65,000	74,000	84,000	96,000	108.2
Waukesha	158,300	192,000	228,000	271,000	322,000	383,000	458,000	189.3
Region	1,574,000	1,718,000	1,870,000	2,035,000	2,223,000	2,435,000	2,678,000	70.1

Source: SEWRPC.

Increases in the number of households in the Region will occur with the forecast increase in population. Forecast increases in the number of households have particular implications for long-range transportation planning, since it is the household population which creates nearly all the demand for transportation facilities. As shown in Table 79, the number of households in the Region is estimated to increase to 795,000 by 1990. Implicit in the forecast are the assumptions that approximately 98 percent of the population will reside in households over the forecast period, and the average household size will be about 3.3 persons, based on past trends.

Employment in the Region is forecast to reach 984,000 by 1990. The forecast rate of increase is less than the forecast population growth rate, reflecting implicit assumptions that fewer employees will support the regional population in the future and that the size of the labor force relative to the total population will decrease. These assumptions appear to be reasonable, not only in light of recent trends, but in light of trends toward higher educational attainment and retirement at earlier ages. As indicated in Table 80, agricultural employment is forecast to continue its historical long-term decline; construction and mining, manufacturing, trade, and transportation-communication-utilities employment are all forecast to increase by 1990 at rates ranging from 29 to 35 percent; and service employment, including finance, insurance, real estate, and other private services and government services and education, is forecast to increase at rates ranging from 95 to 153 percent. From Table 80, it can be seen that the major industry groups are manufacturing and services. Table 81 shows a breakdown of the manufacturing employment forecast by various industries, and offers additional insight as to the types of employment anticipated within the Region during the forecast periods.

The industrialization of the underdeveloped countries of the world in the next 20 years will also require large capital expenditures, particularly construction equipment and machine tools. These two industries are both important within the Region. If southeastern Wisconsin can increase or maintain its market share in capital goods, it may so benefit that the forecast of manufacturing employment may prove to be conservative.

Incomes of residents of the Region are forecast to continue their post-war upward climb. As indicated in Table 82, the total income available within the Region is forecast to reach over 10 million dollars by 1990. This increase is based on the assumption that per capita incomes will increase at an average annual rate of 2 percent, which is a continuation of the trends established in the Region between 1949 and 1963 and is consistent with the assumed rates of increase in personnel productivity.

National per capita income is also forecast to increase by approximately 2 percent per year, but per capita income within the Region should be higher than the national average in 1990. The regional per capita income forecast for 1990 is $4,093, while the national per capita income forecast is about $3,500. This difference reflects the fact that the highly urbanized Region has, like other urbanized regions, enjoyed a higher-than-national-average per capita income. As further indicated in Table 82, average household incomes are projected to increase to nearly $14,000 by 1990.

Table 79

ACTUAL AND FORECAST HOUSEHOLDS IN THE REGION SELECTED YEARS 1960-1990

Year	Total Population	Household Population	Number of Households	Persons Per Household
1960	1,574,000	1,537,000	466,000	3.30
1970	1,870,000	1,833,000	555,000	3.30
1980	2,223,000	2,178,000	660,000	3.30
1990	2,678,000	2,624,000	795,000	3.30

Source: U. S. Bureau of the Census and SEWRPC.

Table 80

EMPLOYMENT FORECASTS FOR THE REGION BY MAJOR INDUSTRY GROUP SELECTED YEARS 1960-1990

Industry Group	1960	1963	1970	1980	1990	Percent Change 1960-1990
Agriculture	12,900	12,000	10,600	9,100	7,900	38.8
Construction and Mining	29,500	29,700	32,500	35,800	39,500	33.9
Manufacturing	253,000	258,200	274,600	299,000	326,500	29.1
Trade	120,200	122,100	132,700	146,600	162,000	34.8
Transportation, Communication, and Utilities	34,800	35,300	38,400	42,500	46,900	34.8
Finance, Insurance, and Real Estate Services	23,000	24,000	28,700	35,900	44,800	94.8
Private Services	94,700	101,200	124,100	172,600	240,100	153.5
Government Services and Education	47,900	52,400	64,400	86,500	116,300	142.8
Total	616,000	634,900	706,000	828,000	984,000	59.7

Source: Wisconsin Industrial Commission and SEWRPC.

Table 81

MANUFACTURING EMPLOYMENT FORECASTS FOR THE REGION BY INDUSTRY
SELECTED YEARS 1960-1990

Industry	1960	1963	1970	1980	1990	Percent Change 1960-1990
Food and Related Products	21,300	20,900	20,300	19,300	18,300	- 14.1
Textile, Apparel, Leather Products	14,200	14,200	14,200	14,200	14,200	--
Paper and Wood Products	9,500	9,600	9,900	10,200	10,700	12.6
Printing and Publishing	16,300	16,800	18,500	20,900	23,700	45.4
Chemical and Related Products	4,000	4,100	4,500	5,300	5,800	45.0
Primary Metal Products	19,400	19,600	20,900	22,500	24,300	25.3
Fabricated Metal Products	18,300	18,300	19,200	20,200	21,300	16.4
Machinery	58,800	59,600	62,400	65,600	69,000	16.2
Electrical Equipment	40,900	42,900	47,500	57,900	70,600	72.6
Transportation Equipment	33,400	34,300	36,900	40,800	45,000	34.7
Instruments and Related Products	3,400	3,400	3,800	4,400	4,900	44.1
Miscellaneous Manufacturing Products	13,500	14,500	16,500	17,700	18,700	45.0
Total	253,000	258,200	274,600	299,000	326,500	29.1

Source: Wisconsin Industrial Commission and SEWRPC.

These income forecasts have important implications for airport planning. First, they indicate that there will be a strong market in the Region for all types of goods and services. This is consistent with the employment forecasts for the Region presented previously, which indicate that there will be a fairly rapid increase in trade and service industry employment to meet this growing local demand. Also, increased incomes and leisure time will probably result in greater demand for recreational facilities and increased travel activities of all types. All of these probabilities must be considered in the preparation of a long-range airport system plan.

The population, employment, and income growth experienced in the Region in the recent past has been accompanied by the demand to convert large areas of land from rural to urban use. Much of this urban development was for residential purposes, but a substantial amount of land was also used for commercial, industrial, governmental, institutional, and recreational use. The adopted land use plan for southeastern Wisconsin is shown on Map 28. Under this plan about 128,000 acres of land would be converted to urban use during the period 1963-1990 (see Table 83).

Air Carrier Passenger Traffic at General Mitchell Field

One major element of air carrier activity is passenger activity. As shown in Table 84, passenger originations and enplanements at General Mitchell Field have grown significantly in the past two decades. (An originating passenger is defined as one whose flight begins at a given airport—in this case, General Mitchell Field. An enplaning passenger is either one whose flight begins at the airport, or one making a connection (or transfer) from another flight.) Through passengers, who arrive and depart a city on the same flight, are not counted for the purpose of this analysis. The difference between total enplaning passengers and originating passengers is the number of connecting passengers.

Table 82

TOTAL, PER CAPITA, AND HOUSEHOLD
INCOME FORECASTS FOR THE REGION
SELECTED YEARS 1949-1990

Year	Total Personal Income[a]	Per Capita Income[a]	Household Income[a]
1949	$ 2,216,000,000	$1,786	$ 6,250
1959	3,671,000,000	2,333	7,878
1963	4,014,000,000	2,398	8,322
1970	5,150,000,000	2,754	9,279
1980	7,465,000,000	3,358	11,311
1990	10,961,000,000	4,093	13,786

[a] *Income expressed in constant 1963 dollars.*

Source: U. S. Bureau of the Census and SEWRPC.

Connecting traffic is shown in Table 84 in terms of connections per 1,000 originations. This represents a logical approach to analysis of connections as well as their projection, since this type of traffic is generally related to the volume of flights provided to serve the basic market. The enplaning and originating traffic is shown graphically in Figure 68.

Table 83

EXISTING AND PROPOSED LAND USE IN THE REGION: 1963 AND 1990 ADOPTED LAND USE PLAN

Land Use Category	Existing (1963)		Planned Increment		Total 1990	
	Acres	Percent of Major Category	Acres	Change	Acres	Percent of Major Category
Urban Land Use						
Residential	*129,358*	*44.6*	*71,187*	*55.0*	*200,545*	*48.0*
High-Density.	34,463	11.9	2,790	8.0	37,253	8.9
Medium-Density	24,748	8.5	53,784	217.3	78,532	18.8
Low-Density	70,147	24.2	14,613	20.8	84,760	20.3
Commercial[a].	6,706	2.3	5,048	75.2	11,754	2.8
Industrial[a]	9,746	3.4	5,123	52.5	14,869	3.6
Governmental[b]	14,722	5.1	9,573	65.0	24,295	5.8
Transportation[c].	96,117	33.1	28,623	29.7	124,740	29.8
Recreation	33,262[d]	11.5	8,718[e]	26.2	41,980	10.0
Total Urban Land Use	289,911	100.0	128,272	44.2	418,183	100.0
Rural Land Use						
Agriculture.	*1,085,144*	*75.8*	*- 102,837*	*- 9.4*	*982,307*	*75.4*
Prime Agriculture.	443,952	31.0	- 21,267	- 4.7	422,685	32.5
Other Agriculture.	641,192	44.8	- 81,570	- 12.7	559,622	42.9
Other Open Lands[f]	345,951	24.2	- 25,435	- 7.3	320,516	24.6
Total Rural Land Use	1,431,095	100.0	- 128,272	- 8.9	1,302,823	100.0
Total	1,721,006	--	--	--	1,721,006	--

NOTE: Figures in italics indicate subtotals.

[a] Includes onsite parking.

[b] Includes institutional uses and onsite parking.

[c] Includes communications and utilities uses.

[d] Includes the entire site areas of public and nonpublic recreation sites.

[e] Includes only the increment recommended for public recreation uses.

[f] Includes woodlands, water, wetlands, and quarries.

Source: SEWRPC.

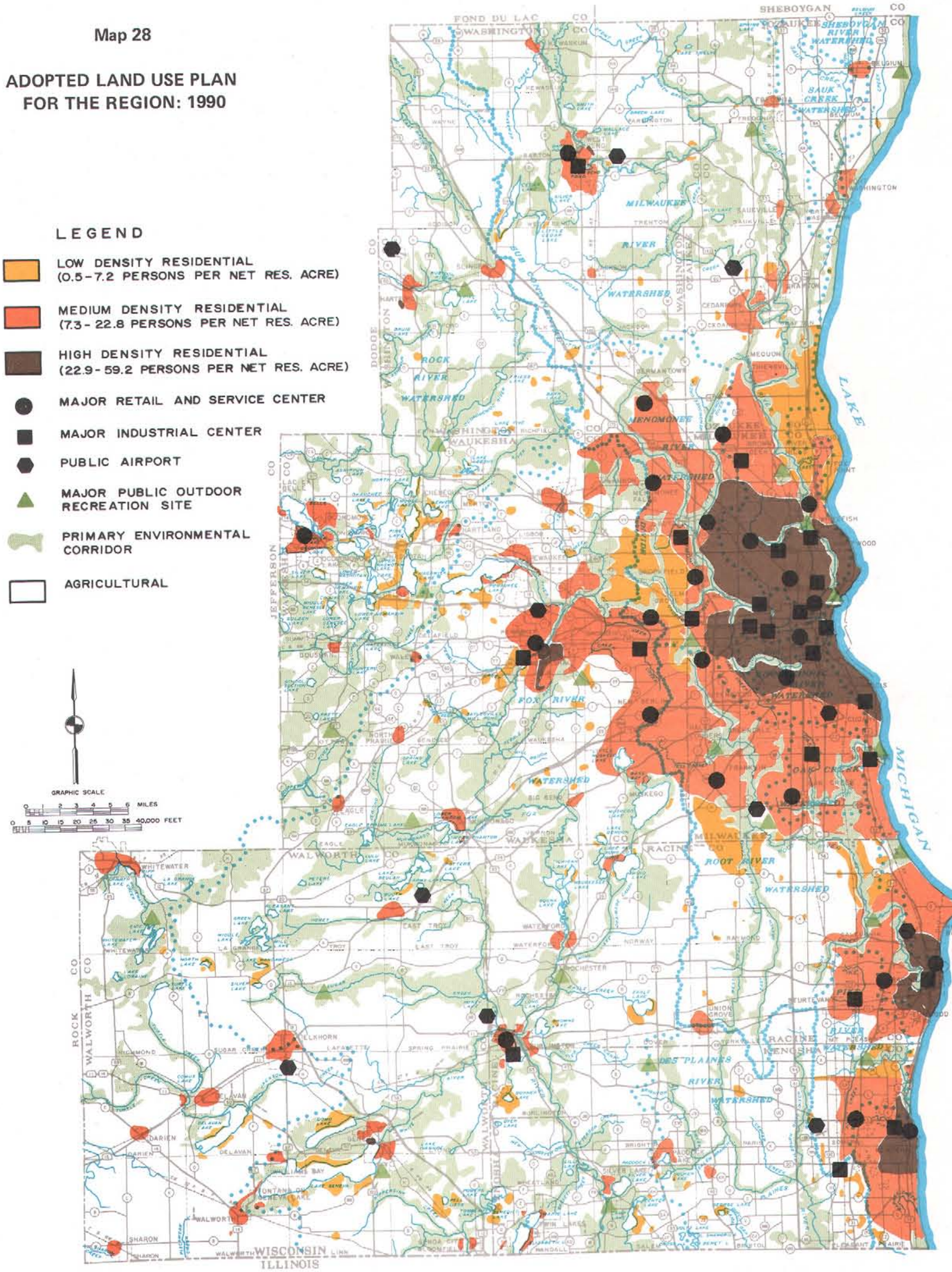
Local air carrier traffic in relation to national traffic is shown in Table 85. Of specific interest is the relative stability in the General Mitchell Field percentage of total U. S. air carrier traffic for the period 1963 to 1971. During this period, General Mitchell Field averaged 0.66 percent of the U. S. total, with a high of 0.68 percent and a low of 0.63 percent. Prior to the development of a major traffic pattern at Chicago's O'Hare Airport, the percent of the total at Milwaukee was higher (0.82 percent in 1959). The decline in Milwaukee's share of total U. S. traffic was accelerated from 1960 through 1962. There is an inverse relationship during this period between Milwaukee's share of total U. S. originations and the development of a significant pattern of service at O'Hare Airport. Table 86 shows the changes in air carrier activity at Milwaukee and Chicago from 1955 to 1971.

The analysis of the effect of O'Hare on Milwaukee is of particular interest in estimating the total number of originating passengers in the Region, including those who use airports outside the Region, particularly Chicago.

The Region's percentage of total U. S. originations, including persons who use airports outside the Region but originate or terminate their trips within the Region, is estimated to range between 0.80 and 0.90 percent. This can be verified in two ways. First, it can be hypothesized that the 1959 General Mitchell Field percentage of U. S. originations is an appropriate base, and that the subsequent decrease was due to development of significant air carrier service at O'Hare Airport. The second verification is a survey of registered owners of vehicles parked at Chicago's O'Hare Airport, conducted by the

Map 28

ADOPTED LAND USE PLAN FOR THE REGION: 1990



The adopted regional land use plan places heavy emphasis on the continued effect of the urban land market in determining the location, intensity, and character of future development. In so doing, however, it seeks to modify the effect of this market on regional development by attempting to guide new urban development into those areas of the Region most suitable for such development. Most importantly, the plan seeks to prevent urban development from intruding on the primary environmental corridors of the Region. With respect to airport system planning, it is important to know the location and density of anticipated residential, commercial, and industrial development so that future demand for airport facilities can be determined. Knowledge of such development is also important so that airport facilities can be located and designed to minimize potential adverse effects, such as noise and air pollution, on surrounding land uses, and on the natural resource base. The airport locations shown on this map were included in the National Airport System Plan, completed before preparation of this study, and were modified under the regional airport system plan.

Source: SEWRPC.

Table 84

PASSENGER TRAFFIC AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1955-1972

Year	Enplaning Passengers	Originating Passengers	Connecting Passengers	Connections Per 1,000 Originations
1955	258,830	N/A[b]	N/A[b]	N/A[b]
1956	291,276	N/A[b]	N/A[b]	N/A[b]
1957	328,117	N/A[b]	N/A[b]	N/A[b]
1958	328,869	N/A[b]	N/A[b]	N/A[b]
1959	368,002	316,770	51,232	162
1960	367,282	295,300	71,982	244
1961	N/A[b]	284,590	N/A[b]	N/A[b]
1962	365,284	303,250	62,034	205
1963	399,393	327,980	71,413	218
1964	438,206	360,620	77,586	215
1965	495,769	437,970	57,799	132
1966[a]	536,682	488,690	47,992	98
1967	679,673	599,000	80,673	135
1968	805,413	652,080	153,333	235
1969	840,758	705,830	134,928	191
1970[a]	887,047	714,530	172,517	241
1971	976,609	729,990	246,619	338
1972[a]	941,400	N/A[b]	N/A[b]	N/A[b]

[a] *Traffic was significantly affected by air carrier work stoppages.*

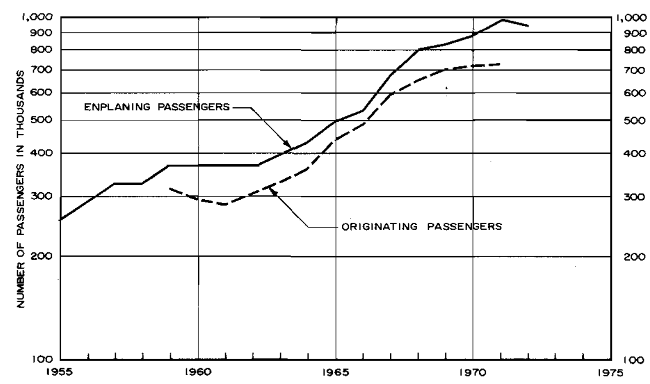
[b] *Not available.*

Source: Federal Aviation Administration, Airport Activity Statistics; General Mitchell Field airport activity records; and Civil Aeronautics Board, Origin-Destination Survey of Airline Passenger Traffic.

Wisconsin Department of Transportation in February and March of 1970. Review of this study indicates that, within the accuracy of the data available, between 20 and 25 percent of the passengers actually having a true trip end within southeastern Wisconsin use O'Hare Airport, with the balance using General Mitchell Field. Therefore, if the 0.66 percent of the total U. S. activity using General Mitchell Field in 1970 represents 75 to 80 percent of the Region's air travel generation, the total air activity for the Region is between 0.83 and 0.88 percent of the total U. S. traffic. It is forecast that O'Hare will continue to divert approximately 20 to 25 percent of the Region's air travel demand from General Mitchell Field.

Figure 68

ENPLANING AND ORIGINATING PASSENGERS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1955-1972



Source: R. Dixon Speas Associates, Inc.

Table 85

DOMESTIC AIR CARRIER PASSENGER TRAFFIC FOR THE UNITED STATES AND GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1959-1971

Year	Passenger Traffic				
	United States	General Mitchell Field			General Mitchell Field Total as Percent of U. S. Total
		Inbound	Outbound	Total	
1959	77,725,120	323,670	316,770	640,440	0.82
1960	77,736,720	308,200	295,300	603,500	0.78
1961	80,284,900	292,660	284,590	577,250	0.72
1962	85,507,260	308,780	303,250	612,030	0.72
1963	98,094,240	330,830	327,980	658,810	0.67
1964	111,393,040	369,240	360,620	729,860	0.66
1965	131,166,940	442,950	437,970	880,920	0.67
1966[a]	150,137,560	490,380	488,690	979,070	0.65
1967	176,869,640	599,930	599,000	1,198,930	0.68
1968	207,491,100	655,790	652,080	1,307,870	0.63
1969	223,393,560	707,310	705,830	1,413,140	0.63
1970[a]	215,903,360	714,340	714,530	1,428,870	0.66
1971	216,533,180	730,570	729,990	1,460,560	0.67

[a] *Traffic was significantly affected by air carrier work stoppages.*

Source: Civil Aeronautics Board, Origin-Destination Survey of Airline Passenger Traffic.

Table 86

AIR CARRIER OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY AND O'HARE AND MIDWAY AIRPORTS IN CHICAGO 1955-1971

Year	Air Carrier Operations[a]			
	General Mitchell Field	Chicago		
		O'Hare	Midway	Total
1955	58,272	10,668	321,882	332,550
1956	60,231	36,762	311,964	348,726
1957	68,510	57,692	341,316	399,008
1958	64,722	66,205	337,421	403,626
1959	64,673	82,417	345,170	427,587
1960	67,812	163,351	298,582	461,933
1961	59,002	235,908	187,978	423,886
1962	60,771	331,090	46,873	377,963
1963	59,866	358,266	19,054[b]	377,320
1964	57,860	389,640	19,017	408,657
1965	57,795	443,026	16,716	459,742
1966	56,924	478,644	5,090	483,734
1967	65,828	573,506	4,427	577,983
1968	74,513	616,743	24,425	641,168
1969	76,619	632,030	31,394	663,424
1970	73,817	625,412	37,620	663,032
1971	78,552	609,447	46,845	656,292

[a] *The data include nonrevenue service, such as training.*

[b] *There were no scheduled operations at Midway in 1963, but they resumed at a low level in 1964.*

Source: R. Dixon Speas Associates, Inc.

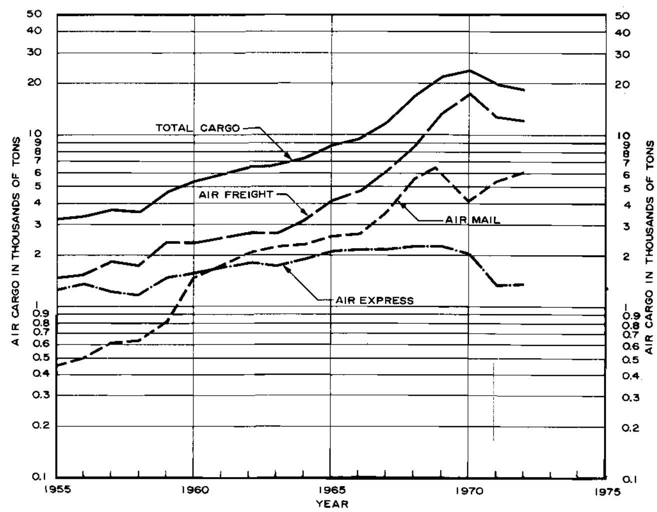
Air Carrier Cargo Activity at General Mitchell Field

A second basic element of air carrier activity at General Mitchell Field involves air cargo activity. Air carrier cargo activity increased significantly at Milwaukee between 1955 and 1972, as shown in Table 87 and Figure 69. The main causes of growth in air freight volume are similar to those for air passenger growth. Primarily, the cost of air freight service has become more competitive at a time when the service provided has increased significantly. In terms of total intercity freight ton-miles, however, air freight is still a small proportion, amounting to only 0.18 percent of total intercity freight ton-miles in 1970.[2]

Mail volumes changed significantly in 1968 due to a change in postal policy. In that year, the airlift of most first class mail that was destined to points more than 200 miles from the originating city was inaugurated. This policy was subsequently altered, and air carriers presently

Figure 69

AIR CARGO TRAFFIC AT GENERAL MITCHELL FIELD MILWAUKEE COUNTY: 1955-1972



Source: Federal Aviation Administration, Airport Activity Statistics, 1955-1969; and General Mitchell Field airport activity records for 1970-1972.

haul considerable volumes of nonpriority mail on a space available basis. Air express growth has been relatively stable since 1955, following industry-wide trends toward use of other air services, both in terms of mail and freight. It should be noted that air freight activity is susceptible to relatively large variations over short-term periods, primarily because of changes in corporate distribution policies reflecting changes in general economic conditions.

Air Carrier Aircraft Operations at General Mitchell Field

The third basic element of air carrier activity at General Mitchell Field involves air carrier operations.[3] Table 88 shows the history of operations for several different types of activity. Total air carrier operations include not only scheduled flights, but also movements such as ferry flights, flight training, and charter and weather diversion flights. The scheduled operations are those air carrier flights which are performed over the carriers' certificated routes, are based on published flight schedules, and include extra sections.

Although passenger activity has increased threefold in the past 15 years, air carrier operations have increased only 34 percent. The major difference in operations growth, compared to traffic increases, is due to the significant increase in the average aircraft size and the number of enplaning passengers per departure. The recent increase in total annual airline seats available and in average seats per scheduled departure is shown in Table 89. By combining the average aircraft size and the enplaning passengers per departure, the enplaning load factor at Milwaukee can be estimated. This factor is the percentage

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[2]*This percentage includes all modes of intercity transportation, both public and private. If oil pipelines and inland waterway freight are excluded, the air percentage is 0.29 percent.*

[3]*An operation is a takeoff or a landing.*

Table 87

AIR CARGO TRAFFIC FOR THE UNITED STATES AND GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1955-1972

Year	Freight and Express (Tons)					Airmail (Tons)		
	United States	General Mitchell Field			General Mitchell Field Total as Percent of U. S. Total	United States	General Mitchell Field	General Mitchell Field Total as Percent of U. S. Total
		Freight	Express	Total				
1955	329,000	1,484	1,232	2,716	0.83	127,000	468	0.37
1956	431,000	1,514	1,324	2,838	0.66	133,000	506	0.38
1957	456,000	1,806	1,219	3,025	0.66	141,000	619	0.44
1958	453,000	1,737	1,174	2,911	0.64	151,000	637	0.42
1959	512,000	2,326	1,437	3,763	0.73	165,000	828	0.50
1960	522,000	2,323	1,513	3,836	0.73	185,000	1,488	0.80
1961[a]	--	--	--	--	--	--	--	--
1962	686,000	2,693	1,802	4,495	0.66	241,000	2,046	0.85
1963	736,000	2,672	1,716	4,388	0.60	247,000	2,206	0.89
1964	891,000	3,135	1,886	5,021	0.56	263,000	2,316	0.88
1965	1,111,000	4,090	2,075	6,165	0.55	310,000	2,560	0.83
1966	1,274,000	4,682	2,122	6,804	0.53	387,000	2,621	0.68
1967	1,373,000	6,080	2,127	8,207	0.60	547,000	3,564	0.65
1968	1,621,000	8,792	2,239	11,031	0.68	737,000	5,686	0.77
1969	1,785,000	13,202	2,233	15,435	0.86	773,000	6,409	0.83
1970	1,925,000	17,370	2,065	19,435	0.94	782,000	4,230	0.76
1971	1,874,000	12,907	1,328	14,235	0.76	673,000	5,404	0.80
1972	N/A[b]	12,085	1,342	13,427	--	N/A[b]	6,011	--

[a] *Data were not published for 1961.*

[b] *Not available.*

Source: Federal Aviation Administration, Airport Activity Statistics, 1955-1969; and General Mitchell Field airport activity records for 1970-1972.

Table 88

AIR CARRIER AIRCRAFT OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1955-1972

Year	Scheduled Airline Departures	Air Carrier Operations			
		Scheduled	Nonscheduled	Total	Nonscheduled As Percent of Scheduled
1955	25,490	50,980	7,292	58,272	14.3
1956	27,068	54,136	6,095	60,231	11.3
1957	30,178	60,356	8,154	68,510	13.5
1958	31,406	62,812	1,910	64,722	3.0
1959	31,639	63,278	1,395	64,673	2.2
1960	33,410	66,820	992	67,812	1.5
1961	N/A[b]	N/A[b]	N/A[b]	59,002	N/A[b]
1962	28,906	57,812	2,959	60,771	5.1
1963	28,566	57,132	2,734	59,866	4.8
1964	27,354	54,708	3,152	57,860	5.8
1965	27,226	54,452	3,343	57,795	6.1
1966[a]	27,303	54,606	2,318	56,924	4.2
1967	31,896	63,792	2,036	65,828	3.2
1968	33,901	67,802	6,711	74,513	9.9
1969	35,268	70,536	6,083	76,619	8.6
1970[a]	N/A[b]	N/A[b]	N/A[b]	73,817	N/A[b]
1971	N/A[b]	N/A[b]	N/A[b]	78,552	N/A[b]
1972[a]	N/A[b]	N/A[b]	N/A[b]	73,832	N/A[b]

[a] *Passenger traffic was significantly affected by air carrier work stoppages.*

[b] *Not available.*

Source: R. Dixon Speas Associates, Inc.

Table 89

AIR CARRIER AIRCRAFT DEPARTURES AND AVERAGE SEATS PER DEPARTURE AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1962-1969

Year	Scheduled Airline Departures	Total Annual Seats Available (In Millions)	Average Seats Per Departure
1962	28,906	1.36	47
1963	28,566	1.61	56
1964	27,354	1.55	57
1965	27,226	1.70	62
1966	27,303	1.73	63
1967	31,896	2.21	69
1968	33,901	2.61	77
1969	35,268	2.89	82

Source: R. Dixon Speas Associates, Inc.

of seats on outbound flights that are filled by passengers enplaning at a particular airport. It is lower than the total air carrier operating load factor, which includes through passengers as well as enplaning passengers. The enplaning load factor for 1962 to 1969 is shown in Table 90. Data beyond 1969, while not available on a comparable basis, show a similar load factor situation.

Another aspect of air carrier operations to be evaluated is the peak period characteristics of air carrier movements, which have a critical impact on facility needs. The historical activity at General Mitchell Field has been unusual, but does show a realistic pattern. Table 91 shows operations on peak and average days, as well as busy hour operations.

The unusual air traffic delay problems of the 1967-1969 period that occurred nationally appear to have affected the busy hour operations at Milwaukee. The busy hour operations in 1960, 1965, 1970, and 1971 are more in line with other cities the size of Milwaukee.

Forecast of Passenger Traffic at General Mitchell Field

As outlined previously, the basic passenger projections used in this study were developed from two different methodologies in order to provide confirmation of one projection by the other and to provide a likely range of possible future demand projections.

Top-Down Projection: The first projection discussed is based on the top-down method. Essentially, this approach seeks to determine predictable relationships in the dynamic air transportation industry, and to use these relationships to project future volumes of traffic. The key to this approach is the projected volume of U. S. domestic traffic, since there is no discernible trend which would indicate that the Milwaukee share of the national traffic is changing. Recent statistics indicate that Milwaukee's share of the national total has stabilized at about 0.66 percent.

An analytical model has been developed to show the relationship of total domestic air traffic of the certificated carriers to various economic activity values. The model relates air passenger trips to several variables: the U. S. population, particularly persons between the ages of 20 and 64; personal consumption expenditures, particularly airline expenditures; average yield per revenue passenger mile; and the average length of passenger trips. The basic historical values are shown in Table 92.

These values and trends are extrapolated into the future to derive projections of U. S. air transportation of passengers. The population projection used in the model corresponds to the latest "D" level, or low level, forecast of U. S. population published by the U. S. Bureau of the Census. Per capita expenditures are expected to increase about 3 percent per year in constant dollars, and air passenger revenues are expected to comprise a greater percentage of transportation expenditures, continuing past trends. Airline yields are expected to increase gradually over the next 30 years, from about 4.6 cents per mile today (expressed in 1958 constant dollars) to 5.2 cents per mile in the year 1990. The length of airline passenger trips is also expected to increase gradually in the future, continuing past trends. The projections of the national economic variables and resultant airline originations are shown in Table 93.

Table 90

ENPLANING LOAD FACTOR FOR GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1962-1969

Year	Average Number of Enplaning Passengers Per Departure	Average Number of Seats Per Departure	Enplaning Load Factor[a]
1962	10.7	47	23
1963	11.6	56	21
1964	13.5	57	24
1965	16.3	62	26
1966	18.0	63	29
1967	18.8	69	27
1968	19.3	77	25
1969	20.0	82	24

[a] *The enplaning load factor is the percentage of seats on outbound flights that are filled by passengers enplaning at a particular airport.*

Source: R. Dixon Speas Associates, Inc.

Table 91

DAILY AND BUSY HOUR AIR CARRIER AIRCRAFT OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY SELECTED YEARS 1960-1971

	Air Carrier Operations				
Year[a]	Average Day	Peak Day	Ratio of Peak/Average Day	Busy Hour	Busy Hour as Percent of Average Day
1960	186	219	1.18	18	9.7
1965	156	190	1.22	18	11.5
1967	163	200	1.23	40	24.5
1968	194	246	1.27	40	20.6
1969	207	267	1.29	32	15.5
1970	217	301	1.39	24	11.1
1971	197	273	1.39	19	9.6

[a] *Data for each year except 1960 are for fiscal years.*

Source: Federal Aviation Administration, Terminal Area Air Traffic Relationships.

Table 92

DOMESTIC SCHEDULED AIR TRAVEL MARKET VARIABLES FOR THE UNITED STATES: 1950-1971

Year	Population (Aged 20-64)	Personal Consumption Expenditures[a]		Airline Revenues		Average Airline Yield in Cents Per Revenue Passenger Mile[a]	Revenue Passenger Miles (In Millions)	Average Length of Haul (Miles)	Enplaned Passengers
		Per Capita	Total (In Billions)	Total[a] (In Millions)	Percent of Total Personal Consumption Expenditures				
1950	88,201,000	$2,613	$230.5	$ 464.1	0.20	5.83	7,955	435	18,269,000
1951	89,017,000	2,615	232.8	613.6	0.26	5.84	10,501	441	23,832,000
1952	89,729,000	2,668	239.4	716.2	0.30	5.75	12,461	472	26,411,000
1953	90,242,000	2,779	250.8	828.1	0.33	5.64	14,689	484	30,373,000
1954	90,775,000	2,817	255.7	948.9	0.37	5.68	16,696	487	34,262,000
1955	91,414,000	2,999	274.2	1,126.7	0.41	5.71	19,741	490	40,326,000
1956	92,052,000	3,057	281.4	1,264.6	0.45	5.68	22,276	503	44,251,000
1957	92,634,000	3,111	288.2	1,427.5	0.50	5.65	25,247	529	47,743,000
1958	93,202,000	3,113	290.1	1,419.5	0.49	5.62	25,256	534	47,252,000
1959	93,824,000	3,275	307.3	1,632.2	0.53	5.60	29,151	544	53,544,000
1960	94,458,000	3,346	316.1	1,662.1	0.53	5.47	30,375	556	54,627,000
1961	95,225,000	3,387	322.5	1,638.7	0.51	5.31	30,878	559	55,205,000
1962	96,173,000	3,519	338.4	1,736.7	0.51	5.19	33,436	566	59,087,000
1963	97,421,000	3,627	353.3	2,046.6	0.58	5.35	38,253	566	67,544,000
1964	98,473,000	3,795	373.7	2,321.3	0.62	5.29	43,902	570	76,985,000
1965	99,501,000	3,990	397.7	2,689.4	0.68	5.21	51,608	576	89,588,000
1966	100,519,000	4,159	418.1	3,162.7	0.76	5.25	60,271	587	102,718,000
1967	102,486,000	4,197	430.1	3,888.7	0.90	5.18	75,104	601	124,886,000
1968	104,196,000	4,345	452.7	4,391.6	0.97	5.04	87,101	613	142,199,000
1969	105,871,000	4,433	469.3	4,934.3	1.05	4.84	101,970[b]	660[b]	154,431,000[b]
1970	107,497,000	4,427	475.9	4,784.2	1.01	4.63	103,330[b]	691[b]	149,592,000[b]
1971	109,259,000	4,502	491.9	4,890.1	0.99	4.64	105,463[b]	695[b]	151,686,000[b]

[a] *Data are expressed in constant 1958 dollars.*

[b] *Data include Hawaii and Alaska as domestic traffic.*

Source: U. S. Bureau of the Census, U. S. Department of Commerce, Air Transport Association of America, and R. Dixon Speas Associates, Inc.

Table 93

PROJECTIONS OF DOMESTIC SCHEDULED AIR TRAVEL MARKET VARIABLES AND ORIGINATIONS FOR THE UNITED STATES 1975, 1980, 1985, and 1990

Year	Population (Aged 20-64)	Personal Consumption Expenditures		Airline Revenues		Average Airline Yield in Cents Per Revenue Passenger Mile	Revenue Passenger Miles (In Millions)	Domestic Originations (In Millions)
		Per Capita	Total (In Billions)	Total (In Millions)	Percent of Total Personal Consumption Expenditures			
1975	116,716,000	$5,172	$ 604	$ 8,131	1.35	4.90	165,940	171
1980	126,745,000	6,025	764	13,858	1.81	5.00	277,160	278
1985	136,240,000	7,019	956	21,625	2.26	5.10	424,020	412
1990	142,347,000	8,176	1,164	31,883	2.74	5.20	613,130	579

Source: R. Dixon Speas Associates, Inc.

The next step in projecting Milwaukee originations and enplanements by this top-down method involves projecting the Milwaukee share of the total U. S. traffic and the Milwaukee connections per origination. Based on expected economic development in the Region, a constant 0.66 percent share of U. S. originations for Milwaukee is projected, equivalent to the average for the period 1963 to 1971. Also, since there is no discernible trend in the airline connections occurring at Milwaukee, a constant 190 connections per 1,000 originations is projected, equivalent to the average for the period 1959 to 1970. Applying these two factors to the U. S. originations projection, Milwaukee passenger origination and enplanement projections were developed and are shown in Table 94. This projection of enplanements implies annual compound growth in enplanements of 8 percent from 1971 to 1975, 10 percent from 1975 to 1980, and an average growth of nearly 8 percent from 1980 to 1990.

The top-down approach to projecting is a generalized, frequently used methodology. In addition to this approach, which is basically a trend projection, an independent projection was developed from a "bottom-up" or causal analysis.

Bottom-Up Projection: The basic tool in the bottom-up projection is an econometric model utilizing multiple regression techniques to establish relationships between air traffic originations and socioeconomic variables related to the Region.

For the econometric analysis, the basic variables tested against traffic originations included population; employment, including breakdowns by major types of activity; household types, including breakdown of households with income of $10,000 or more; enrollment of students in public and private colleges and universities; region income levels; and average U. S. airline yields.

All of these variables were analyzed in all combinations within standard statistical limits. After considering the quality of acceptable models, it was apparent that the best one involved only two major variables: region income levels and airline average yields. The projection equation is as follows:

Thousands of Originations = -951 + (-7.81 x yield in cents per mile) + (0.335 x income in millions).

The model developed has an R^2 of 0.935, passed the test of goodness of fit, and had an acceptable standard error of the estimate. Table 95 shows the variable values for the forecast years, as well as the projection of originations which is derived from applying the formula to the variables.

Adding the average of 190 connecting passengers per 1,000 originating passengers, developed from historical relationships at General Mitchell Field, to the projected originations produced the projected enplanements set forth in Table 96.

Other Passenger Projections: The Federal Aviation Administration (FAA) and the Air Transport Association of America (ATA) have prepared forecasts of air passenger demand at General Mitchell Field. The methodologies employed to develop these two forecasts are fully explained in the source documents.[4] For comparison purposes, the two passenger traffic projections developed for this report and the FAA and ATA forecasts are listed in Table 97 and shown graphically in Figure 70. As can be seen, the ATA forecast is slightly higher than the top-down projection, while the FAA forecast is quite similar to the top-down projection.

Following review of the air carrier projections, it was agreed by the Advisory Committee that the two passenger projections developed in this study would be carried through to determine the potential impact of different levels of aircraft movements and peak hour traffic flow, and that comparisons with the FAA and ATA forecasts would also be made, when possible. The

[4] *Federal Aviation Administration, Terminal Area Forecasts, 1975-1985, July 1973, (AEC-200); and Air Transport Association of America, Airline Airport Demand Forecast for Milwaukee, December 1972.*

Table 94

TOP-DOWN PROJECTION OF PASSENGER TRAFFIC AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1975, 1980, 1985, and 1990

Year	Originating Airline Passengers in the United States	Originating Airline Passengers at General Mitchell Field	General Mitchell Field Total as Percent of U. S. Total	Connections Per 1,000 Originations	Total Connecting Passengers	Total Enplaning Passengers
1975	171,000,000	1,129,000	0.66	190	215,000	1,344,000
1980	278,000,000	1,835,000	0.66	190	349,000	2,184,000
1985	412,000,000	2,719,000	0.66	190	517,000	3,236,000
1990	579,000,000	3,821,000	0.66	190	726,000	4,547,000

Source: R. Dixon Speas Associates, Inc.

Table 95

PROJECTION OF ECONOMETRIC VARIABLES AND PASSENGER ORIGINATIONS FOR GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1975, 1980, 1985, and 1990

Year	Region Income (In Millions)	Average Airline Yield in Cents Per Revenue Passenger Mile	Originating Airline Passengers at General Mitchell Field (Bottom-Up Projection)
1975	$ 6,206[a]	4.90	1,087,000
1980	7,465	5.00	1,507,000
1985	9,033[a]	5.10	2,031,000
1990	10,961	5.20	2,674,000

[a] *Interpolated on the basis of average compound growth rate. Income is expressed in constant 1963 dollars.*

Source: R. Dixon Speas Associates, Inc.

Table 97

COMPARISON OF ENPLANING PASSENGER TRAFFIC PROJECTIONS FOR GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1975, 1980, 1985, and 1990

	Enplaning Passengers			
Year	Top-Down Projection (High Range)	Bottom-Up Projection (Low Range)	ATA Forecast[a]	FAA Forecast[b]
1975	1,344,000	1,294,000	1,390,000	1,428,000[c]
1980	2,184,000	1,793,000	2,180,000	2,272,000[d]
1985	3,236,000	2,417,000	3,400,000	3,148,000[e]
1990	4,547,000	3,182,000	5,000,000	N/A[f]

[a] *Air Transport Association of America forecasts, which for purposes of this study were considered as projections.*

[b] *Federal Aviation Administration forecasts, which for purposes of this study were considered as projections.*

[c] *Average of fiscal 1975 and 1976.*

[d] *Estimate based on average annual rate of growth between projection for fiscal 1977 and fiscal 1985.*

[e] *Extrapolation of fiscal 1985 projection, based on continuation of annual rate of growth between projection for fiscal 1977 and fiscal 1985.*

[f] *Not available.*

Source: Air Transport Association of America, Airline Airport Demand Forecast for Milwaukee, December 1972; Federal Aviation Administration, Terminal Area Forecasts—1975-1985, July 1973, (AEC-200); and R. Dixon Speas Associates, Inc.

top-down projection was selected from among the several projections reviewed to become the regional forecast used for plan design and evaluation.

It should be pointed out that both the top-down and bottom-up projections were developed from data which included only those region passengers who utilized General Mitchell Field. This approach was dictated by the fact that it was not possible (due to a lack of adequate data) to generate a valid time series for total region passengers, that is, those passengers from the Region utilizing Chicago's O'Hare Airport as well as those utilizing General Mitchell Field. Due to the approach taken, then, there is an implicit assumption in both projections that Chicago's

Table 96

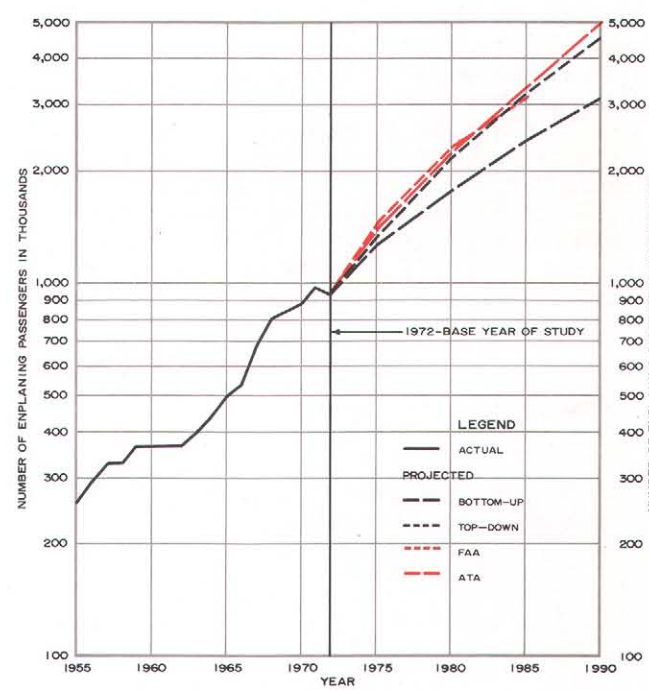
BOTTOM-UP PROJECTION OF PASSENGER TRAFFIC AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1975, 1980, 1985, and 1990

Year	Originating Airline Passengers at General Mitchell Field	Connections Per 1,000 Originations	Total Connecting Passengers	Total Enplaning Passengers
1975	1,087,000	190	207,000	1,294,000
1980	1,507,000	190	286,000	1,793,000
1985	2,031,000	190	386,000	2,417,000
1990	2,674,000	190	508,000	3,182,000

Source: R. Dixon Speas Associates, Inc.

Figure 70

ACTUAL AND PROJECTED ENPLANING PASSENGER TRAFFIC AT GENERAL MITCHELL FIELD MILWAUKEE COUNTY: 1955-1990



Source: Federal Aviation Administration, Airport Activity Statistics, and Terminal Area Forecasts—1975-1985, July 1973, (AEC-200); General Mitchell Field airport activity records; Civil Aeronautics Board, Origin-Destination Survey of Airline Passenger Traffic; Air Transport Association of America, Airline Airport Demand Forecast for Milwaukee, December 1972; and R. Dixon Speas Associates, Inc.

O'Hare Airport will continue to be attractive to southeastern Wisconsin passengers. This assumption, discussed later in the portion of the study involving diversion, results in more conservative projections (all other things remaining equal), but was chosen to counterbalance a potentially optimistic projection of total U. S. air carrier activity.

Forecast of Air Cargo Activity at General Mitchell Field

Using the top-down methodology, a projection of air cargo was developed for the Southeastern Wisconsin Region. Air cargo has been a dynamic growth industry, and developments have been similar to passenger growth in many ways.

Projections for freight, express, and mail at General Mitchell Field were developed by extrapolating the U. S. air cargo industry total and applying the Milwaukee participation rates in this activity. The U. S. projection was developed by projecting annual rates of growth for the 20-year forecast period. The rates utilized in this projection are similar to the growth rates that resulted from a recent study of the aviation industry.[5]

The Region's future participation in U. S. total domestic activity is based on extension of recent trends. Airmail participation has been relatively stable, and an average of 0.80 percent of the U. S. total is used for the future rate. This represents an average for the period 1962 to 1971. The freight and express rate of participation has fluctuated considerably in the last ten years, with a low of 0.53 percent, a high of 0.94 percent, and an average of 0.67 percent. It appears that an upward trend has been in effect since 1966, however, and the projection of future participation is estimated to approximate 1 percent in 1980 and beyond.

This projection of air cargo activity which was developed was also selected as the regional forecast of such activity.

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[5]*Air Transport Association of America, Airline Airport Demand Forecasts, July 1969.*

The forecast air cargo originations for General Mitchell Field and the United States are shown in Table 98 and in Figures 71 and 72. Based on an analysis of the historical relationship between inbound and outbound cargo at General Mitchell Field summarized in Table 99, inbound mail is expected to be about equal to outbound mail, and inbound freight and express are forecast to approximate 90 percent of outbound volumes.

With the ability to handle most of the cargo on combination passenger/cargo aircraft, exclusive all-cargo operations at Milwaukee's General Mitchell Field are limited at present. This condition is expected to continue in the future. Based on analysis of future air carrier operations by type, reviewed in a latter section of this report, the forecast passenger operations will generate demand for aircraft that will have sufficient belly capacity to handle all of the forecast freight, express, and mail volumes. A minimum number of all-cargo operations will exist to serve the convenience of the carrier and for unusual shipments that will not fit into belly holds.

Forecast of Air Carrier Aircraft Operations at General Mitchell Field

The forecasts of passenger and cargo traffic must be converted into air carrier operation projections to be of maximum use in planning. The procedure for developing projections of aircraft movements is a complex one, but one which can be broken into several parts.

Primarily, it is expected that the air carrier fleets will continue their expansion as traffic grows, with today's larger aircraft gradually becoming the predominant types, particularly with regard to the trunk carriers. The regional carriers—Ozark and North Central—will gradually phase out of turboprop equipment, and by the later years of the forecast period will have all-jet fleets. The regional carriers will eventually operate some larger aircraft such as a twin engine version of the DC-10 or L-1011, or the A-300 European Airbus.

Milwaukee's air carrier service patterns are expected to improve gradually with the addition of new nonstop

Table 98

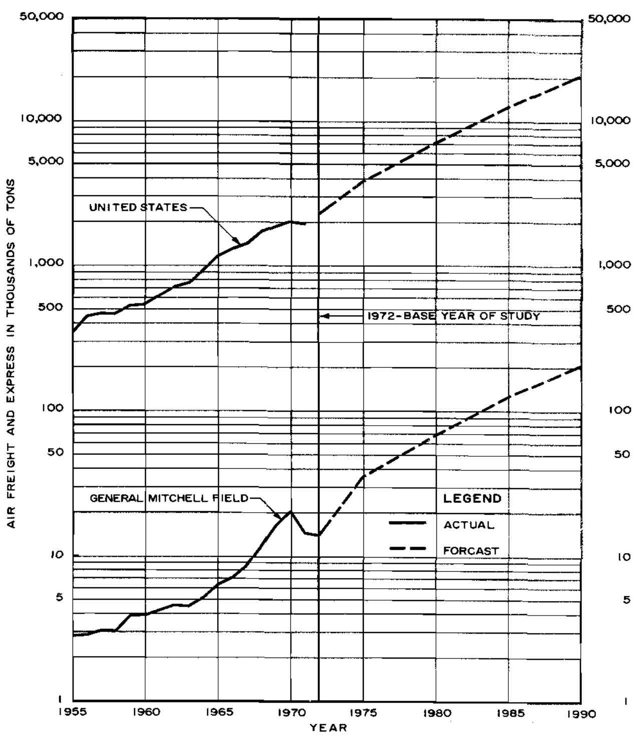
FORECAST OF AIR CARGO TRAFFIC ORIGINATIONS FOR THE
UNITED STATES AND GENERAL MITCHELL FIELD—MILWAUKEE COUNTY
1975, 1980, 1985, and 1990

Year	Freight and Express (Tons)			Mail (Tons)		
	United States	General Mitchell Field	General Mitchell Field Total as Percent of U. S. Total	United States	General Mitchell Field	General Mitchell Field Total as Percent of U. S. Total
1975	3,705,000	33,350	0.90	1,000,000	8,000	0.80
1980	6,825,000	68,250	1.00	1,400,000	11,200	0.80
1985	12,000,000	120,000	1.00	1,900,000	15,200	0.80
1990	20,000,000	200,000	1.00	2,500,000	20,000	0.80

Source: R. Dixon Speas Associates, Inc.

Figure 71

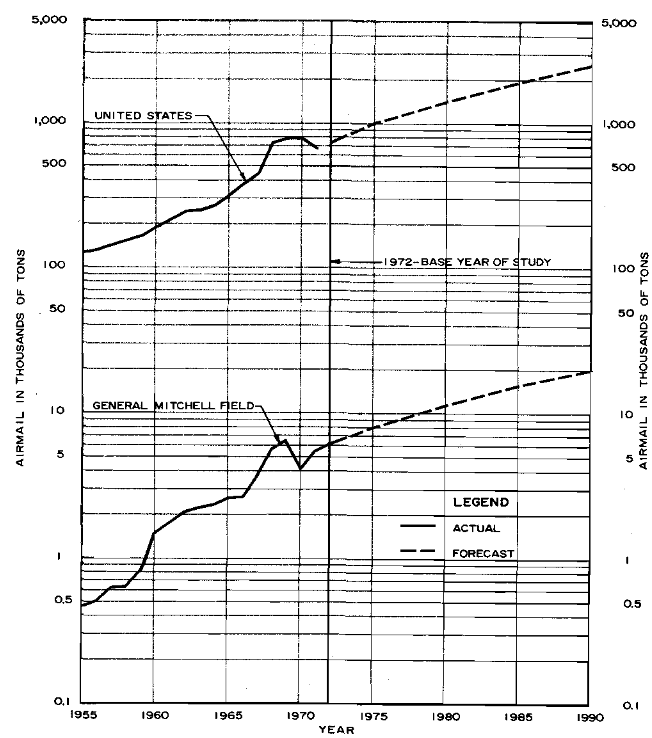
ACTUAL AND FORECAST AIR FREIGHT AND EXPRESS ORIGINATIONS FOR THE UNITED STATES AND GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1955-1990



Source: R. Dixon Speas Associates, Inc.

Figure 72

ACTUAL AND FORECAST AIRMAIL ORIGINATIONS FOR THE UNITED STATES AND GENERAL MITCHELL FIELD MILWAUKEE COUNTY: 1955-1990



Source: R. Dixon Speas Associates, Inc.

Table 99

INBOUND AND OUTBOUND AIR CARGO AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1965-1972

Year	Freight (Tons)		Express (Tons)		Mail (Tons)	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
1965	4,895	5,731	1,699	2,018	2,251	2,529
1966	5,015	6,173	1,748	2,002	2,450	2,571
1967	6,930	7,383	1,517	2,079	3,666	3,512
1968	10,226	10,437	1,681	2,184	5,520	5,501
1969	13,511	15,470	1,573	2,184	6,371	5,996
1970	14,592	17,370	1,605	2,065	5,205	4,230
1971	10,787	12,907	1,006	1,328	5,627	5,404
1972	14,874	12,085	1,030	1,342	5,530	6,011

Source: General Mitchell Field airport records.

city services as well as new direct services. It is also expected that competition will increase on present routes. One or more additional air carriers are expected to serve Milwaukee in the earlier years of the forecast period, and certainly by 1980. Although it is not possible to forecast this type of institutional change, analysis of other cities the size of Milwaukee bears out that an increase in the number of carriers serving the area is reasonable. For example, in fiscal year 1970, Milwaukee enplaned 870,000 passengers with five certificated carriers. Based on analysis of Civil Aeronautics Board and Federal Aviation Administration airport activity statistics for fiscal 1970, the next largest city in terms of enplaned passengers was Hartford, Connecticut, presently served by six certificated carriers, while the third city in terms of enplaned passengers was Columbus, Ohio, served by eight certificated carriers. Addition of a carrier or carriers may be expected to bring additional service and route improvements at Milwaukee.

It is anticipated that the air carrier industry will operate at a load factor average that is somewhat better than recent performance. The industry suffered from overcapacity in the period 1967 through 1971. The overall domestic trunk air carrier's load factor dropped to 48 percent in 1971 from a high of 58 percent in 1966. It is projected that the industry average load factor will range between 55 and 60 percent during the projection period. Milwaukee's enplaning load factor will increase to 30 percent in 1975 and to 37 percent in 1990, reflecting not only an increase in the industry load factor, but a gradual decrease in the amount of through traffic, with Milwaukee being over-flown on some routes that now generate considerable through traffic at Milwaukee. The composition of present through traffic, as well as projected changes, are difficult to quantify. At present, for example, North Central serves several markets to New York by through service at Milwaukee. Madison and Duluth are two of these markets that could be served by other direct service in the future, conceivably by nonstop New York to Madison service, in addition to onestop service over Milwaukee. This type of service improvement would decrease the level of Milwaukee through traffic.

Combining these factors, and taking into account known trends in air carrier aircraft on order, the forecast of operations can be developed. The approach involves deriving a first estimate of gross departures by utilizing quantities such as average aircraft size and average enplaning load factors. These estimates are then checked against the probable fleets that will be operated in the forecast years. By a process of comparison, revisions are made to the general approach to relate it to the specific fleet forecasts. Thus, the final determination of total operations, and operations by equipment type, can be made.

Projections of air carrier aircraft operations at General Mitchell Field were developed utilizing the top-down and bottom-up methods discussed earlier. Where applicable, these projections were compared with ATA and FAA forecasts of similar elements. The top-down projection was ultimately selected as the regional forecast of air carrier aircraft operations to be used in plan design and evaluation, although both projections are presented in the following discussion.

Table 100 shows the projected high and low range of air carrier operations, and offers a comparison of these two projections with the forecast of similar elements prepared by the ATA. For the lower range, operations in 1990 are 20 percent lower than the high range, while traffic is 30 percent lower. Higher load factors and the percentage of larger aircraft are directly related to the volume of traffic in the long run.

The air carrier fleet can be projected in terms of the general aircraft types that are expected to be flown, as shown in Table 101. It is understood that there will be new types of aircraft, but these are expected to be similar to aircraft already in existence, at least relative to the Milwaukee fleet operations. The forecast distribution of the fleet serving General Mitchell Field, by general aircraft type, is shown in Table 102. Although it is not directly comparable, since different seat ranges are used to classify the aircraft types, the ATA forecast air carrier fleet distribution by aircraft type is also shown in Table 102.

Total air carrier operations must also include nonscheduled arrivals and departures. These nonscheduled operations are projected by using the historical relationships of nonscheduled and scheduled operations. For the period 1962 to 1969, nonscheduled operations averaged 6 percent of total scheduled operations. This relationship is also projected for the future. Table 103 shows projected total air carrier operations, including nonscheduled activity, by aircraft type. These air carrier operations are further compared with FAA and ATA forecasts in Table 104.

The number of air carrier passengers to be served and aircraft operations occurring in a typical peak hour are important variables in terms of airport planning. They are estimated by applying observed values of the general relationships that exist between annual, daily, and hourly characteristics. Table 91 showed the available historical records of air carrier peak day activity at General Mitchell Field. In the projection of busy hour activity, the 1970-1971 ratio of peak day to average day air carrier operations (1.39) has been used. The busy hour has been assumed to represent 10 percent of the average day. This is the average for the available data, excluding 1967 and 1968, since these years are not representative of typical busy hour activity, but appear to represent true peaks in activity. The 10 percent factor compares favorably with other cities with Milwaukee's approximate level of activity. Table 105 shows the projected busy hour and peak day air carrier operations. A comparison of these busy hour operations with those forecast by the ATA is shown in Table 106.

The volume of busy hour passengers can be determined by relating busy hour aircraft operations to the number of passengers per operation. It has been estimated that the passengers per operation in the busy hour are approximately 10 percent higher than the average daily number of passengers per aircraft operation. This is based on observed characteristics at medium sized airports, and is due to the scheduling of larger aircraft and the generally higher desirability of flights at the time of day when the schedules are greatest. Table 107 shows the projected number of busy hour passengers through 1990.

Forecast of Supplemental and Commuter Air Carrier Activity at General Mitchell Field

Two additional types of air carriers require specific mention. These are the supplemental carriers, and the third level, or commuter, carriers. Supplemental carriers are air carriers operating under charter authority granted by the Civil Aeronautics Board, but without regular schedule

Table 100

PROJECTIONS OF AIR CARRIER OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY
1975, 1980, 1985, and 1990

Projection	Average Aircraft Size (Number of Seats)	Average Enplaning Load Factor[a]	Enplanements Per Departure	Annual Departures
Top-Down (High Range)				
1975	113	30	34	40,000
1980	155	33	51	42,500
1985	185	35	65	50,000
1990	213	37	79	58,000
Bottom-Up (Low Range)				
1975	113	30	34	38,000
1980	145	31	45	40,000
1985	170	33	58	43,000
1990	198	35	69	46,100
ATA[b]				
1975	92	40	37	37,500
1980	112	44	49	41,500
1985	140	48	67	51,000
1990	180	50	90	55,500

[a] *The enplaning load factor is the percentage of seats on outbound flights that are filled by passengers enplaning at a particular airport.*

[b] *Air Transport Association of America.*

Source: Air Transport Association of America, Airline Airport Demand Forecast for Milwaukee, December 1972; and R. Dixon Speas Associates, Inc.

Table 101

TYPES OF FLEET AIRCRAFT
EXPECTED TO BE IN OPERATION AT
GENERAL MITCHELL FIELD—MILWAUKEE COUNTY

Aircraft Group[a]	Number of Seats		Example of Current Group Type
	Range	Average	
I.	300 - 400	340	B-747
II	220 - 250	230	DC-10, L-1011
III	170 - 200	180	A-300, New Wide-Body Jet, DC-8 Stretch
IV	130 - 140	135	DC-8, B-707, B-720
V	90 - 135	100	B-727, B-727 Stretch, DC-9, DC-9 Stretch
VI	40 - 52	48	Convair 580, F-27

[a] *The group classification indicates the types of aircraft expected to be operated. Groups I and II are jumbo jet aircraft, which currently comprise a relatively small part of the air carrier fleet. Group III is large jet aircraft with up to 200 seats, including the A-300 European short-haul airbus and a probable aircraft of the wide-body type, smaller than the DC-10, with two engines instead of three. Types IV, V, and VI are self-explanatory, and relate to current jet and turboprop equipment.*

Source: R. Dixon Speas Associates, Inc.

rights. Third level, or commuter, airlines operate under authority of the FAA and CAB, but are not subject to rigorous economic or route regulations, as long as they operate aircraft with 30 or fewer seats and less than 7,500 pounds of payload. The recent history of these activities at General Mitchell Field has been irregular, as shown in Table 108.

The forecast of supplemental air carrier passengers is based on the expectation that this type of activity will grow significantly, reversing the trend of the last few years. This decreasing trend at Milwaukee is counter to the national trend, which has increased in the last four years. Recent decisions of the Civil Aeronautics Board have lessened restrictions on charter airlines, allowing a significant increase in the future market base for supplemental airlines. As a result of these decisions, the number of passengers on supplemental airlines is projected to increase 15 percent per year over the forecast period. The average growth in the number of supplemental flights is projected to be somewhat lower, however, reflecting the increasing use of larger aircraft in charter operations. The projection of supplemental air carrier flights and passengers, which was selected as the forecast for such flights and passengers, is shown in Table 109. This forecast should be reviewed periodically to take into account changes in the institutional factors, particularly

Table 102

PERCENTAGE DISTRIBUTION OF THE AIR CARRIER FLEET AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY ON AN AVERAGE DAY BY AIRCRAFT GROUP: SELECTED YEARS 1972-1990

Aircraft Group	Number of Seats	1972	Top-Down Projection (High Range)			
			1975	1980	1985	1990
I.	300-400	2	6	12	15	20
II	220-250	--	7	16	27	35
III	170-200	--	--	1	4	8
IV	130-140	7	9	7	2	2
V	90-135	52	51	47	43	30
VI	40- 52	39	27	17	9	5
Total	--	100	100	100	100	100

Aircraft Group	Number of Seats	1972	Bottom-Up Projection (Low Range)			
			1975	1980	1985	1990
I.	300-400	2	6	13	18	23
II	220-250	--	7	18	31	38
III	170-200	--	--	2	6	10
IV	130-140	7	9	8	2	2
V	90-135	52	51	43	35	23
VI	40- 52	39	27	16	8	4
Total	--	100	100	100	100	100

Aircraft Group	Number of Seats	1972	ATA[a] Forecast			
			1975	1980	1985	1990
I.	350-500	--	--	2	3	9
II	200-260	--	4	13	29	47
III	95-125	62	69	63	52	33
IV	50- 70	38	27	22	16	11
Total	--	100	100	100	100	100

[a] *Air Transport Association of America.*

Source: Air Transport Association of America, Airline Airport Demand Forecast for Milwaukee, December 1972; and R. Dixon Speas Associates, Inc.

CAB regulations, which could significantly alter the future activity of supplemental airlines. The forecast operations of supplemental carriers have been accounted for in the forecast of total air carrier operations previously described.

Commuter airline activity at General Mitchell Field has been limited, and shows an unusual trend. Third level air carrier service has typically lasted for only a short time, then terminated, despite failure of these carriers to develop a financially sound operation, however, other carriers are willing to attempt scheduled service. There are two main reasons why commuter service to Milwaukee is expected to remain limited. First, the schedule pattern at Milwaukee is dwarfed by that provided at Chicago. Passengers flying to destinations in the East or West from northern Wisconsin find a much broader schedule pattern at Chicago than at Milwaukee, and commuter passengers will use the commuter carriers to connect with this scheduled service. Second, from the standpoint of the commuter carriers serving Wisconsin, it is to the carrier's benefit to carry the passenger to Chicago rather than Milwaukee. Air Wisconsin, for example, prefers to carry passengers an extra 60 miles to Chicago rather than connect them to scheduled flights at Milwaukee.

Despite the difficulties in the development of a larger number of schedules for commuter carriers to Milwaukee, it is forecast that passenger growth will increase about 10 percent per year through the planning period, with flights increasing at a lesser annual rate. The forecast of passengers and flights for commuter airlines is also shown in Table 109. The forecast operations of commuter airlines have been taken into account in the forecast of general aviation activity at General Mitchell Field.

Table 103

PROJECTIONS OF AIR CARRIER AIRCRAFT OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY BY AIRCRAFT GROUP: 1975, 1980, 1985, and 1990

Aircraft Group	Top-Down Projection (High Range)			
	1975	1980	1985	1990
I.	5,100	10,800	15,900	24,600
II	5,900	14,400	28,600	43,000
III	--	1,000	4,200	9,800
IV	7,600	6,300	2,100	2,500
V	43,300	42,300	45,600	36,900
VI	22,900	15,300	9,600	6,200
Total	84,800	90,100	106,000	123,000

Aircraft Group	Bottom-Up Projection (Low Range)			
	1975	1980	1985	1990
I.	4,800	10,900	16,400	22,500
II	5,600	15,300	28,300	37,100
III	--	1,700	5,500	9,800
IV	7,300	6,800	1,800	1,900
V	41,100	36,500	31,900	22,500
VI	21,800	13,600	7,300	3,900
Total	80,600	84,800	91,200	97,700

Source: R. Dixon Speas Associates, Inc.

Table 104

COMPARISON OF AIR CARRIER AIRCRAFT OPERATION PROJECTIONS FOR GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1975, 1980, 1985, and 1990

Year	Air Carrier Aircraft Operations			
	Top-Down Projection (High Range)	Bottom-Up Projection (Low Range)	ATA Forecast[a]	FAA Forecast[b]
1975	84,800	80,600	81,500	81,500
1980	90,100	84,800	95,000	91,500
1985	106,000	91,200	108,000	101,500
1990	123,000	97,700	119,000	N/A[c]

[a] *Air Transport Association of America forecasts, which for purposes of this study were considered as projections.*

[b] *The Federal Aviation Administration 1975 forecast is an average of fiscal years 1975 and 1976. Beyond 1976, FAA's forecast increases an average of 2,000 operations per year. For purposes of this study, the FAA forecasts were considered as projections.*

[c] *Not available.*

Source: Air Transport Association of America, Airline Airport Demand Forecast for Milwaukee, December 1972; Federal Aviation Administration, Terminal Area Forecasts, 1975-1985, July 1973, (AEC-200); and R. Dixon Speas Associates, Inc.

Table 105

PROJECTIONS OF DAILY AND BUSY HOUR AIR CARRIER AIRCRAFT OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1975, 1980, 1985, and 1990

Projection	Air Carrier Aircraft Operations				
	Average Day	Peak Day	Ratio of Peak Day to Average Day	Busy Hour	Busy Hour as Percent of Average Day
Top-Down (High Range)					
1975	232	322	1.39	24	10.5
1980	247	343	1.39	26	10.5
1985	290	403	1.39	30	10.5
1990	337	468	1.39	35	10.5
Bottom-Up (Low Range)					
1975	221	307	1.39	23	10.5
1980	232	322	1.39	24	10.5
1985	250	348	1.39	26	10.5
1990	268	373	1.39	28	10.5

Source: R. Dixon Speas Associates, Inc.

Table 106

COMPARISON OF PROJECTED BUSY HOUR AIR CARRIER AIRCRAFT OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1975, 1980, 1985, and 1990

Year	Busy Hour Aircraft Operations		
	Top-Down Projection (High Range)[a]	Bottom-Up Projection (Low Range)[a]	ATA Forecast[b]
1975	24	23	22
1980	26	24	26
1985	30	26	29
1990	35	28	32

[a] *The busy hour for the top-down and bottom-up projections is the typical busy hour activity, excluding atypical highs.*

[b] *The design hour is the peak hour of the average day of the peak month. For purposes of this study the Air Transport Association of America forecasts were considered as projections.*

Source: Air Transport Association of America, Airline Airport Demand Forecast for Milwaukee, December 1972; and R. Dixon Speas Associates, Inc.

Table 107

PROJECTIONS OF BUSY HOUR AIR CARRIER PASSENGER TRAFFIC AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1975, 1980, 1985, and 1990

Projection	Busy Hour Operations	Passengers Per Operation	Busy Hour Passengers
Top-Down (High Range)			
1975	24	37.4	900
1980	26	56.1	1,460
1985	30	71.5	2,150
1990	35	86.9	3,040
Bottom-Up (Low Range)			
1975	23	37.4	860
1980	24	49.5	1,190
1985	26	61.6	1,600
1990	28	75.9	2,130

Source: R. Dixon Speas Associates, Inc.

Table 108

SUPPLEMENTAL AND COMMUTER AIR CARRIER ACTIVITY AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY 1969-1972

Year	Air Carrier Activity			
	Supplemental		Commuter	
	Flights	Passengers	Flights	Passengers
1969	371	35,900	1,285	4,926
1970	339	32,900	1,594	3,598
1971	194	20,000	561	2,670
1972[a]	186	19,600	800	2,728

[a] *The 1972 annual estimate is based on figures for the 10 months ending in October 1972.*

Source: General Mitchell Field airport records.

Table 109

FORECAST OF SUPPLEMENTAL AND COMMUTER AIR CARRIER ACTIVITY AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY SELECTED YEARS 1972-1990

Year	Air Carrier Activity			
	Supplemental		Commuter	
	Flights	Passengers	Flights	Passengers
1972[a]	220	23,500	960	3,300
1975	300	35,800	1,000	4,800
1980	450	71,500	1,200	7,700
1985	800	143,000	1,400	12,400
1990	1,300	286,000	1,600	20,000

[a] *The 1972 annual estimate is based on figures for the 10 months ending in October 1972.*

Source: R. Dixon Speas Associates, Inc.

Forecast Diversion of Passenger Traffic to Other Travel Modes

One factor which can affect future facility needs is the possible diversion of potential air passengers to other modes of transportation, including both surface modes, such as rail and highway, and air transport systems other than the conventional takeoff and landing (CTOL) system.

The forecasts of air travel developed herein do not anticipate any significant diversion from the forecast air traffic volumes due to new surface systems. Highway improvements have affected air traffic volumes in many parts of the country, including Milwaukee, for all of the basic historical period. Future highway improvements will be a factor, but the effect is expected to be about the same as that experienced in the past. Rail schedules have deteriorated in recent years, and there are no known plans for major future developments that would be expected to significantly alter the present service levels at Milwaukee. Therefore, rail competition in the future is discounted as having significant diversion potential.

The potential future air systems that might alter CTOL demand levels include vertical and short takeoff and landing systems (V/STOL). The development of these short-haul systems is uncertain at this time because it involves development of aircraft that are both economical and acceptable to the traveling public, and the building of additional airports or V/STOL ports near city centers. The numerous problems of these system operations have been analyzed in detail elsewhere.[6]

Although the potential developments are uncertain, V/STOL transportation systems do offer distinct advantages to short-haul intercity downtown travelers as well as intraurban travelers. In areas having congested surface systems, for example, VTOL has proven to be effective in serving travelers who place a high value on their time.

The size of potential markets is difficult to determine, since the major variables cannot be isolated and defined. For example, it is difficult to judge which system might be developed, due to the unsettled status of the technological problems. Also, it is not possible to determine what price difference might apply to VTOL or STOL

[6] *Feasibility and Cost of Expanded Intercity Air Service in Washington—Boston Corridor, Systems Analysis and Research Corporation, 1963; and Report of Planning Study for the Northeast Corridor Transportation Project, Massachusetts Institute of Technology, 1965.*

systems, compared to CTOL. However, it is generally expected that V/STOL service would be provided at a premium rate, due to the more sophisticated technology and convenience of the systems. Certain assumptions, deemed reasonable at this time, have been used to determine the potential market of V/STOL systems at Milwaukee, and the impact on the forecast of CTOL systems.

The primary V/STOL markets are defined as those within 500 miles of Milwaukee, with an origin-destination traffic flow of at least 100 passengers per day in each direction. The distance criterion is used because of the technical characteristics of all proposed operating systems. The traffic flow characteristic is used to define the minimum market size required for an efficient competitive operation.

The limited V/STOL markets which will meet these criteria in future years are shown in Table 110. The table also indicates the percentage of total enplaning passenger traffic at General Mitchell Field which is destined for each market city, as well as the forecast of average daily enplaning passenger traffic between Milwaukee and the market cities. The method of determining future passenger traffic involved projecting the 1980, 1985, and 1990 percentages of the total such traffic based on a straight line trend extrapolation of the period 1960 to 1970. Exceptions were made in the Detroit, Minneapolis, Grand Rapids, and Cleveland markets, which declined from 1960 to 1970. The rates of decline in these city pairs were forecast to taper off in the future.

To determine the percentage of travelers in the markets who were destined for a downtown location, this total traffic between cities must be factored. This information is available from responses to passenger survey questions which asked whether the traveler was destined for the central business district (CBD) in the city to which he was traveling. It is forecast that this percentage will remain a constant in the future, and is representative of the percentage of intercity travelers who would find use of V/STOL systems more desirable than CTOL systems. Table 111 shows the daily intercity V/STOL passenger potential when the CBD percentage is applied to the intercity traffic for those city pairs having more than a total of 100 daily passengers each way.

Based on the general estimates presented in Table 111, it can be seen that the potential diversion to V/STOL systems is not great. A V/STOLport serving a potential of 300,000 to 400,000 enplaning passengers annually by 1990 is indicated by the present analysis. The forecast demand outlined above relates primarily to diversion from CTOL systems. There is another prospective market that might be viable, depending on the economics of the actual system, which involves diversion from surface transportation, particularly automobile traffic, between Chicago and Madison. The technology, operating feasibility, and economic viability of V/STOL operations should be reviewed periodically as part of the continuing system planning process.

Forecast Diversion of Passenger Traffic to Airports Outside the Region

The high and low range forecasts of General Mitchell Field passenger traffic reflect continued distribution of regional demand to the two major commercial airports considered to serve the Region—Milwaukee's General

Table 110

ACTUAL AND FORECAST ENPLANING PASSENGER TRAFFIC IN POTENTIAL SHORT-HAUL AIR TRAFFIC MARKETS BETWEEN MILWAUKEE AND SELECTED U. S. CITIES: SELECTED YEARS 1960-1990[a]

City	Distance From Milwaukee (Miles)	Percent of Total Enplaning Passenger Traffic at General Mitchell Field: Actual 1960	Actual 1965	Actual 1970	Forecast 1980	Forecast 1985	Forecast 1990	Forecast of Average Daily Enplaning Passenger Traffic Between Milwaukee and Selected Cities: 1980	1985	1990
Detroit, Mich.	244	11.5	9.5	8.1	7.0	6.0	5.0	352	447	523
Minneapolis, Minn.	297	8.6	8.6	7.3	7.0	6.5	6.0	352	484	628
Cleveland, Ohio	331	4.8	4.3	3.9	3.5	3.2	3.0	176	238	314
St. Louis, Mo.	317	2.1	2.1	2.6	3.1	3.6	4.1	156	268	429
Pittsburgh, Pa.	431	1.8	1.9	1.8	1.8	1.8	1.8	91	134	189
Kansas City, Mo.	438	1.0	1.0	1.3	1.6	1.7	1.9	81	127	199
Cincinnati, Ohio	318	0.9	0.9	1.3	1.7	1.9	2.1	85	142	220
Grand Rapids, Mich.	120	1.9	1.3	1.1	1.1	1.1	1.1	55	82	115
Columbus, Ohio	331	0.8	0.7	1.1	1.4	1.5	1.7	70	112	178
Total	--	33.4	30.3	28.5	28.2	27.3	26.7	1,418	2,034	2,795

[a] *This analysis considers only the top-down level of passenger traffic.*

Source: R. Dixon Speas Associates, Inc.

Table 111

FORECAST OF ENPLANING PASSENGER TRAFFIC IN POTENTIAL SHORT-HAUL AIR TRAFFIC MARKETS BETWEEN MILWAUKEE CENTRAL BUSINESS DISTRICT (CBD) AND CBD OF SELECTED U. S. CITIES: 1980, 1985, and 1990

City	Passengers Destined for CBD as Percent of Total Average Daily Enplaning Passengers Between Milwaukee and Selected Cities	Forecast of Average Daily Enplaning Passenger Traffic Between Milwaukee CBD and CBD of Selected Cities		
		1980	1985	1990
Detroit, Mich.	29	102	130	152
Minneapolis, Minn.	42	148	203	264
Cleveland, Ohio.	30	53	71	94
St. Louis, Mo.	39	61	105	167
Pittsburgh, Pa.	44	--	59	83
Kansas City, Mo.	47	--	60	94
Cincinnati, Ohio	33	--	47	73
Grand Rapids, Mich.	18	--	--	21
Columbus, Ohio	26	--	29	46
Total Short-Haul Traffic	--	364	704	994
Total Average Daily Passenger Traffic From General Mitchell Field	--	10,054	14,899	20,937
Short-Haul Traffic as Percent of Total Average Daily Passenger Traffic From General Mitchell Field	--	3.6	4.6	4.7

Source: R. Dixon Speas Associates, Inc.

Mitchell Field and Chicago's O'Hare Field. Considering the relative attractiveness of schedules and service, this distribution of passenger demand is expected to continue generally as at present, with Chicago's O'Hare Field diverting approximately 25 percent of the total demand generated within the Region away from General Mitchell Field.

In developing the passenger and cargo demand forecasts, it was assumed that in the long run, Chicago would not have gross congestion at its air carrier airports. Although aircraft operations at O'Hare Field reach the capacity of the landing area system during many hours of the day, there is considerable expansion potential in the volume of passengers handled. Further, Chicago's Midway Airport can handle additional aircraft operations, and it is expected that schedules will be greatly improved over the long-term period to provide additional aircraft movements and passenger handling capabilities at Midway. Also, it is not expected that Chicago's business and civic leaders will allow any long-term lapse in the provision of adequate airport facilities.

Improved airline scheduling, the anticipated increase in the number of airlines serving General Mitchell Field, and the surface transportation improvements within the Region which will increase the accessibility of the airport are expected to permit General Mitchell Field to maintain its share of the national airline passenger market.

GENERAL AVIATION DEMAND

This section describes the forecast of general aviation activities in southeastern Wisconsin prepared under the regional airport system planning program. The forecast demand presented is that which may be expected to be generated under an extension of the socioeconomic conditions which have generally affected the growth of aviation activities in the Region in the recent past. The demand forecast presumes the continued availability of adequate resources for aviation facility development so as to preclude any new physical constraints on the growth of general aviation activities. These assumptions appear reasonable in light of economic growth trends within the Region and the considerable lead time for airport facility development which should be afforded by an orderly airport system planning effort. The degree to which the private and public sectors invest in aeronautical development within the Region will in large measure determine the degree to which general aviation will realize its potential.

During 1970, approximately 90 percent of total aircraft operations in the Region were attributed to general aviation activity. Military aircraft operations at the civil airports in the Region accounted for about 1 percent of the total, while air carrier operations accounted for the remaining 9 percent. From occupancy and flight data obtained from the regional pilot survey and FAA information, it has been estimated that general aviation operations carried about 825,000 passengers and pilots during 1970, in contrast to the 887,047 enplaning passengers served by the air carrier operations. General aviation travel consisted primarily of trips for social/recreation, work-connected business, and instruction/proficiency purposes, accounting for 37, 18, and 15 percent, respectively, of the total trip purposes. Air carrier travel is primarily for business and social/recreation purposes, accounting for 35 and 32 percent, respectively, of the total trip purposes for air carrier airport enplaning passengers.

The methodology used to forecast general aviation activity within the Region may be summarized as follows:

1. Historical data on the size of the active general aviation fleet within the Region was assembled and related to the size of the active general aviation fleets in Wisconsin and the United States.

2. Based upon an extrapolation of the proportion which the regional general aviation fleet has comprised of the state and U. S. fleets, the probable future size and composition of the regional fleet was computed from nationally prepared forecasts of the future size and composition of the state and U. S. fleets.

3. Based upon analyses of the historical relationships between fleet size and fleet operations within the Region, forecasts of future operations by aircraft type were developed.

4. Finally, based upon analyses of historical relationships, ancillary forecasts of peak day and peak hour activity, local and itinerant activity, number of instrument approaches, and pilot and passengers served were developed.

Forecast of the General Aviation Fleet Size

Registration of general aviation aircraft with state and federal authorities provides certain important information about the aircraft being registered, and the owner. Two such items of information used in the forecast of general aviation fleet size within the Region are the residence of the aircraft owner and the airport and county in which the aircraft is based. The distinction between the location of based aircraft and owner residence is important for system planning purposes. Forecasts of the general aviation fleet size and its distribution within the Region are related to the residence of aircraft owners rather than the location of the based aircraft, both to permit consideration of user convenience in facility location and to permit activity demand to be related to future population levels and distributions.

A historical record of aircraft registrations within southeastern Wisconsin by owner's place of residence, based upon FAA data, is provided in Table 112. For comparison purposes, Table 113 shows a similar record based on Wisconsin Department of Transportation data. The

Table 112

NUMBER OF GENERAL AVIATION AIRCRAFT REGISTERED IN THE UNITED STATES, WISCONSIN, AND THE REGION: 1955-1971

Year	United States	Wisconsin	Southeastern Wisconsin Region by County of Owner's Residence							Region Total
			Kenosha	Milwaukee	Ozaukee	Racine	Walworth	Washington	Waukesha	
1955	58,790	1,257	22	261	18	45	31	50	52	479
1956	62,886	1,338	20	332	16	46	44	39	44	541
1957	65,289	1,410	26	345	18	48	45	37	53	572
1958	67,839	1,494	20	362	22	47	42	34	64	591
1959	68,727	1,323	20	315	20	50	34	29	54	522
1960	76,549	1,544	26	338	19	58	38	26	61	566
1961	80,632	1,665	39	341	18	52	41	27	73	591
1962	84,121	1,692	35	334	14	65	48	39	84	619
1963	84,088	1,689	34	327	13	68	50	48	87	627
1964	88,742	1,706	30	315	18	71	46	39	101	620
1965	95,442	1,834	45	337	27	71	51	44	108	683
1966	104,706	1,919	51	350	29	79	43	48	126	726
1967	114,186	2,188	49	368	38	94	52	46	159	806
1968	124,237	2,347	59	390	44	100	67	61	174	895
1969[a]	133,814	2,424	53	388	30	103	62	56	185	877
1970	131,743	2,608	75	361	16	101	50	104	207	914
1971	131,148	2,615	98	351	21	114	56	108	213	961

[a] *Last year for which data for owner residence by county are available. Data for 1970 and 1971 reflect Federal Aviation Administration records of based aircraft.*

Source: Federal Aviation Administration, Census of U. S. Civil Aircraft; and R. Dixon Speas Associates, Inc.

difference in the number of aircraft reported in these two two tables is due in part to the fact that state information is reported on the basis of the location of the based aircraft, while the FAA information is reported on the basis of the aircraft owner's place of residence. In addition, it must be recognized that the Wisconsin data thus include aircraft based within the state, but owned by persons residing outside of the state. The relationship between the place of residence of aircraft owners and the location where registered aircraft are based is shown in Table 114.

As already noted, the forecast of general aviation activity within the Region requires a forecast of the total size and composition of the active general aviation aircraft within the Region, a forecast derived from a national forecast of the size of the general aviation fleet and the distribution

Table 113

NUMBER OF GENERAL AVIATION AIRCRAFT BASED IN THE UNITED STATES, WISCONSIN, AND THE REGION: 1955-1971

Year[a]	United States	Wisconsin	Southeastern Wisconsin Region (by County)							Region Total
			Kenosha	Milwaukee	Ozaukee	Racine	Walworth	Washington	Waukesha	
1955	58,790	1,229	24	198	12	45	23	37	92	479
1956	62,886	1,442	30	249	13	48	37	26	113	516
1957	65,289	1,538	29	295	16	49	44	29	120	582
1958	67,839	1,594	13	319	19	53	34	31	128	607
1959	68,727	1,708	14	315	20	60	31	45	135	620
1960	76,549	1,814	28	338	19	65	23	45	118	636
1961	80,632	1,924	42	344	12	63	30	34	114	639
1962	84,121	2,000	44	337	13	60	30	48	141	673
1963	84,088	2,008	56	329	17	61	25	47	139	674
1964	88,742	2,098	57	334	16	82	33	67	152	741
1965	95,442	2,165	60	362	13	89	31	63	163	781
1966	104,706	2,350	58	368	13	97	39	71	195	841
1967	114,186	2,423	64	355	18	100	40	67	220	864
1968	124,237	2,523	71	324	20	96	47	89	232	879
1969	133,814	2,743	70	343	24	102	47	108	248	942
1970	131,743	2,945	74	363	32	107	54	112	242	984
1971	131,148	3,014	82	368	27	123	59	115	232	1,006

[a] *Data are for October of the year indicated.*

Source: Federal Aviation Administration and Wisconsin Department of Transportation.

Table 114

NUMBER OF GENERAL AVIATION AIRCRAFT REGISTERED IN THE REGION BY COUNTY WHERE BASED AND BY PLACE OF RESIDENCE OF OWNER: 1971

County Where Aircraft Based	County or Other Place of Residence of Aircraft Owner										Total
	Kenosha	Milwaukee	Ozaukee	Racine	Walworth	Washington	Waukesha	Other Wisconsin Counties	Illinois	Other States	
Kenosha	64	1	0	9	3	0	0	0	5	0	82
Milwaukee . . .	0	322	8	3	0	2	28	1	0	4	368
Ozaukee	0	6	19	0	0	1	0	1	0	0	27
Racine.	0	3	0	115	5	0	0	0	0	0	123
Walworth. . . .	1	0	0	1	54	0	0	3	0	0	59
Washington . .	0	17	12	0	0	72	6	7	0	1	115
Waukesha. . . .	0	81	0	3	0	1	144	3	0	0	232
Total	65	430	39	131	62	76	178	15	5	5	1,006

Source: Wisconsin aircraft registration records, October 1971.

of that fleet among the largest metropolitan areas of the United States.[7] The national forecast of fleet size was prepared with the assistance of a model relating the number of general aviation aircraft to the level of economic activity measured by the gross national product. Distribution of the forecast fleet among the 75 largest standard metropolitan statistical areas within the United States was accomplished with the aid of multivariate regression analyses, relating known demographic economic factors for each metropolitan area to the number of general aviation aircraft.

The distribution model approach was supplemented by a "step-down" ratio analyses, in which the historical relationships between the number of aircraft registered within the Region, the state, and the nation were determined and applied to the national forecast of fleet size (see Table 115). The analysis indicated that the number of aircraft registered in the state has been declining as a percent of the total national fleet. The rate of decline is expected to moderate, however, so that by 1990 the state's proportion of the nation's fleet is expected to be about 1.7 percent, about a 0.1 percent decline over the 20-year forecast period. The aircraft registered within the Region as a proportion of the total aircraft registered within the state declined in the late 1950s, and stabilized at about 37 percent during the 1960s. A modest increase in this proportion is forecast.

In 1969, there were 877 owners registering aircraft within the Region. The number of owners is expected to increase to over 1,200 by 1975 and to about 3,000 by 1990, a slightly more than threefold increase during the forecast period, or about 7 percent annually. It should be noted that, although the actual number of aircraft based within the Region may be expected to be somewhat higher than the number of resident owners, the latter was used without adjustment as equivalent to the number of aircraft which could be expected to comprise the future regional fleet.

[7] *R. Dixon Speas Associates, Inc., The Magnitude and Economic Impact of General Aviation-1968 to 1980, June 1969.*

Table 115

ACTUAL AND FORECAST GENERAL AVIATION AIRCRAFT REGISTERED IN THE UNITED STATES, WISCONSIN, AND THE REGION: SELECTED YEARS 1955-1990

Year	Registered Aircraft				
	United States	Wisconsin		Southeastern Wisconsin Region	
		Number	Percent of U. S. Total	Number	Percent of Wisconsin Total
Actual					
1955	58,800	1,257	2.14	461	36.7
1956	62,900	1,338	2.13	541	40.4
1957	65,300	1,410	2.16	572	40.6
1958	67,800	1,494	2.20	591	39.6
1959	68,700	1,323	1.93	522	39.5
1960	76,500	1,544	2.02	566	36.7
1961	80,600	1,665	2.07	591	35.5
1962	84,100	1,692	2.01	619	36.6
1963	84,100	1,689	2.01	627	37.1
1964	88,700	1,706	1.92	620	36.3
1965	95,400	1,834	1.92	683	37.2
1966	104,700	1,919	1.83	726	37.8
1967	114,200	2,188	1.92	806	36.8
1968	124,200	2,347	1.89	895	38.1
1969[a]	133,800	2,424	1.81	877	36.2
Forecast					
1975	178,000	3,150	1.77	1,220	38.7
1980	241,000	4,220	1.75	1,670	39.6
1985	319,000	5,510	1.73	2,220	40.2
1990	424,000	7,290	1.72	3,000	41.2

[a] *The Federal Aviation Administration registration information which was used necessitated adopting 1969 as the base year for certain analyses.*

Source: R. Dixon Speas Associates, Inc., The Magnitude and Economic Impact of General Aviation 1968-1980; and SEWRPC.

The regional aircraft owner forecast was distributed to each county of the Region based on the historical relationship between aircraft owners and total population of each county. This simplified approach—which assumes that the propensity of the population to own aircraft will not change significantly over the forecast period—was undertaken after a more complicated multivariate regression analysis failed to produce superior results.

Table 116 shows the actual and forecast distribution of aircraft owners' residence by county within the Region. Historically, the proportion of owners residing in Milwaukee County has declined, while the proportion of owners residing in Waukesha County has increased. Application of these historical percentage distributions by county to the forecast number of owners within the Region, summarized in Table 117, indicates that Milwaukee County may be expected to have an increasing number of aircraft owners residing within the county even though its percentage of the total is declining. By 1990, over 1,000 aircraft may be expected to be owned by people living in Milwaukee County and about 900 by persons residing in Waukesha County. Together, these two counties may be expected to account for almost 65 percent of the total aircraft owners living within the Region, the same percentage as in 1969.

The 1969 composition of the general aviation aircraft fleet in the Region and the nation is indicated in Table 118. The composition of the fleets is quite similar except in the one-to-three-seat single-engine category. The current regional and national fleet composition was assumed to remain essentially unchanged over the forecast period, and was used to classify the forecast regional fleet into aircraft types, as summarized in Table 119.

Forecast of General Aviation Aircraft Operations

Having forecast the future number and type of aircraft that may be expected within the Region, the operations which these aircraft could be expected to produce was forecast by applying historical rates of aircraft use to the forecast number of aircraft. The operations forecasts were made by aircraft type on an average annual, peak day, and peak hour basis.

Rates of aircraft use were developed from the number of hours the aircraft registered within the Region have been used, as reported in FAA records and other sources listed in the inventory records.

The hours of aircraft use for the base period (1970-1971) and forecast periods are shown in Table 120. The average number of hours of aircraft use within the Region and

Table 116

ACTUAL AND FORECAST PERCENTAGE DISTRIBUTION OF REGISTERED GENERAL AVIATION AIRCRAFT IN THE REGION BY COUNTY OF RESIDENCE OF OWNER: SELECTED YEARS 1960-1990

Year	County							Total
	Kenosha	Milwaukee	Ozaukee	Racine	Walworth	Washington	Waukesha	
Actual								
1960	4.6	59.8	3.3	10.2	6.7	4.6	10.8	100.0
1965	6.6	49.3	4.0	10.4	7.5	6.4	15.8	100.0
1969	6.0	44.3	3.4	11.7	7.1	6.4	21.1	100.0
Forecast								
1975	6.1	43.3	4.0	10.8	6.8	6.0	23.0	100.0
1980	6.6	36.8	4.6	11.2	6.9	6.6	27.3	100.0
1985	6.3	37.4	4.6	10.8	6.4	6.3	28.2	100.0
1990	6.5	33.7	4.9	11.1	6.2	6.5	31.1	100.0

Source: Federal Aviation Administration and R. Dixon Speas Associates, Inc.

Table 117

FORECAST NUMBER OF OWNERS OF GENERAL AVIATION AIRCRAFT REGISTERED IN THE REGION BY COUNTY OF RESIDENCE: 1975, 1980, 1985, and 1990

Year	County							Total
	Kenosha	Milwaukee	Ozaukee	Racine	Walworth	Washington	Waukesha	
1975	70	540	50	130	80	70	280	1,220
1980	110	600	80	190	120	110	460	1,670
1985	140	830	100	240	140	140	630	2,220
1990	200	1,010	150	330	190	200	920	3,000

Source: R. Dixon Speas Associates, Inc.

the United States agree within narrow limits except for the one-to-three-seat single-engine and multiengine turboprop aircraft. These differences are apparently due to the limited number of training operations within the Region for the single-engine aircraft, and the relatively low number of turboprop aircraft within the Region as identified in Table 119.

The operations per aircraft hour, summarized by aircraft type in Table 121, were multiplied by the number of annual hours of operation per aircraft and the forecast number of aircraft to develop the forecast annual operations by aircraft type. The aircraft operations per hour were assumed to remain constant through the forecast period in accordance with national trends. As noted in Table 121, the single engine, four-seat aircraft may be expected to continue to dominate future activity within the Region, increasing more than 1.25 million annual operations by 1990. The most rapid growth, however, may be expected to occur in business jet activity,which is forecast to increase from 2,000 annual operations in 1970 to over 45,000 operations by 1990. Improved reliability and utility of helicopters are also expected to spur growth in their operation.

The forecast of total general aviation operations was further refined to provide estimates of future local and itinerant operations and the number of instrument approaches. According to FAA definitions, local operations are those which occur in the local traffic pattern or within sight of the tower, are known to be departing for or arriving from flight in local practice areas (those within a twenty-mile radius), or execute simulated instrument approaches or low passes at the airport. Itinerant operations are those aircraft operations other than local operations. Basically, local operations are associated with training flights, and are therefore closely correlated with the number of single-engine, one-to-three-seat aircraft. Most instructional flights are local operations. The historical trends in general aviation local and itinerant operations and instrument approaches as recorded at the Region's tower airports are summarized in Table 122.

Table 118

PERCENTAGE DISTRIBUTION OF GENERAL AVIATION AIRCRAFT REGISTERED IN THE UNITED STATES AND THE REGION BY TYPE: 1969

Aircraft Type	United States	Region
Single-Engine Reciprocating		
1-3 seats.	34.3	31.6
4 seats or more	49.3	50.0
Multiengine Reciprocating		
Less than 12,500 pounds		
Less than 600 horsepower . .	9.0	10.4
600 or greater horsepower . .	2.3	2.8
12,500 pounds or more	0.7	1.1
Multiengine Turboprop		
Less than 12,500 pounds. . . .	0.7	0.6
12,500 pounds or more.	0.2	0.5
Turbojet	0.7	0.5
Rotorcraft	1.7	1.1
Other	1.1	1.4
Total	100.0	100.0

Source: Federal Aviation Administration.

Table 119

ACTUAL AND FORECAST GENERAL AVIATION AIRCRAFT REGISTERED IN THE REGION BY TYPE: SELECTED YEARS 1969-1990

Aircraft Type	Actual 1969[a]	Forecast			
		1975	1980	1985	1990
Single-Engine Reciprocating					
1-3 seats.	277	350	420	470	560
4 seats or more	439	620	890	1,210	1,640
Multiengine Reciprocating					
Less than 12,500 pounds					
Less than 600 horsepower	91	130	180	260	390
600 or greater horsepower	25	40	60	80	110
12,500 pounds or more.	10	10	--	--	--
Multiengine turboprop					
Less than 12,500 pounds.	5	10	30	40	60
12,500 pounds or more.	4	10	10	20	30
Turbojet	4	10	20	40	70
Rotorcraft	10	20	40	70	100
Other	12	20	20	30	40
Total	877	1,220	1,670	2,220	3,000

[a] *The 1969 base was used for this analysis because of the unavailability of data on a strictly comparable basis for 1970 and 1971.*

Source: Federal Aviation Administration and R. Dixon Speas Associates, Inc.

Table 120

ACTUAL AND FORECAST ANNUAL HOURS OF USE FOR GENERAL AVIATION AIRCRAFT REGISTERED IN THE REGION BY AIRCRAFT TYPE: SELECTED YEARS 1970-1990

Aircraft Type	Annual Hours of Use					
	Actual[a]		Forecast (Region)			
	United States	Region	1975	1980	1985	1990
Single-Engine Reciprocating						
1-3 seats.	218	160	180	190	210	230
4 seats or more	164	163	180	190	200	210
Multiengine Reciprocating						
Less than 12,500 pounds.	--	--	--	--	--	--
Less than 600 horsepower	231	230	240	245	250	255
600 or greater horsepower	308	325	290	310	340	370
12,500 pounds or more.	319	343	335	--	--	--
Multiengine Turboprop						
Less than 12,500 pounds.	563	425	550	600	600	600
12,500 pounds or more.	624	632	640	640	640	640
Turbojet	430	422	430	435	440	450
Rotorcraft	360	340	350	350	350	350
Other	105	102	100	100	100	100
Weighted Average	199	178	--	--	--	--

[a] *Computed by dividing reported hours by the number of aircraft for which hours were reported within each category. The base period for this analysis is an average of 1970 and 1971.*

Source: Federal Aviation Administration and R. Dixon Speas Associates, Inc.

Table 121

FORECAST NUMBER OF OPERATIONS OF GENERAL AVIATION AIRCRAFT REGISTERED IN THE REGION BY AIRCRAFT TYPE: 1975, 1980, 1985, and 1990

Aircraft Type	Operations Per Aircraft Hour[a]	Annual Operations (Landings and Takeoffs)			
		1975	1980	1985	1990
Single-Engine Reciprocating					
1-3 seats.	5.4	339,000	430,000	532,000	694,000
4 seats or more	3.7	416,000	631,000	903,000	1,261,000
Multiengine Reciprocating					
Less than 12,500 pounds					
Less than 600 horsepower	2.1	66,000	93,000	138,000	210,000
600 or greater horsepower	1.9	22,000	36,000	52,000	78,000
12,500 pounds or more.	1.8	6,000	--	--	--
Multiengine Turboprop					
Less than 12,500 pounds.	2.2	12,000	39,000	52,000	78,000
12,500 pounds or more.	1.5	9,000	9,000	18,000	28,000
Turbojet	1.4	6,000	13,000	25,000	45,000
Rotorcraft	4.3	30,000	61,000	106,000	152,000
Other	4.5	9,000	9,000	13,000	18,000
Total	--	915,000	1,321,000	1,839,000	2,564,000

[a] *The base period for this analysis is an average of 1970 and 1971.*

Source: R. Dixon Speas Associates, Inc.

These activities, related to the historical aircraft operations by aircraft type within the Region, were used to forecast general aviation operations. The forecast of local operations was based upon an estimate of the number of training operations, and was related to the growth of single-engine aircraft owned within the Region. The forecast of itinerant operations is the difference between the forecast local and total movements. The forecasts indicate that about 1.2 million local aircraft operations and about 1.3 million itinerant operations can be expected within the Region by 1990, totaling approximately 2.5 million annual general aviation operations (see Table 123). A substantial change in the division between local and itinerant activity is forecast. Presently, local aviation activity in the Region approximates 60 percent of the total activity, disproportionately high in comparison to other areas of the nation. This proportion is expected to decrease to about 50 percent of the total annual general aviation activity within the Region by 1990, closer to the averages experienced in other areas of the country.

Although the total number of aircraft operations within the Region is important in any determination of future airport facility requirements, that portion of the total demand which occurs during peak hours and under instrument approach conditions is also important to consider. These levels are related to the available facilities, and may change under alternative airport systems. Peak day and peak hour data within the Region are limited to the historical information available at Milwaukee's General Mitchell and Timmerman Fields. These two airports together accommodate about half of the general aviation activity within the Region. The primary source of peak day and peak hour activity information is the Terminal Area Air Traffic Relationship publication of the FAA. The future estimates of peak day and peak hour activity were derived from data provided in this publication for these two airports, as well as for other airports throughout the United States. The values derived relate peak day to average day and peak hour to peak day.

Even though the ability to predict peak activity for the Region is limited because of the limited existing data base, considerable confidence is attached to the figures forecast for the later years, since total annual operations will have reached a level where the proportion of the total activity which occurs on the peak day and at the peak hour will approach stable, minimum levels. Therefore, although the total annual general aviation operations generated in the Region are expected to increase from approximately 770,000 at present to 2,500,000 by 1990, more than a threefold increase, the peak-day operations are expected to increase by a factor of only 2.2 over the same period, as indicated in Table 124. Thus, approximately 12,600 general aviation operations may be expected to occur at the Region's airports on the peak day in 1990, provided sufficient capacity is developed to accommodate this level of demand. During the peak hour, more than 1,500 general aviation operations could occur, given no new constraints on demand growth.

Table 122

GENERAL AVIATION AIRCRAFT OPERATIONS AT FAA TOWER AIRPORTS IN THE REGION 1955-1970

Year	Aircraft Operations at FAA Tower Airports[a]				
				Instrument Approaches	
	Local	Itinerant	Total	Number	Percent of Itinerant Operations
1955	22,000	32,000	54,000	296	0.9
1956	26,000	37,000	63,000	565	1.5
1957	26,000	45,000	71,000	912	2.0
1958	26,000	46,000	72,000	854	1.9
1959	25,000	45,000	70,000	1,380	3.1
1960	30,000	55,000	85,000	1,459	2.7
1961	47,000	82,000	129,000	1,326	1.6
1962	37,000	77,000	114,000	1,850	2.4
1963	50,000	84,000	134,000	1,700	2.0
1964	64,000	92,000	156,000	2,207	2.4
1965	95,000	101,000	196,000	3,218	3.2
1966	144,000	125,000	269,000	3,299	2.6
1967	171,000	131,000	302,000	3,438	2.6
1968	158,000	146,000	304,000	3,833	2.6
1969	149,000	153,000	302,000	4,701	3.1
1970	120,000	129,000	258,000	3,748	2.9

[a] *In 1970 there were control towers operating within the Region at General Mitchell Field and Timmerman Field.*

Source: Federal Aviation Administration, Air Traffic Activity, for the years shown.

Table 123

FORECAST OF LOCAL AND ITINERANT GENERAL AVIATION AIRCRAFT OPERATIONS IN THE REGION: 1975, 1980, 1985, and 1990

Year	Aircraft Operations		
	Local	Itinerant	Total
Actual			
1970	453,000	318,000	771,000
Forecast[a]			
1975	523,000	392,000	915,000
1980	709,000	612,000	1,321,000
1985	932,000	907,000	1,839,000
1990	1,252,000	1,312,000	2,564,000

[a] *Based on the relationship between local (training) flights and single-engine, 1-3 seat aircraft operations.*

Source: R. Dixon Speas Associates, Inc.

Table 124

FORECAST OF GENERAL AVIATION AIRCRAFT OPERATIONS IN THE REGION: 1975, 1980, 1985, and 1990

Aircraft Operations	Year			
	1975	1980	1985	1990
Operations				
Annual				
Local	523,000	709,000	932,000	1,252,000
Itinerant	392,000	612,000	907,000	1,312,000
Total	915,000	1,321,000	1,839,000	2,564,000
Average Day	2,507	3,619	5,038	7,025
Peak Day	5,917	7,238	9,572	12,645
Peak Hour	828	868	1,149	1,517
Instrument Approaches				
Annual	7,124	10,650	15,388	22,520
Average Day	20	30	40	60
Peak Day	51	50	80	110
Peak Hour	6	8	10	15

Source: Federal Aviation Administration and R. Dixon Speas Associates, Inc.

Nationally, the volume of instrument approaches has tended to be related to itinerant operations, and in turn, to multiengine operations. The regionwide estimate of instrument approaches,[8] also summarized in Table 124, was developed from an analysis of historical activity within the Region and from information assembled nationally relating multiengine and jet aircraft activity to instrument approaches. Using this method, it is estimated that more than 22,000 instrument approaches could occur annually at airports within the Region by 1990. Approximately 110 instrument approaches could occur during the peak day under instrument conditions, of which 15 could occur during the peak hour.

Forecast of General Aviation Passenger Activity

The last element of the general aviation activity forecast within southeastern Wisconsin involved a determination of the volume of passengers expected to be served by general aviation aircraft. Since pilots of general aviation aircraft generally fly for the same purpose as their passengers, as described in Chapter V of this report, no distinction has been made between the operators of the aircraft and those who are passengers. The term occupant for this analysis represents both pilot and passengers.

Unfortunately, no truly good data base exists on which to base a forecast of the number of occupants in general aviation aircraft. A combination of two sources offers a base sufficient for planning purposes. These include an FAA study of the number of occupants in general aviation aircraft derived from accident records, and the user survey conducted by the Commission in 1971. Although direct comparison between the data presented in these two sources must be made with care because of the different techniques employed in collecting the data, the results of the studies confirm one another.

Since the data from the FAA study represent the most extensive long-term data base available, they were more heavily weighted in the forecast than the regional data. The FAA information relates general aviation occupant load factors to the type of flying being undertaken—that is, trips for business, personal, or instructional purposes. The national average for the years 1964 to 1968 was 2.5 occupants per flight, with little variation in each of the specific trip purposes. Consequently, these averages, together with the known distribution of flying activity in southeastern Wisconsin, were used to arrive at an average aircraft occupancy for the Region of 2.2 occupants for the 1970 fleet. By assigning specific occupancy factors to each of the aircraft types based upon usage, and adjusting these factors to match the weighted total average of 2.2 occupants per aircraft, occupancy rates were projected throughout the forecast period for each aircraft type (see Table 125). Since no change in trend was found in the available FAA historical data, these occupant data have been assumed to remain constant throughout the forecast period. Applying these rates to the forecast number of operations, the forecast number of occupants (pilots and passengers) served was determined (see Table 126). The forecast indicates that the approximately 800,000 pilots and passengers served by general aviation activity within the Region in 1970 may be expected to increase to almost 3,000,000 by 1990.

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[8] *Instrument approaches are defined as those approaches required to be made under instrument flight rules because of adverse weather conditions, and thus do not represent the total number of instrument approaches or operations which may be conducted.*

Table 125

PROJECTED NUMBER OF OCCUPANTS PER GENERAL AVIATION FLIGHT IN THE REGION BY TYPE OF AIRCRAFT 1970-1990

Aircraft Type	Average Number of Occupants Per Flight
Single-Engine Reciprocating	
1-3 seats	1.6
4 seats or more	2.5
Multiengine Reciprocating	
Less than 12,500 pounds	
Less than 600 horsepower	2.2
600 or greater horsepower	2.4
12,500 pounds or more	5.6
Multiengine Turboprop	
Less than 12,500 pounds	2.8
12,500 pounds or more	3.8
Turbojet	3.7
Rotorcraft	2.2
Other	2.1

Source: Federal Aviation Administration, 1970 Study of General Aviation Flying Occupant Load Factors, May 1970; and R. Dixon Speas Associates, Inc.

Although another objective of the general aviation activity forecast was to determine the volume of cargo which could be expected to move on general aviation aircraft, no reliable source of historical data was found on which to base such a forecast. Analysis of the data from the Commission's general aviation aircraft pilot survey revealed that little cargo moved by general aviation within the Region at present. A reliable forecast of cargo movement by general aviation could not, therefore, be produced at this time.

MILITARY AVIATION ACTIVITY

Military aircraft activity levels are difficult to forecast, but in the case of the Southeastern Wisconsin Region they are also of relatively little importance. The recent history of military movements at Mitchell Field, the only field where records of military activity are maintained, is shown in Table 127. Also shown is the forecast, which is an average of the five-year period 1967-1971.

SUMMARY

Forecasts of probable future aviation demand within the Southeastern Wisconsin Region, which provide the basis for determining the extent of needs and scheduling of new facility components of the regional airport system, have been described within this chapter for the period 1975 through 1990 for each of the following demand components: commercial passengers, commercial cargo, air carrier movements, diversion to or from other modes and/or regions, general aviation activity, and military aviation activity.

Table 126

FORECAST OF OCCUPANTS PER GENERAL AVIATION FLIGHT IN THE REGION 1975, 1980, 1985, and 1990

Year	Number of Operations	Number of Flights	On-Board Occupants	
			Total[a]	Per Flight
1975	915,000	458,000	995,000	2.17
1980	1,321,000	661,000	1,451,000	2.20
1985	1,839,000	920,000	2,053,000	2.23
1990	2,564,000	1,282,000	2,889,000	2.25

[a] Corresponds to air carrier enplaning passengers, but also includes pilots.

Source: Federal Aviation Administration, 1970 Study of General Aviation Flying Occupant Load Factors, May 1970; and SEWRPC.

Table 127

ACTUAL AND FORECAST MILITARY AIRCRAFT ACTIVITY AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY SELECTED YEARS 1967-1990

Year	Military Aircraft Operations		
	Local	Itinerant	Total
Actual			
1967	9,313	6,674	15,987
1968	7,834	6,854	14,688
1969	8,627	7,022	15,694
1970	6,968	7,101	14,069
1971	9,103	5,689	14,792
Forecast			
1975-1990 (Average)	8,400	6,700	15,100

Source: Federal Aviation Administration, Air Traffic Activity Statistics.

The phenomenal growth of air passenger traffic nationwide, in which this Region has shared, is based upon several factors, including diversion from other travel modes; numerous service improvements, such as increased speed and lower costs; increases in personal income; and increased levels of business activity. Passenger originations and enplanements at Milwaukee's General Mitchell Field, the Region's only commercial air carrier airport, have grown significantly in the past two decades. Originating passengers, or those whose trip begins within the Region and who first board an airplane at General Mitchell Field, rose from 316,770 passengers annually in 1959 to 714,530 in 1970, a 125 percent increase over the decade.

During the latter part of this period (1963 to 1970), following establishment of the national airline service pattern at Chicago's O'Hare Airport, the General Mitchell Field share of national passenger enplanements stabilized at about 0.66 percent, ranging from 0.63 to 0.68 percent during this period. From enplanement data prior to the impact of O'Hare and from studies conducted by the Wisconsin Department of Transportation, it has been judged that about 20 to 25 percent of the air passenger demand generated within the Region is diverted to Chicago's O'Hare Airport. In other words, the total percent of national enplanements generated from southeastern Wisconsin is judged to be between 0.83 and 0.88 percent.

Although air cargo movements are a small proportion of total freight movements in terms of intercity freight ton-miles, this activity has increased five-fold from a total of 4,591 tons of cargo originating at General Mitchell Field in 1959 to 23,665 tons in 1970. Air mail, increasing from 828 to 4,230 tons per year during this period, and air freight, increasing from 2,326 to 17,370 tons per year, represent the major air cargo element increases during the 11 years. Air express movements remained relatively stable, increasing from 1,437 tons in 1959 to 2,065 tons in 1970.

While passenger and cargo activity has increased dramatically in the past decade, air carrier operations have increased only slightly. The major difference in operations growth, compared to traffic increases, is due to the significant increase in the average aircraft size and the number of enplaned passengers per aircraft departure. The average number of seats per departure has risen from 47 to 82 and the average enplanements per departure from 10.7 to 20.0 during the period from 1962 to 1969.

The historical data summarized above were used in the development of various aviation element forecasts. The basic commercial air passenger forecast was developed based on two basic projections. The first, using a top-down model, is based upon a projection of national air passengers obtained from an analytical model developed by R. Dixon Speas Associates, Inc. that relates air passenger trips to several variables: the U. S. population, particularly between the ages of 20 and 64; personal consumption expenditures; average yield per revenue passenger mile; and the average length of the passenger trip. Applying the projected share of the national demand which General Mitchell Field can be expected to accommodate, passenger enplanements at General Mitchell Field, including both originating and connecting passengers, have been projected to increase from 976,609 in 1971 to 2,184,000 passengers in 1980 and 4,547,000 passengers in 1990. Of these total enplanements, originating passengers have been projected to increase from the 1970 volume of 714,530 to 1,835,000 in 1980 and 3,821,000 in 1990.

The second projection relied upon a bottom-up econometric model developed under the regional airport planning program. This model establishes the relationship between air passenger originations and selected socio-economic data for the Region. Several basic variables were tested against existing traffic originations. The best combination was found to involve only two major variables: regional income levels and airline average yields. Using projections of these variables to project originations, and adding the connecting flight pasengers, total enplanements at General Mitchell Field were projected to total 1,793,000 passengers in 1980 and 3,182,000 passengers by 1990. Of these total enplanements, originating passengers were forecast to increase from the 1970 volume of 714,530 to 1,507,000 in 1980 and 2,674,000 by 1990.

These two projections provide a high and low range of airline passenger demand for use in subsequent analyses and plan preparation. Both projections assume continued diversion to Chicago's O'Hare Airport of about 20 to 25 percent of the Region's total air carrier demand. It should be noted that an independently prepared Federal Aviation Administration forecast of regional airline passenger demand for the next 10-year period is similar to the first projection, and a forecast developed by the Air Transport Association for General Mitchell Field is slightly higher than the FAA forecast and the two projections prepared under the regional airport system study. The top-down projection, or the high range, was ultimately selected as the forecast of airline passenger demand.

Air freight and air express cargo is expected to increase from 19,435 tons in 1970 to 68,250 tons in 1980 and 200,000 tons in 1990, or about 1 percent of the national total of air cargo movements. Airmail from General Mitchell Field is forecast to continue to remain at about 0.8 percent of the national total, and will increase from the 4,230 tons handled in 1970 to 11,200 tons in 1980 and 20,000 tons in 1990. It is anticipated that these increasing cargo needs can be served in the belly holds of the fleet provided to serve the forecast air passenger demands.

The forecasts of passenger and cargo traffic must be converted into air carrier operation projections to be of maximum use in planning. The procedure for developing these projections is complex, but is broken into several parts involving assumptions regarding aircraft fleet size and aircraft type, service patterns, and load factors. Larger aircraft are anticipated, and gradually improving service patterns can be expected. Application of these factors and other minor considerations to the annual passenger forecast results in an increase of aircraft departures from 35,268 in 1969 to a low range projection of 46,100 and a high range projection of 58,000 in 1990. Scheduled and nonscheduled aircraft movements are forecast to increase from 73,817 in 1970 to 97,700 per year under the low range projection and 123,000 per year under the high range projection in 1990. Peak day operations are forecast to increase from 301 in 1970 to a low range projection of 373 or a high range projection of 468 by 1990. Similar busy hour forecasts are 28 and 35 by 1990, up from 24 in 1970. The high range projection of air carrier operations was selected as the regional forecast to be used in plan design and evaluation.

No significant change in diversion to or from other modes or other airports is forecast. The potential of V/STOL systems was explored, and a potential demand of 300,000 to 400,000 enplaning passengers annually by 1990 was forecast for such service. At this level of demand, the provision of a special V/STOL airport facility would not be justified.

In 1970, general aviation activity accounted for approximately 90 percent of the total aviation activity within the Region, measured in terms of aircraft operations. This activity, however, accounted for 48 percent of the passenger demand served and for only a limited amount of the cargo demand served. General aviation aircraft registered within the Region are expected to increase from 877 in 1969 to 1,670 in 1980 and 3,000 in 1990 based on national trends and the percent of the share allocated to the Region, and the assumption there will be no constraints to this growth. Aircraft operation forecasts for these aircraft, necessary to determine total runway requirements in terms of number, capacity, and spacing, are expected to increase within the Region from 771,000 in 1970 to 1,321,000 in 1980 and 2,564,000 in 1990. A total of 7,000 operations can thus be expected within the Region on an average day in 1990, increasing to 12,650 on the peak day. These forecast conditions compare with average day operations of 2,100 and peak day operations of 5,160 during 1970. Peak hour operations in 1990 will total 1,500, up from 770 in 1970.

The number of persons served, including the pilot, by these general aviation activities, which totaled about 800,000 occupants in 1970, will total nearly 3,000,000 people per year in 1990.

Military activity, amounting to only 1 percent of the total aircraft activity in 1970, is expected to remain at the present level of about 15,000 annual operations throughout the planning period.

The forecasts of aviation activity for southeastern Wisconsin presented within this chapter provide the basis for development of the alternative airport system plans prepared to satisfy these needs.

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Chapter IX

AIR TRANSPORTATION DEMAND DISTRIBUTION MODELS

INTRODUCTION

The geographic distribution of the existing and probable future demand for air transportation in the Southeastern Wisconsin Region is as important a factor in measuring air service adequacy and determining the need for, and location of, new aviation facilities as is the overall magnitude of that demand. The location of a major new air carrier airport, for instance, would be greatly influenced by the relative proximity of passenger demand concentrations to the proposed site, compared to the proximity to the existing air carrier airports (Chicago's O'Hare Field and Milwaukee's General Mitchell Field). Similarly, studies for the location of possible vertical and short takeoff and landing (V/STOL) airports and for the provision of third level airline service require localized demand data for evaluation of travel time savings made possible by introduction of direct air carrier service from local airports. The development of a plan for improvements to general aviation airports also depends on the forecast geographic distribution of general aviation users.

The overall magnitude of air carrier passenger demand and the demand for general aviation services within the Region has been forecast to the year 1990 utilizing the methodology described in Chapter VIII of this report. The methodology is such that distribution to geographic areas smaller than the Region is inherently limited, and another technique must be applied to distribute the forecast overall demand to smaller geographic units. To this end, two demand distribution models employing mathematical and statistical techniques were developed and applied to geographically distribute the overall regional demand forecasts to the 619 traffic analysis zones delineated by the Commission in the initial land use and transportation study. The models distribute the forecast air carrier passenger and general aviation demand to the traffic analysis zones as a function of one or more of the eight socioeconomic and land use variables listed in Table 128 that have been forecast for each zone under prior Commission planning programs.[1]

DEMAND DISTRIBUTION MODELS

The demand distribution models were developed by postulating potentially stable relationships between aviation demand and those socioeconomic and land use variables that can be independently forecast. Utilizing existing aviation demand and socioeconomic and land use data together with multiple regression techniques, the independent variables most closely associated with the dependent variable were identified and the actual relationships between the dependent and independent variables were formulated. Application of the resulting equations, or models, using the forecasts of the independent socioeconomic and land use variables for each traffic analysis zone produced a distribution of forecast overall regional aviation demand for the years 1980 and 1990 to each traffic analysis zone.

One of the distribution models was developed to distribute airline passenger demand and the other to distribute general aviation demand. The airline passenger demand model distributes the regional forecast of passenger originations to traffic analysis zones, while the general aviation demand model distributes the forecast of registered aircraft owners within the Region to traffic analysis zones.

Air Carrier Passenger Demand Model

Data used to calibrate the air carrier passenger model were derived primarily from Commission surveys of enplaning passengers at General Mitchell Field, it being assumed that the distribution of terminating passengers is similar to the distribution of originating passengers. Region-generated passenger data from the enplaning passenger survey were expanded to represent the number of annual airline passengers using General Mitchell Field and originating and terminating in the Region through use of seasonal traffic profiles prepared from data supplied by the airlines. Using results from a 1964 license plate survey conducted at O'Hare Field by the Wisconsin Department of Transportation, this annual estimate was further adjusted to account for those airline passengers

Table 128

FORECAST SOCIOECONOMIC AND LAND USE VARIABLES AVAILABLE FOR USE IN THE AVIATION DEMAND DISTRIBUTION MODELS

Forecast Demand Variables	
X1 -	Number of automobiles available
X2 -	Population
X3 -	Number of households
X4 -	Number of first work trips for total employment
X5 -	Number of first work trips for retail employment at retail and service land
X6 -	Number of first work trips for total employment at retail and service land
X7 -	Amount of retail and service land (acres)
X8 -	Amount of developed residential land (acres)

Source: SEWRPC.

[1] *SEWRPC Planning Report No. 7, The Land Use-Transportation Study, Volume Two, Forecasts and Alternative Plans—1990, Chapter II.*

generated within the Region but diverted to Chicago. The total airline passenger demand from each of the Region's seven counties is shown in Table 129. The number of passengers diverted to Chicago, approximating 25 percent of the total demand for commercial air travel generated within the Region, was distributed by county as shown in Table 130.

Since the socioeconomic and land use factors affecting home-based airline passenger demand were considered to be different from those affecting non-home-based passenger demand, the total demand was subdivided into these two components prior to analysis. Home-based passengers were defined as those beginning or ending their trip directly at their home, whereas non-home-based passengers were defined as those beginning or ending their trip at places other than their home, such as place of employment, out-of-town office, hotel, or the home of a friend or relative. The total airline passenger originations and terminations generated within the Region by home- or non-home-based trip are summarized by county in Table 131.

General Aviation Demand Model

Resident address information, extracted from Federal Aviation Administration data on registered general aviation aircraft owners and assigned to traffic analysis zones, was used to calibrate the general aviation model. Since a number of the general aviation aircraft were owned by corporations having addresses at airports, the data were corrected to remove these distortions before being used to calibrate the model.

Development of the Demand Distribution Models

A first step in developing the form of the demand distribution models was to compute correlation coefficients among various independent and dependent variables. The results, as shown in Table 132, supported subdividing total airline passenger demand into home- and non-home-based trips, since the initial analyses indicated a high correlation between home originations (Y2) and autos (X1), population (X2), and number of households (X3), while non-home originations (Y1) show high correlation with the employment measures (X4, X5, and X6). Separate equations were developed, therefore, for the home- and non-home-based components of the total airline passenger originations.

Although each of the independent variables considered exhibited a high correlation with the dependent variable being estimated, additional variables could have been

Table 129

REGION-GENERATED AIRLINE PASSENGER TRAFFIC BY COUNTY AT GENERAL MITCHELL FIELD–MILWAUKEE COUNTY AND O'HARE FIELD IN CHICAGO: 1971

County	Originating and Terminating Passengers		
	General Mitchell Field	O'Hare Field	Total
Kenosha	37,057	77,991	115,048
Milwaukee	1,403,767	226,624	1,630,391
Ozaukee	38,653	26,617	65,270
Racine.	110,532	127,528	238,060
Walworth.	10,230	38,998	49,228
Washington . . .	28,805	22,286	51,091
Waukesha.	227,961	99,053	327,014
Region	1,857,005	619,097	2,476,102

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

Table 130

REGION-GENERATED AIRLINE PASSENGER TRAFFIC DIVERTED TO O'HARE FIELD IN CHICAGO BY COUNTY: 1971

County	County-Generated Airline Passenger Originations and Terminations Diverted to Chicago		County Total as Percent of Region Total
	Number	Percent	
Kenosha	77,991	67.8	12.6
Milwaukee . . .	226,624	13.9	36.6
Ozaukee.	26,617	40.8	4.3
Racine	127,528	53.6	20.6
Walworth	38,998	79.2	6.3
Washington . . .	22,286	43.6	3.6
Waukesha	99,053	30.3	16.0
Region	619,097	25.0	100.0

Source: Wisconsin Department of Transportation; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 131

REGION-GENERATED AIRLINE PASSENGER TRAFFIC BY TRIP TYPE: 1971

County	Originating and Terminating Passengers		
	Home-Based Trip	Non-Home-Based Trip	Total
Kenosha	34,257	80,791	115,048
Milwaukee . . .	470,313	1,160,078	1,630,391
Ozaukee	27,485	37,785	65,270
Racine.	87,898	150,162	238,060
Walworth. . . .	10,517	38,711	49,228
Washington . .	21,403	29,688	51,091
Waukesha. . . .	139,896	187,118	327,014
Region	791,769	1,684,333	2,476,102

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

Table 132

CORRELATION OF VARIABLES USED IN THE AVIATION DEMAND DISTRIBUTION MODELS FOR THE REGION

Variables[a]	Correlation										
	Y1	Y2	Y3	X1	X2	X3	X4	X5	X6	X7	X8
Y1	1.000	0.256	- 0.018	0.126	0.123	0.207	0.564	0.481	0.587	0.121	- 0.094
Y2	0.256	1.000	- 0.040	0.537	0.463	0.464	- 0.007	0.071	0.031	0.061	0.245
Y3	- 0.018	- 0.040	1.000	- 0.024	- 0.062	- 0.082	- 0.066	- 0.061	- 0.022	0.144	0.258
X1	0.126	0.537	- 0.024	1.000	0.914	0.870	0.099	0.112	0.057	0.267	0.303
X2	0.123	0.463	- 0.062	0.914	1.000	0.955	0.128	0.122	0.066	0.223	0.195
X3	0.207	0.464	- 0.082	0.870	0.955	1.000	0.192	0.161	0.120	0.235	0.118
X4	0.564	- 0.007	- 0.066	0.099	0.128	0.192	1.000	0.727	0.774	0.197	- 0.223
X5	0.481	0.071	- 0.061	0.112	0.122	0.161	0.727	1.000	0.937	0.231	- 0.148
X6	0.587	0.031	- 0.022	0.057	0.066	0.120	0.774	0.937	1.000	0.176	- 0.123
X7	0.121	0.061	0.144	0.267	0.223	0.235	0.197	0.231	0.176	1.000	0.241
X8	- 0.094	0.245	0.258	0.303	0.195	0.118	- 0.223	- 0.148	- 0.123	0.241	1.000

[a] *Forecast Demand Variables by Traffic Analysis Zone*

Dependent Variables
Y1 - Airline passenger originations (non-home-based)
Y2 - Airline passenger originations (home-based)
Y3 - Aircraft owners

Independent Socioeconomic and Land Use Variables
X1 - Number of automobiles available
X2 - Population
X3 - Number of households
X4 - Number of first work trips for total employment
X5 - Number of first work trips for retail employment at retail and service land
X6 - Number of first work trips for total employment at retail and service land
X7 - Amount of retail and service land (acres)
X8 - Amount of developed residential land (acres)

Source: R. Dixon Speas Associates, Inc.

entered into the equations to produce a better equation for allocating future demand. However, to avoid collinearity problems with the use of highly correlated variables, only one variable from each of the groups was included in each regression equation tested.

Although the forecast variables "retail and service land" and "developed residential land" exhibited the highest correlation with general aviation aircraft ownership, it is evident from Table 132 that general aviation ownership is not highly correlated with even these two estimating variables. This indicates that the propensity to own an airplane is not easy to predict on the basis of the usual socioeconomic variables used in demographic studies. These two independent variables, however, can be used to apportion the forecast of general aviation aircraft owners on the basis of relative zonal levels of developed residential land, an indication of where aircraft owners may reside; and of developed retail and service land, an expression of where business aircraft owners may be located.

Since the demand distribution models merely allocate the regional forecast of air transportation demand to traffic analysis zones on the basis of the best socioeconomic and land use indicators available, and since the independent variables of developed residential land and retail and service land do provide a better correlation with general aviation ownership location than any other combinations of independent variables for which forecasts were readily available, use of these variables may be expected to produce the most reasonable distribution of the overall forecast of general aviation demand, expressed in aircraft owner location, to the traffic analysis zone level.

Two basic forms of the model were evaluated: a linear form (1) and a nonlinear form involving products and exponents (2):

$$(1)\ Y = a_1(X_1) + a_2(X_2) + \ldots\ldots\ldots + a_n X_n$$

$$(2)\ Y = a_1(X_1)^{b_1} (X_2)^{b_2} \ldots\ldots\ldots\ldots X_n^{(b_n)}$$

In the linear form of the model, values of the coefficients were established using multiple regression to obtain the best fit to the calibration data, whereas in the nonlinear case, the values of the coefficients and exponents were determined after the equation was transformed to the linear form by taking the logarithm of both sides:

$$\log Y_1 = \log a_1 + b_1 (\log X_1) + b_2 (\log X_2) \ldots + b_n (\log X_n)$$

It should be noted that the form of the linear model does not include a constant term, since it was reasoned that a traffic analysis zone having zero population and employment activity levels would also have zero passenger demand.

The form of the general aviation demand distribution model is similar to that of the air carrier demand distribution model. The constant term was omitted from this equation also, since it would be unlikely that there could be aircraft ownership in zones having no developed residential or retail and service land.

Use and Results of the Demand Distribution Models
After analyzing and evaluating a number of forms of the various models, the following were adopted for use in distributing future aviation demand to each of the 619 traffic analysis zones within the Region.

1. Number of home-based airline passenger originations in zone

$$Y_2 = 1.18(X_1)$$

2. Number of non-home-based airline passenger originations in zone

$$Y_1 = 1.35(X_3) + 0.87(X_4) + 2.40(X_6)$$

3. Number of general aviation based aircraft in zone

$$Y_3 = 0.0243(X_7) + 0.00304(X_8)$$

where:

X_1 = Number of automobiles available within the traffic analysis zone
X_3 = Number of households located within the traffic analysis zone
X_4 = Number of first work trips for total employment generated from within the traffic analysis zone
X_6 = Number of first work trips for employment at retail and service land generated from within the traffic analysis zone
X_7 = Retail and service land in acres within the traffic analysis zone
X_8 = Developed residential land in acres within the traffic analysis zone

Using the independent variables forecast for each traffic analysis zone in 1980 and 1990, the equations were applied to determine the probable number of passenger originations and general aviation owners per zone. The numerical results for the 619 zones were then summed to obtain a total of passenger originations and general aviation aircraft owners. The percent that each zone represented of the respective regional total was calculated and applied to the regional forecasts to allocate these forecasts to the traffic analysis zones. The resulting allocation of total originating passengers is summarized by county in Table 133, and the allocation of the general aviation aircraft ownership is summarized by county and by aircraft type in Table 134.

Although the basic objective of the airport system planning process is to develop a regional airport system plan consistent with the Commission's adopted land use plan,

Table 133

FORECAST OF REGION-GENERATED AIRLINE PASSENGER ORIGINATIONS BY TRIP TYPE UNDER PLANNED LAND USE CONDITIONS: 1980 and 1990

County	1980			1990		
	Home-Based Trip	Non-Home-Based Trip	Total	Home-Based Trip	Non-Home-Based Trip	Total
Kenosha	66,494	114,006	180,500	154,528	268,152	422,680
Milwaukee	470,980	1,082,952	1,553,932	948,102	2,156,233	3,104,335
Ozaukee	32,630	42,510	75,140	80,236	110,182	190,418
Racine.	90,091	152,774	242,865	212,787	327,203	569,990
Walworth.	33,587	47,077	80,664	71,409	101,957	173,366
Washington	31,901	42,264	74,165	73,973	106,227	180,200
Waukesha.	135,033	182,907	317,940	342,453	485,419	827,872
Region	860,716	1,664,490	2,525,206	1,883,488	3,585,373	5,468,861

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

it was considered important to test the viability of the recommended airport system plan given a continuation of existing land use development trends within the Region. Should land continue to be developed in such an unplanned fashion, a different allocation of air travel demand would result. Forecasts of the independent socioeconomic and land use variables prepared under previous Commission studies for the unplanned land use alternative were used to prepare a second distribution of the overall regional aviation demand to the zonal level. The results of this second demand distribution for 1990 are summarized by county in Table 135.

The distribution of the forecast airline passenger originations to traffic analysis zones, summarized by county in Table 133, represents the allocation of total regional demand, that is, demand diverted to Chicago's O'Hare Field as well as demand accommodated at General Mitchell Field. It was desirable to further distribute this demand to each of the two major commercial airports. Even given the two basic assumptions underlying the distribution model application, namely, that total regional airline passenger origination demand will remain the same under the planned and unplanned regional land use development alternatives, and that the proportionate

Table 134

FORECAST OF GENERAL AVIATION AIRCRAFT OWNERS IN THE REGION BY COUNTY AND AIRCRAFT TYPE UNDER PLANNED LAND USE CONDITIONS: 1980 and 1990

County	1980				1990			
	General Aviation Aircraft Owners by Aircraft Type[a]				General Aviation Aircraft Owners by Aircraft Type[a]			
	C	D	E	Total	C	D	E	Total
Kenosha	8	20	122	150	21	43	213	277
Milwaukee	35	82	511	628	80	170	833	1,083
Ozaukee	6	14	87	107	15	31	151	197
Racine	10	25	152	187	27	57	279	363
Walworth	7	16	101	124	14	31	150	195
Washington	5	11	69	85	11	24	118	153
Waukesha	21	51	317	389	54	115	563	732
Region	92	219	1,359	1,670	222	471	2,307	3,000

[a] *See Appendix D for examples of aircraft types C, D, and E.*

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

Table 135

FORECAST OF REGION-GENERATED AIR TRAVEL DEMAND BY COUNTY UNDER UNPLANNED LAND USE CONDITIONS: 1990

County	Airline Passenger Originations			General Aviation Aircraft Owners by Aircraft Type[a]			
	Home-Based Trip	Non-Home-Based Trip	Total	C	D	E	Total
Kenosha	108,121	184,807	292,928	12	26	127	165
Milwaukee	794,900	1,835,102	2,630,002	55	116	570	741
Ozaukee	137,079	159,091	296,170	20	43	208	271
Racine	200,319	312,994	513,313	23	48	238	309
Walworth	118,654	147,149	265,803	18	39	188	245
Washington	109,053	131,310	240,363	15	31	153	199
Waukesha	556,552	673,789	1,230,341	79	168	823	1,070
Region	2,024,678	3,444,242	5,468,920	222	471	2,307	3,000

[a] *See Appendix D for examples of aircraft types C, D, and E.*

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

diversion of total passenger originations to O'Hare Field from each county of the Region will remain approximately equal to that found in the user surveys, the demand for passenger service at General Mitchell Field and the total diversions to O'Hare Field will differ between the adopted land use plan and the unplanned land use alternative. This is due to the different spatial distribution of population and economic activity associated with the different land use patterns.

The overall regional airline passenger demand was assigned to General Mitchell Field and O'Hare Field under the following procedure. Because the airline passenger origination forecast was based upon an extrapolation of historic trends, the first step was to use the independent socioeconomic and land use variables forecast for each traffic analysis zone under the unplanned regional land use alternative in applying the demand distribution model to allocate the regional forecast of about 3.8 million passengers enplaning at General Mitchell Field in 1990 to the 619 traffic analysis zones. The unplanned land use alternative was used in this initial allocation because this land use pattern was also based upon an extrapolation of historic trends.

The resulting demand allocated to each traffic analysis zone was summed by county and increased proportionately on the basis of the total generated traffic which could be expected to be diverted to Chicago. For example, the total number of General Mitchell Field passenger enplanements allocated to traffic analysis zones comprising Washington County represents 56 percent of the total generated passenger demand from that county. The remaining 44 percent, as shown in Table 130, may be expected to use Chicago's O'Hare Field. Consequently, the initial demand allocation, representing allocation of General Mitchell Field demand, to the zones comprising Washington County was factored by 1.77 $\left(\frac{56.4 + 43.6}{56.4} = 1.77\right)$ to determine total passenger demand.

The resulting airline passenger demand by traffic analysis zone was then summed for the Region as a whole, and the total was redistributed to the traffic analysis zones by applying the demand distribution models, with the independent socioeconomic and land use variables forecast for each traffic analysis zone under the adopted land use plan. The percentage of total regional traffic that could be expected to be diverted to Chicago from zones within each county was then used to assign the resulting zonal demands to General Mitchell Field and O'Hare Field. Table 136 summarizes the distribution of 1980 and 1990 forecast originating passengers by county and by airport under planned land use conditions.

SUMMARY

The geographic distribution of the probable future demand for air transportation within the Region is an important consideration in the preparation of alternative airport system plans to accommodate that demand. Through the application of demand distribution models developed under the regional airport system planning program, the overall regional air transportation demand forecasts were geographically distributed to 619 traffic analysis zones within the Region.

Two demand distribution models, one to distribute airline passenger demand and the other to distribute general aviation demand, were developed using multiple regression techniques to determine those independent socioeconomic and land use variables most closely associated with the dependent aviation demand variables and the actual relationships between the dependent and independent variables. The data used to calibrate the air carrier passenger models were derived primarily from Commission surveys of enplaning passengers at General Mitchell Field. Resident address information extracted from Federal Aviation Administration data on registered general aviation aircraft owners was used to calibrate the general aviation model. The data used to define the socioeconomic and land use variables for calibration

Table 136

FORECAST OF REGION-GENERATED AIRLINE PASSENGER ORIGINATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY AND O'HARE FIELD IN CHICAGO UNDER PLANNED LAND USE CONDITIONS: 1980 and 1990

County	Airline Passenger Originations					
	1980			1990		
	General Mitchell Field	O'Hare Field	Total	General Mitchell Field	O'Hare Field	Total
Kenosha	58,121	122,379	180,500	136,103	286,577	422,680
Milwaukee	1,337,936	215,996	1,553,932	2,672,833	431,502	3,104,335
Ozaukee	44,483	30,657	75,140	112,728	77,690	190,418
Racine.	112,689	130,176	242,865	264,475	305,515	569,990
Walworth.	16,778	63,886	80,664	36,060	137,306	173,366
Washington . . .	41,829	32,336	74,165	101,633	78,567	180,200
Waukesha.	221,604	96,336	317,940	577,027	250,845	827,872
Region	1,833,440	691,766	2,525,206	3,900,859	1,568,002	5,468,861

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

of models under current conditions and forecasts for 1980 and 1990 were available from other Commission planning efforts.

Following development of the mathematical relationships between independent and dependent variables, previously prepared forecasts of the overall regional demand for air transportation service were allocated to each traffic analysis zone through application of the models with forecast independent socioeconomic and land use variables. Two demand distributions were made, one for the adopted regional land use plan and another for the unplanned land use alternative. In both instances, airline passenger demand from each zone was further assigned to General Mitchell Field and O'Hare Field.

Because of the quite different spatial distributions of population and economic activity associated with different land use patterns, the demand for passenger service at General Mitchell Field and the total diversion to O'Hare Field may be expected to differ between the adopted land use plan and the unplanned land use alternative. The demand distribution of general aviation aircraft owners may also be expected to vary between the adopted regional land use plan and the unplanned alternative. The demand for air transportation services as it may be expected to be distributed under adopted land use plan conditions was used to develop, test, and evaluate alternative airport system plans. The recommended airport system plan resulting from the consideration of the alternative systems was then tested against the air transportation service demand that would be expected to occur under the unplanned alternative, in order to ascertain the viability of the recommended plan under greatly varying land use conditions within the Region.

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Chapter X

REGIONAL AIRPORT SYSTEM DEMAND/CAPACITY ANALYSIS

INTRODUCTION

In any transportation system planning and development process, an effort must be made to utilize existing facilities to the fullest extent possible. A determination of the capability of these existing facilities to accommodate existing and probable future demands thus becomes an important step in system analysis and design. In airport system planning, care must be taken to include in the existing system only those facilities that may reasonably be expected to remain in airport use through the design year of the plan. Because of the number of privately owned airports available for public use in the Region, and because of the rapid changes in land use development in the Region, definition of this basic system of existing facilities for long-range airport system planning is difficult.

The basic facility inventories and the land use and natural resource base data described in Chapters IV and III of this report, respectively, together with other adopted regional plan elements, were used to identify the basic airport system which could be expected to remain in service through the plan design year. The characteristics of airport facilities that define airport capacity were then determined and the capacity of the basic system quantified. The existing and forecast air transportation demands, as documented in Chapter VIII of this report, were assigned to this basic system to permit evaluation of its adequacy to meet demands and to identify any deficiencies that should be considered in the planning process. This chapter describes the results of these analyses.

BASIC REGIONAL AIRPORT SYSTEM

The inventory of airport facilities described in Chapter IV of this report identified a total of 46 existing airports within the Region, including one heliport and one seaplane base. Not all of these existing airports, however, can be assumed to be available as components of a future airport system. At the time of the inventory, only 26 of the 46 existing airports (excluding the seaplane base) were available for public use. Within a rapidly urbanizing region such as southeastern Wisconsin, privately owned airports, even if open to public use, are subject to conversion to other types of land use.

Indeed, even since completion of the airport facility inventory, the availability of three privately owned public use airports within the Region has changed. The Rainbow Airport has been purchased by Milwaukee County in accordance with recommendations in the Commission-adopted Root River watershed plan for use as a multiple purpose reservoir as part of the Root River Parkway system. Consequently, this property is no longer available for use as an airport facility. Two other privately owned airports, Mt. Fuji in Walworth County and O'Leary Field in Waukesha County, have recently been changed from public to private use by action of the owners. While the precise reasons for this change are unknown, decisions of this kind, involving complex private considerations including insurance liabilities, are not uncommon and can be expected to occur through the planning period.

In addition to recognizing the changes at these three airports, two privately owned public use airports were eliminated from further consideration as integral parts of the existing regional airport system following detailed investigations of the facility expansion potential of each to accommodate increased demand. These two airports—Hales Corners in Milwaukee County and Aero Park in Waukesha County—cannot be expanded to achieve minimum standards without having a considerable adverse impact on neighboring land use developments. Investigation of the Hales Corners Airport indicated that any primary runway construction required extension into a major regional park. Additionally, construction of a crosswind runway would have a serious impact on adjacent residential development. Development of the freeway interchange for the proposed Bay and Belt Freeways would impinge on the expansion potential of the Aero Park Airport, and might even eliminate the airport.

Thus, the 26 public use airports inventoried at the beginning of the study were reduced to 21 public use airports that can reasonably be expected to comprise the basic existing airport system providing general aviation service within southeastern Wisconsin. In addition to these 21 airports, one proposed and two existing public use airports located outside the Region were considered as integral parts of the regional airport system. These airports, due to their proximity to the Region, can satisfy some air transportation demand originating in the peripheral communities of the Region.

The two existing airports considered as supplemental facilities are Watertown Municipal, located approximately 10 miles west-northwest of the Waukesha-Dodge County line, and Waukegan Memorial Airport, located five miles south of the Kenosha County line in Illinois. Both airports are publicly owned and operated. Watertown Municipal is presently classified as a basic utility stage I airport, while Waukegan has sufficient capabilities to be classified as a basic transport airport. For purposes of this study, however, the Waukegan airport has been treated as a general utility airport in an effort to conservatively reflect its impact on the regional system plan. One other existing airport, Palmyra Municipal in Jefferson County, was considered as a possible supplemental facility, but due to its lack of expansion potential it was discounted.

The proposed public use airport for the Whitewater-Fort Atkinson area was also considered as a supplemental facility located outside the Region. This facility as currently proposed would consist initially of a general utility airport having a single paved runway. Even though a precise site location has yet to be determined, the general search area is known in sufficient detail to define its acceptability as a supplemental airport to the Region.

Another change in the basic airport system that has occurred since the inventory is the upgrading of the Lake Lawn Lodge Airport in Walworth County as a result of construction of a new 4,400-foot paved runway. The ownership of this airport has changed since the inventory, and the new owner, a major corporation, has initiated a major improvement program. It should be noted, however, that the Lake Lawn Lodge Airport, like the Playboy Airport, is a specialized facility. Both airports are intended to serve primarily as "access to recreational facilities" airports. Lake Lawn Lodge Airport, when completed, will provide air access to a planned recreational complex. Similarly, the existing Playboy Airport provides air access to an adjacent recreational complex. Because of this unique service role, the full capacity of these airports cannot be considered available to meet overall system capacity. The restricted capacity, in effect, prohibits reliance upon these airports as major components of the overall system.

In summary, the basic existing regional airport system used as a point of departure in the system planning process consists of 21 existing public use airports within the Region and three supplemental airports located outside the Region. The airports comprising the basic existing system are listed in Table 137.

MEASURES OF AIRPORT SYSTEM CAPACITY

Measuring the capacity of an existing airport system requires definition of the capacity limitations of four distinct elements of the system: the landing area, the terminal area, the airspace, and the surface transportation access facilities. The latter two were discussed separately in Chapter IV of this report, while the landing area and terminal area capacity are discussed below. Utilizing data gathered during the airport planning program inventory, the capacities of the 24 airports comprising the basic airport system of the Region were determined using Federal Aviation Administration and industry accepted methodologies.

Landing Area Capacity

Landing area capacity is defined as the ability of the airport runway and taxiway facilities to accept aircraft takeoffs and landings, and is normally expressed in terms of the number of aircraft operations that can be accommodated in the peak hour and on an annual basis. The latter is called practical annual capacity, or "PANCAP." The airfield capacities derived herein relate the rate of aircraft movements on the runway-taxiway system to a given acceptable level of delay. At air carrier airports, capacity is reached when delays average four minutes per aircraft operation during the two adjacent normal peak hours of the week. For general aviation airports, the average delay level is two minutes. When measuring delay during actual operations, the distribution pattern of the delay must be considered. For example, one aircraft may incur a 30 second delay while during the same hour another may incur a 20 minute delay. The four minute average figure is used because its distribution is such that the maximum delays will not exceed about 20 minutes. This allows controllers some respite, even during busy periods, and also prevents too much traffic backup.

For system planning purposes, the airport landing area capacity is best expressed in terms of PANCAP, since this expression facilitates ready comparison with forecast annual demand. Moreover, if the PANCAP does not meet the forecast demand, it is relatively easy to analyze needed changes to provide the necessary capacity. As with hourly capacity, the PANCAP incorporates the concept of acceptable delay. The PANCAP is selected at

Table 137

BASIC PUBLIC USE AIRPORTS IN THE REGION USED IN THE AIRPORT SYSTEM PLANNING PROCESS: 1971

County	Airport	Present Regional Airport Classification
Kenosha	Kenosha Municipal	GU
	Vincent	< BU-I
Milwaukee . . .	General Mitchell Field	SAT
	Timmerman Field	GU
Ozaukee	Ozaukee	< BU-I
Racine.	Burlington Municipal	BU-II
	Fox River	< BU-I
	Hunt Field	< BU-I
	Racine Commercial	BT
	Sylvania	< BU-I
	Valhalla	< BU-I
Walworth. . . .	Big Foot	BU-I
	East Troy Municipal	< BU-I
	Gruenwald	BU-I
	Lake Lawn Lodge	BU-II
	Playboy	BU-II
Washington . .	Hahn's Sky Ranch	< BU-I
	Hartford Municipal	BU-1
	West Bend Municipal	GU
Waukesha. . . .	Capitol Drive	< BU-I
	Waukesha County	GU
Outside the Region	Fort Atkinson-Whitewater	GU
	Watertown Municipal	BU-I
	Waukegan Memorial	GU

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

a level at which experience indicates the annual delays will be reasonable. In effect, this is done by simulating an airport's operation and computing the delay to operations during heavily loaded hours of the day for all of the airport's operations during a year. The hours of the year when the demand exceeds practical capacity, as well as the number of operations occurring during those hours, are recorded. When the number of overloaded hours, the delay during these hours, and the operations during these hours reach certain empirically specified levels, the operations thus achieved represent the annual capacity.

At those airports within the present system where aircraft operations exceed 90,000 annually (General Mitchell Field, Timmerman Field, and Waukesha County), a computer program analysis was used to analyze capacity. At all other airports where activity is normally much lower, airfield capacities were analyzed using the "Airport Capacity Handbook" prepared for the Federal Aviation Administration[1] (FAA).

Terminal Area Capacity

Terminal area capacity is defined as the ability of all elements of the terminal complex to accept the passengers, cargo, and aircraft that the landing area accommodates. Thus, the individual elements within the terminal areas that must be evaluated for each airport within the system to determine the overall terminal capacity include:

1. Airline passenger and cargo apron area and gate positions.

2. General aviation apron areas and tie-down and hangar facilities.

3. Airline passenger and general aviation terminal buildings and cargo buildings.

4. Aircraft maintenance and support facilities.

5. Automobile parking.

Airport facility requirements were determined primarily by applying appropriate FAA suggested methods for sizing facilities, as presented in that agency's publication, "Aviation Demand and Airport Facility Requirement Forecasts for Medium Air Transportation Hubs Through 1980." The FAA methods were supplemented, as necessary, by planning and design criteria suggested by other industry-recognized organizations to define acceptable current relationships between activity levels and terminal requirements. The facility sizing requirements, as related to capacity, include those defined in Chapter VII of this report. Table 138 summarizes the factors applied to measure the capacity of both the existing and future airport system.

[1] *Prepared by the Airport and Air Traffic Control Planning Group of Airborne Instrument Laboratories, Farmingdale, New York, June 1969.*

DEMAND/CAPACITY ANALYSIS OF THE BASIC REGIONAL AIRPORT SYSTEM

After the basic existing regional airport system was identified and the landing and terminal area features of each airport that determine the airport's capability to accommodate aviation activity were described, the capability of each airport to meet existing and future aviation and attendant demands, in terms of based aircraft, aircraft operations, and passenger activity, was studied. This was accomplished by comparing the facilities available at each airport with the previously defined facility requirements. The description of existing aviation activity was obtained during the facility inventory conducted by the Commission, and from data collected prior to development of the aviation forecasts. Forecast aviation demands, documented in Chapter VIII of this report, were assigned to the basic existing regional airport system so that a comparison between the capabilities of the existing system and the forecast demands could be made. The results of these comparisons identified system deficiencies under current and probable future conditions so that corrective measures or improvements could be considered.

Existing Demand

The demand/capacity analysis of the existing airport system and activity has been subdivided into a comparison of facilities and operations at General Mitchell Field and an analysis of the activities and facilities at the remaining general aviation airports. The runway system at General Mitchell Field under the current aircraft mix and runway configuration has a practical annual capacity (PANCAP) of 341,000 aircraft operations and a peak hour capacity of 106 movements. These capacities are based upon a landing area consisting of two runways—7R-25L and 1L-19R—capable of accommodating air carrier aircraft, and three runways—7L-25R, 13-31, and 1R-17L—accommodating general aviation aircraft. The capacity of these latter runways is restricted due to their runway lengths. These capacity figures contrast with the 224,071 annual operations, of which 78,552 are air carrier operations. Peak hour operations of air carrier traffic totaled only 19 in 1971, but ranged as high as 40 per hour in 1967 and 1968.

A comparison of existing terminal area facilities at General Mitchell Field and suggested standards based upon FAA suggested facility sizing criteria is shown in Table 139. Although the present air carrier terminal complex has adequate aircraft apron area and gate capacity for total needs, the operations of individual airlines may require space beyond that allocated to them during particularly busy times. The amount of terminal building space and public parking, however, is closely related to the suggested standards. As can be seen from Table 139, the amount of apron area and T-hangars available for general aviation use in the four separate general aviation areas at General Mitchell Field appears adequate. There is a need, however, for 55 additional paved aircraft tie-downs. It should be noted that these tie-downs could be accommodated on existing as well as newly paved apron areas. The requirements of the

Table 138

CRITERIA USED TO DETERMINE THE CAPACITY OF AIRPORT FACILITIES IN THE REGION

Airport Facility Element	Capacity Sizing Criteria
Runway System	Variable dependent upon runway configuration, annual airport utilization, and aircraft fleet mix
Terminal Buildings	
Air Carrier Passenger	Gross area equals 242 square feet per typical peak hour passenger
General Aviation Passenger and Pilot Facilities	Gross area equals 24.5 square feet per typical peak hour pilot and passenger
Automobile Parking	
Air Carrier	Sufficient space[c] for 1.5 spaces per typical peak hour passenger
General Aviation	Sufficient space[c] for 1.3 spaces per peak hour pilot and passenger
Paved Aircraft Apron[a]	
Air Carrier Aircraft	Sufficient apron to accommodate peak hour aircraft assuming the following minimum parking areas for each aircraft type
Aircraft Seating Capacity	Area Per Aircraft
<55	3,000 square yards
55- 74	3,000 square yards
75-119	4,000 square yards
120-200	6,000 square yards
>200	15,000 square yards
General Aviation Tie-down Area[a]	
Aircraft Type[b]	Area Per Aircraft
C	1,600 square yards
D	625 square yards
E	300 square yards
General Aviation Hangar Area	
Aircraft Type[b]	Area Per Aircraft
C	500 square yards
D	350 square yards
E	180 square yards

[a] *Includes aircraft parking and maneuvering areas.*

[b] *See Appendix D for examples of aircraft types.*

[c] *The area for each space equals 320 square feet.*

Source: R. Dixon Speas Associates, Inc.

general aviation areas do not take into account five privately owned hangars located in the terminal area that are reserved and used for specific corporate aircraft. To account for these hangars in the gross area calculations would result in exaggerating the capacity available at the existing hangar facilities. In summary, landing area and terminal area facilities at General Mitchell Field are consistent with or exceed standards suggested to accommodate current aviation activity.

A comparison of the physical facilities at the basic existing regional general aviation airports and suggested facility standards, and a comparison of the landing area capacity and current operations at these airports is summarized in Table 140. FAA suggested standards for airport facilities were determined by applying appropriate sizing criteria presented in that agency's publication Aviation Demand and Airport Facility Requirement Forecasts for Medium Air Transportation Hubs Through 1980. The runway capacity data for all airports except Timmerman Field and Waukesha County were computed using the methodology described in the Airport Capacity Handbook prepared for the Federal Aviation Administration. The public use general aviation airports have sufficient capacity to accommodate operations at current demand levels without incurring excessive delays. Fifteen airports, however, have restricted capabilities due to the lack of paved runways and/or paved taxiways, inadequate

Table 139

COMPARISON OF EXISTING TERMINAL AREA FACILITIES AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY AND SUGGESTED FACILITY STANDARDS: 1971

Terminal Area Facility	Number or Size	
	Existing	Suggested Standards[a]
Air Carrier Terminal		
Public, Administrative, and Mechanical Operations (Square Feet)	149,300	152,920
Concessions (Square Feet)	25,600	36,040
Airline Operations (Square Feet)	72,000	52,600
Public Parking (Number of Spaces)	1,450	1,460
Gates		
Passenger	21	15
Cargo	2	1
Apron		
Passenger (Square Yards)	151,400	85,000
Cargo (Square Yards)	7,500	5,000
General Aviation Areas		
Apron Area (Square Yards)	140,300	87,400
"T" Hangars	24	16
Conventional Hangar Area (Square Yards)[b]	23,900	--
Paved Tie-downs	100	155

[a] *U. S. Department of Transportation, Federal Aviation Administration, Aviation Demand and Airport Facility Requirement Forecasts for Large Air Transportation Hubs Through 1980, Appendix 2, 1969.*

[b] *Excludes the five separate corporate hangar units, each designed and utilized for a single aircraft.*

Source: R. Dixon Speas Associates, Inc.

runway length, and limited space for aircraft storage. At those public use airports where only turf surfaces exist, operation of the airport is subject to seasonal and weather conditions such as heavy snow cover, rain soaked soils, and spring-fall flooding, which limit airport usability and reliability.

Based on current needs, nearly all of the public use airports have sufficient aircraft storage and hangar areas for maintenance. However, most of the airports lack sufficient paved aircraft parking, apron, and maneuvering areas to meet the suggested standards. Further, airport terminal facilities for pilots and passengers are limited at all airports except Timmerman Field in Milwaukee County. At most general aviation airports, particularly those that are privately owned, the hangar building of the fixed base operator serves as both an office and the pilot/passenger lounge.

Forecast Demand

Demand Assignment: As an initial step in the development of airport system requirements, it is desirable to assign the forecast of general aviation demand allocated to each traffic analysis zone within the Region to the available public use airports. This identifies future service deficiencies that must be addressed in developing the system plan. The first step in the demand assignment was to develop travel time relationships between airports and traffic analysis zones. This was accomplished by drawing isopleth lines representing 10, 20, and 30 minute ground travel times from each of the 24 airports in the study area. Travel time between airports and analysis zones was prepared from the zone to zone minimum time paths maintained by the Commission in its computer description of the proposed 1990 arterial street and highway network.

These isopleths were superimposed, one at a time, on a map of the traffic analysis zones, and all traffic analysis zones falling within each ring of the isopleth were tabulated for computer input. The process was repeated for each airport. A computer file was thereby created containing an airport code number, a travel time of 10, 20, or 30 minutes, and a list of all traffic analysis zones associated with the specific travel time. An additional file was established identifying the classification of each airport and the largest aircraft type that could be accommodated by each classification. Five airport classifications were used, as shown in Table 141.

An algorithm was then developed to assign the aircraft demand from each traffic analysis zone to an appropriate airport. Basically, demand was assigned to the closest airport capable of servicing the class of aircraft involved. In those cases where several airports were located within the same travel time isopleth of the traffic analysis zone being considered, the least congested airport capable of servicing the aircraft class was chosen. Class E aircraft were not assigned to airports with a classification higher than basic transport unless there were no other airports within the 30 minute service area.

To facilitate the demand assignment, an airport availability file was established for each traffic analysis zone, containing the number, classification, and ground travel time to each airport within 30 minutes. The file was ordered first by travel time, and then by airport classification within each travel time range. The resulting computer file contained, for each zone, all the airports within 10 minutes, followed by all those 20 minutes from the zone, and finally all those within 30 minutes travel time from the zone. Within each group, the data were arranged by airport category, with the smallest airports first.

Table 140

COMPARISON OF BASIC GENERAL AVIATION PUBLIC USE AIRPORT FACILITIES IN THE REGION AND SUGGESTED FACILITY STANDARDS: 1971

County	Airport	Paved Apron (Square Yards)	Aircraft Storage: Hangared Spaces	Aircraft Storage: Unhangared Tie-downs: Paved	Aircraft Storage: Unhangared Tie-downs: Turf	Pilot and Passenger Terminal: Building (Square Feet)	Pilot and Passenger Terminal: Auto Parking (Spaces)	Runway Capacity: Peak Hour	Runway Capacity: Practical Annual Capacity	Annual Operations
Kenosha	Kenosha Municipal									
	Existing Facilities . . .	18,889	41	31	29	Fixed Base Operator	60	95	181,000	64,500
	Suggested Standards. .	24,144	25	69	0	3,400	91	--	--	--
	Vincent									
	Existing Facilities . . .	0	6	0	N/A[a]	N/A[a]	N/A[a]	86	91,000	4,000
	Suggested Standards. .	2,444	3	7	0	350	9	--	--	--
Milwaukee	Timmerman Field									
	Existing Facilities . . .	23,300	86	65	125	19,500	250	151	302,000	143,900
	Suggested Standards. .	52,100	54	149	0	3,770	100	--	--	--
Ozaukee	Ozaukee									
	Existing Facilities . . .	0	0	0	4	N/A[a]	N/A[a]	86	91,000	3,500
	Suggested Standards. .	2,800	1	8	0	900	23	--	--	--
Racine	Burlington Municipal									
	Existing Facilities . . .	4,250	7	5	30	1,125	50	95	133,000	8,000
	Suggested Standards. .	10,500	10	30	0	1,500	39	--	--	--
	Fox River									
	Existing Facilities . . .	0	2	0	12	Fixed Base Operator	N/A[a]	87	87,000	3,200
	Suggested Standards. .	3,889	2	9	0	350	10	--	--	--
	Hunt Field									
	Existing Facilities . . .	0	0	N/A[a]	N/A[a]	N/A[a]	N/A[a]	86	84,000	800
	Suggested Standards. .	1,278	1	3	0	350	10	--	--	--
	Racine Commercial									
	Existing Facilities . . .	10,000	34	2	15	Fixed Base Operator	N/A[a]	89	145,000	35,000
	Suggested Standards. .	20,094	10	27	0	1,000	22	--	--	--
	Sylvania									
	Existing Facilities . . .	2,100	8	6	3	Fixed Base Operator	N/A[a]	90	172,000	12,000
	Suggested Standards. .	12,950	11	37	0	2,450	65	--	--	--
	Valhalla									
	Existing Facilities . . .	0	2	0	3	Fixed Base Operator	N/A[a]	87	90,000	200
	Suggested Standards. .	1,278	1	3	0	350	10	--	--	--
Walworth	Big Foot									
	Existing Facilities . . .	0	10	N/A[a]	N/A[a]	360	N/A[a]	90	126,000	1,000
	Suggested Standards. .	3,850	3	11	0	1,000	26	--	--	--
	East Troy Municipal									
	Existing Facilities . . .	0	18	0	12	Fixed Base Operator	25	86	86,000	5,700
	Suggested Standards. .	5,600	5	16	0	1,000	26	--	--	--
	Gruenwald									
	Existing Facilities . . .	0	0	0	0	N/A[a]	N/A[a]	95	95,000	1,600
	Suggested Standards. .	2,111	1	5	0	350	350	--	--	--
	Lake Lawn Lodge									
	Existing Facilities . . .	0	0	N/A[a]	N/A[a]	0	N/A[a]	86	86,000	1,400
	Suggested Standards. .	1,667	1	4	0	350	10	--	--	--
	Playboy									
	Existing Facilities . . .	10,000	N/A[a]	N/A[a]	N/A[a]	N/A[a]	N/A[a]	93	183,000	5,700
	Suggested Standards. .	3,500	2	10	0	1,000	26	--	--	--

Table 140 (continued)

County	Airport	Paved Apron (Square Yards)	Aircraft Storage: Hangared Spaces	Unhangared Tie-downs: Paved	Unhangared Tie-downs: Turf	Pilot and Passenger Terminal: Building (Square Feet)	Pilot and Passenger Terminal: Auto Parking (Spaces)	Runway Capacity: Peak Hour	Runway Capacity: Practical Annual Capacity	Annual Operations
Washington	Hahn's Sky Ranch									
	Existing Facilities . . .	0	1	0	15	Fixed Base Operator	N/A[a]	95	98,000	1,000
	Suggested Standards. .	3,850	2	11	0	1,700	46	--	--	--
	Hartford Municipal									
	Existing Facilities . . .	3,333	39	3	5	Fixed Base Operator	30	112	211,000	57,600
	Suggested Standards. .	15,050	16	43	0	1,300	22	--	--	--
	West Bend Municipal									
	Existing Facilities . . .	N/A[a]	47	6	24	Fixed Base Operator	112	93	175,000	90,540
	Suggested Standards. .	19,950	20	57	0	2,500	66	--	--	--
Waukesha	Capitol Drive									
	Existing Facilities . . .	0	23	0	35	Fixed Base Operator	N/A[a]	84	83,000	35,000
	Suggested Standards. .	16,450	17	47	0	1,300	35	--	--	--
	Waukesha County									
	Existing Facilities . . .	8,000	103	8	78	Fixed Base Operator	300	142	284,000	117,000
	Suggested Standards. .	44,450	49	127	0	3,000	78	--	--	--

[a] *Data are not available.*

Source: R. Dixon Speas Associates, Inc.

Table 141

RELATIONSHIP BETWEEN AIRPORT CLASSIFICATIONS AND TYPE OF AIRCRAFT SERVED

Code Number	Airport Classification	Aircraft Type[a]	Approximate Gross Weight Limits of Aircraft To Be Accommodated
1	Basic Utility[b]	E	Less than 8,000 pounds
2	General Utility	D	8,000-12,500 pounds
3	Basic Transport.	C	12,500-60,000 pounds
4	General Transport	B	60,000-175,000 pounds
5	Scheduled Air Transport.	A, AA	More than 175,000 pounds

[a] *See Appendix D for examples of aircraft types.*

[b] *Due to physical runway limitations, some basic utility airports cannot safely accommodate all aircraft types less than 8,000 pounds gross weight. Based upon analyses conducted by the Wisconsin Department of Transportation, basic utility stage I airports were assumed to be able to serve 90 percent of the Type E aircraft within the general aviation aircraft fleet, while the less-than-basic-utility stage I airports were assumed to be able to accommodate only 60 percent of the Type E aircraft within the general aviation aircraft fleet.*

Source: R. Dixon Speas Associates, Inc.

The general aviation demand, expressed in terms of based aircraft, was then converted into aircraft operations. As described in Chapter VIII of this report, both the number of general aviation aircraft and the number of general aviation aircraft operations were forecast, by type, under the planning program. From these forecasts, the average number of annual aircraft operations per type of based aircraft was derived and is shown in Table 142. The average number of operations per aircraft type was applied to the aircraft assigned to each airport to determine the annual number of aircraft operations.

In the demand assignment, the airport availability list is searched for the first airport capable of servicing the aircraft class consistent with travel time limits. If the other airports on the list are within the same travel time

Table 142

FORECAST OF GENERAL AVIATION AIRCRAFT OPERATIONS IN THE REGION BY AIRCRAFT TYPE 1980 and 1990

Aircraft Type[a]	Average Number of Annual Aircraft Operations Per Based Aircraft	
	1980	1990
C	730	730
D	620	650
E	810	890

[a] *See Appendix D for examples of aircraft types.*

Source: R. Dixon Speas Associates, Inc.

contour, the assignment is made to the least congested airport as determined by a comparison of the number of operations generated by the aircraft already assigned to the airport with the PANCAP of the airport. When all the airports closest to the traffic analysis zone have operations exceeding 60 percent of PANCAP, the search area for the least congested airport is enlarged by an additional 10 minutes travel time. As the load on the airport surpasses 80 percent of PANCAP, the search area is enlarged to a maximum of 30 minutes travel time, and the assignment is made to an appropriate airport with the greatest reserve capacity. To minimize bias in the assignment due to the numbering system used to identify the traffic analysis zones, the demand assignment is made in three iterations. In each iteration the demand from one-third of the traffic analysis zones is made. This method of assignment results in a uniform and closely balanced loading of airports in the Region, and is believed to realistically simulate the manner in which the load on each airport tends to be "evened out" in accordance with the availability of airport capacity and facilities.

Four computer reports were produced for each application of the airport assignment model. The first is a tabulation, by traffic analysis zone, of the general aviation demand by aircraft type and the airport to which the demand was assigned. All aircraft not assigned to an airport are listed as unsatisfied demand, which results when there are no airports capable of servicing the aircraft type within the specified ground travel time. Although an effort is made within the program to balance the runway loading on airports, a reassignment may be required to stay within additional capacity constraints. To facilitate a manual reassignment of aircraft from one airport to another, an abbreviated airport availability table is also included in the report for each traffic analysis zone.

The second report is an entire airport availability table, which is useful when the abbreviated form is insufficient. The third report is a duplicate of the first, tabulating, however, only those zones with unsatisfied demands. The pattern of zones in this table is useful in identifying potential locations for additional airports to satisfy existing and probable future demand. These three detailed reports are maintained in the Commission offices.

The fourth report summarizes the demand assignment to each airport by aircraft type for 1980 and 1990, as shown in Tables 143 and 144, respectively. These summary tables result from the process begun by first allocating the regional general aviation forecast by aircraft type to the traffic analysis zone, and then assigning these aircraft to airports in accordance with the methodology described above.

Comparison of Forecast Airport Facility Needs and Existing Facilities: After the existing basic airport system for the Region was identified, and the future demand in terms of based aircraft, aircraft operations, and passenger activity was determined for each airport in that system, the capabilities of the present system to satisfactorily accommodate the forecast demand were determined. This was accomplished through a comparative evaluation of the airport facility needs, as dictated by the forecast activity, and the available facilities at each airport. The results identified system deficiencies. Once these deficiencies were quantified, corrective measures or improvements to the system could be considered.

To facilitate assessment of the impact of the assigned demand on the existing airport facilities, the demand data in the form of originating passengers and based aircraft were converted to forms more consistent with the facility sizing criteria. Demand expressed as originating airline passengers can be readily converted to annual enplaning passengers by utilizing the origination/connection ratios established in Chapter VIII. Similarly, by utilizing the various ratios of average aircraft size, aircraft fleet mix, and enplaning passengers per departure, annual aircraft operations can be derived from demand expressed as originating airline passengers. Peak hour aircraft operations and passenger movements can be obtained by applying the appropriate factors as defined in Chapter VIII. Once all the demand factors are established, the sizing criteria as set forth in Table 138 can readily be applied to determine the facilities required to adequately accommodate the demand.

With respect to general aviation, application of the facility sizing requirements to the demand assignment factor "based aircraft" identifies the appropriate needs. The assignment factor "annual operations" can be directly applied to the calculated PANCAP of the particular airport to determine if deficiencies exist. As in the case with the peak hour airline passenger activity, the general aviation peak hour pilot and passenger data must be derived by utilizing the appropriate "average occupants per flight" factor as developed in Chapter VIII.

The comparative analysis of the facilities presently available at General Mitchell Field and the forecast 1990 demand for facilities is presented in Table 145. It can be seen that the existing landing area system at General

Table 143

ASSIGNMENT OF GENERAL AVIATION AIRCRAFT TO THE BASIC PUBLIC USE AIRPORTS IN THE REGION: 1980

County	Airport	Airport Classification	Aircraft Type[a]						Total Aircraft Assigned
			AA	A	B	C	D	E	
Kenosha	Kenosha Municipal	GU	--	--	--	--	20	108	128
	Vincent	<BU-I	--	--	--	--	--	28	28
Milwaukee	General Mitchell Field	SAT	--	--	--	38	60	--	98
	Timmerman Field	GU	--	--	--	--	36	246	282
Ozaukee	Ozaukee	< BU-I	--	--	--	--	--	47	47
Racine.	Burlington Municipal	BU-II	--	--	--	--	--	42	42
	Fox River	< BU-I	--	--	--	--	--	42	42
	Hunt Field	< BU-I	--	--	--	--	--	39	39
	Racine Commercial	BT	--	--	--	13	11	104	128
	Sylvania	< BU-I	--	--	--	--	--	75	75
	Valhalla	< BU-I	--	--	--	--	--	48	48
Walworth.	Big Foot	BU-I	--	--	--	--	--	19	19
	East Troy Municipal	< BU-I	--	--	--	--	--	41	41
	Gruenwald	BU-I	--	--	--	--	--	26	26
	Lake Lawn Lodge	BU-II	--	--	--	--	--	11	11
	Playboy	BU-II	--	--	--	--	--	13	13
Washington	Hahn's Sky Ranch	< BU-I	--	--	--	--	--	14	14
	Hartford Municipal	BU-I	--	--	--	--	--	40	40
	West Bend Municipal	GU	--	--	--	--	20	64	84
Waukesha.	Capitol Drive	< BU-I	--	--	--	--	--	47	47
	Waukesha County	GU	--	--	--	--	46	225	271
Outside the Region	Fort Atkinson-Whitewater	GU	--	--	--	--	8	17	25
	Watertown Municipal	BU-I	--	--	--	--	--	29	29
	Waukegan Memorial	GU	--	--	--	--	7	34	41
Unassigned Demand	--	--	--	--	--	39	8	--	47
Total	--	--	--	--	--	90	216	1,359	1,665

[a] *See Appendix D for example of aircraft types.*

Source: R. Dixon Speas Associates, Inc.

Mitchell Field will not have the capacity to handle the number of forecast aircraft operations in the design year 1990. However, since the system will accommodate nearly 90 percent of the forecast demand, a decision to provide additional runway system capacity must be weighed against airport operating policy decisions such as restricting general aviation operations or tolerating additional delays and their attendant cost beyond those expressed in the determination of the PANCAP.

Further evaluation of the information presented in Table 145 indicates that the airline passenger terminal building and the air cargo areas will not be of sufficient size to accommodate the forecast 1990 demands. The passenger terminal complex plan prepared by the Milwaukee County Department of Public Works and Herbert H. Howell, airport consultant, provides for a 1,200,000 square foot terminal building complete with domestic and international facilities and 52 landing gates, which will satisfactorily accommodate the forecast airline passenger needs. Areas available for general aviation aircraft and attendant activities will require some expansion to satisfy forecast demands.

Table 146 presents a demand/capacity analysis of the existing general aviation airports. A comparison of probable forecast demand with the capabilities of the basic existing airport system indicates that although the system has a total landing area capacity that exceeds the forecast operations, the geographic location is such that some airports will be operating over capacity, while others will have underutilized runway systems. Several of the Region's larger airports—Waukesha County, Kenosha Municipal, Racine Commercial, and Timmerman Field—can be expected to operate over capacity in 1990 if improvements are not undertaken, while Burlington Municipal, Hartford Municipal, and West Bend Municipal will have adequate runway system capacity to handle the forecast demands. It should be noted that 92 of the type C general aviation aircraft are unassigned to basic

Table 144

ASSIGNMENT OF GENERAL AVIATION AIRCRAFT TO THE BASIC PUBLIC USE AIRPORTS IN THE REGION: 1990

County	Airport	Airport Classification	Aircraft Type[a]						Total Aircraft Assigned
			AA	A	B	C	D	E	
Kenosha	Kenosha Municipal	GU	--	--	--	--	26	212	238
	Vincent	<BU-I	--	--	--	--	--	59	59
Milwaukee	General Mitchell Field	SAT	--	--	--	105	171	--	276
	Timmerman Field	GU	--	--	--	--	79	318	397
Ozaukee	Ozaukee	<BU-I	--	--	--	--	--	61	61
Racine	Burlington Municipal	BU-II	--	--	--	--	--	120	120
	Fox River	<BU-I	--	--	--	--	--	66	66
	Hunt Field	<BU-I	--	--	--	--	--	64	64
	Racine Commercial	BT	--	--	--	24	21	150	195
	Sylvania	<BU-I	--	--	--	--	--	131	131
	Valhalla	<BU-I	--	--	--	--	--	72	72
Walworth	Big Foot	BU-I	--	--	--	--	--	37	37
	East Troy Municipal	<BU-I	--	--	--	--	--	68	68
	Gruenwald	BU-I	--	--	--	--	--	51	51
	Lake Lawn Lodge	BU-II	--	--	--	--	--	11	11
	Playboy	BU-II	--	--	--	--	--	20	20
Washington	Hahn's Sky Ranch	<BU-I	--	--	--	--	--	41	41
	Hartford Municipal	BU-I	--	--	--	--	--	133	133
	West Bend Municipal	GU	--	--	--	--	47	127	174
Waukesha	Capitol Drive	<BU-I	--	--	--	--	--	63	63
	Waukesha County	GU	--	--	--	--	67	309	376
Outside the Region	Fort Atkinson-Whitewater	GU	--	--	--	--	15	24	39
	Watertown Municipal	BU-I	--	--	--	--	--	49	49
	Waukegan Memorial	GU	--	--	--	--	27	121	148
Unassigned Demand	--	--	--	--	--	92	16	--	108
Total	--	--	--	--	--	221	469	2,307	2,997

[a] *See Appendix D for example of aircraft types.*

Source: R. Dixon Speas Associates, Inc.

transport airports within the Region, since more than 30 minutes of ground time is required for the owner to reach the airport where his aircraft would be based. Similarly, 16 of the owners of the type D aircraft are more than 30 minutes from an airport capable of accommodating their aircraft. Table 146 also indicates that the existing physical facilities available to serve the forecast of based aircraft and attendant activities can be expected to be inadequate in the plan design year.

SUMMARY

An effort must be made in any transportation system planning and development process to utilize existing facilities to the fullest extent possible. Determination of the capacity of these facilities, therefore, becomes one of the first steps in system analysis and design. Because the existing airport system is comprised of both publicly and privately owned facilities, care must be taken to include in the basic existing system only such facilities as may reasonably be expected to remain in airport use by the design year of the plan. This chapter has identified the existing basic airport system in the Region, described the capacity of the facilities comprising the system, and summarized the results of a comparison of existing and probable future aviation demands with the capacity of the basic system in order to identify system deficiencies that should be overcome through the system planning and development process.

Evaluation of the inventory conducted by the Commission of all existing airports within the Region indicated that 21 of the 26 existing publicly and privately owned public use airports should be considered to comprise the basic existing regional airport system. Further, the evaluation indicated that two existing and one proposed publicly owned airport located outside the Region should be considered as supplementary to the basic system, since these three facilities reasonably could be expected to accommodate some of the demand generated within the Region.

Table 145

EXISTING FACILITY CAPACITY AND FORECAST FACILITY DEMAND AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1972 and 1990

Airport Facility Element	1972 Facility Capacity	1990 Facility Demand	Percent of Forecast Demand Satisfied
Annual Aircraft Operations			
Air Carrier	--	124,700	--
General Aviation	--	187,800	--
Military	--	15,100	--
Total	290,000[a]	327,600	88
Passenger Terminal			
Total Floor Area (Square Yards)	27,434	84,162	32
Aircraft Loading Gates	21	31	68
Aircraft Parking Apron (Square Yards)	151,400	368,400	41
Passenger Auto Parking (Spaces)	1,450	4,695	31
General Aviation Areas			
Parking Apron (Square Yards)	140,300	137,401	102
Hangared Storage (Square Yards)	27,644	56,182	49
Terminal (Square Yards)	598	1,004	60
Auto Parking (Spaces)	310	480	65
Air Cargo Areas			
All-Cargo Gates	2	5	40
Cargo Aircraft Apron (Square Yards)	7,500	30,000	25
Cargo Terminal (Square Yards)	3,556	16,989	21
Cargo Truck Docks	27[b]	13	208

[a] *The practical annual runway capacity of 290,000 aircraft operations was computed on the basis of the 1990 aircraft mix and 1972 runway system and navigation aid environment. The forecast aircraft fleet mix by aircraft type is AA, 29 percent; A, 1 percent; B, 10 percent; C, 20 percent; and D and E, 40 percent.*

[b] *Of the 27 existing cargo truck docks, 21 are part of an air freight forwarding facility.*

Source: R. Dixon Speas Associates, Inc.

After the existing airport system was identified, the capacity of each of the facilities comprising this system was quantified utilizing well-established engineering techniques. Measuring the capacity of an existing airport system requires definition of the capacity limitations of four distinct elements of the airport system: the landing area, the terminal area, the airspace, and the surface transportation access facilities. Airspace and surface transportation were discussed in Chapter IV of this report. This chapter dealt with the capacity of the landing and terminal areas of the basic existing airport system. Landing area capacity is defined as the ability of the airport runway and taxiway facilities to accept aircraft operations to a given acceptable level of delay. At air carrier airports, capacity is reached when delays average four minutes per aircraft operation during the two adjacent normal peak hours of the week. For general aviation airports, the average delay level is two minutes. Landing area capacity is normally expressed in terms of the number of aircraft operations that can be accommodated in the peak hour and on an annual basis. The practical annual capacity (PANCAP) of the landing area system was used to describe the capability of each airport to accommodate aircraft operations.

The terminal area elements that must be evaluated for each airport within the system include:

1. Aircraft passenger and cargo apron area and gate positions.
2. General aviation apron areas and tie-down and hangar facilities.
3. Airline passenger and general aviation terminal buildings and cargo buildings.
4. Aircraft maintenance and support facilities.
5. Automobile parking.

After the capacity of this basic existing airport system was quantified, comparisons with current air travel demands were made. Results of this comparison indicated that the basic existing regional airport system has adequate landing area capacity to safely accommodate the current level of aircraft operations. However, the runway systems at 15 of the 23 general aviation airports present weather and seasonal limitations due to lack of paved runways and/or paved taxiways, inadequate runway length, and limited space for aircraft storage. Terminal facilities at the only air carrier airport in the Region, General Mitchell Field in Milwaukee, are consistent with standards for such facilities suggested to serve current demand levels. However, deficiencies in the amount and size of physical facilities such as paved aircraft tie-downs, hangar areas, and terminal building space do exist at most general aviation airports within the existing system when compared with the standards developed to guide provision of facilities for various activity levels.

The regionally generated demands for air transportation service, expressed in terms of airline passengers and general aviation aircraft, that have been forecast for the design year 1990 and distributed to the traffic analysis zones within the Region were then assigned to the airports comprising the basic existing airport system for further demand-capacity analysis. This assignment was made by means of a mathematical model which took into account travel time to each airport, the airport classification, and the capacity of the runway system of each airport. The classification of the airport was used to identify the type of aircraft that could be accommodated, and the capacity of the runway system, when related to the number of annual operations generated by assigned aircraft, was used to further influence the assignment of aircraft to various airports. Once assigned, the number of aircraft and annual operations were further equated to airport facility requirements for comparison with the existing facilities at those airports within this basic system. The comparison of probable forecast demand with the abilities of the basic existing regional airport system to accommodate that demand indicated that:

1. The capacity of the existing runway system at General Mitchell Field will be exceeded by anticipated aircraft operations.

Table 146

EXISTING FACILITIES AND RECOMMENDED FACILITY STANDARDS FOR GENERAL AVIATION AIRPORTS IN THE REGION: 1972 and 1990

County	Airport	Airport Classification	Number of Forecast Aircraft By Type[a]			Practical Annual Capacity (1972)	Forecast Operations (1990)	Existing Capacity as Percent of Forecast Operations	Existing Facilities and Recommended Standards: Terminal Building (Square Yards)		
			C	D	E				Existing	Recommended	Existing as Percent of Recommended
Kenosha	Kenosha Municipal	GU	--	26	212	181,000	205,727	88	--	874	--
	Vincent	< BU-I	--	--	59	81,900	52,332	157	--	569	--
Milwaukee	General Mitchell Field	SAT	105	171	--	290,000	187,808	154[b]	--	1,004	--
	Timmerman Field	GU	--	79	318	302,000	334,654	90	2,167	1,222	177
Ozaukee	Ozaukee	< BU-I	--	--	61	54,600	54,379	100	--	577	--
Racine	Burlington Municipal	BU-II	--	--	120	133,000	106,800	125	125	721	17
	Fox River	< BU-I	--	--	66	52,200	58,473	89	--	599	--
	Hunt Field	< BU-I	--	--	64	50,400	57,227	88	--	591	--
	Racine Commercial	BT	24	21	150	145,000	164,840	88	--	841	--
	Sylvania	< BU-I	--	--	131	103,200	116,768	88	--	743	--
	Valhalla	< BU-I	--	--	72	54,000	64,347	84	--	621	--
Walworth	Big Foot	BU-I	--	--	37	113,400	33,019	343	40	427	9
	East Troy Municipal	< BU-I	--	--	68	51,600	60,253	86	--	607	--
	Gruenwald	BU-I	--	--	51	85,500	45,657	187	--	528	--
	Lake Lawn Lodge	BU-II	--	--	11	15,000	9,523	158	--	172	--
	Playboy	< BU-II	--	--	20	18,000	18,067	100	67	253	26
Washington	Hahn's Sky Ranch	BU-I	--	--	41	58,800	36,401	162	--	460	--
	Hartford Municipal	BU-I	--	--	133	189,900	118,281	161	--	746	--
	West Bend Municipal	GU	--	47	127	175,000	143,727	122	--	798	--
Waukesha	Capitol Drive	< BU-I	--	--	63	49,800	56,337	88	--	588	--
	Waukesha County	GU	--	67	309	284,000	318,293	89	278	1,152	24
Outside the Region	Fort Atkinson-Whitewater	GU	--	15	24	200,000	31,459	636	--	427	--
	Watertown Municipal	BU-I	--	--	49	189,000	43,699	433	56	514	11
	Waukegan Memorial	GU	--	27	121	100,000	125,209	80	--	770	--
Unassigned	--	--	92	16	--	--	77,211	--	--	879	--
Total	--	--	221	469	2,307	2,977,300	2,520,491	--	2,733	16,683	--

Table 146 (continued)

County	Airport	Existing Facilities and Recommended Standards								
		Hangar Facility (Square Yards)			Apron Facility (Square Yards)			Number of Auto Parking Spaces		
		Existing	Recommended	Existing as Percent of Recommended	Existing	Recommended	Existing as Percent of Recommended	Existing	Recommended	Existing as Percent of Recommended
Kenosha	Kenosha Municipal	6,377	23,699	27	18,880	40,038	47	60	417	14
	Vincent	933	5,292	18	--	8,820	--	--	272	--
Milwaukee	General Mitchell Field	27,644	56,182	49	140,300	137,401	102	310	480	65
	Timmerman Field	17,855	42,506	42	23,333	72,457	32	250	584	43
Ozaukee	Ozaukee	--	5,499	--	--	9,165	--	--	276	--
Racine.	Burlington Municipal	944	10,800	9	5,083	18,000	28	50	344	15
	Fox River	311	5,913	5	--	9,855	--	--	286	--
	Hunt Field	--	5,787	--	--	9,645	--	--	282	--
	Racine Commercial	4,180	23,247	18	10,000	48,558	21	--	402	--
	Sylvania	1,244	11,808	11	2,100	19,680	11	--	355	--
	Valhalla	311	6,507	5	--	10,845	--	--	296	--
Walworth.	Big Foot	1,280	3,339	38	--	5,565	--	--	204	--
	East Troy Municipal	2,567	6,093	42	--	10,155	--	25	290	9
	Gruenwald	--	4,617	--	--	7,695	--	--	252	--
	Lake Lawn Lodge	--	963	--	--	1,605	--	--	82	--
	Playboy	--	1,827	--	10,000	3,045	328	--	121	--
Washington	Hahn's Sky Ranch	266	3,681	7	--	6,135	--	--	220	--
	Hartford Municipal	4,633	11,961	39	5,555	19,935	28	30	356	8
	West Bend Municipal	8,890	19,724	45	2,100	33,840	6	112	381	29
Waukesha.	Capitol Drive	3,600	5,697	63	--	9,495	--	--	281	--
	Waukesha County	16,020	39,508	41	8,000	67,209	12	300	550	55
Outside the Region . .	Fort Atkinson-Whitewater	--	4,864	--	--	8,420	--	--	204	--
	Watertown Municipal	2,390	4,419	54	6,680	7,365	91	20	246	8
	Waukegan Memorial	--	15,666	--	--	26,670	--	--	368	--
Unassigned		--	25,690	--	--	78,290	--	--	420	--
Total		99,445	345,289	--	232,031	669,888	--	1,157	7,969	--

[a] *See Appendix D for examples of aircraft types.*

[b] *Relates only general aviation operations to runway system capacity. Operations of air carrier and military aircraft must be added to develop a total demand/capacity analysis, which is shown in Table 145.*

Source: R. Dixon Speas Associates, Inc.

2. Existing airline passenger terminal facilities, automobile parking spaces, and facilities for general aviation based aircraft will be inadequate at General Mitchell Field to serve forecast demands.

3. The existing runway capacities of several of the major general aviation airports—Waukesha County, Kenosha Municipal, Racine Commercial, and Timmerman Field—will be exceeded.

4. The basic transport and general utility airports, which can accommodate the larger aircraft, will not be geographically distributed within the Region to provide this classification of airport within 30 minutes ground travel time of all owners of the larger type C and D aircraft.

5. The existing general aviation airports will be deficient in the provision of paved tie-down areas, hangar areas, and terminal building areas.

Further discussion of deficiencies identified in this manner and of the alternative system improvements available to overcome these deficiencies are described in Chapter XI of this report.

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Chapter XI

ALTERNATIVE REGIONAL AIRPORT SYSTEM PLANS

INTRODUCTION

The planning process used in the regional airport system planning program consisted of several interrelated steps. These included the formulation of objectives and supporting standards to define the kind and level of air transportation service desired for the Region; the conduct of inventories to provide basic factual data required to quantitatively describe and understand not only the existing air transportation system and its use and operation, but also the physical, social, and economic environments that support that system; and the preparation of forecasts of the probable future demand for air transportation and the conduct of analyses to scale the existing and probable future demands against the objectives and standards and the existing supply of airport facilities to determine existing and probable future deficiencies. All of these steps, however, were preparatory to the design of alternative airport system plans for public review and evaluation which, through various combinations of airport facility location, function, capacity, and service area, could overcome the identified deficiencies and thereby meet the agreed upon objectives to varying degrees and at differing costs. It is this most critical step in the planning process that is the subject of this chapter.

Before describing the alternative plans formulated under the regional airport system planning program, a summary of the analyses leading to this formulation may be useful in providing the continuity necessary to understand the design and evaluation of the alternative plans. The extensive inventories conducted under the airport system planning program established the data base necessary for subsequent planning. These inventory findings were presented in summary form in Chapters III, IV, V, and VI of this report, and described the demographic, economic, and public financial resource base; the land use pattern; the surface transportation system; the natural resource base and climatological conditions; and the existing airport system of the Region, together with the manner in which that airport system was currently used. The data were subject to extensive analyses, and based on these analyses, a forecast of the probable future demand for air transportation service in the Region was prepared, a distribution of this demand made to subareas of the Region, and the demand assigned to the existing airport system. This assignment of demand provided the basis for an assessment of the existing airport system in terms of its ability to accommodate the existing and probable future demand in a manner consistent with the objectives and supporting standards formulated under the study.

The significant findings of this assessment, described in Chapter X, may be summarized as follows: 1) both the pubic use general aviation airports and General Mitchell Field have sufficient landing area capacity to accommodate operations at current (1971) demand levels without excessive delay; 2) the capacity of the existing runway systems at General Mitchell Field and at five of the 20 public use general aviation airports[1] —Waukesha County, Kenosha Municipal, Racine Commercial, Timmerman Field, and East Troy Municipal—may be expected to be exceeded by the anticipated demand within the next 20 to 25 years; 3) the single existing air carrier airport—General Mitchell Field, the single existing basic transport airport—Racine Commercial, and the four existing general utility airports—Kenosha Municipal, Timmerman Field, West Bend Municipal, and Waukesha County, which together accommodate the larger general aviation aircraft, will not be spatially distributed within the Region to provide airport facilities within the desired 30 minutes ground travel time of the residences of the owners of the larger type "C" and "D" aircraft; 4) all 20 existing public use general aviation airports may be expected to be deficient with respect to paved tie-down area, hangar area, and terminal building area within the next 20 to 25 years; and 5) the runway systems at 15 of the 20 public use general aviation airports have weather and seasonal operational limitations because these runway systems are not paved.

Factors affecting aircraft operations which must be considered in the formulation of practical alternative airport system plans were identified during the analyses of the inventory data. These factors include operational requirements for the various aircraft types in terms of runway length, orientation, and structural strength; the ability to operate under instrument flight rule conditions; and the level of engine noise generated. The factors affecting aircraft operations within the airspace environment and under air traffic control procedures and the requirements for navigational aids were also identified. All this prior work was brought forward for use in the most critical step in the planning process—the design and evaluation of alternative airport system plans that satisfy the agreed upon airport system development objectives and supporting standards.

During the approximately 20- to 25-year planning period, the demand for air transportation services within the Region may be expected to continue to increase. Annual

[1] *Initially, all 26 existing public use airports within the Region, as inventoried in 1971, were considered for potential inclusion in the alternative system plans. Subsequently, five airports were eliminated from the list—Rainbow, Hales Corners, Aero Park, Mt. Fuji, and O'Leary Field—because they either offered poor expansion potential, had already been or were expected to be purchased and converted to other uses, or were no longer available for public use.*

enplanements at the regional air carrier airport may be expected to increase from about 980,000 in 1971 to almost 4.5 million by 1990, the design year of the plan. The number of general aviation aircraft based within the Region may be expected to increase from about 1,000 in 1971 to about 3,000 by 1990. The number of general aviation aircraft operations per year may be expected to increase from about 769,000 in 1971 to over 2.5 million by 1990. It is also anticipated that the general aviation aircraft fleet will contain more, both absolutely and proportionately, of the larger multiengine and turbojet general aviation aircraft than does the present fleet.

Analyses of these forecasts indicated that the probable future air carrier needs can be readily accommodated at one air carrier airport within the Region. The analyses also indicate that the probable future demand for general aviation can be accommodated with a minimum of 11 properly located airports, including the single air carrier airport, each capable of serving about 285 to 300 based aircraft and about 285,000 annual aircraft operations. By comparison, the busiest general aviation airports within the Region—Waukesha County Airport and Timmerman Field—served 165 and 160 based aircraft and 117,000 and 143,900 aircraft operations, respectively, in 1971. Neither of these airports can presently accommodate business jet aircraft, which are included in the type C aircraft, and which may be expected to grow from the four based within the Region in 1971 to about 70 such aircraft by 1990. Thus, the regional airport system plan should contain one air carrier airport; six to eight basic transport airports to serve C aircraft; and five to seven general utility and basic utility airports to meet the needs of D and E aircraft, the smaller, propeller driven, general aviation aircraft.

A large number of system plans comprised of various combinations of numbers, locations, and classifications of individual airports can meet these identified needs. The design and evaluation of alternative airport system plans is in large part addressed to the determination of the best combination of number, classification, and location of airports.

RATIONALE AND EVOLUTION OF ALTERNATIVE AIRPORT SYSTEM PLANS

Any functional planning process should terminate in the adoption of a general plan that best meets the particular needs under consideration. This plan should be selected through a systematic and logical process that identifies, for public review and evaluation, the alternative plans available, and that carefully evaluates these plans to provide a basis for selection of the best one for adoption and implementation. In the case of the regional airport system planning program, the alternative plan design process, because of the numerous subsystem planning problems involved, was necessarily evolutionary, involving several successive iterations. Solutions were sought to subsystem problems relating to the disposition of individual airports within a given alternative system plan and the effect on the total system.

Public policy issues of particular importance to be addressed in the analyses leading to plan selection, and in the alternative plan design and evolution process itself, included alternative proposals for satisfying the probable future commercial air transportation demand, the objectionable nature of aircraft operations at airports located in urbanized areas of the Region, and the future aviation function, if any, of the abandoned Richard I. Bong Air Force Base located in western Kenosha and southern Racine Counties. The evolution of the final set of alternative airport system plans described and evaluated in this chapter was accomplished through the cooperative efforts of the staffs of the Regional Planning Commission, the Wisconsin Department of Transportation, and the consultant, all under the guidance and direction of the Technical Coordinating and Advisory Committee on Regional Airport Planning.

Initially, trial sets of alternative system plans were developed that were predicated on utilizing the 26 existing public use airports in the Region, plus three such airports located outside the Region but close enough to satisfy travel time criteria for service to residents of the Region. Systems consisting of various combinations of publicly owned airports only; publicly and privately owned airports; airports located within the Region only; airports located within and outside the Region; and existing airports only and existing and proposed new airports, were analyzed. Through trial and error, alternative system plans gradually evolved which provided a high level of satisfaction of the forecast demand and of the adopted airport system development objectives and standards.

Following staff and committee review and evaluation of an initial set of alternative system plans, a second and finally a third set of plans were developed. In the analysis of the third set, special attention was given to investigating the potential of abandoning or restricting the operation of certain existing general aviation airports located in areas of existing or potentially intensive urban development. Although all three sets of plans developed are described herein, only the final set is fully evaluated. The system design process extended over a nine-month period, in which more than 20 alternative system plans involving various combinations of from eight to 30 airports were examined.

DESCRIPTION OF ALTERNATIVE SYSTEM PLANS

The three sets of alternative system plans prepared in the system design process are described below. The sets, identified as set 1, set 2, and set 3, are presented in the order in which they were developed. The initial evaluation of each alternative plan consisted of a review of the capability of the plan to meet the probable future demand. This capability was quantitatively expressed in terms of the numbers of the various types of based aircraft which could not be accommodated within the ground travel time standard of 30 minutes between the closest airport capable of handling the aircraft type and the owner location, in terms of the number of based aircraft assigned to each airport, and in terms of a comparison of the attendant aircraft operations to the existing and physically feasible runway capacity in order to determine gross airport overuse or underuse. Airports within the set 3 plans were subsequently evaluated in much greater detail.

Alternative System Plan—Set 1

The initial set of alternative system plans contained eight general aviation airport system plans. In addition, two new air carrier airport locations were investigated. The general aviation plans contained from eight to 30 airports, with ownership categories ranging from publicly owned to various combinations of public and private ownership. Airports located outside of the Region, as well as proposed new airports within the Region, were considered in the alternative system plans within this set.

As already noted, an important criteria for determining the assignment of future demand to airports, expressed in terms of based aircraft, was travel time as specified in the objectives and supporting standards. Initially, travel times of 30 minutes for C (business jet) aircraft and 20 minutes for D (medium weight, multiengine) and E (single-engine) aircraft were established. This standard as initially formulated was used in the design of all of the alternative system plans in set 1. Based upon the analysis of these plans, this standard was subsequently changed to 30 minutes for all aircraft types.

A description of each alternative system plan in set 1, together with its principal components and characteristics, is presented below. The first four plans contain only publicly owned airports, and the remaining four contain both publicly and privately owned facilities.

Alternative System Plan 1A: The first alternative system plan considered under set 1 attempted to satisfy the probable future aviation demand through use of the eight existing publicly owned airports in the Region—Kenosha Municipal, General Mitchell Field, Timmerman Field, Burlington Municipal, East Troy Municipal, Hartford Municipal, West Bend Municipal, and Waukesha County (see Table 147). This plan represented essentially a "no build" plan, wherein it was attempted to meet the forecast demand through continued operation of only the

Table 147

AIRPORT CLASSIFICATION AND AIRCRAFT ASSIGNED UNDER ALTERNATIVE AIRPORT SYSTEM PLAN—SET 1: PUBLICLY OWNED AIRPORTS IN AND ADJACENT TO THE REGION

		Existing System		Alternative System Plan							
				1A		1B		1C		1D	
County	Airport	Type of Ownership	Airport Classification	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned
Kenosha	Kenosha Municipal	Public	GU	GU	280	GU	240	BT	146	BT	146
	Vincent	Private	BU	--	--	--	--	GU	72	GU	72
Milwaukee	General Mitchell Field	Public	SAT	SAT	557	SAT	270	SAT	233	SAT	233
	Timmerman Field	Public	GU	GU	596	GU	499	GU	705	GU	365
	Site B	--	--	--	--	GU	470	GU	444	GU	444
Ozaukee	Ozaukee	Private	BU	--	--	--	--	GU	104	GU	104
	Site A	--	--	--	--	GU	406	BT	138	BT	138
Racine	Burlington Municipal	Public	GU	GU	86	BT	78	BT	33	BT	33
	Racine Commercial	Private	BT	--	--	--	--	BT	200	BT	200
Walworth	East Troy Municipal	Public	BU	BU	129	BU	112	GU	116	GU	116
	Big Foot	Private	BU	--	--	--	--	BT	12	BT	12
	Lake Lawn Lodge	Private	BU	--	--	--	--	GU	90	GU	90
Washington	Hartford Municipal	Public	BU	BU	96	BU	96	GU	109	GU	109
	West Bend Municipal	Public	GU	GU	90	BT	83	BT	70	BT	71
Waukesha	Waukesha County	Public	GU	GU	724	BT	366	BT	340	BT	228
	Aero Park	Private	BU	--	--	--	--	--	--	GU	452
Outside the Region	Palmyra Municipal	Public	BU	--	--	BU	42	BT	34	BT	34
	Watertown Municipal	Public	BU	--	--	BU	57	GU	64	GU	64
	Waukegan Memorial	Public	GU	--	--	GU	52	GU	52	GU	52
Total Airports	--	--	17	8	--	13	--	18	--	19	--
Total Aircraft (1990)	--	--	--	--	3,000	--	3,000	--	3,000	--	3,000
Assigned	--	--	--	--	2,558	--	2,774	--	2,966	--	2,966
Unassigned	--	--	--	--	442	--	226	--	34	--	34

Source: R. Dixon Speas Associates, Inc.

existing publicly owned airports. This plan also provided an important basis for the identification and understanding of the extent, location, and type of deficiencies that would result from such a course of action.

Analysis of this plan indicated that about 15 percent of the forecast demand, expressed in terms of based aircraft, could not be satisfied if the ground travel time from the residence of the aircraft owner to the airport was limited to 30 minutes for C aircraft and 20 minutes for D and E aircraft. On this basis, 75 C, 52 D, and 315 E aircraft owners, or a total of 442, would be modestly inconvenienced because an airport in the system was not located within the prescribed travel time from the owner's residence. More importantly, the analysis indicated that three of the eight airports in the system could be expected to be severely overloaded with aircraft to the point where it was doubtful that sufficient airport capacity could be achieved to accommodate the level of traffic generated. Waukesha County with 724 assigned aircraft, Timmerman Field with 596, and General Mitchell Field with 557 were the three airports that would have to accommodate a high number of aircraft.

Alternative System Plan 1B: The second alternative system plan considered under set 1 included 13 publicly owned airports—the eight publicly owned airports comprising system plan 1A, three publicly owned airports located outside the Region at Waukegan in northern Illinois and at Watertown and Palmyra in Jefferson County, and two proposed new general utility airports, one located in southwestern Milwaukee County and one in southern Ozaukee County (see Table 147). Since the analysis of alternative plan 1A indicated that a high percentage of the demand for based C aircraft would be unsatisfied within the travel time constraints initially established, three existing airports were proposed to be upgraded from a GU to a BT classification so they could accommodate C aircraft. These airports—Waukesha County, Burlington Municipal, and West Bend Municipal—were selected because their locations were estimated to be within 30 minutes travel time from a significant concentration of C aircraft owners.

Analysis indicated that plan 1B was an improvement over plan 1A. Only about 8 percent of the forecast demand, expressed in terms of based aircraft and consisting of 14 C, 38 D, and 174 E aircraft, or a total of 226 aircraft owners, would not be satisfied within the travel time constraints. Four of the airports—Timmerman Field with 499 assigned aircraft, the new Milwaukee County site with 470, the new Ozaukee County site with 406, and Waukesha County with 366—would be overloaded, but not as severely as under plan 1A. The evaluation of this alternative indicated that the proposed airport spacing would not totally satisfy the objectives and standards, and that four of the 13 airports would have to accommodate a very high level of traffic.

Alternative System Plan 1C: Five additional airports were added to those included in alternative system plan 1B to form alternative system plan 1C, bringing the total in this system plan to 18. Four existing privately owned airports were assumed to be converted to public ownership and upgraded: Ozaukee, BU to GU; Vincent, BU to GU; Big Foot, BU to BT; and Lake Lawn Lodge, BU to GU. Another privately owned airport, Racine Commercial, was added to the system without an assumed change in ownership or classification. In addition, six of the publicly owned airports included in plan 1C were assumed to be upgraded as follows: Kenosha Municipal, GU to BT; East Troy Municipal, BU to GU; Palmyra Municipal, BU to BT; Watertown Municipal, BU to GU; Hartford Municipal, BU to GU; and the new Ozaukee County site, GU to BT (see Table 147).

Analysis of alternative 1C indicated a significantly higher accommodation of demand than any of the previous system plans. The unsatisfied demand amounted to only 34 aircraft—4 D and 30 E—of the 3,000 total aircraft to be accommodated. Only one airport, Timmerman Field with 705 aircraft, would be overloaded and in need of relief. The new airport in southwestern Milwaukee County was assigned over 440 aircraft, however.

It was evident from the analysis that this system plan would come close to satisfying the forecast total aviation demand within the Region, and that the addition of one new airport would provide relief to Timmerman Field. Further, from an analysis of the demand distribution and of the ground travel time constraints, it was determined that the unsatisfied demand of 34 aircraft could only be eliminated in one of two ways—by a change in the travel time standard for D and E aircraft, or by the provision of a new airport along the shore of Lake Michigan east of the Bayside-Fox Point area.

Alternative System Plan 1D: The final system plan analyzed under set 1 consisted of 19 airports, and sought to reduce the assignment of 705 aircraft to Timmerman Field under plan 1C. Aero Park Airport was assumed to be converted to public ownership and upgraded from a BU to GU airport. While this reduced the demand at Timmerman to 365 aircraft, Aero Park was assigned over 450 aircraft, and the new Milwaukee County site was assigned over 440 aircraft. The travel time standard, however, remained unmet to the same degree as under plan 1C—34 aircraft—and for the same basic reason.

Table 147 summarizes the number and classification of airports considered in each of the four publicly owned alternative airport system plans of alternative set 1, and lists the number of aircraft assigned to each airport considered in each of the alternatives. Four additional alternative system plans were considered in set 1, which included airports that are both publicly and privately owned. The number of airports in these alternative system plans ranged from 25 to 30.

Alternative System Plan 1E: The first alternative plan considered under this subset utilized all of the existing 26 public use airports within the Region—except Mt. Fuji, which changed from public use to private use while the study was in progress, without changing any of the classifications of these airports (see Table 148). Alternative system plan 1E constitutes, in effect, another "no build" plan similar to plan 1A. The former, however, utilized only the eight existing publicly owned airports within the Region, while the latter utilizes 25 of the existing public use airports within the Region in their present state of development. Analysis of this alternative indicated that 169 aircraft—66 type C, 33 D, and 70 E—could not be accommodated within the ground travel time constraints, and therefore the airport spacing does not fully satisfy the travel time standard. Based aircraft demand assigned to the airports under this alternative was reasonable, with Timmerman receiving a high of 403 aircraft.

Alternative System Plan 1F: Alternative system plan 1F consists of 30 airports. Three public use airports located outside of the Region at Waukegan, Illinois, and at Watertown and Palmyra in Jefferson County; Mt. Fuji Airport; and two proposed new airports, one in southwestern Milwaukee County to replace Rainbow, which was purchased by the Milwaukee County Park Commission and eliminated from further consideration, and another in southern Ozaukee County were added to the airports included in alternative 1E (see Table 148). In addition, the Waukesha County, West Bend, and Burlington Municipal Airports were upgraded to BT airports. The unsatisfied demand under this alternative would total 59 aircraft—6 C, 22 D, and 30 E type—and therefore the airport spacing remained somewhat deficient. Assignment of based aircraft among airports materially improved over alternative 1E, with aircraft assigned to Timmerman reduced from 403 to 262.

Table 148

AIRPORT CLASSIFICATION AND AIRCRAFT ASSIGNED UNDER ALTERNATIVE AIRPORT SYSTEM PLAN—SET 1: PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION

		Existing System		Alternative System Plan							
				1E		1F		1G		1H	
County	Airport	Type of Ownership	Airport Classification	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned
Kenosha	Kenosha Municipal	Public	GU	GU	130	GU	84	GU	84	BT	92
	Vincent.	Private	BU	BU	54	BU	46	BU	55	GU	28
Milwaukee	General Mitchell Field . .	Public	SAT	SAT	239	SAT	193	SAT	191	SAT	191
	Timmerman Field	Public	GU	GU	403	GU	262	GU	367	GU	367
	Hales Corners	Private	BU	BU	165	BU	220	BU	220	GU	220
	Rainbow	Private	BU	BU	145	--	--	--	--	--	--
	Site B	--	--	--	--	GU	110	GU	103	GU	106
Ozaukee	Ozaukee	Private	BU	BU	91	BU	91	GU	104	GU	104
	Site A	--	--	--	--	GU	233	BT	138	BT	138
Racine	Burlington Municipal . . .	Public	GU	GU	8	BT	20	BT	18	BT	10
	Fox River	Private	BU	BU	51	BU	51	BU	51	BU	59
	Hunt Field.	Private	BU	BU	29	BU	29	BU	35	BU	35
	Racine Commercial	Private	BT	BT	196	BT	178	BT	178	BT	168
	Sylvania.	Private	BU	BU	88	BU	88	BU	88	BU	88
	Valhalla.	Private	BU	BU	58	BU	58	BU	58	BU	61
Walworth	East Troy Municipal. . . .	Public	BU	BU	45	BU	36	GU	43	GU	52
	Big Foot	Private	BU	BU	12	BU	12	GU	13	BT	12
	Gruenwald.	Private	BU	BU	33	BU	32	BU	30	BU	46
	Mt. Fuji.	Private	BU	--	--	BU	16	BU	16	BU	17
	Playboy.	Private	GU	GU	33	GU	28	GU	21	GU	31
	Lake Lawn Lodge	Private	BU	BU	64	BU	53	BU	58	GU	50
Washington	Hartford Municipal	Public	BU	BU	73	BU	73	GU	40	GU	40
	West Bend Municipal . . .	Public	GU	GU	62	BT	69	BT	64	BT	64
	Hahn's Sky Ranch.	Private	BU	BU	29	BU	29	GU	31	GU	31
Waukesha	Waukesha County	Public	GU	GU	228	BT	223	BT	204	BT	197
	Aero Park	Private	BU	BU	230	BU	228	BU	243	BU	243
	Capitol Drive	Private	BU	BU	250	BU	220	BU	251	BU	275
	O'Leary Field.	Private	BU	BU	117	BU	130	BU	132	BU	132
Outside the Region	Palmyra Municipal.	Public	BU	--	--	BU	26	GU	24	BT	19
	Watertown Municipal . . .	Public	BU	--	--	BU	57	BU	57	GU	41
	Waukegan Memorial. . . .	Public	GU	--	--	GU	47	GU	47	GU	51
Total Airports	--	--	29	25	--	30	--	30	--	30	--
Total Aircraft (1990)	--	--	--	--	3,000	--	3,000	--	3,000	--	3,000
Assigned.	--	--	--	--	2,831	--	2,942	--	2,962	--	2,966
Unassigned	--	--	--	--	169	--	58	--	38	--	34

Source: R. Dixon Speas Associates, Inc.

Alternative System Plan 1G: Alternative system plan 1G, also consisting of 30 airports, includes the following modifications to plan 1F: the East Troy Municipal, Palmyra Municipal, Hartford Municipal, Ozaukee, Hahn's Sky Ranch, and Big Foot Airports were upgraded from BU to GU classification to accommodate D type aircraft, and the new Ozaukee County airport was upgraded to a BT airport (see Table 148). The total unsatisfied demand was reduced to 38 aircraft—2 type C, 7 D, and 29 E aircraft. Assignments of based aircraft remained the same at nine airports under both plan 1G and 1F, whereas 10 airports received somewhat less and 11 received somewhat more. Based aircraft assigned to Timmerman Field rose to 367 under alternative plan 1G.

Alternative System Plan 1H: The final alternative system plan considered under set 1 represented an attempt to approximate an "optimum" system of airports within the Region to accommodate based aircraft within the time constraints (see Table 148). Six of the airports included in alternative plan 1G were upgraded as follows: Kenosha Municipal, GU to BT; Palmyra Municipal, GU to BT; Watertown Municipal, BU to GU; Big Foot, GU to BT; Vincent, BU to GU; and Lake Lawn Lodge, BU to GU. These changes produce an unsatisfied demand of only 34 aircraft—4 D and 30 E—identical to that for alternative system plan 1D, the optimum publicly owned system plan that contained only 19 publicly owned airports. The analyses indicated that, as under plan 1D, this remaining unsatisfied demand could be satisfied only by changing the travel time criteria for D and E type aircraft or by providing a new airport on the shore of Lake Michigan east of the Bayside-Fox Point area.

Scheduled Airline Service Analysis: The alternative system plans in set 1 were also analyzed with respect to satisfying forecast air carrier passenger demand in terms of travel time criteria established in the objectives and standards. The air carrier analysis considered the probable future distribution of passenger originations to traffic analysis zones and the probable future travel times between each traffic analysis zone and General Mitchell Field under adopted land use and transportation system conditions. Traffic analysis zones located in excess of 60 minutes from General Mitchell Field were identified and the total forecast passenger origination volumes in these zones were accumulated. This analysis indicated that travel times in excess of 60 minutes could be expected only from the extreme northern portion of the Region in Washington and Ozaukee Counties, from the extreme southwestern corner of the Region in Walworth County, and from the extreme southwestern corner of Kenosha County.

In the northern portion of the Region, 10,532 passenger originations could be expected to be located beyond a 60 minute travel time to General Mitchell Field but none would be beyond 65 minutes travel time. The total travel time which could be expected to exceed the 60 minute standard was estimated at only 52,660 passenger minutes, or 877 passenger hours, by the plan design year of 1990. In the southern portion of the Region, 21,738 originating passengers could be expected to be beyond a 60 minute travel time to General Mitchell Field, but none would be beyond 75 minutes travel time. The total travel time which could be expected to exceed the standard was estimated at only 130,530 passenger minutes, or 2,176 passenger hours, by the plan design year of 1990.

Two alternative air carrier airport locations were investigated to alleviate the excess travel time associated with the forecast passenger originations. The first assumed establishment of a scheduled transport feeder airport at the West Bend Municipal Airport, providing scheduled commuter service to markets evidencing a significant traffic potential. The second assumed establishment of a scheduled transport feeder airport at the East Troy Municipal Airport or at the Burlington Municipal Airport. All originating passengers in the northern zones would be located within 30 minutes travel time of the selected feeder airport site, and all originating passengers in the southern zones would be located within 45 minutes travel time of the selected sites.

Summary of the Set 1 Alternative System Plans: Analyses of the set 1 alternative system plans provided a better understanding of the capability of each of the alternatives to meet forecast aviation demand within the established objectives and standards, and thereby provided guidance not only for the design of refined alternative plans, but also for judging practicability of the standards originally specified. The most significant findings may be summarized as follows:

1. The full satisfaction of total aviation demand within the Region, expressed in terms of siting airports such that aircraft can be based within the ground travel time standards, can be accomplished only if a new airport is located along the shore of Lake Michigan east of the Bayside-Fox Point area. This solution was deemed impractical by the Technical Coordinating and Advisory Committee, since it would entail either construction of a new airport in an area devoted to intensive high value residential use, or the construction of such an airport in Lake Michigan adjacent to high value residential areas.

2. A maximum ground travel time standard of 20 minutes from place of residence to an airport for type D and E aircraft owners was deemed too constraining by the Technical Coordinating and Advisory Committee. Therefore, this standard was modified to provide a maximum ground travel time criteria of 30 minutes from place of residence to airport for general aviation aircraft owners of all types of aircraft.

3. Total reliance on existing publicly owned airports only to meet the forecast aviation demand appears to be an unrealistic approach. Further investigation of the use of privately owned airports to meet the total demand and of the probability of the survival of these airports was necessary.

4. Airport development outside the Region but in close proximity thereto should be considered in the formulation of the final regional airport system plan, since it is evident that external airports can readily satisfy some of the forecast aviation demand generated within the Region.

5. There is an apparent need to provide some new airports within the Region to satisfy travel time criteria and reduce the forecast number of based aircraft and attendant aircraft operation overloads at existing airport sites.

6. The set 1 alternative system plan did not address the disposition of the abandoned Richard I. Bong Air Force Base site. Additional alternative plans would have to be analyzed to determine if this site should be reserved for another air carrier airport, a replacement to General Mitchell Field, a general aviation airport, or a special-purpose airport such as a landing strip serving the recreation area or for flight training.

7. The need to establish two scheduled transport feeder airport service points in the Region to satisfy travel time criteria does not appear reasonable from two standpoints: the future passenger demand volume may be expected to be very low and the feasibility of providing scheduled service of sufficient frequency is consequently doubtful; and passengers have an attractive alternative of using ground transportation to the principal scheduled air transport airport. Therefore, the travel time criteria will remain unmet for some air carrier passengers originating within the Region.

Alternative System Plan—Set 2

The second set of alternative system plans was developed on the basis of findings derived from the analyses of the first set. Set 2 consisted of five alternative system plans which utilized various combinations of existing and proposed new publicly and privately owned airports within and outside the Region. Two subsystem alternatives dealing with Timmerman Field and Racine Commercial Airport were also analyzed. Each of the system plans are described below. The ground travel time standard for all general aviation aircraft was changed to 30 minutes as a result of the analyses of the first set of alternatives.

Alternative System Plan 2A—No Build Alternative: The first alternative system plan considered under set 2 was a "no build" plan comprised of 21 existing public use airports within the Region and three existing airports outside the Region in Waukegan, Illinois and Fort Atkinson-Whitewater and Watertown in Jefferson County. Five private airports were eliminated from the existing 26 public use airports considered previously—Hales Corners, Rainbow, Aero Park, Mt. Fuji, and O'Leary Field—because they were considered as not having adequate expansion potential, known to have been purchased for other uses, or known to have been designated by their owners as not available for public use (see Table 149). The Palmyra Municipal Airport was replaced by the proposed Fort Atkinson-Whitewater airport. All airports were assumed to be utilized in their existing classification and runway configuration.

Analysis of the demand assignment to alternative 2A indicated that 92 type C based aircraft would not be satisfied within the ground travel time standard. Several airports could be expected to receive a high assignment of aircraft under this alternative, including Waukesha County (341), Timmerman Field (353), and General Mitchell Field (260). Further, forecast general aviation activity combined with the forecast of airline and military aircraft movements would exceed the existing runway capacity of General Mitchell Field under this alternative. The Waukesha County, Timmerman Field, and East Troy Municipal Airports would operate at capacity.

Alternative System Plan 2B—Upgrade Existing Publicly Owned Airports to Standards: Although alternative system plan 2B contained the same airports as plan 2A, the publicly owned airports were assumed to be upgraded to meet prescribed safety and reliability standards suitable for the airport's classification as set forth in the objectives and supporting standards. These improvements consisted primarily of navigation aids and provision of all-weather runways. In some cases, the upgrading also resulted in an attendant incidental benefit of higher airfield capacity. Airport classifications remained unchanged from those assumed in plan 2A (see Table 149).

The results of the traffic assignment and analysis were similar to those for plan 2A. A total demand of 92 C aircraft remained unsatisfied with respect to ground travel time. The highest assignments of aircraft were made to Timmerman Field (359), Waukesha County (337), and General Mitchell Field (256). The most significant change from plan 2A was the increase in landing area capacity gained by providing paved all-weather runways at the East Troy Municipal Airport.

Alternative System Plan 2C—Expand Publicly Owned Airports to Provide Additional Landing Area Capacity: Alternative system plan 2C represented a further expansion of plan 2B, using the same number and classification of airports but assuming airport landing area expansion at all publicly owned airports in an effort to achieve increased system capacity. The results of the traffic assignment analysis indicated that the same number of C aircraft would remain unsatisfied with respect to ground travel time standards as under plans 2A and 2B (see Table 149). Although the traffic assignment to the 24 airports was slightly different from alternatives 2A and 2B, reflecting the influence of landing area capacity increases at some airports, the same three airports—Waukesha County, Timmerman Field, and General Mitchell Field—experienced the highest levels of assigned traffic. Landing area capacity was increased at the Kenosha, Burlington, and West Bend Municipal Airports under this alternative. Nevertheless, both Waukesha County Airport and Timmerman Field would still be expected to operate at capacity.

Table 149

AIRPORT CLASSIFICATION AND AIRCRAFT ASSIGNED UNDER ALTERNATIVE AIRPORT SYSTEM PLAN— SET 2: PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION

County	Airport	Alternative System Plan									
		2A		2B		2C		2D		2E	
		Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned
Kenosha	Kenosha Municipal	GU	194	GU	188	GU	241	BT	259	GU	168
	Vincent	BU	37	BU	37	BU	37	BU	37	BU	37
Milwaukee	General Mitchell Field	SAT	260	SAT	256	SAT	250	SAT	233	SAT	222
	Timmerman Field	GU	353	GU	359	GU	359	GU	364	GU	325
Ozaukee	Ozaukee	BU	98	BU	98	BU	98	BU	100	BU	86
	Site A	--	--	--	--	--	--	--	--	BT	201
Racine	Burlington Municipal	GU	110	GU	91	GU	93	BT	116	GU	69
	Fox River	BU	93	BU	86	BU	81	BU	84	BU	67
	Hunt Field	BU	92	BU	86	BU	86	BU	86	BU	82
	Racine Commercial	BT	160	BT	167	BT	149	BT	140	BT	137
	Sylvania	BU	190	BU	173	BU	169	BU	170	BU	151
	Valhalla	BU	96	BU	90	BU	77	BU	86	BU	77
	Site C	--	--	--	--	--	--	--	--	BT	164
Walworth	East Troy Municipal	BU	95	BU	165	BU	160	BU	168	BU	149
	Big Foot	BU	11	BU	11	BU	11	BU	11	BU	11
	Gruenwald	BU	29	BU	26	BU	26	BU	26	BU	26
	Playboy	GU	68	GU	69	GU	68	GU	69	GU	69
	Lake Lawn Lodge	GU	73	GU	63	GU	62	GU	63	GU	63
Washington	Hartford Municipal	BU	113	BU	117	BU	107	BU	113	BU	102
	West Bend Municipal	GU	163	GU	163	GU	178	BT	193	GU	137
	Hahn's Sky Ranch	BU	56	BU	56	BU	47	BU	52	BU	49
Waukesha	Waukesha County	GU	341	GU	337	GU	337	BT	355	GU	313
	Capitol Drive	BU	89	BU	89	BU	89	BU	90	BU	82
Outside the Region	Fort Atkinson-Whitewater	GU	27	GU	27	GU	27	GU	27	GU	27
	Watertown Municipal	BU	49	BU	49	BU	49	BU	49	BU	45
	Waukegan Memorial	GU	112	GU	107	GU	107	GU	99	GU	105
Total Airports	--	24	--	24	--	24	--	24	--	26	--
Total Aircraft (1990)	--	--	3,000	--	3,000	--	3,000	--	3,000	--	3,000
Assigned	--	--	2,908	--	2,908	--	2,908	--	2,990	--	2,964
Unassigned	--	--	92	--	92	--	92	--	10	--	36

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

Alternative System Plan 2D—Expand Publicly Owned Airports to Accomodate Forecast Demand: Alternative system plan 2D represents a further improvement of the basic 24 public use airports to achieve a fuller satisfaction of demand. This alternative assumes an upgrading of classifications of those airports in alternatives 2B and 2C that were judged capable of expansion and that are located near concentrations of aviation demand that remained unsatisfied in alternative 2C. Specifically, Waukesha County, Kenosha Municipal, Burlington Municipal, and West Bend Municipal Airports were assumed to be upgraded from a GU to a BT classification (see Table 149).

The results of the traffic assignment analysis indicated that the demand of only 10 C aircraft remained unsatisfied. Compared with plan 2C, 15 airports received more assigned aircraft, three received less, and six airports received the same. The assignment of aircraft to airports under this alternative reduced General Mitchell Field to the fourth highest in terms of based general aviation aircraft, and elevated the Kenosha Municipal Airport into the third busiest general aviation aircraft airport behind the Waukesha County Airport and Timmerman Field.

Alternative System Plan 2E—Develop New Airports to Accommodate Forecast Demand: Alternative system plan 2E represented an attempt to improve the basic public use airport system by introducing two new BT airports—one in southern Ozaukee County and one in northern Racine County—to obtain the capacity to satisfy forecast demands.

The results of the traffic assignment analysis indicated that plan 2E offered a better system arrangement than plan 2B, having only 36 C aircraft unsatisfied as opposed to 92, but not as satisfactory as plan 2D, which accommodated all but 10 C aircraft within 30 minutes of an airport (see Table 149). Although Waukesha County Airport, Timmerman Field, and General Mitchell Field were still assigned relatively high numbers of aircraft, they were assigned less aircraft than in plans 2B and 2D.

Alternative plans 2A through 2E represent variations of the existing basic public use airport system, and were analyzed to determine the relative effectiveness of various courses of action in satisfying the forecast general aviation demand. These basic courses of action included:

1. Upgrading existing publicly owned airports to minimum standards for the airport classifications—alternative 2B.

2. Expanding existing publicly owned airports to obtain added capacity but retaining the existing airport classifications—alternative 2C.

3. Expanding existing publicly owned airports to obtain added capacity and changing the classifications of selected existing publicly owned airports—alternative 2D.

4. Upgrading existing publicly owned airports to minimum standards and constructing new airports to serve added demands—alternative 2E.

The question of alternative accommodations of the forecast commercial air passenger origination demand was not addressed in these alternative plans. However, several regional airport issues raised in the set 1 analysis and dealing with general aviation were addressed in the set 2 analysis. These investigations were accomplished by analyzing two additional alternative system plans: one that would upgrade Timmerman Field to BT classification, and another that would not include either Timmerman Field or Racine Commercial Airport, both of which are located in highly urbanized areas. The results of these subsystem analyses are briefly summarized below:

Alternative System Plan 2F: Alternative system plan 2F was the same as plan 2C, except that Timmerman Field was assumed to be upgraded to a BT classification. This alternative was designed to investigate the effect of expanding Timmerman Field to accommodate corporate jet aircraft. Analysis indicates that of the unsatisfied demand of 92 C aircraft under alternative 2 C, 39 C aircraft would be satisfied by a BT airport at Timmerman Field. Moreover, a total of 50 jet aircraft could be expected to find Timmerman more convenient than the other two airports—General Mitchell Field and Racine Commercial—capable of serving jet aircraft under this alternative. The classification change also resulted in minor variations in based aircraft assignments such that Timmerman Field would lose some D and E aircraft.

Alternative System Plan 2G: Timmerman Field occupies a strategic location with respect to demand concentration. In the absence of any new airport, its closing would result in the relocation of many aircraft to General Mitchell Field, thus saturating the capacity of the only scheduled air transport airport in the Region. Therefore, any proposal to close Timmerman Field without accommodating the demand it satisfies was deemed impractical.

Since Racine Commercial is quite similar to Timmerman Field with respect to its location in an urbanized area, this alternative also assumed the closing of this busy airport. To offset the loss of capacity and convenience to aircraft owners, two new airports were substituted for the two airports assumed closed. A new BT airport to replace Timmerman Field was located in southern Ozaukee County, and a second BT airport to replace Racine Commercial was located in northern Racine County. In addition, several airports in this system were assumed to be upgraded to help accommodate C and D aircraft. Waukesha County, Kenosha Municipal, Burlington Municipal, and West Bend Municipal were upgraded from GU to BT, and Hartford Municipal and Ozaukee were upgraded from BU to GU.

Analysis of this alternative indicates that the number of based aircraft beyond 30 minutes travel time of the owner's address is identical to the systems containing both of these airports. This means that the airport spacing of both systems provides approximately the same degree of demand satisfaction with respect to ground travel times. Further, based aircraft assigned to airports in each alternative system differed, but not significantly. Thus, it appears that if replacement airports can be provided, the two highly urbanized airports can be closed with no more adverse impact than described under system plan 2D.

Summary of Set 2 Alternative System Plans: The set 2 alternative system plan provided additional information concerning possible system plans that would best satisfy the forecast aviation demand and the objectives and supporting standards specified in the study. An analysis of the set 2 alternative and the supporting information provided by analysis of the set 1 alternative were presented to the advisory committee for review and comment and to obtain direction in the preparation of the final set of alternative plans for which a complete evaluation would be conducted. The findings of the analyses of the set 2 alternatives and of the committee review of the alternative plans may be summarized as follows:

1. The locations and classifications of existing public use airports within the Region are such that a significant number of the larger C type general aviation aircraft cannot be based within 30 minutes travel time of the probable location of the owners, and some airports may be anticipated to serve numbers of aircraft and attendant aircraft operations matching or exceeding their capabilities. Changing the classification of a centrally located airport such as Timmerman Field to basic transport, and thus permitting it to accommodate C general aviation aircraft, would overcome some of the deficiencies. Changing the classification of several airports—specifically Waukesha County, Kenosha Municipal, Burlington Municipal, and

West Bend Municipal—to basic transport would provide airports capable of handling the larger general aviation aircraft within the ground travel time standards adopted for this study. However, providing additional landing system capacity at airports capable of being expanded does not readily overcome the anticipated overloads at the more centrally located urban airports.

2. The provision of two new airports would mean improved system capacity, but even if both were basic transport airports, some users of the C aircraft could still be expected to be located beyond the 30 minute ground travel time standards.

3. As an alternative to increasing the classification of Timmerman Field to basic transport, a system plan was developed that did not include either Timmerman Field or Racine Commercial, but included two new airports and upgraded the classification of other airports. This plan provided a level of air transportation service similar to plans that contained the two highly urbanized airports.

4. An evaluation of a theoretically optimum system plan was desirable to provide a basis for development of an alternative system plan that represents a "practical" modification of such a theoretically optimum plan. The optimum plan would contain airports located at the centers of forecast aviation demand without regard to the configuration of the existing airport system or the availability of land for airport construction.

5. An evaluation of a "nonurban" airport system plan which minimized the adverse impact of airport development and aircraft operations on the present urban and urbanizing areas of the Region, and that accommodated forecast aviation demands through use and expansion of existing airports and construction of new airports in areas not now or forecast to become used for intense urban activity, was considered necessary.

6. Restrictions on aircraft operations at selected airports, particularly those in urbanized areas, to reduce the nuisance effects of certain kinds of operations should be considered in the plan evaluation. Changes in traffic patterns and relocation of touch-and-go operations to less urbanized areas could help overcome many adverse community impacts experienced at some urban airports.

7. Subsequent assignments of aircraft to alternative public use airport system plans should be modified to recognize the lesser role that recreation oriented airports and many privately owned airports may have in attracting and accommodating forecast demands. Although these airports will accommodate some of the demand throughout the planning period, many are not capable of serving, and do not desire to serve, all aircraft within the general aviation fleet that might otherwise be assigned to such an airport.

Alternative System Plan—Set 3

The third and final set of alternative system plans was developed based on the findings derived from the analyses of the two previous sets of alternatives and the direction offered by the advisory committee. This third set was evaluated in greater detail than the first two, since the results were intended to provide a basis for the selection of a final regional airport system plan.

Set 3 contains a "no build" alternative; four alternatives designed to meet the forecast general aviation demand; and an alternative that includes proposals to relocate the single scheduled air carrier airport required to serve the Region through the plan design year. In addition to evaluating these six basic alternatives, conclusions were drawn concerning subsystem variations, such as restricting touch-and-go operations at airports in urban areas to ameliorate the adverse effects on surrounding areas devoted to residential use.

One of the refinements effected in the analysis of the set 3 alternatives was a reclassification of many basic utility airports in order to more accurately reflect their capability. Many such airports have limited runway lengths, and therefore cannot accommodate all of the types of aircraft which they are normally expected to accommodate. By reducing the number of type E aircraft that can be accommodated at basic utility airports, based on an analysis of corrected runway lengths, a more realistic assignment of forecast demands could be made.

A revised classification of basic utility airports was used to assign forecast based aircraft and attendant operations. Airports identified under this reclassification as basic utility airports would be able to accommodate all of the E aircraft assigned to the airport. Basic utility stage I airports would have runway lengths capable of accommodating 90 percent of the E aircraft within the general aviation fleet, and airports classified as less than basic utility stage I would have corrected runway lengths capable of accommodating only 60 percent of the E aircraft within the general aviation fleet. The assignment model was adjusted to restrict the assignment of type E aircraft to those airports that were reclassified below basic utility. The adjustment was applied to the runway capacity of the airport, since capacity is the key factor in the distribution of forecast aircraft. Sixteen airports were reclassified, as shown in Table 150, which indicates the airports affected, their original classification in alternative plan sets 1 and 2, and the new classification used in evaluating the set 3 alternative plan.

Alternative System Plan 3A—"No Build": The first alternative system plan considered under set 3 was intended to represent a "no build" plan in which only that minimal new capital investment would be made which was necessary to improve the existing publicly owned airports in order to meet the minimum landing system and navigation standards required for the designated airport classification, and in which no new capital investment would be made to upgrade airport classification or develop new airports to meet forecast air transportation demands. This system plan is comprised of the 24 existing public use airports considered under alternative system plan 2A.

Table 150

AIRPORTS IN AND ADJACENT TO THE REGION RECLASSIFIED FOR ANALYSIS UNDER ALTERNATIVE AIRPORT SYSTEM PLAN—SET 3

County	Airport	Airport Classification	
		Sets 1 and 2	Set 3
Kenosha	Vincent.	BU	< BU-I
Ozaukee	Ozaukee	BU	< BU-I
Racine	Burlington Municipal . .	GU	BU-II
	Fox River	BU	< BU-I
	Hunt Field.	BU	< BU-I
	Sylvania	BU	< BU-I
	Valhalla	BU	< BU-I
Walworth	East Troy Municipal . .	BU	< BU-I
	Big Foot	BU	BU-I
	Gruenwald.	BU	BU-I
	Playboy	GU	BU-II (Recreational)
	Lake Lawn Lodge. . . .	GU[a]	BU-II (Recreational)
Washington	Hartford Municipal . . .	BU	BU-I
	Hahn's Sky Ranch . . .	BU	< BU-I
Waukesha	Capitol Drive	BU	< BU-I
Outside the Region	Watertown Municipal. .	BU	BU-I

[a] *Lake Lawn Lodge was classified as a BU airport in set 1 of the alternative system plans, and as a GU airport in set 2.*

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

Twenty-one of these airports are located within the Region, and three are located outside of the Region at Waukegan, Illinois and at Watertown and Fort Atkinson—Whitewater in Jefferson County. The most significant difference between this plan and plan 2A is that in this plan, 16 of the airports were reclassified downward, reflecting the corrected runway lengths previously discussed and providing a more conservative assignment of aircraft to the various airports comprising the system. This alternative plan is shown graphically on Map 29.

This reclassification of airports results in an increase in the number of D aircraft that cannot be served within the 30 minute ground travel time standard, and an increase in the number of aircraft assigned to those airports having the full capabilities of their classification. However, except for the addition of 16 D aircraft unassigned under this alternative, the conditions that would exist are similar to those previously described under alternative 2A, that is, an overloading of General Mitchell Field and the East Troy Municipal, Timmerman Field, and Waukesha County Airports.

Alternative System Plan 3B—"Ideal": Based upon the results of previous analyses, and in response to a direct request from the Wisconsin Department of Transportation representatives on the advisory committee, an alternative system plan was developed in which the airports were ideally located to serve the needs of the air transportation users. A minimum number of airports were developed, sized to accommodate approximately 300 based aircraft and attendant operations, and located at the centroid of air service demand to minimize ground travel time, as shown on Map 30. The one regional air carrier airport is also located at the centroid of total originating passenger demand generated within the Region. An air carrier airport located as shown would minimize the total ground travel time of originating passengers between their points of origin within the Region and the air carrier airport.

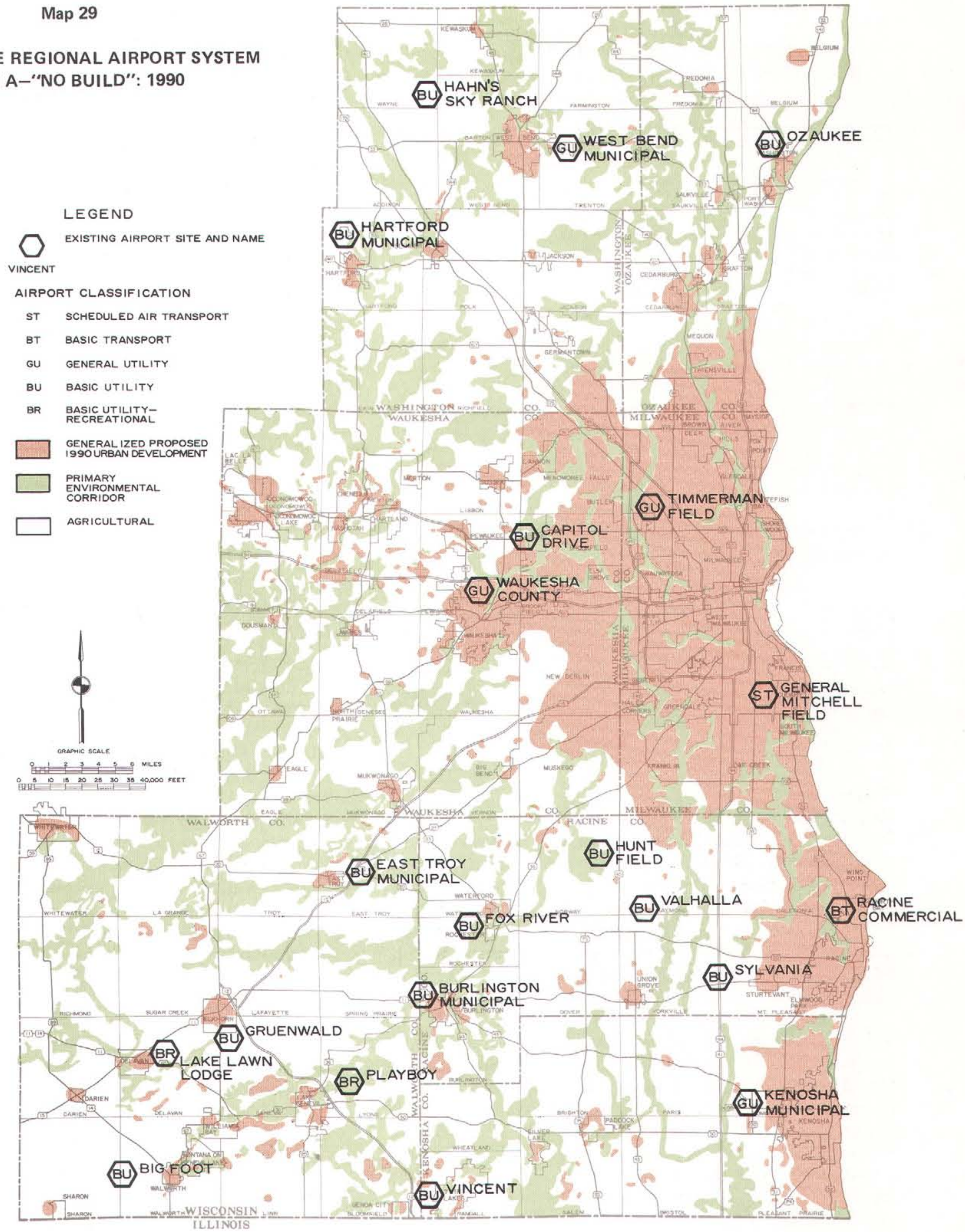
This airport system contains 11 general aviation airports and one air carrier airport. Five of the airports, including the air carrier airport, would be located in areas already devoted to other urban land uses. The four general aviation airports that would be sited in extensively developed urban lands include two in Milwaukee County and two in eastern Waukesha County. Although none of the airport sites under this alternative are located where airports presently exist, four major existing airports—Kenosha Municipal, Racine Commercial, Burlington Municipal, and General Mitchell Field—are located within four miles of ideal airport sites identified under this alternative. In addition, the privately owned, public use Gruenwald Airport is located within one mile of the centroid of general aviation demand identified in Walworth County. General Mitchell Field, the Region's existing air carrier airport, is less than eight miles from the centroid of originating air carrier passenger demand within the seven-county Region.

Under this plan, all eleven general aviation airports would be basic transport airports capable of accommodating C, D, and E aircraft and a total of approximately 300 based aircraft. Each such airport would have a landing area system consisting of primary and crosswind runways and associated taxiways to provide sufficient capacity for operations related to the based aircraft, and would occupy about 700 acres, or over one square mile of land. It is apparent that the direct and indirect costs of acquiring this much land in highly developed areas of the Region would be absolutely prohibitive. Moreover, the adverse impact on surrounding land uses would be extreme. Because of the obvious impracticality of constructing most of the airports identified under this alternative, and because of the availability of existing publicly owned airports reasonably well located with respect to the identified centroids of service demand, no additional evaluation of the airports under this alternative was undertaken. This alternative, however, did serve as a valuable guide in the preparation of alternative system plan 3C, which represents a practical approximation of the ideal airport system plan alternative.

Alternative System Plan 3C—"Ideal Modified": As noted, alternative system plan 3C was intended to represent a practical approximation of plan 3B. Accordingly, the plan shown on Map 31 is comprised of 13 airports located within the Region and three airports located outside the Region, all selected as close to the ideal centroids of

Map 29

ALTERNATIVE REGIONAL AIRPORT SYSTEM PLAN A—"NO BUILD": 1990

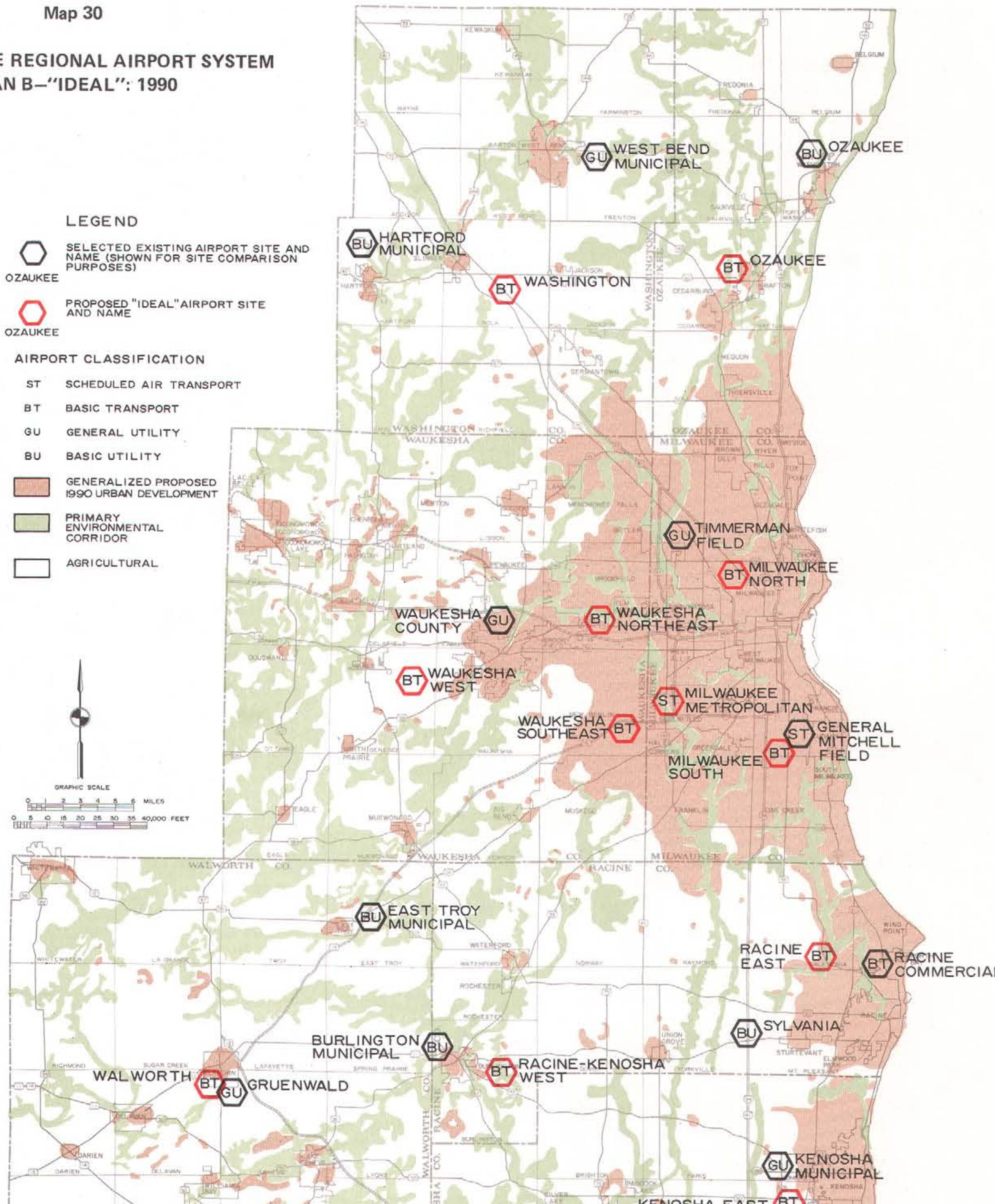


The first alternative system plan considered was a "no build" plan in which only minimal new capital investment required to meet minimum landing system and navigation standards at the eight publicly owned airports for the designated airport classification would be made, and in which no new capital investment would be made to upgrade airport classification or develop new airports to meet forecast air transportation demands. This system plan includes 24 existing public use airports, including 21 located within the Region, as shown on this map, and three outside the Region which are not shown on the map, located at Waukegan, Illinois, and at Watertown and Fort Atkinson-Whitewater in Jefferson County.

Source: R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 30

ALTERNATIVE REGIONAL AIRPORT SYSTEM PLAN B—"IDEAL": 1990

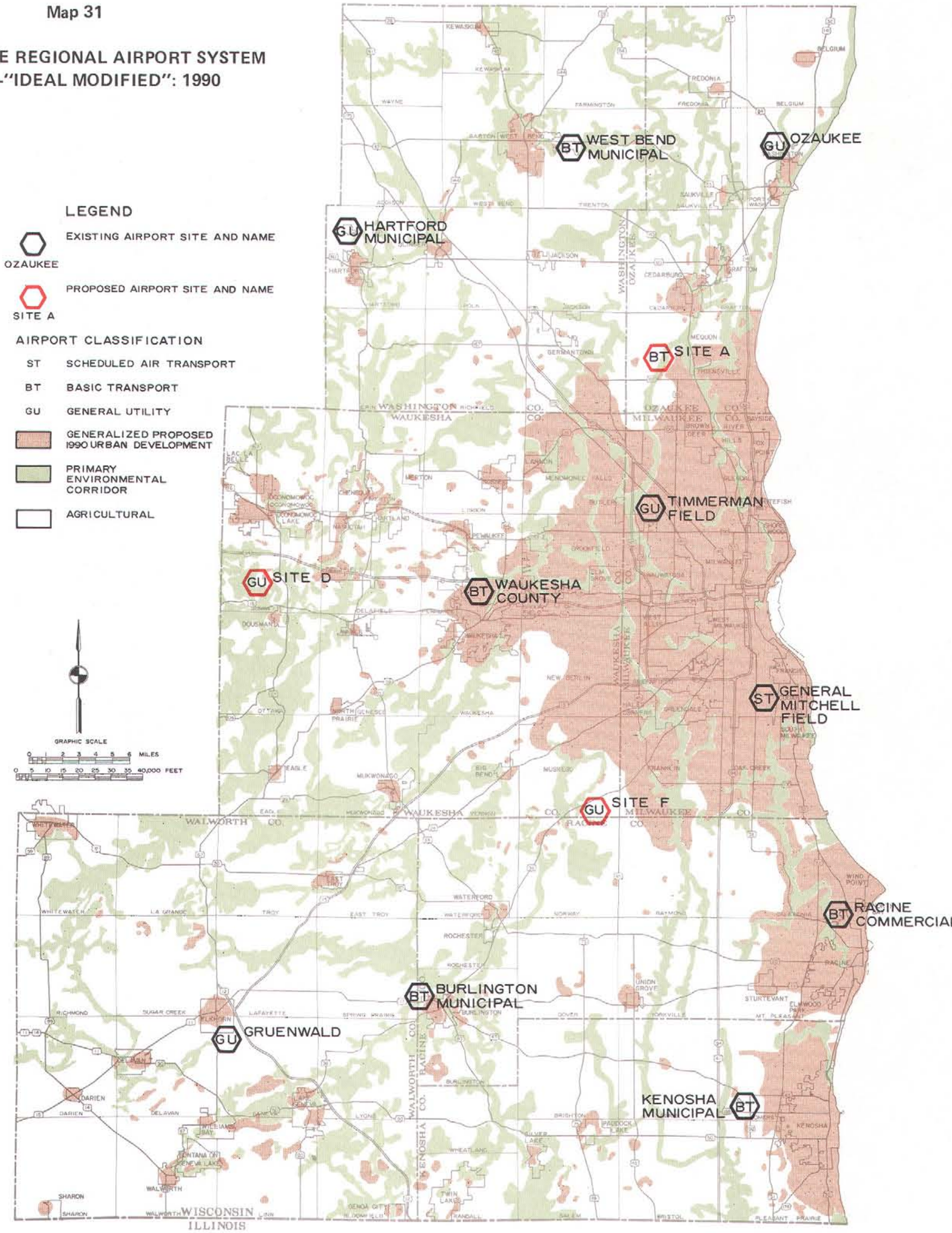


Analysis indicated that to meet the existing and forecast air transportation demand within the Region, a total of 12 airports would be required, including one scheduled air transport and 11 basic transport airports. Under this alternative, the airports were ideally located and classified to serve the needs of air transportation users. In addition to the proposed ideal sites, selected existing airports approximating the ideal site locations are shown on this map for comparison. Although none of the proposed sites are located at existing airport locations, four major existing airports—Kenosha Municipal, Racine Commercial, Burlington Municipal, and General Mitchell Field—are located within four miles of the proposed sites. General Mitchell Field, the Region's existing air carrier airport, is located less than eight miles from its ideal location at the centroid of originating air carrier passenger demand in the Region.

Source: R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 31

ALTERNATIVE REGIONAL AIRPORT SYSTEM PLAN C—"IDEAL MODIFIED": 1990



The third alternative system plan considered represents a modified version of the second alternative plan, the "ideal" plan. It includes 13 airports within the Region as shown on this map, and three airports outside the Region—at Waukegan, Illinois, and at Watertown and Fort Atkinson-Whitewater in Jefferson County—not shown on this map. Of the 13 airports in the Region, 10 are existing and three are proposed new airports. The three new sites would be located in southern Ozaukee County and in southeastern and western Waukesha County.

Source: R. Dixon Speas Associates, Inc.; and SEWRPC.

demand as practical considerations permit. Of the 13 airports located within the Region, 10 are existing and three are proposed new airports. The 10 existing sites within the Region include General Mitchell Field, six publicly owned general aviation airports, and three existing privately owned public use airports—Ozaukee, Racine Commercial, and Gruenwald. Under this alternative, the East Troy Municipal Airport would be abandoned. The three new airport sites include a site in southern Ozaukee County and one in southeastern Waukesha County, both identified as good sites under alternative plans previously investigated, and a new site in western Waukesha County near Oconomowoc. To accommodate the forecast aircraft mix, basic transport airports would be required in West Bend, southern Ozaukee County, central Waukesha County, Burlington, Kenosha, Racine, and in the Fort Atkinson-Whitewater area. All other airports under this plan except General Mitchell Field would be classified as general utility airports.

The analysis of aircraft assigned to this system plan indicated that only one type C aircraft would be beyond 30 minutes ground travel time from a basic transport airport, and that the number of general aviation aircraft assigned to the airports was well balanced, with Kenosha Municipal Airport having 329 based aircraft, Timmerman Field, 306, and Waukesha County, 297. Except for the Kenosha Municipal and Racine Commercial Airports, the capacity of the landing area systems was able to accommodate the operations attendant to the number of based aircraft.

Alternative System Plan 3D—"Nonurban": Alternative system plan 3D was intended to represent a plan which, to the maximum extent possible, was comprised of airports located away from the urban and urbanizing areas of the Region. A total of 14 airports comprise this system plan, two of which are located outside the Region. As shown on Map 32, seven of the 12 airports within the Region are existing airports, and five are proposed new airports located in nonurban areas—site C in Racine County, site D near Oconomowoc and site F in southeastern Waukesha County, site E in Walworth County, and site G near Germantown in Washington County. The urban airports used in previous alternatives but abandoned under this system plan are Timmerman Field, Waukesha County, Racine Commercial, East Troy Municipal, Watertown Municipal, and the new site in the Mequon area of southern Ozaukee County. An alternative to the urban air carrier airport—General Mitchell Field—is treated as a separate issue in a subsequent alternative under this set, and considered to remain as a scheduled air carrier airport under alternative system plan 3D.

An analysis of the traffic assignment indicates that the spacing and classification of airports under this alternative would satisfy the travel time criteria, except for the demand exerted by only one type C aircraft. The number of operations generated by the based aircraft would indicate that the Kenosha Municipal Airport and the new airport in Racine County would be operating over capacity, and the excess capacity in many of the other airports was not as great as would exist under alternative 3C.

Alternative System Plan 3E—No New Sites: Nearly all of the previous alternative system plans considered under this set included new airport sites located within the Region to accommodate forecast demand. Alternative system plan 3E was developed to identify and evaluate the feasibility of utilizing expanded existing publicly and privately owned airports to accommodate forecast demands. Based on analysis of prior alternative sets and the alternatives considered under this set, the critically located privately owned public use airports within the Region were identified. Under this alternative, it was assumed that either steps would be taken to encourage continued private operation of these airports throughout the planning period, or that the public would purchase these sites to assure continued existence of an airport.

Under either public or private ownership, it was assumed that the airports would be brought to the minimum standards required for the assumed airport classification. All seven existing publicly owned general aviation airports, General Mitchell Field, four privately owned airports, and two recreation-oriented airports within the Region comprise the alternative system plan, as shown on Map 33. The plan also includes three airports outside the Region, at Waukegan, Illinois and at Watertown and Fort Atkinson-Whitewater in Jefferson County, which are not shown on Map 33. To accommodate the based aircraft demands within the ground travel time standards, the Waukesha County, Kenosha Municipal, Burlington Municipal, and West Bend Municipal Airports were upgraded to basic transport airports, and the Hartford Municipal Airport was upgraded to a general utility airport. The privately owned Ozaukee Airport was also upgraded to basic transport, and the Gruenwald Airport was upgraded to general utility. Sylvania was assumed to be a basic utility airport, and Playboy and Lake Lawn Lodge Airports maintained their current basic utility-recreational classification.

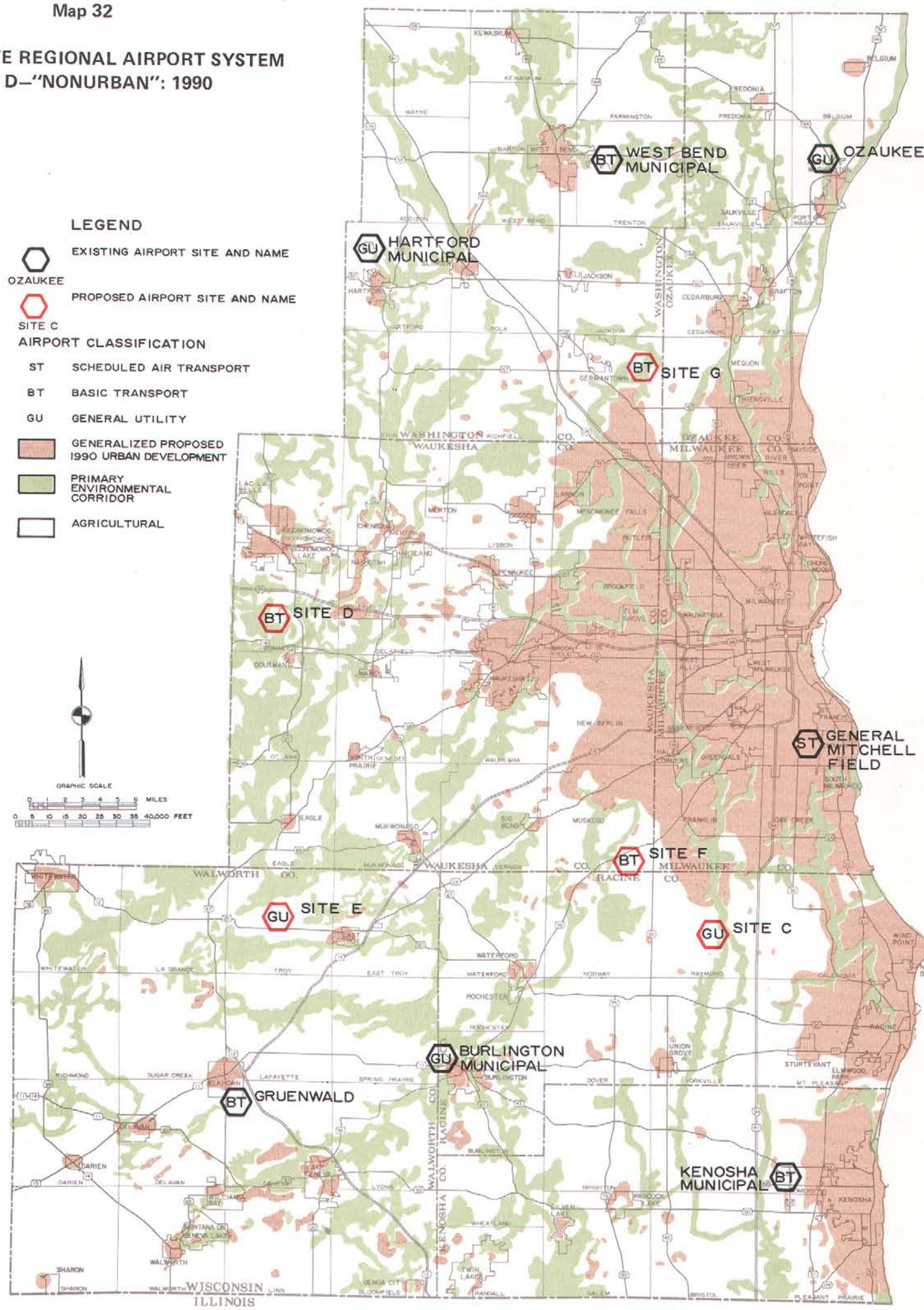
All but two type C aircraft can be accommodated within the revised ground travel time constraints under this alternative system plan. However, aircraft assignment to Timmerman Field was such that that airport could be expected to become overloaded. Assignment to both Kenosha Municipal and Waukesha County Airports also exceeded 350 aircraft.

Alternative System Plan 3F—"Relocated Air Carrier": Alternative system plan 3F represents a variation of plan 3C wherein a new scheduled air transport airport would be developed in northern Racine County and General Mitchell Field would be reclassified to a basic transport airport to serve only general aviation and military aviation activity. Alternative 3F, shown on Map 34, is comprised of 17 airports, compared to only 16 in plan 3C.

Based on analyses of alternative system plan 3C, and of a site in Jefferson County capable of serving as the location for a commercial airport serving both the Madison and Milwaukee areas, of the Richard I. Bong site in Kenosha and Racine Counties, and a site in northern Racine County, the site in northern Racine County was selected for relocation of the regional air carrier airport.

Map 32

ALTERNATIVE REGIONAL AIRPORT SYSTEM PLAN D—"NONURBAN": 1990

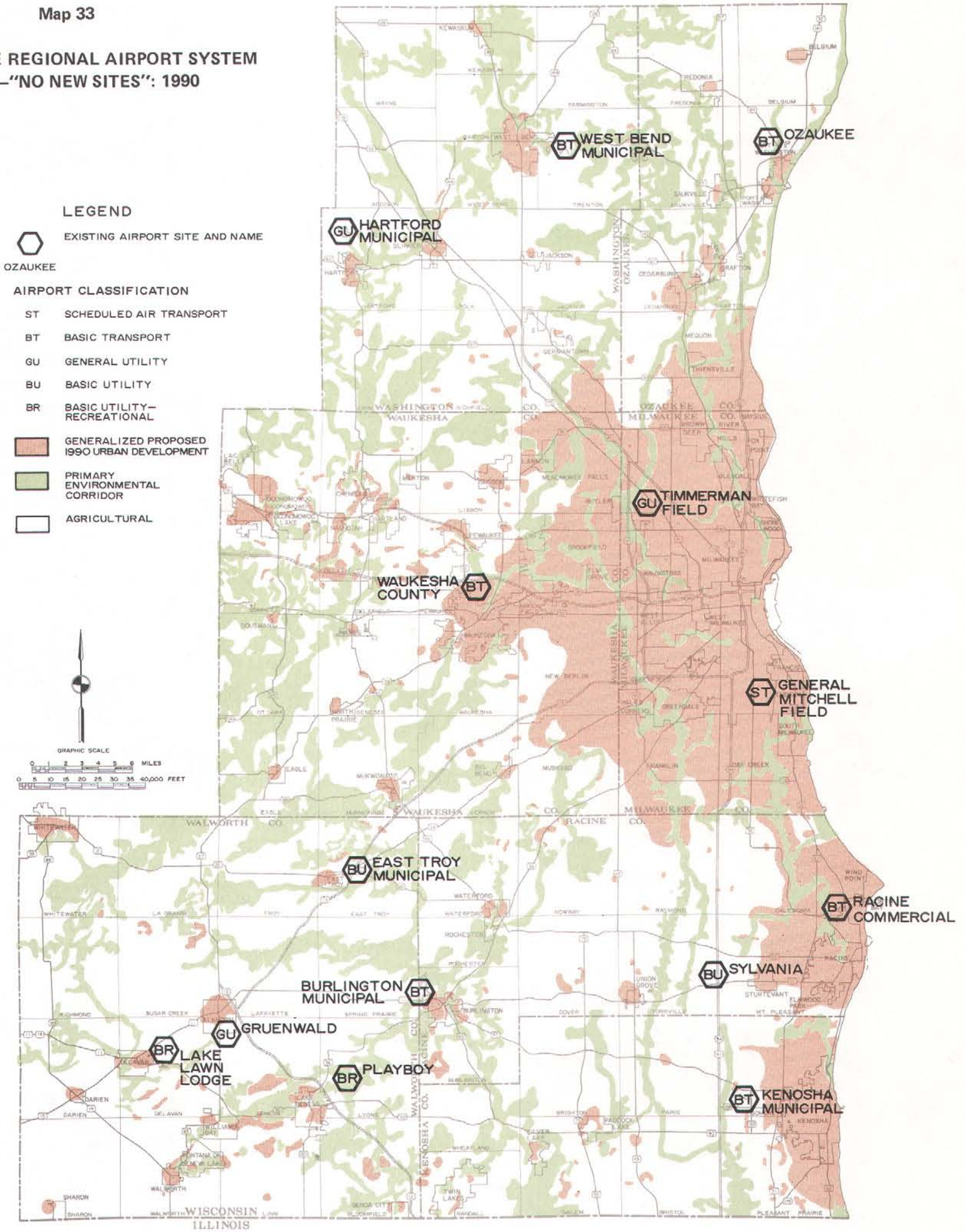


The fourth alternative system plan considered was a "nonurban" plan. The 14 airports which comprise this system would be located away from urban and urbanizing areas to the maximum extent possible. Twelve of the airports are located inside the Region, and two, which are not shown on this map, are located outside the Region at Waukegan, Illinois, and Fort Atkinson-Whitewater in Jefferson County. Of the 12 airports in the Region, seven are existing airports and five are proposed new airports located in nonurban areas of Racine, Waukesha, Walworth, and Washington Counties.

Source: R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 33

ALTERNATIVE REGIONAL AIRPORT SYSTEM
PLAN E—"NO NEW SITES": 1990

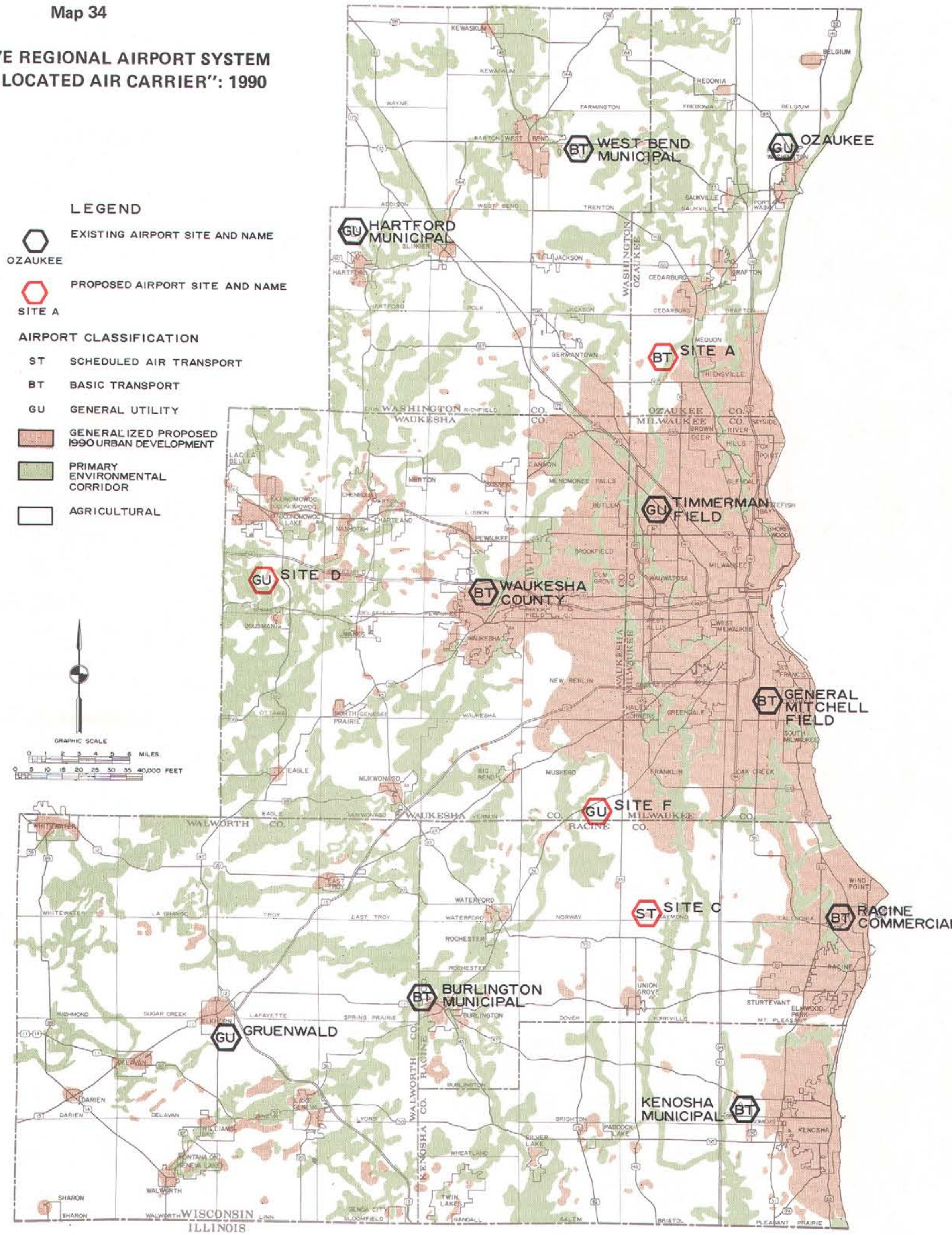


The fifth alternative system plan considered was a "no new sites" plan, developed to identify and evaluate the feasibility of utilizing expanded existing publicly and privately owned airports in the Region to accommodate forecast air transportation demands. This system plan includes 17 airports, 14 of which are located in the Region, as shown on this map, and three of which are located outside the Region at Waukegan, Illinois, and at Watertown and Fort Atkinson-Whitewater in Jefferson County. Analyses indicated that the forecast demand can be well accommodated within the reasonable ground travel time constraints under this alternative.

Source: R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 34

ALTERNATIVE REGIONAL AIRPORT SYSTEM PLAN F—"RELOCATED AIR CARRIER": 1990



The sixth alternative system plan considered entailed relocation of General Mitchell Field. Under this alternative, a new scheduled air transport airport would be developed in northern Racine County, and General Mitchell Field would be reclassified as a basic transport airport to serve only general aviation and military aviation activity. The 17 airports in the plan include 10 existing and four new airports in the Region, as shown on this map, and three airports located outside the Region at Waukegan, Illinois, and at Watertown and Fort Atkinson-Whitewater in Jefferson County, which are not shown on this map.

Source: R. Dixon Speas Associates, Inc.; and SEWRPC.

Analysis of these three sites included determination of the total demand generated within the Region that could be expected to be attracted to the site and that could be expected to be diverted to Chicago's O'Hare Field, and a determination of the associated ground travel time. The results are summarized in Table 151 and are compared to the attraction of, and travel time to, General Mitchell Field. About 5,469,000 passenger originations within the Region are forecast for the plan design year. The difference between the forecast total and the originations in Table 151 is the number of passengers that could be expected to be diverted to Chicago's O'Hare Field. The diversion can be expected to become significantly more pronounced with a shift away from the General Mitchell Field site, as shown in Table 151. Ground travel time can also be expected to increase significantly for the new air carrier sites, even though the volume of passenger attraction would be less. The Bong site, located further from the concentrations of demand than the Racine County site and further from major ground transportation corridors, would compare even less favorably with General Mitchell Field than the Racine County site selected.

Analysis of the traffic assigned to plan 3F indicates that the airport spacing would be about as effective as that in plan 3C. The demand exerted by only one type C aircraft would be unsatisfied with respect to the travel time standards. Some shifting of assigned based aircraft would occur, and a reduction from 329 aircraft under alternative 3C to only 264 aircraft under this alternative could be expected at the Kenosha Municipal Airport. General Mitchell Field could be expected to accommodate 360 general aviation aircraft under this alternative, up from 239 under alternative 3C. Under prior alternatives, type E aircraft were not accommodated at General Mitchell Field, whereas under alternative 3F, over 280 of the E aircraft could be expected to be attracted to General Mitchell Field. The addition of another airport in the southern part of the Region, and the resultant redistribution of assigned aircraft, would serve to provide additional landing area capacity for the forecast operations. Whereas both Kenosha Municipal and Racine Commercial were expected to operate over capacity under plan 3C, neither of these airports would have to operate at capacity under this alternative.

Table 151

NUMBER OF PASSENGER ORIGINATIONS ATTRACTED BY AND GROUND TRAVEL TIME TO ALTERNATIVE AIR CARRIER SITES WITHIN AND ADJACENT TO THE REGION: 1990

Air Carrier Airport Site	Forecast Passenger Originations 1990	Forecast Passenger Hours Spent in Ground Travel Time 1990
Inside Region		
General Mitchell Field-Milwaukee County. . .	3,900,858	4,060,801
Racine County.	3,407,064	5,180,583
Outside Region		
Jefferson County	2,288,203	6,151,822

Source: R. Dixon Speas Associates, Inc.

Table 152 summarizes the number and classification of, and aircraft assignment to, airports considered under the set 3 alternative airport system plans. Subsystem variations dealing with the restriction or elimination of touch-and-go aircraft operations at selected airports and with changing air traffic operating patterns and runway orientations at airports in or near developed urban areas of the Region are discussed in later sections of this chapter.

EVALUATION OF ALTERNATIVE AIRPORT SYSTEM PLANS

Each of the alternatives described consists of various combinations of individual airport site locations and airport functions or classifications within the system. The impact of each airport on the level of air transportation service and on the overall quality of the environment under each of the system plans varies. A means for evaluating each alternative plan and comparing it to the other alternatives and to the agreed-upon airport system development objectives and supporting standards is essential to assist public officials in selecting the best airport system plan for the Region. Ideally, the evaluation process would express all factors involved in terms of a common quantitative measure, such as dollar value. Because of the difficulties inherent in expressing certain factors in monetary terms, however, the evaluation process must rely on the use of both quantitative and qualitative factors.

Because one air carrier airport can meet the probable future demand for air carrier service within the Region, the alternative plans emphasize differing configurations of airport types and locations to meet existing and forecast general aviation demand. Each alternative is evaluated on its ability to satisfy the demand for general aviation service, and on its potential impact on other regional plan elements and on the land use pattern and natural resource base of the Region. Since an air carrier airport is an element of each plan, however, the influence of the air carrier airport is also discussed under each alternative. Further, an analysis of alternative air carrier airport sites is discussed separately following discussion of the basic general aviation service alternatives. The potential aviation-related use of the abandoned Richard I. Bong Air Force Base is also discussed under the evaluation of alternative air carrier airport locations.

FACTORS USED TO EVALUATE ALTERNATIVE AIRPORT SYSTEM PLANS

Both quantitative and qualitative factors were considered in the comparative analysis and evaluation of the alternative system plans. The quantitative factors included those system elements that could be converted to, and expressed in terms of, dollar costs. The qualitative factors included elements that could only be expressed in essentially nonquantitative, but nevertheless real, terms.

Table 152

AIRPORT CLASSIFICATION AND AIRCRAFT ASSIGNED UNDER ALTERNATIVE AIRPORT SYSTEM PLAN—SET 3: PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION

County	Airport	Alternative System Plan									
		3A		3C		3D		3E		3F	
		Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned	Airport Classification	Aircraft Assigned
Kenosha	Kenosha Municipal	GU	238	BT	329	BT	347	BT	294	BT	264
	Vincent.	<BU-I	59	--	--	--	--	--	--	--	--
Milwaukee	General Mitchell Field . .	SAT	276	SAT	239	SAT	360	SAT	249	BT	360
	Timmerman Field	GU	398	GU	306	--	--	GU	370	GU	298
Ozaukee	Ozaukee	<BU-I	61	GU	153	GU	201	BT	231	GU	156
	Site A	--	--	BT	247	--	--	--	--	BT	251
Racine	Burlington Municipal . . .	BU-II	120	BT	213	GU	187	BT	194	BT	184
	Fox River	<BU-I	66	--	--	--	--	--	--	--	--
	Hunt Field.	<BU-I	64	--	--	--	--	--	--	--	--
	Racine Commercial	BT	195	BT	179	--	--	BT	163	BT	150
	Sylvania.	<BU-I	131	--	--	--	--	BU	188	--	--
	Valhalla.	<BU-I	72	--	--	--	--	--	--	--	--
	Site C	--	--	--	--	GU	263	--	--	SAT	136
Walworth	East Troy Municipal. . . .	<BU-I	68	--	--	--	--	BU	218	--	--
	Big Foot	BU-I	37	--	--	--	--	--	--	--	--
	Gruenwald.	BU-I	51	GU	169	BT	153	GU	150	GU	150
	Playboy.	BU-II (Recreational)	20	--	--	--	--	BU-II (Recreational)	16	--	--
	Lake Lawn Lodge	BU-II (Recreational)	11	--	--	--	--	BU-II (Recreational)	11	--	--
	Site E	--	--	--	--	GU	88	--	--	--	--
Washington	Hartford Municipal	BU-I	133	GU	144	GU	183	GU	166	GU	121
	West Bend Municipal . . .	GU	174	BT	150	BT	187	BT	178	BT	130
	Hahn's Sky Ranch	<BU-I	41	--	--	--	--	--	--	--	--
	Site G	--	--	--	--	BT	281	--	--	--	--
Waukesha	Waukesha County	GU	376	BT	297	--	--	BT	356	BT	300
	Capitol Drive	<BU-I	63	--	--	--	--	--	--	--	--
	Site D	--	--	GU	185	BT	295	--	--	GU	145
	Site F	--	--	GU	203	BT	289	--	--	GU	197
Outside the Region	Fort Atkinson-Whitewater.	GU	40	BT	44	GU	30	GU	26	BT	43
	Watertown Municipal. . .	BU-I	49	BU-I	14	--	--	BU	73	BU-I	12
	Waukegan Memorial. . . .	GU	148	GU	127	GU	135	GU	115	GU	102
Total Airports	--	24	--	16	--	14	--	17	--	17	--
Total Aircraft (1990)	--	--	3,000	--	3,000	--	3,000	--	3,000	--	3,000
Assigned.	--	--	2,892	--	2,999	--	2,999	--	2,998	--	2,999
Unassigned	--	--	108	--	1	--	1	--	2	--	1

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

The factors considered can be grouped into six basic categories: landing area demand/capacity relationships; direct capital, operation, and maintenance costs; environmental considerations; compatibility with other regional plan elements; compatibility with regional airport system development objectives and supporting standards; and other considerations. Another factor which was considered was the location of the air carrier airport in the Region. The four sites considered are discussed in a later section of this chapter.

After the structure of the final system alternatives was established and the future aviation demand on each system airport defined, the evaluation process was initiated by determining how well each airport, and in turn each system, accommodated the existing and probable future demand. Since the capability of an airport's runway system is the primary determinant of airport capacity, more detailed runway capacity analyses were made in order to account for changes in function, aircraft use, and runway configuration of the various airports under the different system plans. The demand-capacity analysis, the first factor considered, also provided information required to define the physical facility requirements for each airport in each system plan.

The second evaluation category involved quantification of several cost factors related to the alternative plans. Included among these is identification of the capital investment needed for airport project development and attendant facility construction as dictated by the forecast demand. Other costs associated with the operation of each system were also investigated, including the cost to the system users (passengers and aircraft owners), the cost of aircraft operations, and the cost of operating and maintaining each public airport throughout the planning period. These cost factors were translated to equivalent average annual costs and discounted to a present worth value to facilitate comparison.

In addition to quantitative evaluation of cost factors, qualitative factors were also taken into account. Consideration was given first to the potential impact of each alternative on the land use pattern and natural resource base of the Region. Of particular importance in this third evaluation category was an investigation of the impact of each alternative on air quality. The potential impact of aircraft noise was also measured by determining the number of people adversely affected.

The fourth category of factors considered was the determination of the compatibility of the alternative airport system plans with other regional plan elements. This determination was one of the more subjective factors considered in the evaluation process. Because the regional airport system planning effort was conducted as an integral part of the overall regional planning program, close coordination of the alternative airport system plans with other regional plan elements was effected in the design process. It was, however, necessary to define which airport system is most consistent with the other regional plan elements.

A fifth evaluation category was the comparison of each alternative plan with the nine development objectives and supporting standards discussed in Chapter VII of this report. The standards used in this evaluation were both qualitative and quantitative, and incorporated in summary form all of the previously considered factors. The final evaluation category included additional factors that should be considered in selecting a final system plan. Among these were the future operating role of existing privately owned airports, the potential consequences resulting from public airport abandonment, and the possible implementation of certain airport operating procedures to aid in alleviating the airport nuisance factor associated with urban locations.

Landing Area Demand/Capacity

A fundamental factor in the selection of any transportation system plan is the determination of how well future traffic activity or demand can be accommodated by the alternative system plans. The accommodation of future demand is determined by comparing the system capacity with the demand and noting the magnitude and characteristics of capacity deficiencies. These deficiencies may then be translated into required physical facility requirements or improvements.

In airport system planning, the airport landing area is the critical component which must be subjected to demand/capacity analysis. The landing area capacity of all existing airports was computed as reported in Chapter 10, and expressed in terms of practical annual capacity (PANCAP). The computed capacities were used for two purposes—as a factor in assigning demand to airports in the alternative system plans, and as a measure of the facility improvements required at each airport under the various alternatives.

The PANCAP of each airport landing area as originally computed was suitable for initial systems analyses and design purposes. To evaluate the alternative plans, however, it was necessary to reexamine and refine the landing area capacities. Therefore, a detailed study was made of the airspace and air traffic control circumstances entailed by each alternative to determine the limits, if any, such air traffic control requirements might place upon individual airport capacity. Further, the annual use that each airport could be expected to experience under the operating conditions imposed by each alternative plan was determined. The annual utilization of an airport is used to multiply its peak hourly capacity to obtain the PANCAP, and is the number of hours per year that the level of aircraft operations is such that the landing area could be expected to operate at its peak hourly capacity.

In Chapter IV of this report it was noted that the airspace system consists of two subsystems—an enroute air traffic control system, and a terminal air traffic control system.

Enroute Air Traffic Control System: Enroute air traffic control system improvements made possible through the implementation of available new technologies have been mandated by the U. S. Department of Transportation. When completed, they may be expected to provide greatly increased airspace system capacity even in areas where severe constraints used to exist. The U. S. Department of Transportation, Air Traffic Advisory Committee, has estimated that implementation of the improvement programs could produce a ninefold increase in air traffic controller capability. In view of these improvements and the fact that the enroute airspace in the Region is currently operating below capacity, even with existing control systems, it must be concluded that the enroute air traffic control system will not limit operations conducted to and from airports in the Region in the foreseeable future. Therefore, it can be assumed that the enroute airspace capacity will have no adverse impact on the landing area capacities of the airports in the Region.

Terminal Air Traffic Control System: Terminal air traffic control is normally associated with the departure and arrival patterns of aircraft operating under visual and instrument flight rules at airports with federally approved and published instrument approach procedures. In the analysis of the terminal air traffic control system, existing visual flight rule (VFR) airports and proposed new airports that may warrant future instrumentation were examined, together with existing airports operating with published instrument approaches. Operations at existing privately owned airports not considered to be a part of the regional system plan but which may continue to operate during all or part of the planning period were also reviewed. Under each alternative, some of these private airports may continue to serve aviation demands, and may or may not create airspace conflicts with operations at airports included in the proposed system. The nature and extent of these potential conflicts could not be fully assessed, however, because neither the continued operation nor the level of activity at the private airports could be forecast. All private airports located within three miles of a proposed new airport were identified, however, so that potential airspace conflicts could be considered in the individual airport master planning phase of the system plan implementation, when airport locations and runway configurations for the public airports involved could be better known. In effect, the additional in-depth terminal airspace analyses covered much more complex airport systems than the initial analyses, which were limited to existing airports with published instrument procedures.

The initial step involved the distribution of the forecast number of annual instrument aircraft approaches (AIA)[2] to the individual airports comprising the alternative system plans. The regional forecast of approximately 22,500 AIA in 1990 was used as a control total, and was distributed to the individual airports by relating instrument approach estimates to the types of aircraft most likely to perform these types of operations, that is, the better equipped, multiengine aircraft.

The distribution process involved developing a relationship between the forecasts of multiengine aircraft operations and total AIA, and the assignment of these aircraft types to the individual airports under each alternative plan. This analysis derived a factor of one AIA per 20.75 multiengine aircraft operations in the plan design year. Applying this factor to the multiengine aircraft demand assigned to each airport produced an estimate of AIA which may be expected to be made at each airport.

The significance of assigning AIA demand to the airports is that FAA eligibility criteria for instrumentation facilities is predicated on attainment of minimum levels of demand. Current FAA criteria require a minimum of 200 AIA for the establishment of nonprecision navigational facilities (VOR, LOC, NDB) and 700 AIA for the establishment of a precision approach facility (ILS). Comparing the eligibility criteria with the distributed AIA demand indicated which airports in the future systems could be expected to be equipped with either a nonprecision or precision approach facility. This factor will affect the annual utilization of the landing area, and thus was significant in the refined capacity computation.

The results of the AIA demand distribution to airports in each of the alternatives evaluated are summarized in Tables 153 through 157. With the potential IFR airports identified, an analysis of the airspace requirements for each alternative plan was the next logical step, to determine if any initially computed landing area capacity required adjustment to reflect these circumstances.

Each airport included in the five alternative plans was evaluated with respect to the airspace capacity needed to support forecast arrivals and departures. The relative location of each airport in the system was critical to this analysis, since interacting or conflicting airspace could result in reduced landing area capacity or a need to restrict operations to VFR only at one or more of the interacting airports. The required terminal airspace areas were defined and are delineated for each airport having approach instrumentation facilities on Maps 35 through 44. The airspace areas represent that block of airspace within which arrivals and departures can be efficiently conducted. Where the airspace blocks of adjacent airports overlap, there is a possibility that restrictive airspace exists and further analysis is required. In such cases, a detailed study of arrival and departure paths was undertaken to determine if minimum aircraft separation standards could be achieved within the overlapping airspace blocks.

Alternative Airport System Plan A: General Mitchell Field: The terminal airspace at General Mitchell Field is unrestricted for northerly and southerly traffic flows as well as for easterly and westerly flows (see Maps 35 and 36). Procedural air traffic control requirements would have to be imposed with respect to nearby airports and are discussed below for the airports affected.

Waukesha County Airport: A minor overlapping of terminal airspace areas between the Waukesha County Airport and Timmerman Field for northerly traffic flow will occur. However, the two airports are sufficiently separated to permit procedural traffic control without airspace conflict. There is sufficient airspace to support unrestricted operations for southerly traffic flow. Overall, airspace is not considered restrictive with respect to airport capacity.

Kenosha Municipal Airport: Operations in a northerly traffic flow at Kenosha Municipal Airport would be unrestricted with the exception that departures would be restricted to two paths (straight-out and to the south) to avoid conflict with arrivals to Racine Commercial Airport. Operations for southerly traffic flow would be unrestricted. Overall, airspace is not considered restrictive with respect to airport capacity.

Racine Commercial Airport: Operations in a southerly direction at Racine Commercial Airport would be totally unrestricted. With respect to a northerly traffic flow, arrivals could be procedurally handled with altitude separation to permit unrestricted operations. Departures would be restricted to two paths—straight-out and a right turn, with a right turn preferred to minimize interaction with operations at General Mitchell Field. Overall, airspace is not considered restrictive with respect to airport capacity.

[2] *Annual instrument approaches (AIA) were defined as those approaches required to be made under instrument rules because of adverse weather conditions, and thus do not represent the total number of instrument approaches or operations which may be conducted.*

Table 153

NUMBER OF ANNUAL INSTRUMENT APPROACHES FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION ALTERNATIVE AIRPORT SYSTEM PLAN A—"NO BUILD": 1990

County	Airport	Airport Classification	Forecast Aircraft Operations	
			Annual Instrument Approaches	Total
Kenosha	Kenosha Municipal	GU	800	205,700
	Vincent	<BU-I	--	52,300
Milwaukee	General Mitchell Field[a]	SAT	9,100	187,800
	Timmerman Field	GU	2,500	334,700
Ozaukee	Ozaukee	<BU-I	--	54,400
Racine	Burlington Municipal	BU-II	--	106,800
	Fox River	<BU-I	--	58,400
	Hunt Field	<BU-I	--	57,200
	Racine Commercial	BT	1,500	164,800
	Sylvania	<BU-I	--	116,800
	Valhalla	<BU-I	--	64,300
Walworth	East Troy Municipal	<BU-I	--	60,200
	Big Foot	BU-I	--	33,000
	Gruenwald	BU-I	--	45,700
	Playboy	BU-II (Recreational)	--	18,100
	Lake Lawn Lodge	BU-II (Recreational)	--	9,500
Washington	Hartford Municipal	BU-I	--	118,300
	West Bend Municipal	GU	1,500	143,700
	Hahn's Sky Ranch	<BU-I	--	36,400
Waukesha	Waukesha County	GU	2,100	318,300
	Capitol Drive	<BU-I	--	49,800
Outside the Region	Waukegan Memorial[b]	GU	900	125,200
	Fort Atkinson-Whitewater[b]	GU	500	31,500
	Watertown Municipal[b]	BU-I	--	49,100
Unassigned Demand[c]	--	--	3,700	77,300
Total	--	--	22,600	2,519,300

[a] *General aviation operations only. Air carrier and military AIA operations of 7,000 and total operations of 139,800 to be added for total airport demand.*

[b] *Regional demand only assigned to airports outside the Region.*

[c] *Unassigned demand is to be distributed to airports in the system as follows:*

Airport	*Annual Instrument Approaches*	*Total*
Kenosha Municipal	*300*	*5,200*
Racine Commercial	*1,600*	*33,500*
General Mitchell Field	*1,600*	*33,500*
Waukegan Memorial	*200*	*5,100*
Total	*3,700*	*77,300*

Source: R. Dixon Speas Associates, Inc.

Table 154

NUMBER OF ANNUAL INSTRUMENT APPROACHES FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION ALTERNATIVE AIRPORT SYSTEM PLAN C—"IDEAL PLAN MODIFIED": 1990

County	Airport	Airport Classification	Forecast Aircraft Operations	
			Annual Instrument Approaches	Total
Kenosha	Kenosha Municipal	BT	1,600	281,900
Milwaukee	General Mitchell Field	SAT	7,700	162,300
	Timmerman Field	GU	1,100	263,900
Ozaukee	Ozaukee	GU	800	130,400
	Site A	BT	2,100	207,600
Racine	Burlington Municipal	BT	1,400	181,200
	Racine Commercial	BT	400	156,900
Walworth	Gruenwald	GU	1,000	143,600
Washington	Hartford Municipal	GU	800	122,200
	West Bend Municipal	BT	1,300	125,600
Waukesha	Waukesha County	BT	2,200	251,400
	Site D	GU	900	157,500
	Site F	GU	300	178,700
Outside the Region	Waukegan Memorial[b]	GU	600	108,900
	Fort Atkinson-Whitewater[b]	BT	400	35,500
	Watertown Municipal[b]	BU	--	12,300
Unassigned Demand	--	--	--	700
Total	--	--	22,600	2,520,000

[a] *General aviation operations only. Air carrier and military AIA operations of 7,000 and total operations of 139,800 must be added for total airport demand.*

[b] *Regional demand only assigned to airports outside the Region.*

Source: R. Dixon Speas Associates, Inc.

Timmerman Field: The relationship of Timmerman Field to General Mitchell Field currently presents and would continue to present an airspace environment that requires air traffic control procedures to permit a relatively unrestricted traffic flow. Arrivals to Timmerman Field in a northerly traffic flow sometimes must maintain an altitude of 2,500 feet until crossing outbound paths from General Mitchell Field, which are held to an altitude of 1,500 feet until adequate overall separation can be established. At other times, arrivals to Timmerman Field are generally turned onto final approach at an altitude of 1,500 feet relatively close to Timmerman Field. Under this procedûre, arrivals overhead to General Mitchell Field are avoided and departures from General Mitchell Field have sufficient airspace to climb over Timmerman Field arrivals. In a southerly flow, departures from Timmerman Field should be limited to two paths—straight-out and a right turn. A left turn would conflict with aircraft arrivals to General Mitchell Field. Straight-out departures have sufficient airspace to climb over General Mitchell Field arrivals. Overall, airspace is not considered restrictive with respect to airport capacity.

Waukegan Memorial Airport: Operations in a northerly and southerly traffic flow at Waukegan Memorial Airport would be unrestricted by operations at airports within the Region.

Table 155

NUMBER OF ANNUAL INSTRUMENT APPROACHES FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION ALTERNATIVE AIRPORT SYSTEM PLAN D—"NONURBAN": 1990

County	Airport	Airport Classification	Forecast Aircraft Operations: Annual Instrument Approaches	Forecast Aircraft Operations: Total
Kenosha	Kenosha Municipal	BT	1,800	297,300
Milwaukee	General Mitchell Field[a].	SAT	6,300	280,600
Ozaukee	Ozaukee	GU	1,000	171,000
Racine	Burlington Municipal	GU	1,000	158,700
	Site C	GU	800	228,200
Walworth	Gruenwald	BT	1,500	127,100
	Site E	GU	500	74,700
Washington	Hartford Municipal	GU	900	155,800
	West Bend Municipal	BT	1,600	156,300
	Site G	BT	2,300	235,700
Waukesha	Site D	BT	2,500	247,600
	Site F	BT	1,500	247,800
Outside the Region	Waukegan Memorial[b].	GU	700	114,700
	Fort Atkinson-Whitewater[b].	GU	200	24,600
Unassigned Demand	--	--	--	600
Total	--	--	22,600	2,520,000

[a] *General aviation operations only. Air carrier and military AIA operations of 7,000 and total operations of 139,800 must be added for total airport demand.*

[b] *Regional demand only assigned to airports outside the Region.*

Source: R. Dixon Speas Associates, Inc.

Fort Atkinson-Whitewater Airport Site: Operations in a northerly and southerly traffic flow at the Fort Atkinson-Whitewater airport site would be unrestricted.

Alternative Airport System Plan C: General Mitchell Field: The terminal airspace conditions for General Mitchell Field under alternative C are the same as under alternative A.

Ozaukee Airport: In a northerly traffic flow, there is adequate terminal airspace at the Ozaukee Airport to support totally unrestricted operations (see Map 37). In a southerly traffic flow, however, arrival traffic must interact with traffic to the West Bend Municipal Airport (see Map 38). Ozaukee Airport arrivals can be maintained without conflict provided they are initiated either from the north (straight-in) or from the east side. Overall, airspace is not considered restrictive with respect to airport capacity.

West Bend Municipal Airport: In a northerly traffic flow, there is interaction between the West Bend Municipal Airport and arrivals at the Hartford Municipal Airport. This interaction can be accommodated procedurally by maintaining arrivals to West Bend Municipal at an altitude of 2,500 feet until clear of the Hartford Municipal final approach course. In a southerly traffic flow there is arrival interaction with respect to Ozaukee arrivals. To avoid direct conflict, arrivals to West Bend will have to be procedurally established on the northwest side. Overall, airspace is not considered restrictive with respect to airport capacity.

Hartford Municipal Airport: Arrivals and departures to the Hartford Municipal Airport in a southerly flow could operate unrestricted. Northerly flow would interact with that generated at the West Bend Municipal Airport. Overall, airspace is not considered restrictive with respect to airport capacity.

Table 156

NUMBER OF ANNUAL INSTRUMENT APPROACHES FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION ALTERNATIVE AIRPORT SYSTEM PLAN E—"NO NEW SITES": 1990

County	Airport	Airport Classification	Forecast Aircraft Operations: Annual Instrument Approaches	Forecast Aircraft Operations: Total
Kenosha	Kenosha Municipal	BT	1,500	252,400
Milwaukee	General Mitchell Field[a]	SAT	8,100	168,400
	Timmerman Field	GU	1,600	316,800
Ozaukee	Ozaukee	BT	1,600	195,300
Racine	Burlington Municipal	BT	1,600	163,400
	Racine Commercial	BT	800	140,000
	Sylvania	BU	--	167,300
Walworth	East Troy Municipal	BU	--	194,400
	Gruenwald	GU	1,000	125,900
	Playboy	BU-II (Recreational)	--	14,700
	Lake Lawn Lodge	BU-II (Recreational)	--	9,500
Washington	Hartford Municipal	GU	1,200	138,100
	West Bend Municipal	BT	1,500	148,400
Waukesha	Waukesha County	BT	2,800	299,900
Outside the Region	Waukegan Memorial[b]	GU	700	97,500
	Fort Atkinson-Whitewater[b]	GU	100	21,800
	Watertown Municipal[b]	BU	--	65,400
Unassigned Demand	--	--	--	1,800
Total	--	--	22,500	2,521,000

[a] *General aviation operations only. Air carrier and military AIA operations of 7,000 and total operations of 139,800 must be added for total airport demand.*

[b] *Regional demand only assigned to airports outside the Region.*

Source: R. Dixon Speas Associates, Inc.

Site D: For a northerly traffic flow at airport site D, there is no airspace interaction with nearby airports. In a southerly traffic flow, arrivals and departures can operate unrestricted provided Waukesha County Airport arrivals are turned onto final approach overhead at Waukesha at an altitude of 2,500 feet until crossing the final approach to site D. Assuming procedural requirements are applied with respect to Waukesha County, site D airspace may be considered unrestrictive with respect to airport capacity.

Waukesha County Airport: To avoid conflict with respect to site D in a southerly traffic flow, arrivals overhead at Waukesha County Airport must be maintained at an altitude of 2,500 feet until crossing site D inbound final approach course. Given this procedure, overall airspace at Waukesha is not considered restrictive with respect to airport capacity.

Gruenwald Airport: Departure operations from Gruenwald Airport in a northerly traffic flow can be procedurally separated from those departing the Burlington Municipal Airport. Operations in a southerly flow, however, require a one-to-one sharing of airspace with operations at the Burlington Municipal Airport. Resolution of this potential airspace conflict will require close cooperation between the airports, but because the anticipated occurrence of landings at the two airports under adverse weather at the same time is slight, the airspace conflict is not considered restrictive to airport capacity.

Table 157

NUMBER OF ANNUAL INSTRUMENT APPROACHES FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION ALTERNATIVE AIRPORT SYSTEM PLAN F—"RELOCATED AIR CARRIER": 1990

County	Airport	Airport Classification	Forecast Aircraft Operations: Annual Instrument Approaches	Forecast Aircraft Operations: Total
Kenosha	Kenosha Municipal	BT	900	229,300
Milwaukee	General Mitchell Field	BT	2,500	303,800
	Timmerman Field	GU	1,500	253,600
Ozaukee	Ozaukee	GU	800	132,300
	Site A	BT	2,300	209,500
Racine	Burlington Municipal	BT	1,000	157,400
	Racine Commercial	BT	900	128,300
	Site C[a]	SAT	4,400	201,000
Walworth	Gruenwald	GU	700	127,600
Washington	Hartford Municipal	GU	700	103,200
	West Bend Municipal	BT	1,200	108,200
Waukesha	Waukesha County	BT	3,200	247,800
	Site D	GU	800	122,800
	Site F	GU	800	169,200
Outside the Region	Waukegan Memorial[b]	GU	400	87,800
	Fort Atkinson-Whitewater[b]	BT	400	35,500
	Watertown Municipal[b]	BU-I	--	11,200
Unassigned Demand	--	--	--	700
Total	--	--	22,500	2,628,500

[a] *General aviation operations only. Air carrier AIA operations of 5,400 and total operations of 108,700 must be added for total airport demand.*

[b] *Regional demand only assigned to airports outside the Region.*

Source: R. Dixon Speas Associates, Inc.

Burlington Municipal Airport: Operations in a northerly traffic flow at Burlington Municipal Airport can be procedurally handled with altitude separation to permit unrestricted operations upon departure from the airport. Turning movements should be limited to straight-out and right turns. Operations in a southerly flow, however, conflict with operations on approach to the Gruenwald Airport, require a one-to-one sharing of airspace, and require close coordination with approach control to the Gruenwald Airport. However, the required sharing of airspace is not considered restrictive to airport capacity.

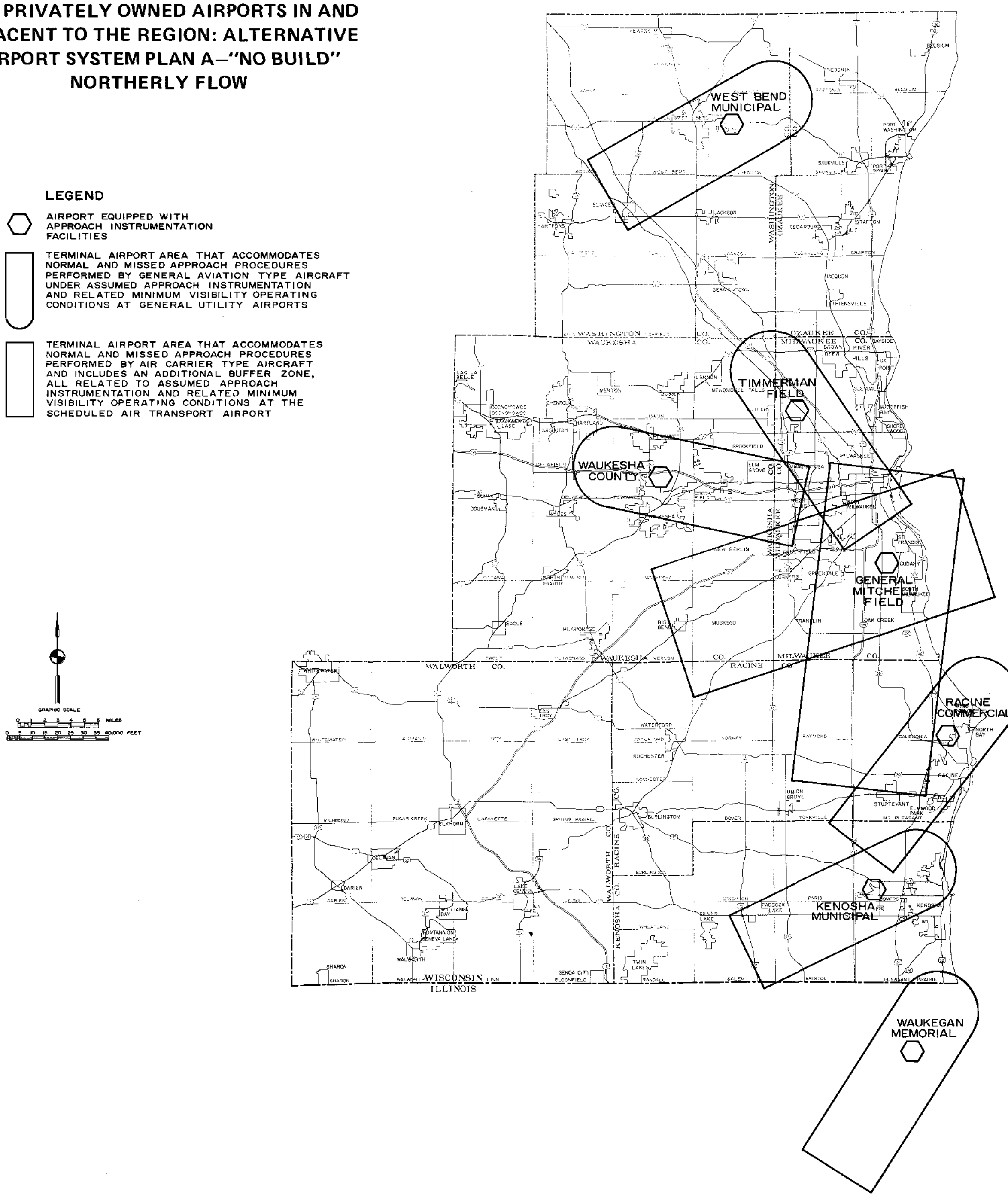
Kenosha Municipal Airport: Operations in a northerly traffic flow at Kenosha Municipal Airport are unrestricted, except for departures, which should be restricted to two paths—straight-out and to the south—to avoid conflict with arrivals to Racine Commercial Airport. Operations in a southerly direction are unrestricted. Overall, airspace is not considered restrictive with respect to airport capacity.

Racine Commercial Airport: Operations in a southerly traffic flow are totally unrestricted. With respect to a northerly traffic flow, arrivals can be procedurally handled with altitude separation to permit unrestricted operations. Departures should be restricted to two paths—straight-out and right turn—with preference given to a right turn to minimize interaction with operations at General Mitchell Field. Overall, airspace is not considered restrictive with respect to airport capacity.

Site A: To avoid conflict with operations at Timmerman Field, arrivals in a northerly traffic flow at site A should be procedurally turned onto final approach from the

Map 35

AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION: ALTERNATIVE AIRPORT SYSTEM PLAN A—"NO BUILD" NORTHERLY FLOW

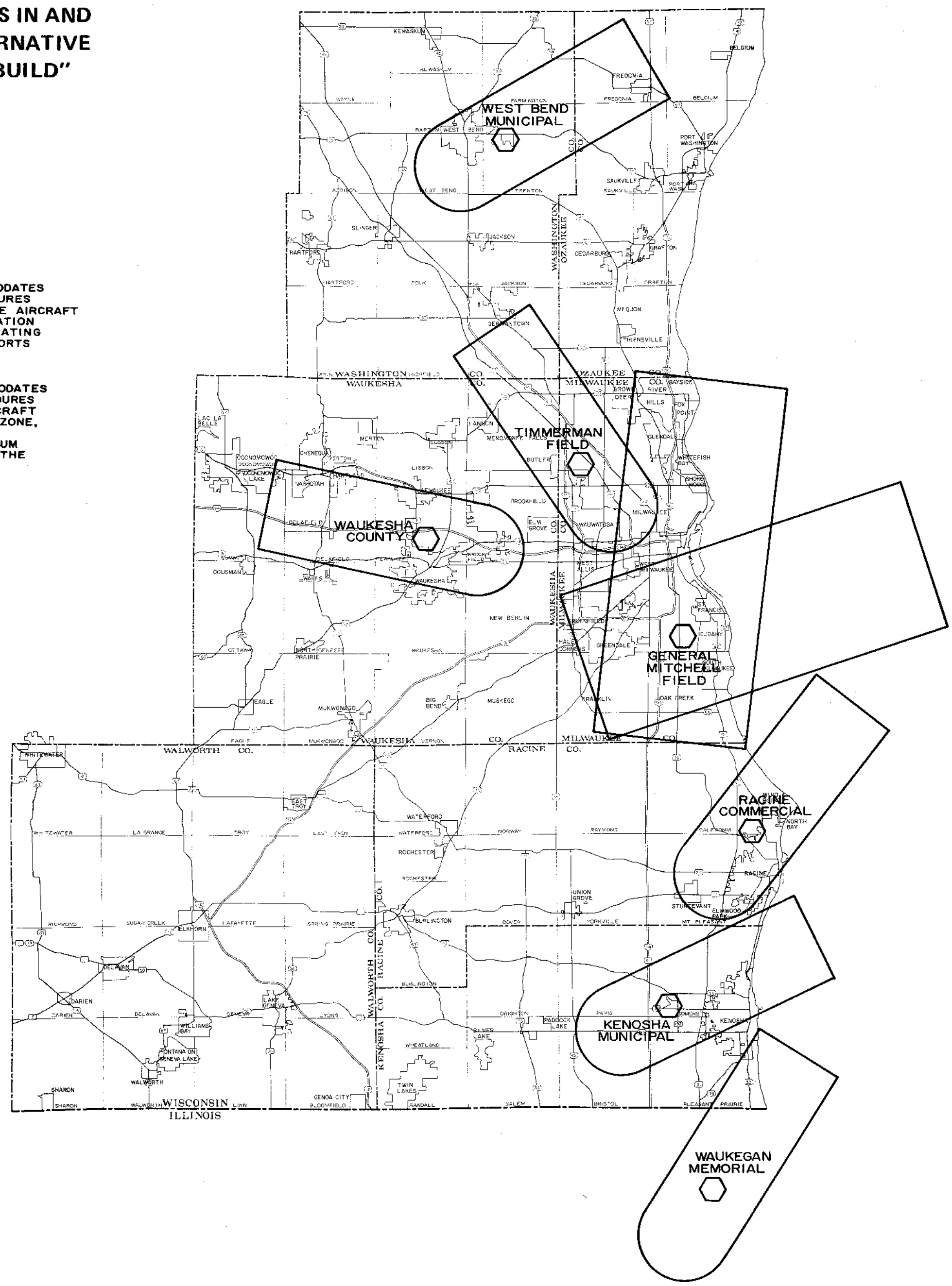


Only six of the airports in the Region may be expected to accommodate aircraft capable of operating under instrument flight rules under alternative system plan A, the "no build" alternative. Operations in a northerly flow will be unrestricted at General Mitchell Field and at the West Bend Municipal Airport, and easily accommodated procedurally on approach to the Waukesha County Airport. Approaches to Timmerman Field and the Racine Commercial Airport must be stratified through altitude separation to provide unrestricted operations. Departures from the Kenosha Municipal and Racine Commercial Airports would be restricted to two paths—straight and right turns—to avoid conflict with operation at adjacent airports. These procedural requirements are not considered unduly restrictive to airport capacity.

Source: R. Dixon Speas Associates, Inc.

Map 36

AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION: ALTERNATIVE AIRPORT SYSTEM PLAN A—"NO BUILD" SOUTHERLY FLOW

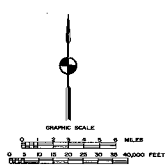


LEGEND

AIRPORT EQUIPPED WITH APPROACH INSTRUMENTATION FACILITIES

TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY GENERAL AVIATION TYPE AIRCRAFT UNDER ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT GENERAL UTILITY AIRPORTS

TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY AIR CARRIER TYPE AIRCRAFT AND INCLUDES AN ADDITIONAL BUFFER ZONE, ALL RELATED TO ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT THE SCHEDULED AIR TRANSPORT AIRPORT

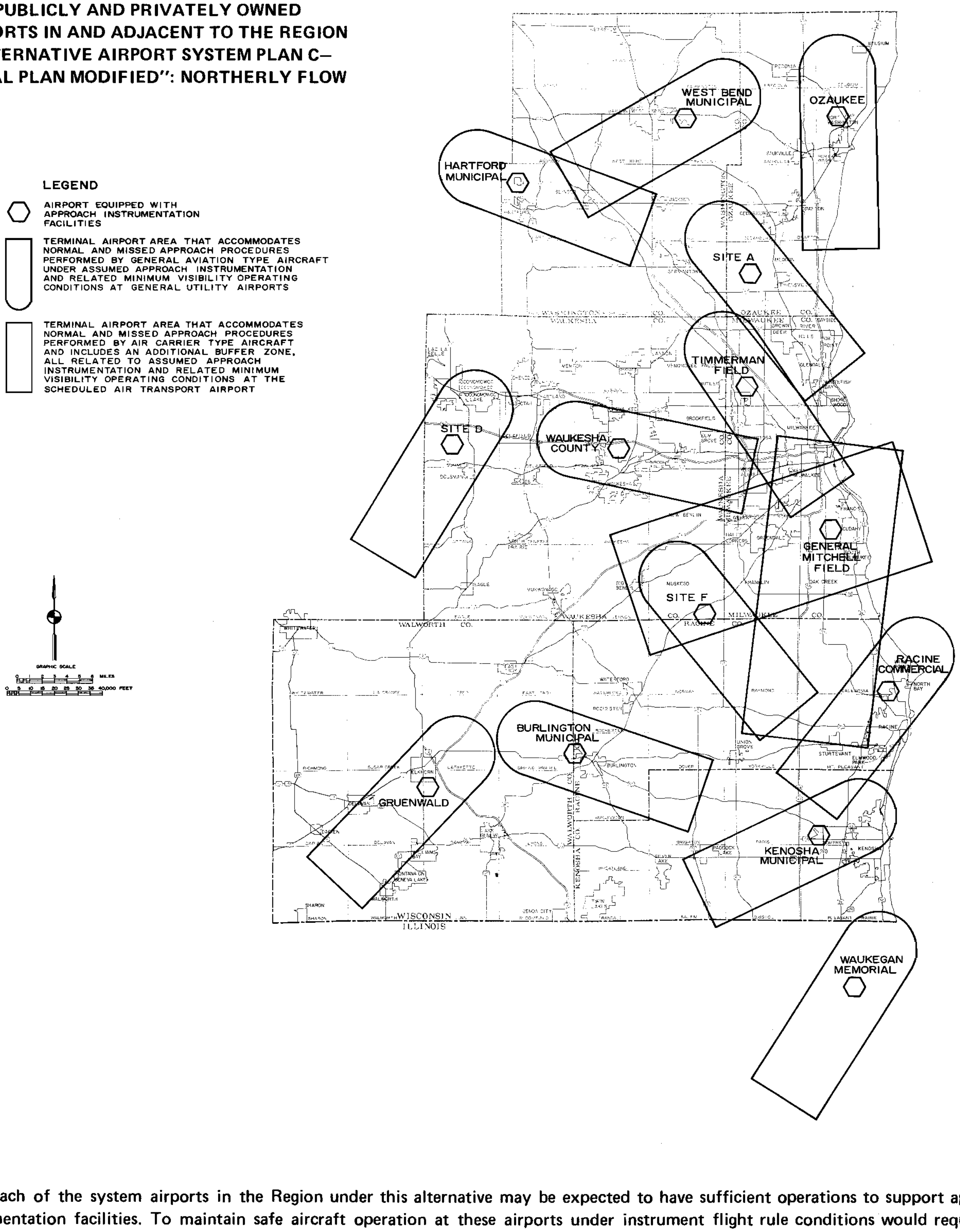


Aircraft operations in a southerly flow under instrument flight rules at the six airports in the Region capable of accommodating such operations under alternative system plan A will be completely unrestricted except at Timmerman Field. Arrivals at Timmerman Field would be unrestricted but departures from Timmerman Field would be limited to right turns and straight out. Sufficient airspace exists to permit the straight-out departures to climb above arrivals to General Mitchell Field. These procedural requirements are not considered unduly restrictive to airport capacity.

Source: R. Dixon Speas Associates, Inc.

Map 37

AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION ALTERNATIVE AIRPORT SYSTEM PLAN C— "IDEAL PLAN MODIFIED": NORTHERLY FLOW

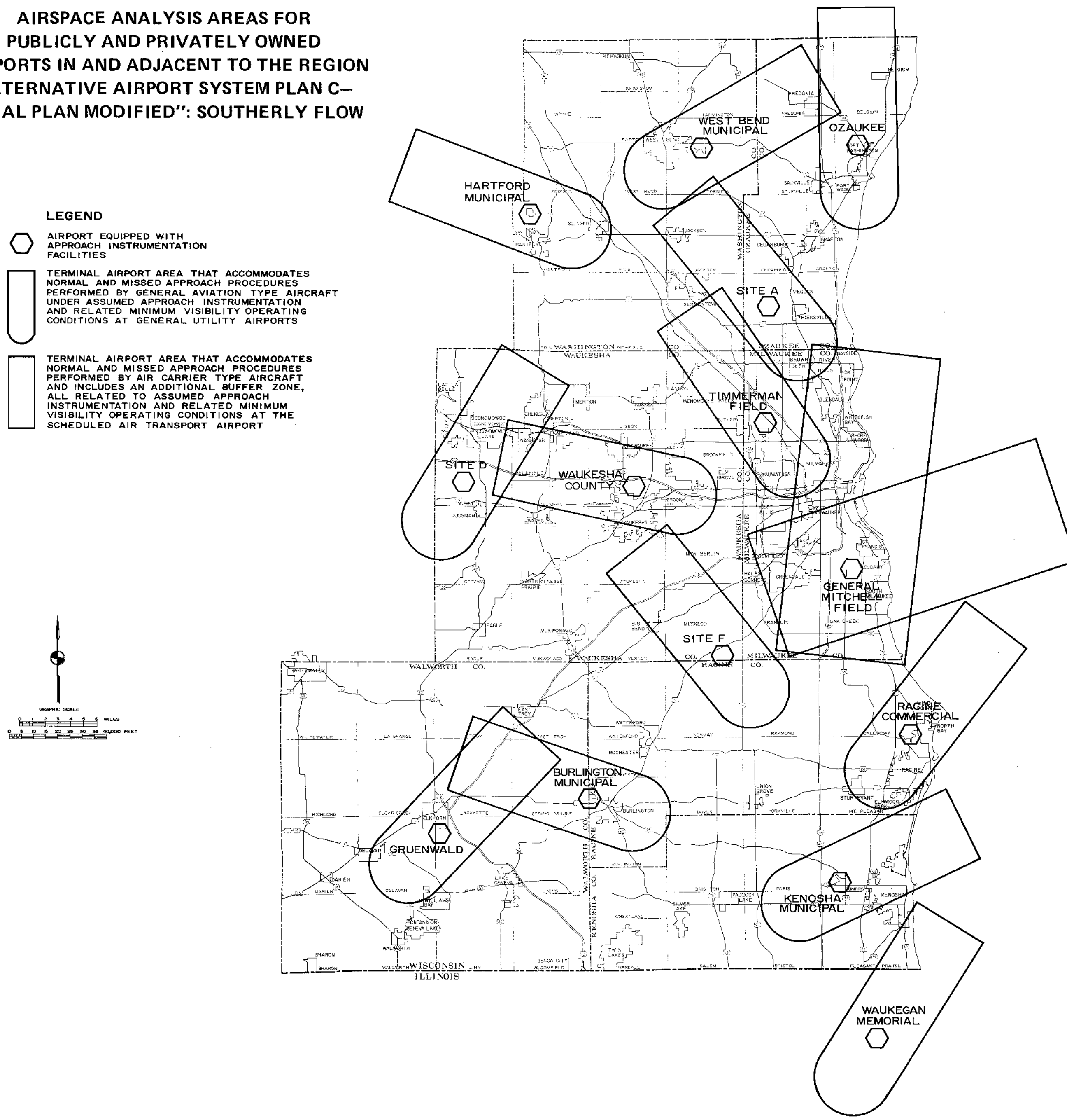


Each of the system airports in the Region under this alternative may be expected to have sufficient operations to support approach instrumentation facilities. To maintain safe aircraft operation at these airports under instrument flight rule conditions would require procedural resolution of the overlapping air space use demands. In northerly flow, no airspace restrictions are expected at General Mitchell Field because of the priority given operations at this airport, nor are conflicts expected at the Ozaukee, Site D, and Waukesha County Airports. Procedural requirements, either restricted turns, altitude separation, or both, may be necessary on approach or departure at the other system airports. None of the procedural requirements are considered unduly restrictive to airport capacity.

Source: R. Dixon Speas Associates, Inc.

Map 38

AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION ALTERNATIVE AIRPORT SYSTEM PLAN C— "IDEAL PLAN MODIFIED": SOUTHERLY FLOW



Aircraft operations in a southerly flow under instrument flight rules may be considered unrestricted at six of the 13 system airports under this alternative: General Mitchell Field, Hartford Municipal, Site D if approaches to Waukesha County Airport are maintained above 2,500 feet until beyond Site D terminal airspace; Kenosha Municipal, Racine Commercial, and Site F. Approaches and departures at the Ozaukee, West Bend Municipal, Waukesha County, Site A, and Timmerman Field Airports must be procedurally separated through either turning restrictions, altitude separation, or both to resolve potential airspace conflicts. Approaches to the Burlington Municipal and Gruenwald Airports would require a one-to-one sharing of airspace. None of the procedural requirements are considered unduly restrictive to airport capacity.

Source: R. Dixon Speas Associates, Inc.

northeast. Departures can operate unrestricted. In a southerly traffic flow, arrivals can operate unrestricted, but should be held to an altitude of 2,500 feet if the approach crosses the centerline extended of the runway at West Bend Municipal Airport, to avoid conflict with departures from the West Bend Airport. Departures in a southerly traffic flow should be limited to two paths—straight-out and a left turn—because right turns would conflict with arrivals to Timmerman Field. Overall, airspace is not considered restrictive with respect to airport capacity.

Timmerman Field: The relationship between Timmerman Field and General Mitchell Field presents an airspace environment that requires air traffic control procedures to permit relatively unrestricted traffic flow. Arrivals to Timmerman Field in a northerly traffic flow must sometimes maintain an altitude of 2,500 feet until crossing outbound paths from General Mitchell Field. These departures are then held at an altitude of 1,500 feet until adequate overall separation can be established. At other times, arrivals to Timmerman Field are generally turned procedurally onto final approach at an altitude of 1,500 feet relatively close to Timmerman Field. Under this procedure, arrivals over General Mitchell Field are avoided and General Mitchell Field departures have sufficient airspace to climb over arrivals to Timmerman Field. In a southerly traffic flow, Timmerman Field departures should be limited to straight-out and right turn paths. A left turn would interact with arrivals to General Mitchell Field, and to some degree with departures from site A. Straight-out departures have sufficient airspace to climb over General Mitchell Field arrivals. Overall, airspace is not considered restrictive with respect to airport capacity.

Site F: Potential airspace conflicts between operations in a northerly traffic flow at this airport and arrivals to General Mitchell Field can be resolved procedurally through vertical separation. Operations in a southerly flow are unrestricted. Airspace is not considered restrictive to airport capacity. Three privately owned VFR airports—Horner Farms, Hunt Field, and O'Leary Field—are located within three miles of the proposed airport at site F. Should site F be developed, it will be necessary for the FAA to establish compatible traffic patterns among these four airports.

Waukegan Memorial Airport: Operations in a northerly and southerly traffic flow at Waukegan Memorial Airport would be unrestricted by operations at airports within the Region.

Fort Atkinson-Whitewater Airport Site: Operations in a northerly and southerly traffic flow at the Fort Atkinson-Whitewater airport site would be unrestricted by operations at airports within the Region.

Alternative Airport System Plan D: With the following exceptions, all comments concerning terminal airspace under alternative plan C are also applicable to alternative plan D.

Site D: There would be no nearby airports to site D under alternative system plan D, and arrivals and departures in a northerly and southerly flow could operate unrestricted (see Maps 39 and 40).

Site E: Arrivals and departures at site E could operate unrestricted in both northerly and southerly traffic flows. Southbound departures should be limited to straight-out and right turns because a left turn would interact to some degree with Burlington Municipal and Gruenwald Airport arrivals. Airspace, however, may be considered not restrictive with respect to airport capacity.

Gruenwald Airport: In a northerly traffic flow, the left turn departures from Gruenwald Airport should be restricted to avoid interaction with approaches to site E, and the straight-out and right turn departures must be procedurally separated from departures from the Burlington Municipal Airport. In a southerly traffic flow, sharing of airspace between approaches to Gruenwald and Burlington Airports shall be required as described under alternative C.

Site C: Because departures in a northerly traffic flow would conflict with arrivals to General Mitchell Field, and in a southerly flow, arrivals would conflict with arrivals to General Mitchell Field, the overall airspace is considered highly restrictive with respect to airport capacity, and the facility would be recommended for VFR operations only.

Site F: With site C operated as a VFR field only, arrivals and departures could be maintained unrestricted in northerly and southerly traffic flow as described under alternative C. Some procedural restrictions would have to be established with respect to General Mitchell Field. Overall, however, airspace is not considered restrictive with respect to airport capacity.

Site G: There would be no airspace conflicts, and unrestricted operations could be maintained at site G under both northerly and southerly traffic flow.

Alternative Airport System Plan E: With the following exceptions, all comments concerning terminal airspace made under alternative plan C are applicable to alternative E.

Timmerman Field: The comments concerning terminal airspace made under alternative plan C apply to Timmerman Field, except for comments made regarding the interaction with site A, which do not apply.

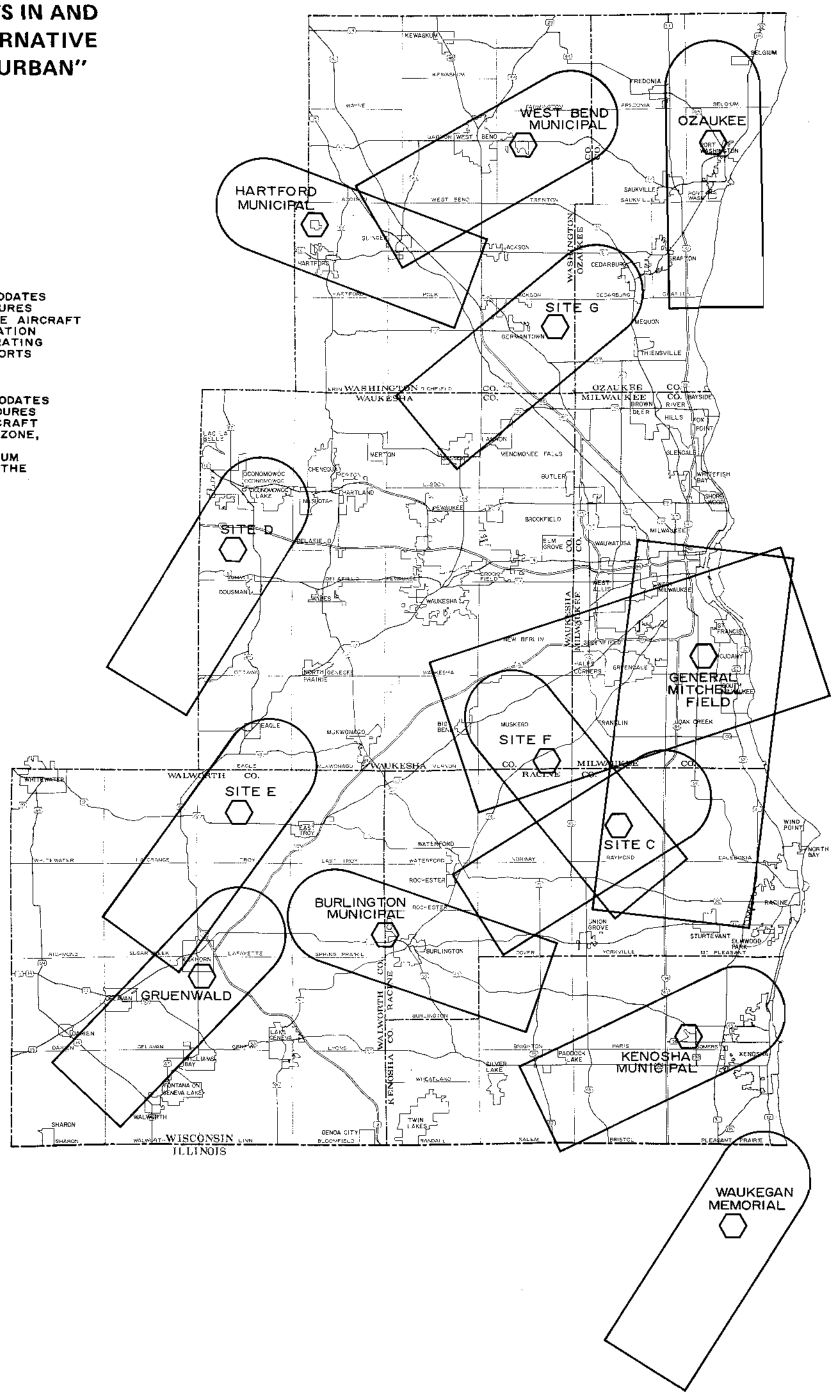
Waukesha County Airport: Operations in a northerly and southerly traffic flow at Waukesha County Airport would be unrestricted (see Maps 41 and 42).

Alternative Airport System Plan F: With the following exceptions, all comments concerning terminal airspace made under alternative plan C are applicable to alternative plan F.

Site C: The terminal airspace at the air carrier airport proposed at site C is considered to be unrestricted for northerly and southerly traffic flows utilizing all runways (see Maps 43 and 44). Procedural air traffic control

Map 39

AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION: ALTERNATIVE AIRPORT SYSTEM PLAN D—"NONURBAN" NORTHERLY FLOW

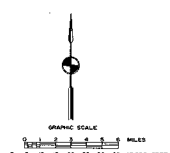


LEGEND

AIRPORT EQUIPPED WITH APPROACH INSTRUMENTATION FACILITIES

TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY GENERAL AVIATION TYPE AIRCRAFT UNDER ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT GENERAL UTILITY AIRPORTS

TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY AIR CARRIER TYPE AIRCRAFT AND INCLUDES AN ADDITIONAL BUFFER ZONE, ALL RELATED TO ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT THE SCHEDULED AIR TRANSPORT AIRPORT



Many potential airspace conflicts could be eliminated under an alternative system plan which replaces present urban airports with ones in less densely developed areas in the Region. Under this "nonurban" alternative, there would be no airspace conflicts with northerly operations at the Ozaukee, Site G, Site D, Kenosha Municipal, Site E, and General Mitchell Field Airports. Turn restrictions and altitude separation procedures would eliminate any potential conflicts between operations at the West Bend and Hartford Municipal Airports, the Burlington Municipal and Gruenwald Airports, and Site F and General Mitchell Field. However, airspace conflicts created by operations at Site C would be considered highly restrictive with respect to airport capacity, and the airport would be recommended for visual flight rule operations only.

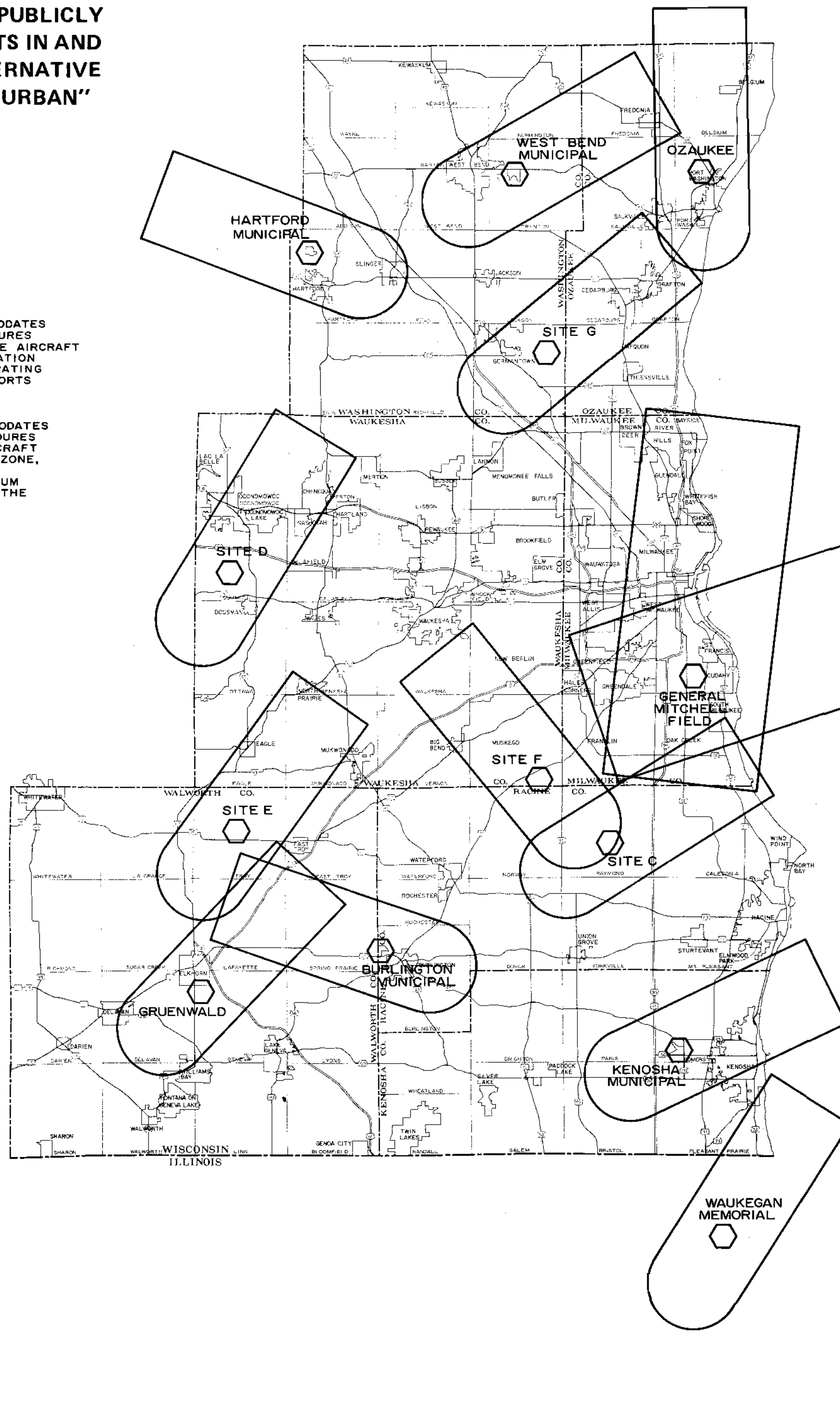
Source: R. Dixon Speas Associates, Inc.

Map 40

AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION: ALTERNATIVE AIRPORT SYSTEM PLAN D—"NONURBAN" SOUTHERLY FLOW

LEGEND

- AIRPORT EQUIPPED WITH APPROACH INSTRUMENTATION FACILITIES
- TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY GENERAL AVIATION TYPE AIRCRAFT UNDER ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT GENERAL UTILITY AIRPORTS
- TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY AIR CARRIER TYPE AIRCRAFT AND INCLUDES AN ADDITIONAL BUFFER ZONE, ALL RELATED TO ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT THE SCHEDULED AIR TRANSPORT AIRPORT



Aircraft operations in a southerly flow may be considered unrestricted at all but five of the airports under the nonurban alternative system plan. Operations on approach to the West Bend Municipal and Ozaukee Airports must be procedurally separated through control of turns on approach to runway headings. Approaches to the Burlington Municipal and Gruenwald Airports require a one-to-one sharing of airspace. Although none of these airspace restrictions are considered to affect airport capacity, the conflict of approaches to Site C with arrivals to General Mitchell Field and departures from Site C with departures from Site F is considered highly restrictive. The airport proposed at Site C would be recommended for visual flight rule operations only.

Source: R. Dixon Speas Associates, Inc.

Map 41

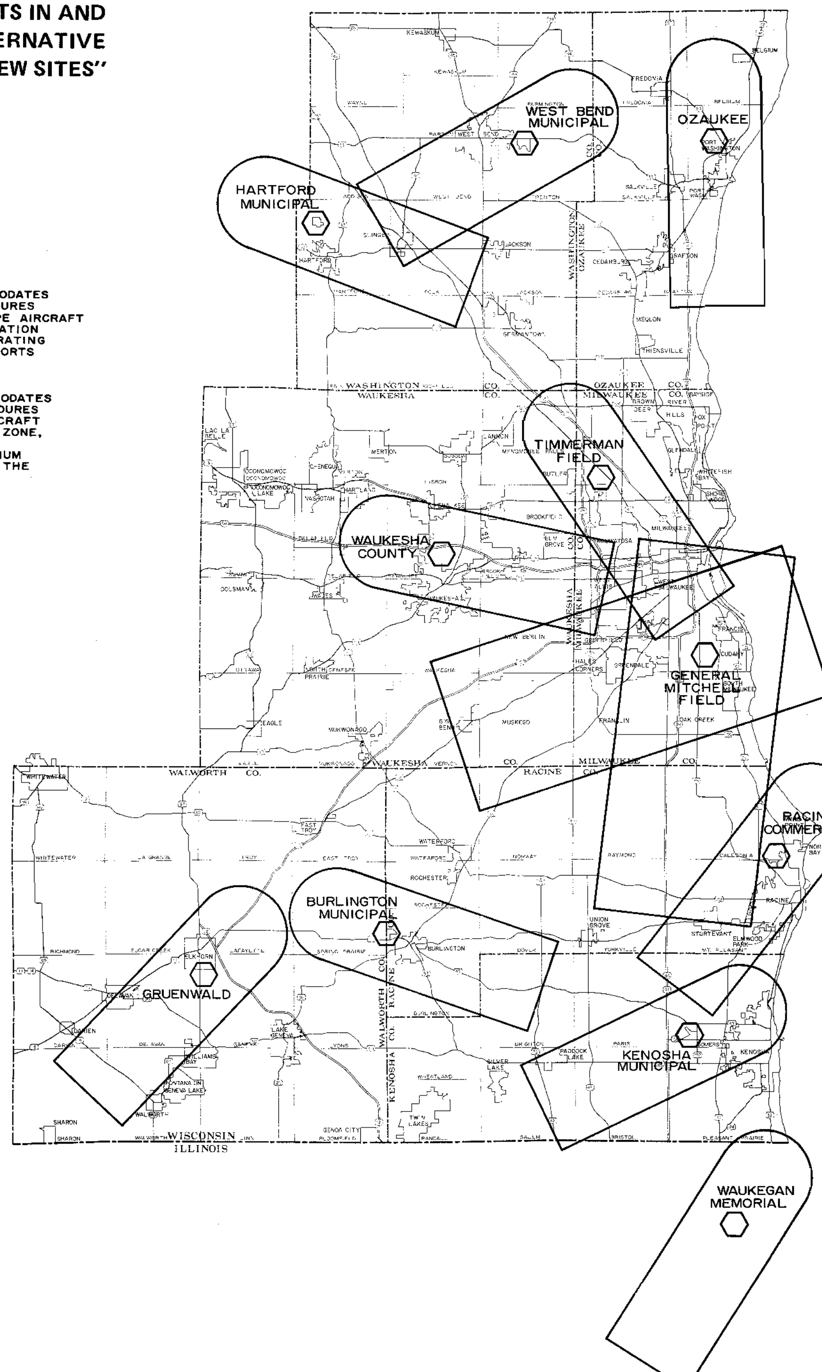
AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION: ALTERNATIVE AIRPORT SYSTEM PLAN E—"NO NEW SITES" NORTHERLY FLOW

LEGEND

AIRPORT EQUIPPED WITH APPROACH INSTRUMENTATION FACILITIES

TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY GENERAL AVIATION TYPE AIRCRAFT UNDER ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT GENERAL UTILITY AIRPORTS

TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY AIR CARRIER TYPE AIRCRAFT AND INCLUDES AN ADDITIONAL BUFFER ZONE, ALL RELATED TO ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT THE SCHEDULED AIR TRANSPORT AIRPORT



Each of the system airports in the Region, under this alternative plan, except recreation-oriented Playboy and Lake Lawn Lodge Airports, may be expected to have sufficient operations to support approach instrumentation facilities. To maintain safe operations at these airports under instrument flight rule conditions would require procedural resolution of overlapping airspace use demands. In a northerly flow, no airspace restrictions are expected at General Mitchell Field, Waukesha County, and Ozaukee Airports. Procedural requirements, either restricted turn on approach or departure and altitude separation, may be required at the other system airports. None of the procedural requirements, however, are so restrictive that airport capacity would be seriously affected.

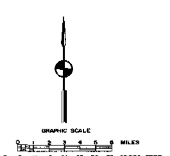
Source: R. Dixon Speas Associates, Inc.

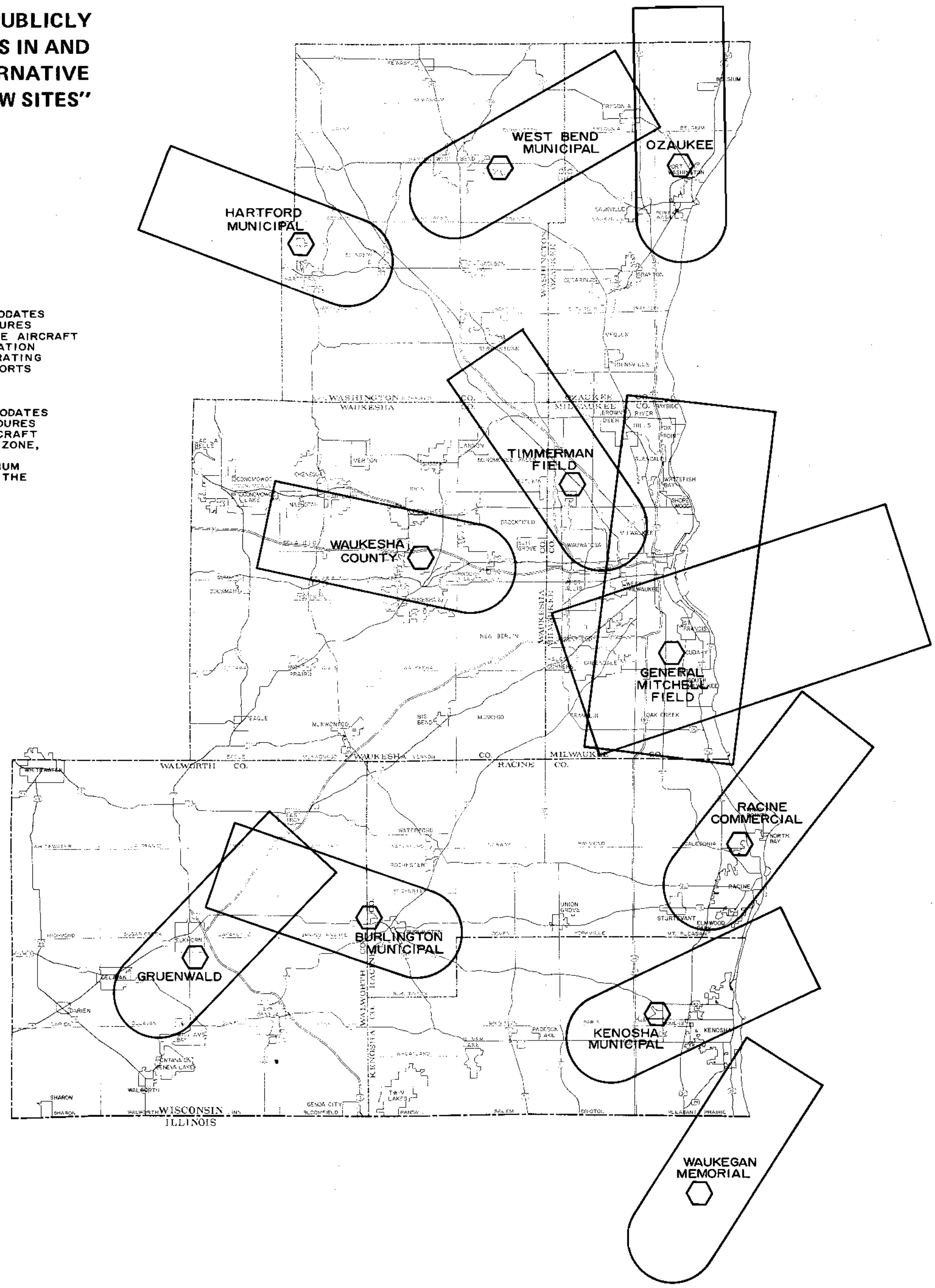
Map 42

AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION: ALTERNATIVE AIRPORT SYSTEM PLAN E—"NO NEW SITES" SOUTHERLY FLOW

LEGEND

- AIRPORT EQUIPPED WITH APPROACH INSTRUMENTATION FACILITIES
- TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY GENERAL AVIATION TYPE AIRCRAFT UNDER ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT GENERAL UTILITY AIRPORTS
- TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY AIR CARRIER TYPE AIRCRAFT AND INCLUDES AN ADDITIONAL BUFFER ZONE, ALL RELATED TO ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT THE SCHEDULED AIR TRANSPORT AIRPORT





Aircraft operations in a southerly direction may be considered unrestricted at six of the 10 system airports having controlled terminal airspace under this alternative. Approaches to the West Bend and Ozaukee Airports must be procedurally separated through approach turn controls and altitude separation to resolve potential airspace conflicts. Approaches to the Burlington Municipal and Gruenwald Airports would require a one-to-one sharing of airspace. None of these restrictions is considered to significantly affect airport capacity.

Source: R. Dixon Speas Associates, Inc.

Map 43

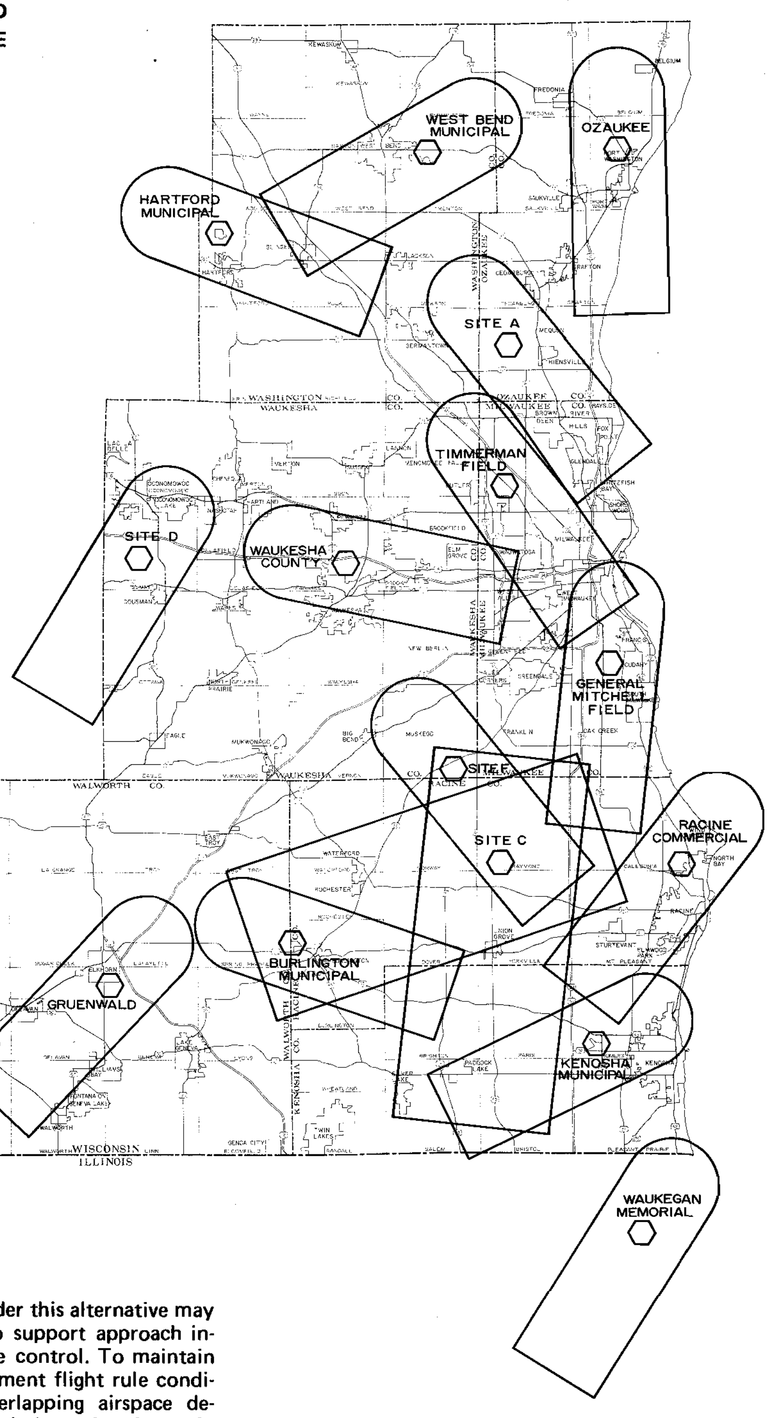
AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION: ALTERNATIVE AIRPORT SYSTEM PLAN F— "RELOCATED AIR CARRIER" NORTHERLY FLOW

LEGEND

AIRPORT EQUIPPED WITH APPROACH INSTRUMENTATION FACILITIES

TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY GENERAL AVIATION TYPE AIRCRAFT UNDER ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT GENERAL UTILITY AIRPORTS

TERMINAL AIRPORT AREA THAT ACCOMMODATES NORMAL AND MISSED APPROACH PROCEDURES PERFORMED BY AIR CARRIER TYPE AIRCRAFT AND INCLUDES AN ADDITIONAL BUFFER ZONE, ALL RELATED TO ASSUMED APPROACH INSTRUMENTATION AND RELATED MINIMUM VISIBILITY OPERATING CONDITIONS AT THE SCHEDULED AIR TRANSPORT AIRPORT

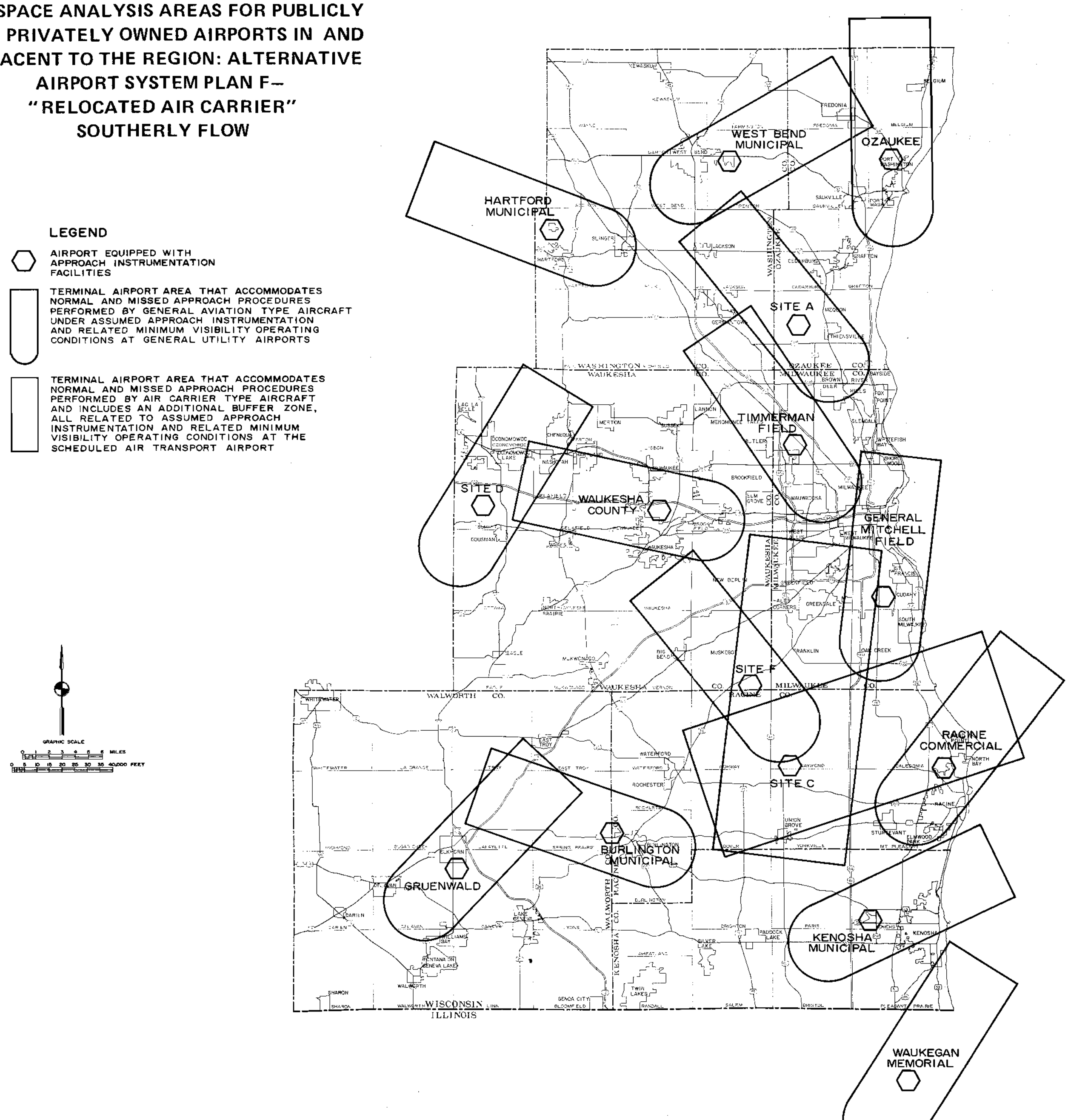


Each of the system airports in the Region under this alternative may be expected to have sufficient operations to support approach instrumentation facilities and terminal airspace control. To maintain safe operations at these airports under instrument flight rule conditions requires procedural resolution of overlapping airspace demands. The terminal airspace at the proposed air carrier airport in northern Racine County is considered to be unrestricted, but procedural controls would have to be imposed upon nearby general aviation airports. In a northerly flow, unrestricted operations may be expected at the Ozaukee, Site D, and Waukesha County Airports. Procedural requirements, either restricted turning patterns, altitude separations, or both, may be necessary on approach or departure at the West Bend Municipal, Hartford Municipal, Site A, Timmerman Field, Racine Commercial, Kenosha Municipal, Burlington Municipal, and Gruenwald Airports. It can be assumed that the general aviation operations at General Mitchell Field would operate on the appropriate runways parallel with those operating at the new air carrier site, and that altitude separtion on approach to General Mitchell Field would eliminate airspace conflicts. Restrictive airspace conflicts between operations at Site F and both the new air carrier airport and General Mitchell Field become such that Site F would be recommended to operate under visual flight rule conditions only.

Source: R. Dixon Speas Associates, Inc.

Map 44

AIRSPACE ANALYSIS AREAS FOR PUBLICLY AND PRIVATELY OWNED AIRPORTS IN AND ADJACENT TO THE REGION: ALTERNATIVE AIRPORT SYSTEM PLAN F— "RELOCATED AIR CARRIER" SOUTHERLY FLOW



Aircraft operations in a southerly flow may be considered unrestricted at four of the 14 system airports under this alternative. The proposed new air carrier site in northern Racine County, Hartford Municipal Airport, Site D if approaches to Waukesha County Airport are maintained above 2,500 feet until beyond Site D terminal airspace, and Kenosha Municipal Airport. Approaches and departures at the Ozaukee and West Bend Municipal, Waukesha County, Site A, Timmerman Field, General Mitchell Field, and Racine Commercial Airports must be procedurally separated through turning restrictions and altitude separation to resolve potential airspace conflicts. Approaches to the Burlington Municipal and Gruenwald Airports would require a one-to-one sharing of airspace. Because of airspace conflicts among operations at Site F, General Mitchell Field, and the new air carrier airport, Site F would be recommended for operation under visual flight rules only. Except for the restrictions required at Site F, the routine procedural controls would not significantly affect airport capacity.

Source: R. Dixon Speas Associates, Inc.

requirements would have to be imposed with respect to nearby airports, and are discussed below where applicable for the airports affected.

General Mitchell Field: Because General Mitchell Field has instrument capability on several runways, it may be assumed that operations at the airport will be on runways parallel to those in use at the air carrier airport at site C to minimize airspace conflicts. In northerly traffic flow, arrivals to General Mitchell Field would have to be held to an altitude of 2,500 feet as long as possible to permit vertical separation between arrivals and departures at site C. Departures could be unrestricted assuming arrivals to Timmerman Field are turned onto the approach course at an altitude of 2,500 feet. Right turn departures should be limited to reduce conflicts with departures from site C. Arrivals from the north could operate unrestricted. Departures in a southerly flow would be limited to two paths—straight-out and a turn away from site C in a left turn off the north-south runway or a right turn off the northeast-southwest runway—to avoid interaction with operations at the air carrier airport at site C. Overall airspace is not considered to restrict airport capacity.

Site F: Northerly traffic flow of arrivals and departures at site F could be maintained relatively unrestricted with site C and General Mitchell Field operating north-south runways, although departures should be limited to left turn and straight-out. With site C and General Mitchell Field operating east-west runways, the airspace would be considered highly restrictive with respect to airport capacity, and the facility at site F would be forced to operate under VFR conditions only. Although departures could operate unrestricted in a southerly traffic flow, arrivals would have to be restricted to avoid conflict with arrivals using the runways at site C and General Mitchell Field. Because of these airspace limitations, site F would be recommended to operate under VFR conditions under this alternative only.

Airport Landing Area Capacity: The landing area capacity of each airport in the five alternative system plans was reviewed and, where appropriate, capacities previously computed and utilized in the demand assignment model were adjusted to reflect the effect of potential airspace interactions, airport layout, aircraft characteristics, and airport utilization. The airport layouts provided information about the number of runways and whether each could be assumed to be paved and lighted. The characteristics of the aircraft types assigned to the airports and the type of operations these aircraft could be expected to perform, including touch-and-go activity, were used in the refined capacity analysis. The forecast aircraft traffic mix obtained from the assignment model was used as a direct input to the capacity calculations.

Calculation of the practical annual capacity of an airport also takes into account normal variations in hourly and daily demand. An annual airport utilization factor is applied to the peak hour capacity of the airport to determine the annual capacity. Utilization factors are determined by several variables, including the number and type of runways and navigation aids as well as the desire of the public to use airports during certain convenient times of the day and days of the week. A utilization factor of 8,760 (24 hours x 365 days) would result from a level of aircraft activity at an airport operating continuously at its peak hourly capacity for each hour of the year. Since demand of this magnitude does not occur, lesser factors developed in recognition of hourly and daily variations in demand and runway and navigation aids at specific airports are used to determine a more realistic practical annual airport capacity.

The initial landing area capacities used in the demand assignment analysis assumed relatively low annual utilization factors. Airport operating experience has shown that airport use increases with increased traffic so that in the refined analysis, utilization factors were increased as appropriately indicated by the demand assignments as related to assumed specific runway configurations and navigation aids under each airport in each alternative system plan. Table 158 summarizes the annual airport utilization factors for general aviation airports within the Region under varying operating environments and airport runway configurations. The annual airport utilization factor was applied to the peak hour runway capacity to determine the PANCAP for each airport. Table 159 summarizes the standard airport capacity factors used to determine the peak hour capacity of basic transport and general and basic utility airports.

Most of the revised landing area capacities were calculated assuming a controlled operating environment, that is, the operation of an air traffic control tower. Current FAA criteria require a minimum of 50,000 annual itinerant aircraft operations to qualify for such a facility. With few exceptions, the general aviation airports within the Region may be expected to meet or exceed this criteria by the plan design year.

With respect to the single air carrier airport within the Region, whether located at General Mitchell Field or relocated to another site, the landing area capacity computation initially performed was based upon proper utilization factors. The only variable requiring review was the change in the total aircraft fleet mix resulting from

Table 158

ANNUAL AIRPORT UTILIZATION FACTORS FOR GENERAL AVIATION AIRPORTS IN THE REGION

Operating Environment and Runway Configuration	Hours of Annual Airport Use
Restricted IFR Operations	
Single Runway Direction.	2,310
Intersecting Runways.	2,381
Nonrestricted IFR Operations	
Single Runway Direction.	2,340
Intersecting Runways.	2,412
VFR Operations Only	2,200

Source: R. Dixon Speas Associates, Inc.

Table 159

STANDARD AIRPORT CAPACITY FACTORS USED TO DETERMINE PEAK HOUR CAPACITY FOR BASIC TRANSPORT AND GENERAL AND BASIC UTILITY AIRPORTS IN THE REGION

Airport Classification	Percent Aircraft Mix by Aircraft Type		Touch-and-Go Operations as Percent of Total Operations	Runway		Peak Hour Runway Capacity (Aircraft)
	C	D and E		Number	Configurations[a]	
Basic Transport	10	90	30	3	⌿⌿	140
	10	90	30	2	//	152
	10	90	30	2	⌿	105
	10	90	30	1	/	95
General Utility	0	100	60	3	⌿⌿	189
	0	100	60	2	//	208
	0	100	60	2	⌿	127
	0	100	60	1	/	118
Basic Utility	0	100 E	80	2	⌿ [b]	134
	0	100 E	80	2	⌿	145
	0	100 E	80	1	/	134

[a] *Air traffic control tower assumed to be operating.*

[b] *Without air traffic control tower.*

Source: R. Dixon Speas Associates, Inc.

the varying general aviation aircraft assigned to the air carrier airport under the five alternative system plans. Table 160 identifies the aircraft mix resulting from the alternatives studied and the PANCAP of the air carrier airport under each alternative system plan.

Based on these considerations, the landing area capacities of all airports were reviewed and adjusted where necessary. The demand assignment based on the initial landing area capacities remains valid because the process relied upon relative values of demand as a percent of capacity. The results of the landing area demand/capacity analysis are summarized in Tables 161 through 165, which set forth the landing area capacities expressed as PANCAP, the demand expressed in terms of annual operations, and the ratio of demand to capacity under each of the five alternative system plans.

Analysis of the tables indicates considerable variation in demand as a percent of landing area capacity at each airport under the alternative plans. The demand/capacity analysis for each airport under the five alternative plans is shown in Table 166. General Mitchell Field may be expected to experience a demand exceeding its runway system capacities under each alternative in which it is expected to serve as the regional air carrier airport. The three new airports included under alternative D that are expected to operate near capacity—site D near Oconomowoc, site F near Big Bend, and site G near Germantown—would require parallel primary runways

Table 160

AIRCRAFT FLEET MIX AND RUNWAY CAPACITY FOR THE AIR CARRIER AIRPORT IN THE REGION UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1990

Aircraft Type	Percent Aircraft Fleet Mix[a]				
	A	C	D	E	F
AA	30	33	23	32	33
A	1	1	1	1	1
B	9	10	8	11	13
C	26	22	14	22	19
D and E . . .	34	34	54	34	29
Total	100	100	100	100	100
Practical Annual Capacity (PANCAP)[b]	284,000	290,000	320,000	290,000	246,000

[a] *Typical aircraft types include:*

AA - 3-4 engine wide body: B-747, DC-10, L-1011
A - 4 engine jets: B-707, DC-8
B - 2-3 engine jets: B-727, DC-9
C - Corporate aircraft: FH-227, Gulfstream II
D and E - Single and twin engine propeller: B-99, C-172

[b] *1973 runway utilization and air navigation aid facilities are assumed.*

Source: R. Dixon Speas Associates, Inc.

Table 161

COMPARISON OF LANDING AREA CAPACITY AND FORECAST AIRCRAFT OPERATIONS DEMAND AT AIRPORTS IN AND ADJACENT TO THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN A—"NO BUILD": 1990

County	Airport	Airport Classification	Capacity			Demand (Operations)	Demand as Percent of Capacity
			Peak Hour	Annual Utilization (Hours)	PANCAP[a] (Operations)		
Kenosha	Kenosha Municipal	GU	118	2,381	284,600	205,700	73
	Vincent.	<BU-I	--	--	81,900	52,300	64
Milwaukee	General Mitchell Field . .	SAT	--	--	284,000	327,600[b]	115
	Timmerman Field	GU	208	2,412	501,700	334,700	67
Ozaukee	Ozaukee	<BU-I	--	--	54,600	54,400	100
Racine	Burlington Municipal . . .	BU-II	--	--	280,900	106,800	38
	Fox River	<BU-I	--	--	52,200	58,500	112
	Hunt Field.	<BU-I	--	--	50,400	57,200	113
	Racine Commercial	BT	95	2,412	229,100	164,800	72
	Sylvania.	<BU-I	--	--	103,200	116,800	113
	Valhalla.	<BU-I	--	--	54,000	64,300	119
Walworth	East Troy Municipal. . . .	<BU-I	--	--	195,300	60,300	31
	Big Foot	<BU-I	--	--	113,400	33,000	29
	Gruenwald.	<BU-I	--	--	85,500	45,700	53
	Playboy[c]	BU-II (Recreational)	--	--	--	18,100	--
	Lake Lawn Lodge[c]	BU-II (Recreational)	--	--	--	9,500	--
Washington	Hartford Municipal	BU-I	--	--	280,900	118,300	42
	West Bend Municipal . . .	GU	118	2,412	284,600	143,700	51
	Hahn's Sky Ranch.	<BU-I	--	--	58,800	36,400	62
Waukesha	Waukesha County	GU	189	2,340	442,300	318,300	72
	Capitol Drive	<BU-I	--	--	49,800	56,300	113
Demand Assigned Outside the Region	--	--	--	--	--	200,400	--
Unassigned Demand	--	--	--	--	--	77,200	--
Total Demand	--	--	--	--	--	2,660,300	--

[a] *PANCAP stands for practical annual capacity, which equals the peak hour capacity times the annual utilization.*

[b] *Includes forecast of 187,800 general aviation and 139,800 air carrier and military operations.*

[c] *Restricted use, private recreation airports. The airport capacity was artifically limited to limit demand assignment.*

Source: R. Dixon Speas Associates, Inc.

Table 162

COMPARISON OF LANDING AREA CAPACITY AND FORECAST AIRCRAFT OPERATIONS DEMAND AT AIRPORTS IN AND ADJACENT TO THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN C—"IDEAL MODIFIED": 1990

County	Airport	Airport Classification	Capacity			Demand (Operations)	Demand as Percent of Capacity
			Peak Hour	Annual Utilization (Hours)	PANCAP (Operations)		
Kenosha	Kenosha Municipal	BT	140	2,412	337,600	281,900	83
Milwaukee	General Mitchell Field . . .	SAT	--	--	290,000	302,100[a]	104
	Timmerman Field	GU	208	2,412	501,700	263,900	52
Ozaukee	Ozaukee	GU	127	2,412	306,300	130,400	42
	Site A	BT	105	2,412	253,300	207,600	82
Racine	Burlington Municipal	BT	105	2,412	253,300	181,200	71
	Racine Commercial	BT	105	2,412	253,300	156,900	62
Walworth	Gruenwald	GU	127	2,412	306,300	143,600	47
Washington	Hartford Municipal	GU	127	2,412	306,300	122,200	40
	West Bend Municipal	BT	105	2,412	253,300	125,600	50
Waukesha	Waukesha County	BT	140	2,412	337,600	251,400	75
	Site D	GU	127	2,412	306,300	157,500	51
	Site F	GU	127	2,412	306,300	178,700	58
Demand Assigned Outside the Region	--	--	--	--	--	156,800	--
Unassigned Demand	--	--	--	--	--	700	--
Total Demand	--	--	--	--	--	2,660,500	--

[a] *Includes forecast of 162,300 general aviation and 139,800 air carrier and military operations.*

Source: R. Dixon Speas Associates, Inc.

to increase their capacity. Except for these three airports and the Kenosha Municipal Airport under alternative D, the Waukesha County Airport under alternative E and the Ozaukee and Sylvania Airports under alternative A, most general aviation airports may be expected to operate near or under 80 percent of the annual runway system capacity under all of the alternative system plans.

The landing area demand/capacity analysis of the five alternatives and significant plan comparisons are summarized in the following paragraphs.

Alternative Airport System Plan 3A: The six IFR airports in this plan are forecast to accommodate a sufficient level of AIA in 1990 to warrant precision instrument approach facilities (ILS). Approximately 0.6 percent of regional AIA will be accommodated at the two IFR airports outside the Region. The landing area capacities of these key airports are adequate to accommodate the forecast IFR aircraft operations. Total forecast operations (general aviation, air carrier, military) at General Mitchell Field, however, exceed the landing area capacity by 15 percent.

Landing area capacities at the six airports are not restricted by airspace limitations. Because of the close spacing, IFR operations will generally require procedural controls on arrivals to the Waukesha County, Timmerman Field, and Racine Commercial Airports, and limited departure paths at Kenosha Municipal, Racine Commercial, and Timmerman Field Airports to maintain separation standards between aircraft performing under IFR conditions.

Implications of these procedures are extra aircraft flight time because of circuitous routing through terminal airspace, and an additional air traffic controller workload.

Table 163

COMPARISON OF LANDING AREA CAPACITY AND FORECAST AIRCRAFT OPERATIONS DEMAND AT AIRPORTS IN AND ADJACENT TO THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN D—"NONURBAN": 1990

County	Airport	Airport Classification	Capacity			Demand (Operations)	Demand as Percent of Capacity
			Peak Hour	Annual Utilization (Hours)	PANCAP (Operations)		
Kenosha	Kenosha Municipal	BT	140	2,412	337,600	297,300	88
Milwaukee	General Mitchell Field . . .	SAT	--	--	320,000	420,400[a]	131
Ozaukee	Ozaukee	GU	127	2,412	306,300	171,000	56
Racine	Burlington Municipal	GU	127	2,412	306,300	158,700	52
	Site C	GU	127	2,200	279,400	228,200	82
Walworth	Gruenwald.	BT	105	2,412	253,300	127,100	50
	Site E	GU	127	2,412	306,300	74,700	25
Washington	Hartford Municipal	GU	127	2,412	306,300	155,800	51
	West Bend Municipal	BT	105	2,412	253,300	156,300	62
	Site G	BT	105	2,412	253,300	235,700	93[b]
Waukesha	Site D	BT	105	2,412	253,300	247,600	98[b]
	Site E	BT	105	2,412	253,300	247,800	97[b]
Demand Assigned Outside the Region	--	--	--	--	--	139,300	--
Unassigned Demand	--	--	--	--	--	600	--
Total Demand	--	--	--	--	--	2,660,500	--

[a] *Includes forecast of 280,617 general aviation and 139,800 air carrier and military operations.*

[b] *The capacity of these airports can be increased by the addition of parallel primary runways on the existing site. Increased capacity would result in a demand as percent of capacity of 73, 73, and 70 percent, respectively.*

Source: R. Dixon Speas Associates, Inc.

Alternative Airport System Plan C: The 13 IFR airports in this plan are forecast to accommodate a sufficient level of AIA in 1990 to warrant precision approach facilities at 11 airports and nonprecision approach facilities at the other two airports. Approximately 0.4 percent of regional AIA will be accommodated at the two IFR airports outside the Region. Although the landing area capacities of these key airports are adequate to accommodate the forecast IFR aircraft operations, total forecast operations at General Mitchell Field exceed the landing area capacity by 4 percent.

Landing area capacities at the 13 airports are not restricted by airspace limitations. Because of the close spacing, IFR operations will generally require procedural controls on arrivals to the Ozaukee, West Bend Municipal, Hartford Municipal, Waukesha County, Racine Commercial, site A, Timmerman Field, Burlington Municipal, Gruenwald and site F Airports. Limited departure paths would have to be imposed at the Kenosha Municipal, Racine Commercial, site A, Burlington Municipal, Gruenwald and Timmerman Field Airports.

Alternative Airport System Plan D: The 12 IFR airports in this plan are forecast to accommodate a sufficient level of AIA in 1990 to warrant precision approach control facilities at 11 airports and a nonprecision approach facility at the remaining airport. However, site C, which would be eligible for a precision approach facility, experiences highly restrictive airspace conflicts. It is recommended that this airport be limited to VFR operations only. Approximately 0.4 percent of regional AIA will be

Table 164

COMPARISON OF LANDING AREA CAPACITY AND FORECAST AIRCRAFT OPERATIONS DEMAND AT AIRPORTS IN AND ADJACENT TO THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN E—"NO NEW SITES": 1990

County	Airport	Airport Classification	Capacity			Demand (Operations)	Demand as Percent of Capacity
			Peak Hour	Annual Utilization (Hours)	PANCAP (Operations)		
Kenosha	Kenosha Municipal	BT	140	2,412	337,600	252,400	75
Milwaukee	General Mitchell Field . . .	SAT	--	--	290,000	308,200[a]	106
	Timmerman Field	GU	208	2,412	501,700	316,800	63
Ozaukee	Ozaukee	BT	105	2,412	253,300	195,300	77
Racine	Burlington Municipal	BT	105	2,412	253,300	163,400	65
	Racine Commercial	BT	105	2,412	253,300	140,000	55
	Sylvania.	BU	--	--	319,000	161,300	51
Walworth	East Troy Municipal.	BU	--	--	319,000	194,400	61
	Gruenwald	GU	127	2,412	306,300	125,900	41
	Playboy[b]	BU-II (Recreational)	--	--	--	14,700	--
	Lake Lawn Lodge[b]	BU-II (Recreational)	--	--	--	9,500	--
Washington	Hartford Municipal	GU	127	2,412	306,300	138,100	45
	West Bend Municipal	BT	105	2,412	253,300	148,400	59
Waukesha	Waukesha County	BT	140	2,412	337,600	299,900	89
Demand Assigned Outside the Region	--	--	--	--	--	184,700	--
Unassigned Demand	--	--	--	--	--	1,800	--
Total Demand	--	--	--	--	--	2,654,800	--

[a] *Includes forecast of 168,400 general aviation and 139,800 air carrier and military operations.*

[b] *Private airports were assumed to serve a limited portion of general aviation demand.*

Source: R. Dixon Speas Associates, Inc.

accommodated at the two IFR airports outside the Region. The landing area capacities of these key airports are adequate to accommodate the forecast IFR aircraft operations except at General Mitchell Field, where the total forecast operations exceed the landing area capacity by 31 percent. Three other new airports (sites D, F, and G) experience heavy demand, and forecast operations use over 90 percent of available landing area capacity. Capacity can be increased at these three airports through the introduction of parallel runways, but there is no feasible solution for the Mitchell Field capacity limitation.

Landing area capacities at 11 of the 12 airports are not restricted by airspace limitations. At site C, operations must be restricted to VFR only because of conflicts with operations at General Mitchell Field and site F. Because of close spacing, IFR operations will generally require procedural controls for operations at site E and Burlington Municipal and Gruenwald Airports.

This plan is the most restrictive from the standpoint of airspace limitations affecting landing area capacity. Site C must be restricted to VFR operations only. This general utility airport is forecast to be assigned about 4 percent of the regional AIA. Due to airspace restrictions, however, this IFR demand must be diverted elsewhere.

Alternative Airport System Plan E: The 10 IFR airports in this plan are forecast to accommodate a sufficient level of AIA in 1990 to warrant precision approach control

Table 165

COMPARISON OF LANDING AREA CAPACITY AND FORECAST AIRCRAFT OPERATIONS DEMAND AT AIRPORTS IN AND ADJACENT TO THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN F—"RELOCATED AIR CARRIER": 1990

County	Airport	Airport Classification	Capacity: Peak Hour	Capacity: Annual Utilization (Hours)	Capacity: PANCAP (Operations)	Demand (Operations)	Demand as Percent of Capacity
Kenosha	Kenosha Municipal	BT	140	2,412	337,600	229,300	68
Milwaukee	General Mitchell Field . . .	BT	208	2,412	501,700	303,800[a]	64
	Timmerman Field	GU	208	2,412	501,700	253,600	51
Ozaukee	Ozaukee	GU	127	2,412	306,300	132,300	43
	Site A	BT	105	2,412	253,300	209,500	83
Racine	Burlington Municipal	BT	105	2,412	253,300	157,400	62
	Racine Commercial	BT	105	2,412	253,300	128,300	51
	Site C	SAT	--	--	246,000	201,000	82
Walworth	Gruenwald	GU	127	2,412	306,300	127,600	42
Washington	Hartford Municipal	GU	127	2,412	306,300	103,200	34
	West Bend Municipal	BT	105	2,412	253,300	108,200	43
Waukesha	Waukesha County	BT	140	2,412	337,600	247,800	73
	Site D	GU	127	2,412	306,300	122,800	40
	Site F	GU	127	2,381	302,400	169,200	56
Demand Assigned Outside the Region	--	--	--	--	--	134,500	--
Unassigned Demand	--	--	--	--	--	700	--
Total Demand	--	--	--	--	--	2,629,200	--

[a] *Includes forecast of 288,800 general aviation and 15,000 military operations.*

Source: R. Dixon Speas Associates, Inc.

facilities at all 10 airports. Approximately 0.4 percent of regional AIA will be accommodated at the two IFR airports outside the Region. Except for General Mitchell Field, the landing area capacities of these key airports are adequate to accommodate the forecast IFR aircraft operations. The 1990 forecast of total operations at General Mitchell Field is 106 percent of the landing area capacity, and further landing area expansion would be required.

Landing area capacities at the 10 IFR airports are not restricted by airspace limitations. Procedural controls similar to those discussed in alternative C will be needed because of the close spacing of several airports in the plan.

Alternative Airport System Plan F: The 14 IFR airports in this plan are forecast to accommodate a sufficient level of AIA in 1990 to warrant precision approach control facilities at 12 airports and nonprecision approach facilities at the other two airports. Approximately 0.4 percent of the regional AIA will be accommodated at the two IFR airports outside the Region. The landing area capacities of these key airports are adequate to accommodate the forecast IFR aircraft operations, and the total forecast operations at General Mitchell Field only utilize 64 percent of the landing area capacity.

Landing area capacities at 13 of the 14 airports are not restricted by airspace limitations. At new airport site F, landing area capacity is limited because of airspace conflicts between operations at site C, the proposed new air carrier airport, and at General Mitchell Field. Because of close spacing of several airports, IFR operations will generally require procedural controls similar to those required in alternative C, with the addition of controls placed on arrivals and departures at General Mitchell Field to avoid conflict with operations at site C and Timmerman Field.

Table 166

LANDING AREA DEMAND/CAPACITY ANALYSIS FOR AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F

		Alternative System Plan									
		A		C		D		E		F	
County	Airport	Airport Classification	Demand as Percent of Capacity	Airport Classification	Demand as Percent of Capacity	Airport Classification	Demand as Percent of Capacity	Airport Classification	Demand as Percent of Capacity	Airport Classification	Demand as Percent of Capacity
Kenosha	Kenosha Municipal . . .	GU	73	BT	83	BT	88	BT	75	BT	68
Milwaukee	General Mitchell Field .	SAT	115	SAT	104	SAT	131	SAT	106	BT	64
	Timmerman Field. . . .	GU	67	GU	52	--	--	GU	63	GU	51
Ozaukee	Ozaukee	<BU-I	100	GU	42	GU	56	BT	77	GU	43
	Site A.	--	--	BT	82	--	--	--	--	BT	83
Racine	Burlington Municipal. .	BU-II	38	BT	71	GU	52	BT	65	BT	62
	Racine Commercial. . .	BT	72	BT	62	--	--	BT	55	BT	51
	Sylvania	<BU-I	113	--	--	--	--	BU	51	--	--
	Site C.	--	--	--	--	GU	82	--	--	SAT	82
Walworth	East Troy Municipal . .	<BU-I	31	--	--	--	--	BU	61	--	--
	Gruenwald	BU-I	53	GU	47	BT	50	GU	41	GU	42
	Playboy[a].	BU-II (Recreational)	--	--	--	--	--	BU-II (Recreational)	--	--	--
	Lake Lawn Lodge[a] . . .	BU-II (Recreational)	--	--	--	--	--	BU-II (Recreational)	--	--	--
	Site E.	--	--	--	--	GU	25	--	--	--	--
Washington	Hartford Municipal . . .	BU-I	42	GU	40	GU	51	GU	45	GU	34
	West Bend Municipal. .	GU	51	BT	50	BT	62	BT	59	BT	43
	Site G.	--	--	--	--	BT	93	--	--	--	--
Waukesha	Waukesha County. . . .	GU	72	BT	75	--	--	BT	89	BT	73
	Site D.	--	--	GU	51	BT	98	--	--	GU	40
	Site F.	--	--	GU	58	BT	97	--	--	GU	56

[a] *Restricted use, private recreation airports. The airport capacity was artificially limited to limit demand assignment.*

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

This plan is somewhat restrictive from the standpoint of airspace limitations affecting landing area capacity. One new airport—site F—cannot achieve full landing area capacity because of airspace conflicts, and would be expected to operate under VFR conditions. Assigned IFR demand must be diverted elsewhere.

Alternative system plans D and F contain the most significant airspace limitations. Site F in alternative F and site C in alternative D must be restricted to VFR operations, and therefore have a two-fold constraint—reduced airport capacity and no accommodation of IFR operations. Alternative plan F is most adversely affected by airspace limitations.

The assigned demand to General Mitchell Field exceeds landing area capacity under alternatives A, C, D, and E. Alternative plans A, C, and E can be expanded to overcome the capacity deficiency, but the deficiency under alternative D is so great that no feasible solution is possible. Of all the alternative system plans, alternative D also contains the most general aviation airports having forecast operations approaching the capacity of the airports. Therefore, alternative D contains the most serious capacity deficiency of all plans evaluated.

All plans require the implementation of procedural controls to affect proper separation standards of aircraft operating in a controlled airspace environment. The degree of procedural controls in terms of the number of airports affected does not vary significantly among the five plans.

Table 167 provides a comparative ranking of each alternative system plan based upon the demand/capacity analysis.

Costs Attendant to the Alternative Airport System Plans

An important part of the plan evaluation involved development of the costs associated with the alternative system plans. Demand/capacity analyses for each airport in each system were translated into physical facility needs

Table 167

COMPARATIVE RANKING OF ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F BASED ON DEMAND/CAPACITY ANALYSIS

Alternative Airport System Plan	Comparative Ranking		
	Airspace Limitations	Landing Area Capacity	Total
A—No Build	5	2	7
C—Ideal Modified	4	4	8
D—Nonurban	2	1	3
E—No New Sites	3	3	6
F—Relocated Air Carrier	1	5	6

Source: SEWRPC.

and attendant capital investment requirements were calculated. Various operating costs associated with each system, including system user costs, delay costs of aircraft operation, and airport operation and maintenance costs, were also estimated. Finally, to facilitate a comparative evaluation of the alternatives, all costs were reduced to a present worth value and an equivalent annual cost.

Capital Costs: The demand/capacity analyses provided the basic information necessary to define the physical facility requirements for each airport in each alternative plan. With knowledge of the proposed operational function of each airport, as indicated by its classification, its probable future activity level, and the needed runway capacity, decisions concerning desirable landing area configuration, terminal area, and aircraft support facility requirements could be made. Once the facility improvements required to either upgrade an existing airport or to develop a new airport were detailed, the Commission staff working with the Wisconsin Department of Transportation staff studied each proposal to determine the engineering feasibility of undertaking the indicated improvements. Finally, cost estimates for required development projects and the cost of attendant facilities, such as utilities and highway access, were estimated.

Project Development Costs: The specified airport improvements include runway number, length, width, and strength; taxiway length and width; runway and taxiway lighting; visual approach aids; terminal building floor space; hangared storage area; aircraft apron parking area; and automobile parking area. The land area required for existing airport expansion and new airport construction is also included. The determination of the needed improvements was based on the airport development standards set forth in Chapter VII, and on a careful review of airport layout plans, aerial photography, and onsite inspection of each existing or proposed airport site. The terminal area and aircraft support area facility requirements for each airport in the alternative plans were determined by applying the appropriate sizing criteria to the forecast aviation demand assigned to each airport site.

For new airport locations, the construction of the required surface access roads within the airport boundaries was considered an integral part of the airport development cost. The length of such roads was determined from an analysis of aerial photographs on which the proposed sites were delineated. The on-airport access roads were assumed to be extensions of county trunk highways as required by the standards, in order to provide users with good direct arterial highway access to the proposed airport. The cost of any required off-airport access roads was not included in the total site development costs.

The unit cost data used to develop the capital cost estimates were derived from a review of recent airport, arterial highway, and public utility system improvement projects within the Region. Typical unit cost data used for a new general utility airport and a new basic transport airport are set forth in summary form in Table 168.

A summary of the estimated total project development costs for each existing or new airport for which improvements are planned under each alternative is provided in Tables 169 through 173. These summary cost data are presented under five main categories: 1) land costs, which include the estimated cost of acquiring land to expand existing or build new airports and the cost of acquiring land for runway clear zones; 2) landing area development costs, which include the estimated cost of constructing, reconstructing, or extending paved runways and taxiways; providing visual approach aids such as REILS and VASI; and constructing or reconstructing aircraft parking apron areas; 3) terminal area development costs, which include the estimated cost of constructing, reconstructing, or expanding terminal buildings, automobile parking areas, and airport access roads; 4) hangar area development costs, which include the estimated cost of constructing, reconstructing, or expanding hangared aircraft storage areas; and 5) engineering design and related costs, which have been estimated at 30 percent of the total of all other costs at basic utility and general utility airports, 25 percent at basic transport airports, and 20 percent at the air carrier airports.

Although not a cost normally borne by the sponsor of the airport involved, the cost of providing needed hangared aircraft storage area was included in the estimated total project development costs. The construction of hangars is normally accomplished as a lease-hold improvement at publicly owned airports. It is recognized that the sale of land currently in airport use represents a potential revenue source to partially offset the cost of developing an airport at an alternative site. Under alternative D, four urban airports would be abandoned and replaced by new airports elsewhere in the Region. The revenues received from the sale of airport land for other purposes must be reinvested in new airport development according to the Federal Aviation Administration regulations, if federal funds have been used in development of the existing airport and are anticipated to be used in the new airport. The estimated revenues from the sale of the abandoned airport sites will be identified under discussion of alternative D.

Attendant Facility Costs: In addition to the airport project development costs, some new airport construction projects and major expansion programs for existing

Table 168

ESTIMATED COST OF CONSTRUCTING NEW GENERAL UTILITY AND BASIC TRANSPORT AIRPORTS IN THE REGION: 1973 DOLLARS

Airport Construction Item	General Utility Airport[f]		Basic Transport Airport[g]	
	Unit Cost	Total Cost	Unit Cost	Total Cost
Runways (Feet)				
Primary				
75 x 4,000	$ 63/lineal foot	$252,000	$ --	$ --
100 x 5,600	--	--	115/lineal foot	644,000
Secondary				
75 x 3,200	63/lineal foot	201,600	--	
100 x 4,500	--	--	115/lineal foot	517,500
Taxiways	40/lineal foot	332,000	50/lineal foot	560,000
Lighting				
HIRL-Primary Runway[a]	14/lineal foot	56,000	14/lineal foot	78,400
MIRL-Secondary Runway[b]	10/lineal foot	32,000	10/lineal foot	45,000
Visual Aids				
Taxiway Exit Lights	Lump Sum	40,000	Lump Sum	40,000
REILS[c]	3,000/End	12,000	3,000/End	12,000
VASI-2[d]	Lump Sum	12,000	--	
VASI-4[d]	--	--	Lump Sum	15,000
Total Estimated Construction Cost[e]	$ --	$937,600	$ --	$1,911,900

[a] *HIRL-High Intensity Runway Lights.*

[b] *MIRL-Medium Intensity Runway Lights.*

[c] *REILS-Runway End Identification Lights.*

[d] *VASI-Visual Approach Slope Indicator.*

[e] *Includes cost of minimum grading and drainage but not tree clearing and grubbing, estimated to cost $450 per acre, nor the cost of turfing grubbed acres, estimated at $1,000 per acre.*

[f] *Costs based on 12,500 pound single wheel gross takeoff weight and E-7 soil classification.*

[g] *Costs based on 60,000 pound dual wheel gross takeoff weight and E-7 soil classification.*

Source: Wisconsin Department of Transportation, Division of Aeronautics.

airports may entail related facility costs. These attendant costs, which usually involve providing or extending public utility services and public highway access, are engendered by increased airport demands. Attendant facility costs for the expansion of public utilities, including water and sewer service, and the provision of highway access between the airport boundary and an existing arterial highway, were estimated for existing or proposed locations where the need for such facilities was evident. Table 174 summarizes these costs by airport within each alternative plan.

The attendant cost of providing public highway access was determined by estimating the distance required to provide each existing or new airport with the type of highway service specified in Objective 6 set forth in Chapter VII of this report. This standard stipulates that both general utility and basic transport airports be directly connected to a county trunk highway. The estimated cost for connecting highways was based on the construction of the required roadway from the airport property boundary to an existing county trunk highway. The estimated cost of the Airport Spur Freeway proposed to connect General Mitchell Field with IH 94 was obtained from the Wisconsin Division of Highways, and was included as an attendant cost to improvements at General Mitchell Field under alternative plans in which air carrier serivce is maintained at the airport. The on-airport access road costs are accounted for in the project development costs.

Table 169

PROJECT DEVELOPMENT COSTS FOR GENERAL AVIATION AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN A—"NO BUILD": 1973 DOLLARS

County	Airport[b]	Airport Classification	Development Cost[a]					
			Land	Landing Area	Terminal Area	Hangar Area	Engineering	Total
Kenosha	Kenosha Municipal . . .	GU	$ --	$ 11,000	$ --	$ --	$ 3,300	$ 14,300
Milwauke	Timmerman Field	GU	--	23,000	--	--	6,900	29,900
Ozaukee	--	--	--	--	--	--	--	--
Racine	Burlington Municipal . . Racine Commercial . . .	BU-II BT	-- 350,000	206,000 1,119,200	-- --	-- --	61,800 367,300	267,800 1,836,500
Walworth	East Troy Municipal. . .	<BU-I	373,100	396,000	--	--	230,700	999,800
Washington	Hartford Municipal . . . West Bend Municipal . .	BU-I GU	-- --	170,000 89,000	-- --	-- --	51,000 26,700	121,000 115,700
Waukesha	Waukesha County	GU	--	53,000	--	--	13,300	66,300
Total	--	--	$723,100	$2,067,200	$ --	$ --	$761,000	$3,551,300

[a] *Includes project development costs to bring existing publicly owned airports and Racine Commercial Airport to minimum standards of the airport classifications shown.*

[b] *Except for developments at Racine Commercial Airport, no improvement to other privately owned airports within this system plan have been assumed, therefore, no project development costs have been shown.*

Source: R. Dixon Speas Associates, Inc., Wisconsin Department of Transportation, and SEWRPC.

Under alternative F, the single air carrier airport required to serve the Region is relocated to a site other than General Mitchell Field. This new site would have to be provided with a controlled access highway spur connecting the airport with a state trunk highway freeway facility, and the cost for such a connection was included as part of the airport development costs. Improvements to other arterials around the relocated air carrier airport are included under attendant costs.

Summary-Capital Cost Requirements: The capital investment required for the general aviation airports in the alternative plans ranged from a low of $3.5 million under the "no build" alternative to a high of $45.3 million under the "nonurban" alternative, which requires the construction of five new airports to replace four existing airports. The estimated revenue that may be anticipated from the sale of the land occupied by the urban airports which would be abandoned is as follows: Timmerman Field, 497 acres, $1,750,000; Racine Commercial, 490 acres, $1,700,000; East Troy Municipal, 40 acres, $120,000; and Waukesha County, 443 acres, $1,550,000. Except for the revenue received from the sale of the privately owned Racine Commercial Airport, these funds must be reinvested in airport facilities at alternative locations, thus offsetting the cost of development of the new airports required under alternative D. Some of the revenues received from sale of the airport lands may have to be applied to the cost of demolishing airport facilities and making the land suitable for other urban uses. Table 175 summarizes the capital costs for general aviation airports under each alternative. It is interesting to note that with the exception of alternative A, the capital investment requirements vary by only approximately $5 million.

Alternative E is the second least costly plan—$36.9 million—in that it utilizes several existing private airport locations upgraded to the required airport classification standards. This alternative also includes improvement of four key privately owned airports to achieve maximum practical capacity.

The capital investment required for alternative C, $41.1 million, is between that required for alternatives D and E. Rather than rely on the use of existing privately-owned public use airports, this alternative provides three new general aviation airports. Also, the existing publicly owned airports in the Region would be improved to achieve maximum practical capacity.

Table 170

PROJECT DEVELOPMENT COSTS FOR GENERAL AVIATION AND AIR CARRIER AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN C—"IDEAL MODIFIED": 1973 DOLLARS

County	Airport	Airport Classification	Development Cost					
			Land	Landing Area	Terminal Area	Hangar Area[a]	Engineering	Total
Kenosha	General Aviation Kenosha Municipal	BT	$ 722,600	$ 3,849,300	$ 622,700	$ 471,300	$ 1,298,700	$ 6,964,600
Milwaukee	General Mitchell Field . .	SAT	--	140,300	231,900	323,700	93,100	789,000
	Timmerman Field	GU	--	261,900	396,900	214,200	197,700	1,070,700
Ozaukee	Ozaukee	GU	438,200	1,119,400	395,400	266,300	585,900	2,805,200
	Site A	BT	840,600	2,520,300	548,500	484,700	977,400	5,371,500
Racine	Burlington Municipal . . .	BT	447,000	2,026,900	438,800	375,700	728,100	4,016,500
	Racine Commercial	BT	2,161,600	1,361,500	483,200	214,100	1,001,600	5,222,000
Walworth	Gruenwald	GU	399,600	1,143,300	403,800	300,600	584,000	2,831,300
Washington	Hartford Municipal	GU	191,700	878,900	386,100	178,200	437,100	2,072,000
	West Bend Municipal . . .	BT	490,800	1,848,300	464,400	152,000	700,800	3,656,300
Waukesha	Waukesha County	BT	644,800	1,521,100	416,500	313,000	645,600	3,541,000
	Site D	GU	406,200	1,159,000	410,700	324,000	592,900	2,892,800
	Site F	GU	579,800	1,156,400	419,100	324,200	646,600	3,126,100
Subtotal	--	--	$7,322,900	$18,986,600	$ 5,618,000	$3,942,000	$ 8,489,500	$ 44,359,000
Milwaukee	Air Carrier General Mitchell Field . .	SAT	$1,000,000	$13,300,000	$76,300,000	$1,200,000	$18,120,000	$109,920,000
Subtotal	--	--	$1,000,000	$13,300,000	$76,300,000	$1,200,000	$18,120,000	$109,920,000
Total	--	--	$8,322,900	$32,286,600	$81,918,000	$5,142,000	$26,609,500	$154,279,000

[a] *Includes engineering costs.*

Source: Wisconsin Department of Transportation and SEWRPC.

Alternative F illustrates the cost impact which results from shifting the air carrier airport serving the Region from General Mitchell Field to a new site. The capital investment for the air carrier airport required to serve the Region is estimated at about $122 million under each alternative that retains and improves General Mitchell Field as the air carrier airport (see Table 176). This cost pertains to alternatives C, D, and E. Under alternative F, which relocates the air carrier airport to a new site in northern Racine County, the cost to provide the new air carrier airport approximates $213.0 million.

The total capital costs required to implement improvements to the Region's air carrier airport and general aviation airports under each alternative are summarized in Table 177.

<u>Cost to the Federal Government:</u> As already noted, many airports included in each alternative plan could be expected to have sufficient aviation activity to warrant the provision and operation of an air traffic control tower to ensure a controlled operating environment and thus increase runway capacity, and to warrant some type of instrument landing aid to facilitate poor-weather flight operations. Normally both types of facilities are constructed, equipped, operated, maintained, and owned by the federal government. The control towers, and for the most part the landing aids, are constructed and equipped with money from the FAA facilities and equipment fund, while the FAA operating budget provides for the staffing and maintenance of the facilities. The costs of providing, operating, and maintaining the air traffic control towers and the electronic landing aids were assumed to be borne entirely by the federal government, and were not included in the capital or operating costs.

To illustrate the magnitude of the cost of these supplemental facilities, estimates of the cost of providing the equipment were developed for each alternative. A unit cost of $275,000 was assumed for provision of a traffic control tower at the general aviation airports. Installation of a nonprecision landing aid, such as a VOR, was assumed to cost about $100,000, while the installation of a precision landing aid, such as an ILS or MLS, was assumed to cost about $200,000. Based upon these unit costs, the cost of providing both control towers and instrument approach aids for each airport system plan is summarized in Table 178. Table 179 provides similar costs by airport. These costs reflect the landing aid requirements as dictated by probable future aviation demand.

Table 171

PROJECT DEVELOPMENT COSTS FOR GENERAL AVIATION AND AIR CARRIER AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN D—"NONURBAN": 1973 DOLLARS

County	Airport	Airport Classification	Development Cost					
			Land	Landing Area	Terminal Area	Hangar Area[a]	Engineering	Total
	General Aviation							
Kenosha	Kenosha Municipal	BT	$ 722,600	$ 3,912,700	$ 643,900	$ 513,000	$ 1,319,800	$ 7,112,000
Milwaukee	General Mitchell Field . .	SAT	--	140,300	309,400	433,700	112,400	495,000
Ozaukee	Ozaukee	GU	438,200	1,177,900	417,600	351,700	610,100	2,995,500
Racine	Burlington Municipal . . .	GU	424,000	554,700	349,600	313,900	398,400	2,040,600
	Site C	GU	573,800	1,234,500	468,900	437,400	683,100	3,397,700
Walworth	Gruenwald	BT	788,400	2,307,400	483,200	309,700	894,700	4,783,400
	Site E	GU	447,200	1,044,500	338,500	156,300	549,000	2,535,500
Washington	Hartford Municipal	GU	191,700	924,700	407,000	245,300	457,000	2,225,700
	West Bend Municipal . . .	BT	490,800	1,920,300	483,900	218,100	723,800	3,836,900
	Site G	BT	845,800	2,584,000	582,800	546,300	1,003,100	5,562,000
Waukesha	Site D	BT	736,600	2,600,400	595,800	568,900	983,200	5,484,900
	Site F	BT	830,000	2,481,700	586,100	505,200	974,500	5,377,500
Subtotal	--	--	$6,489,100	$20,883,100	$ 5,666,700	$4,599,500	$ 8,709,100	$ 46,347,500
	Air Carrier							
Milwaukee	General Mitchell Field . .	SAT	$1,000,000	$13,300,000	$76,300,000	$1,200,000	$18,120,000	$109,920,000
Subtotal	--	--	$1,000,000	$13,300,000	$76,300,000	$1,200,000	$18,120,000	$109,920,000
Total	--	--	$7,489,100	$34,183,100	$81,966,700	$5,799,500	$26,829,100	$156,267,500

[a] *Includes engineering costs.*

Source: Wisconsin Department of Transportation and SEWRPC.

Operating Costs: In addition to the capital investment required to improve the airports comprising each alternative, the costs associated with the operation of each system were estimated. These include the associated ground travel cost to the system users, the delay cost of aircraft operations, and the cost to operate and maintain the airports in each alternative system.

Cost to System Users: An important factor in evaluating alternative airport system plans is the cost borne by the system users in getting to and from the airports. For general aviation users, the cost entailed by pilots and passengers in getting from their point of origin to the airport and from the airport to their destination is determined. For commercial airline users, the ground travel time and cost must be similarly determined.

The general aviation assignment model used in the airport system planning effort permits computation of total ground travel time to and from the assigned airports. The number of person trips to and from the airport is a function of the number of operations generated by each type of aircraft and the average number of passengers involved in each such operation. For each type C aircraft operation, three person trips are assumed to be generated; for each D or E aircraft, 2.4 and 2.2 person trips, respectively, are assumed to be generated per aircraft operation. The number of person trips are converted to man-hours of ground travel time by applying appropriate travel time factors for each airport service area.

Since the assignment model will distribute aircraft owners to more distant airports when nearby airports become congested, the model is sensitive to airport capacity, and tabulates the extra travel time incurred due to these congested facilities. Since the program computes travel time of assigned aircraft owners only, these values must be supplemented with travel time values for those aircraft owners not assigned to an airport, that is, for the unsatisfied demand. The unsatisfied demand is assigned to the closest airport that can support the aircraft type, and the ground travel time is computed using zone of origin or destination to airport travel timetables.

The travel time spent by air carrier passengers originating within the Region and using the Region's air carrier airport was identified in an earlier section of this chapter. About 4.1 million hours of ground travel time are expected to be used annually by air carrier passengers

Table 172

PROJECT DEVELOPMENT COSTS FOR GENERAL AVIATION AND AIR CARRIER AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN E–"NO NEW SITES": 1973 DOLLARS

County	Airport	Airport Classification	Development Cost					
			Land	Landing Area	Terminal Area	Hangar Area[b]	Engineering	Total
	General Aviation[a]							
Kenosha	Kenosha Municipal	BT	$ 722,600	$ 3,787,200	$ 585,100	$ 415,100	$ 1,273,800	$ 6,783.8
Milwaukee	General Mitchell Field . .	SAT	--	140,300	216,300	362,100	89,200	807,900
	Timmerman Field	GU	--	390,600	471,900	333,400	258,800	1,454,700
Ozaukee	Ozaukee	BT	840,600	2,412,800	525,700	426,300	944,700	5,150,100
Racine	Burlington Municipal . . .	BT	447,000	2,036,800	492,300	363,500	744,000	4,083,600
	Racine Commercial	BT	2,161,600	1,379,300	478,400	213,200	1,004,800	5,237,300
	Sylvania.	BU	468,400	563,700	410,700	264,900	432,900	2,140,600
Walworth	East Troy Municipal. . . .	BU	373,100	618,800	428,400	288,800	426,100	2,135,200
	Gruenwald	GU	399,600	1,128,100	394,000	277,200	576,500	2,775,400
Washington	Hartford Municipal	GU	191,700	901,400	398,600	226,000	447,500	2,165,200
	West Bend Municipal . . .	BT	490,800	1,902,300	480,700	201,200	718,500	3,793,500
Waukesha	Waukesha County.	BT	644,800	1,647,500	477,000	424,900	692,300	3,886,500
Subtotal	--	--	$6,740,200	$16,908,800	$ 5,359,100	$3,796,600	$ 7,609,100	$ 40,413,800
	Air Carrier							
Milwaukee	General Mitchell Field . .	SAT	$1,000,000	$13,300,000	$76,300,000	$1,200,000	$18,120,000	$109,920,000
Subtotal	--	--	$1,000,000	$13,300,000	$76,300,000	$1,200,000	$18,120,000	$109,920,000
Total	--	--	$7,740,200	$30,208,800	$81,659,100	$4,996,600	$25,729,100	$150,333,800

[a] *The Lake Lawn Lodge and Playboy Airports are a part of this alternative system plan, but no costs have been shown since these two airports are assumed to remain as private airports.*

[b] *Includes engineering costs.*

Source: Wisconsin Department of Transportation and SEWRPC.

traveling to and from their in-Region origin and destination and General Mitchell Field, and about 5.2 million hours of ground travel time are expected to be spent in ground travel related to an air carrier airport in northern Racine County.

Weighted ground travel unit costs per hour of ground travel were developed to estimate the cost of ground travel required under the various alternative system plans. Believing that the most sophisticated general aviation aircraft are used for the most part for corporate business purposes, the ground travel cost related to passengers and pilots using the C aircraft is assumed to be $15 per hour. For users of D and E aircraft, the ground travel costs are assumed to be $5 per hour. Air carrier passenger ground costs are also assumed to be $5 per hour. These hourly costs assume the value of a person's time and the cost of vehicle operation. Vehicle operation costs approximate 10 cents per mile, and at the average ground transportation speed of about 30 miles per hour, result in an hourly vehicle cost of $3 per hour. Application of these unit costs to the travel time estimates produces the cost of ground transportation by system users under each alternative plan, as shown in Table 180.

Cost for Aircraft Operations: In the evaluation of each alternative system plan, consideration was also given to the cost of aircraft operations at the airport. Rather than determine the total cost of all aircraft operations, the relevant cost or delay cost of aircraft operations, considered as that increment of cost associated with aircraft operations occurring under interrupted arrival and departure flow conditions that is above costs associated with uninterrupted flow conditions, was computed. In a radar-controlled operating environment, interruptions to aircraft arrivals are accomplished by radar vectoring, position holding, and speed control measures, and in a nonradar-controlled operating environment, interruptions are accomplished by speed control, position holding, and path stretching measures. In a nonair traffic controlled environment, interruptions to arrivals are accomplished by pilot initiated speed control measures and path

Table 173

PROJECT DEVELOPMENT COSTS FOR GENERAL AVIATION AND AIR CARRIER AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN F—"RELOCATED AIR CARRIER": 1973 DOLLARS

County	Airport	Airport Classification	Development Cost					
			Land	Landing Area	Terminal Area	Hangar Area[a]	Engineering	Total
	General Aviation							
Kenosha	Kenosha Municipal. . . .	BT	$ 722,600	$ 3,668,400	$ 550,900	$ 331,600	$ 1,235,400	$ 6,508,900
Milwaukee	Timmerman Field	GU	--	267,100	388,700	219,400	196,700	1,071,900
	General Mitchell Field. .	BT	--	140,300	306,200	268,800	111,600	826,900
Ozaukee	Ozaukee.	GU	438,200	1,125,600	396,900	274,900	588,200	2,823,800
	Site A	BT	840,600	2,565,500	555,000	508,100	990,300	5,459,500
Racine	Burlington Municipal . .	BT	447,000	1,945,900	419,300	314,900	703,100	3,830,200
	Racine Commercial . . .	BT	2,161,600	1,357,200	470,100	195,700	997,200	5,181,800
Walworth	Gruenwald	GU	399,600	1,115,500	394,000	260,600	572,700	2,742,400
Washington	Hartford Municipal. . . .	GU	191,700	849,600	363,900	135,700	421,500	1,962,400
	West Bend Municipal. . .	BT	490,800	1,806,600	443,100	115,600	685,100	3,541,200
Waukesha	Waukesha County	BT	644,800	1,626,400	421,500	369,700	673,100	3,735,500
	Site D	GU	406,200	1,114,600	389,900	258,500	573,100	2,742,300
	Site F	GU	579,800	1,164,700	416,300	333,600	648,200	3,142,600
Subtotal	-	--	$ 7,322,900	$ 18,747,400	$ 5,515,800	3,587,100	$ 8,396,200	$ 43,569,400
	Air Carrier							
Racine	Site C	SAT	$ 6,750,000	$ 86,137,000	$77,015,000	$ 600,000	$34,048,000	$204,550,000
Subtotal	--	--	$ 6,750,000	$ 86,137,000	$77,015,000	$ 600,000	$34,048,000	$204,550,000
Total	--	--	$14,072,900	$104,884,400	$82,530,800	$4,187,100	$42,444,200	$248,119,400

[a] *Includes engineering costs.*

Source: Wisconsin Department of Transportation and SEWRPC.

stretching in local patterns. Interruptions to free-flow aircraft departures result from an aircraft having to hold short of takeoff position awaiting the completion of an arrival, queueing of departures, or a combination of both. These interruptions do not necessarily mean that demand is exceeding capacity. While delay as used herein occurs even when demand is far less than capacity, it does become significant when demand approaches and exceeds capacity.

Aircraft delay as used in this analysis is a function of annual demand and annual capacity. Relationships between delay—the increment of aircraft operating time between interrupted and noninterrupted flow—and airport demand/capacity ratios were evaluated and quantified to provide an estimate of the average delay per aircraft operation. The delay per operation was multiplied by the appropriate number of operations at each airport to obtain the total delay used in this analysis. To compare aircraft operating delay costs associated with each alternative, a cost per hour of delay by aircraft type was developed for each airport within each alternative system plan. Basic hourly costs by type of aircraft (type E at $20, D at $75, C at $225, B at $380, A at $550, and AA at $755) were used and weighted for each airport on the basis of the proportion of each type of aircraft in the anticipated traffic. The resulting aircraft operating costs for each alternative plan are summarized in Table 181. The delay costs are extremely sensitive to operations at the air carrier airports. The substantial costs associated with alternatives A and D demonstrate the overloaded conditions which may be expected to prevail at General Mitchell Field and the near capacity conditions at many other airports under these two alternative system plans.

Airport Operation and Maintenance Costs: Another important cost element to be considered in alternative system plan evaluation is the annual operation and maintenance (O and M) costs associated with each airport system. These costs must be borne entirely by the airport sponsor, since there are no federal or state aids available for maintaining and operating an airport once it has been built and is operating. It is generally acknowledged that airports serving only general aviation activity are at best a break-even operation, and some form of subsidy may be required to meet annual O and M costs. Under these circumstances, the airport system that requires the least amount of O and M expenditures would be most attractive to individual airport sponsors.

Table 174

ATTENDANT FACILITY COSTS FOR AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1973 DOLLARS

County	Airport	Alternative System Plan									
		A		C		D		E		F	
		Utilities	Highways	Utilities	Highways	Utilities	Highways	Utilities	Highways	Utilities	Highways
Kenosha	Kenosha Municipal . . .	$ 0	$ 0	$ --[b]	$ 0	$ --[b]	$ 0	$ --[b]	$ 0	$ --[b]	$ 0
	Vincent.	--[a]	--[a]	--	--	--	--	--	--	--	--
Milwaukee	General Mitchell Field .	0	13,100,000	--[b]	13,100,000	--[b]	13,100,000	--[b]	13,100,000	--[b]	0
	Timmerman Field	0	0	--[b]	0	--	--	--[b]	0	--[b]	0
Ozaukee	Ozaukee	--[a]	--[a]	18,000	0	18,000	0	29,000	0	18,000	0
	Site A	--	--	29,000	150,000	--	--	--	--	29,000	150,000
Racine	Burlington Municipal . .	0	0	--[b]	0	--[b]	0	--[b]	0	--[b]	0
	Fox River	--[a]	--[a]	--	--	--	--	--	--	--	--
	Hunt Field.	--[a]	--[a]	--	--	--	--	--	--	--	--
	Racine Commercial . . .	--[a]	--[a]	--[b]	0	--	--	--[b]	0	--[b]	0
	Sylvania.	--[a]	--[a]	--	--	--	--	18,000	0	--	--
	Valhalla.	--[a]	--[a]	--	--	--	--	--	--	--	--
	Site C	--	--	--	--	29,000	0	--	--	2,000,000	7,000,000
Walworth	East Troy Municipal. . .	0	0	--	--	--	--	--[b]	0	--	--
	Big Foot	--[a]	--[a]	--	--	--	--	--	--	--	--
	Gruenwald.	--[a]	--[a]	18,000	0	18,000	0	18,000	0	18,000	0
	Playboy.	--[a]	--[a]	--	--	--	--	--[a]	--[a]	--	--
	Lake Lawn Lodge	--[a]	--[a]	--	--	--	--	--[a]	--[a]	--	--
	Site E	--	--	--	--	18,000	--	--	--	--	--
Washington	Hartford Municipal . . .	0	0	29,000	150,000	29,000	150,000	29,000	150,000	29,000	150,000
	West Bend Municipal . .	0	0	29,000	0	29,000	0	29,000	0	29,000	0
	Hahn's Sky Ranch. . . .	--[a]	--[a]	--	--	--	--	--	--	--	--
	Site G	--	--	--	--	29,000	--	--	--	--	--
Waukesha	Waukesha County	0	0	--[b]	0	--	--	--[b]	0	--[b]	0
	Capitol Drive	0	--[a]	--	--	--	--	--	--	--	--
	Site D	--	--	18,000	150,000	18,000	150,000	--	--	18,000	150,000
	Site F	--	--	29,000	75,000	29,000	75,000	--	--	29,000	75,000
Total	-	$ 0	$13,100,000	$170,000	$13,625,000	$217,000	$13,475,000	$123,000	$13,250,000	$2,170,000	$7,525,000

[a]*Privately owned airport.*

[b]*No additional cost, since the airport is located within a public service area.*

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

Table 175

PUBLIC DEVELOPMENT COSTS FOR GENERAL AVIATION AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1973 DOLLARS

Cost Element	Capital Cost in Millions of Dollars				
	A	C	D	E	F
Project Development Costs					
Less Hangar Area Costs[a]	$3.55	$40.42	$41.76	$36.61	$39.98
Cost of Attendant Facilities.	0	0.70	0.59	0.27	0.69
Total Public Development Costs	$3.55	$41.12	$42.35	$36.88	$40.67

[a]*Hangar area costs assumed to be a private capital investment.*

Source: Wisconsin Department of Transportation; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 176

PUBLIC DEVELOPMENT COSTS FOR THE AIR CARRIER AIRPORT INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1973 DOLLARS

Cost Element	Capital Cost in Millions of Dollars				
	A	C	D	E	F
Project Development Costs					
Less Hangar Area Costs[a]	$ 0	$108.7	$108.7	$108.7	$204.0
Cost of Attendant Facilities.	13.1	13.1	13.1	13.1	9.0
Total Public Development Costs	$13.1	$121.8	$121.8	$121.8	$213.0

[a]Hangar area costs assumed to be a private capital investment.

Source: Wisconsin Department of Transportation, R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 177

PUBLIC DEVELOPMENT COSTS REQUIRED TO IMPROVE GENERAL AVIATION AND AIR CARRIER AIRPORTS IN THE REGION UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1973 DOLLARS

Alternative Airport System Plan	Capital Cost (Millions of Dollars)		
	General Aviation Airports	Air Carrier Airports	Total
A	$ 3.6	$ 13.1	$ 16.7
C	41.1	121.8	162.9
D	42.4	121.8	164.2
E	36.9	121.8	158.7
F	40.7	213.0	253.7

Source: Wisconsin Department of Transportation; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 178

COST TO THE FEDERAL GOVERNMENT OF PROVIDING NAVIGATION AND TRAFFIC CONTROL FACILITIES UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1973 DOLLARS

Alternative Airport System Plan	Aid Facility Cost (Millions of Dollars)			
	Air Traffic Control Towers	Nonprecision Landing Aids	Precision Landing Aids	Total
A	$ --[a]	$--[a]	$ --[a]	$ --[a]
C	3.75	0.2	2.50	6.5
D	3.75	--	2.50	6.3
E	3.48	--	2.30	5.8
F	5.25	--	5.76	11.0

[a] No additional facilities envisioned.

Source: R. Dixon Speas Associates, Inc.

Several sources of information were used to estimate the O and M costs for the five alternative system plans. Operating statements obtained for eight of the publicly owned airports in the Region provided annual O and M expenditures for 1966 through 1970, and average annual expenditures for this purpose over a five-year period. Relating the annual average expenditures to annual aircraft operations estimated for 1971 produced the O and M costs per aircraft operation at each of the existing publicly owned general aviation airports in the Region shown in Table 182.

The financial statements of the Minneapolis-St. Paul Metropolitan Airports Commission (MAC) were also studied for this purpose. The MAC system of airports includes one air carrier airport and five general aviation airports operated and maintained by a single public authority. This administrative arrangement permits certain economies to be effected in O and M costs, since pooling certain equipment and personnel is possible for the five general aviation airports. Since the MAC statements contained an item for depreciation of facilities and equipment, the expenditures used in the analysis were adjusted downward to reflect only O and M costs. The results of this analysis are shown in Table 183. The weighted average O and M cost per operation for four of the MAC airports equals $0.37 per operation, or about $0.09 per operation less than the weighted average for the seven airports in the Region.

A third source of information, the Civil Aviation Research and Development Policy Study (CARD),[3] was also used to determine the variation of O and M costs with respect to level of activity. The CARD study produced airport O and M cost experience for airports operating at different levels of activity. The principal data for this research consisted of financial statements of airport sponsors from

[3] *Civil Aviation Research and Development Policy Study, Report DOT TST 10-4, NASA SP 265, Department of Transportation and National Aeronautics and Space Administration, March 1971.*

Table 179

COST TO THE FEDERAL GOVERNMENT OF PROVIDING AIR TRAFFIC CONTROL TOWERS AND INSTRUMENT APPROACH AIDS TO AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1973 DOLLARS

County	Airport	Aid Facility Costs									
		A		C		D		E		F	
		ATC[a]	APAD[b]	ATC[a]	APAD[b]	ATC[a]	APAD[b]	ATC[a]	APAD[b]	ATC[a]	APAD[b]
Kenosha	Kenosha Municipal	$ 0	$ 0	$ 275,000	$ 200,000	$ 275,000	$ 200,000	$ 275,000	$ 200,000	$ 275,000	$ 200,000
Milwaukee	General Mitchell Field . .	--	--	1,000,000	500,000	1,000,000	500,000	1,000,000	500,000	--[c]	--[c]
	Timmerman Field	--	--	--[c]	200,000	--	--	--[c]	200,000	--[c]	200,000
Ozaukee	Ozaukee	--	--	275,000	200,000	275,000	200,000	275,000	200,000	275,000	200,000
	Site A.	--	--	275,000	200,000	--	--	--	--	275,000	200,000
Racine	Burlington Municipal. . .	--	--	275,000	200,000	275,000	200,000	275,000	200,000	275,000	200,000
	Racine Commercial. . . .	--	--	275,000	100,000	--	--	275,000	200,000	275,000	200,000
	Sylvania	--	--	--	--	--	--	275,000	--	--	--
	Site C.	--	--	--	--	--[f]	--	--	--	2,500,000[e]	3,357,000
Walworth	East Troy Municipal . . .	--	--	--	--	--	--	275,000	--	--	--
	Gruenwald	--	--	275,000	200,000	275,000	200,000	275,000	200,000	275,000	200,000
	Site E.	--	--	--	--	275,000	200,000	--	--	--	--
Washington	Hartford Municipal	--	--	275,000	200,000	275,000	200,000	275,000	200,000	275,000	200,000
	West Bend Municipal. . .	--	--	275,000	200,000	275,000	200,000	275,000	200,000	275,000	200,000
	Site G.	--	--	--	--	275,000	200,000	--	--	--	--
Waukesha	Waukesha County.	--	--	--[c]	200,000	--	--	--[c]	200,000	--[c]	200,000
	Capitol Drive	--	--	--	--	--	--	--	--	--	--
	Site D.	--	--	275,000	200,000	275,000	200,000	--	--	275,000	200,000
	Site F.	--	--	275,000	100,000	275,000	200,000	--	--	275,000	200,000
Outside the Region	Fort Atkinson— Whitewater	--	--	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]
	Watertown Municipal . .	--	--	N/A[d]	N/A[d]	--	--	--	--	N/A[d]	N/A[d]
	Waukegan Memorial . . .	--	--	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]
Total	--	$ 0	$ 0	$3,750,000	$2,700,000	$3,750,000	$2,500,000	$3,475,000	$2,300,000	$5,250,000	$5,757,000

[a] *ATC - Air Traffic Control Tower*

[b] *APAD - Approach Aid—Nonprecision approach aid, $100,000; precision approach aid, $200,000*

[c] *Facility is currently available.*

[d] *N/A - Not applicable; airport located outside the Region.*

[e] *Includes Weather Bureau facilities.*

[f] *Airspace restrictions necessitate operations under visual flight rules, therefore, no control towers and approach aids are recommended.*

Source: R. Dixon Speas Associates, Inc.

various sections of the U. S. The significant findings of the CARD study relevant to the analysis of O and M costs are shown in Table 184.

While the results of the O and M cost analysis from the three data sources are not uniformly consistent, it is possible to discern some patterns that can be applied to the five alternative plans. The patterns believed to be significant are:

- The unit O and M cost is inversely proportional to the level of traffic activity. This is demonstrated by the CARD study and from a comparison of the MAC airports. Flying Cloud, with 205,000 operations, had a lower unit O and M cost than Anoka County, with 95,000 operations.
- The unit O and M cost is inversely proportional to the extent of airport development, and particularly to the pavement area of the airfield.
- The unit O and M cost is directly proportional to the airport classification. This is demonstrated by the MAC airport system, where Holman Field, a BT airport, has a higher unit O and M cost than either the GU or BU airports.

The airports in the Region do not clearly show similar relationships, suggesting that the reported O and M costs may not be uniformly reported. From the cost analysis, the unit O and M airport costs associated with general aviation activity shown in Table 185 were developed

Table 180

COST OF GROUND TRAVEL FROM WITHIN THE REGION TO GENERAL AVIATION AND AIR CARRIER AIRPORTS IN THE REGION UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1990

Alternative Airport System Plan	Ground Travel Cost (Millions of Dollars)		
	General Aviation User	Air Carrier User	Total
A	$14.1	$20.3	$34.4
C	12.5	20.3	32.8
D	13.9	20.3	34.2
E	12.7	20.3	33.0
F	11.4	25.9	37.3

Source: R. Dixon Speas Associates, Inc.

Table 181

ANNUAL COST OF AIRCRAFT DELAY AT GENERAL AVIATION AND AIR CARRIER AIRPORTS IN THE REGION UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1990

Alternative Airport System Plan	Annual Cost of Aircraft Delay		
	General Aviation Airports	Air Carrier Airports	Total
A	$238,437	$4,075,145	$4,313,582
C	326,629	3,262,500	3,589,129
D	414,397	6,675,000	7,089,397
E[a]	373,018	3,239,600	3,612,618
F	348,941	1,197,700	1,546,641

[a] *Includes costs incurred by operations at the Playboy and Lake Lawn Lodge Airports.*

Source: R. Dixon Speas Associates, Inc.

Table 182

OPERATION AND MAINTENANCE COSTS PER AIRCRAFT OPERATION AT PUBLICLY OWNED AIRPORTS IN THE REGION: 1971

County	Airport	Airport Classification	Operation and Maintenance Costs Per Operation
Kenosha	Kenosha Municipal	GU	$0.41
Milwaukee	Timmerman Field	GU	0.11
Ozaukee	--	--	--
Racine	Burlington Municipal	BU	2.93
Walworth	East Troy Municipal.	BU	1.31
Washington	Hartford Municipal	BU	0.10
	West Bend Municipal	GU	0.52
Waukesha	Waukesha County	GU	0.82
Weighted Average	--	--	$0.46

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

and used in evaluating the five alternative system plans. A similar analysis was performed to determine air carrier airport O and M costs.

The O and M cost experience for General Mitchell Field, as computed from information presented in Chapters IV and VI, is $4.55 per aircraft operation. Four other air carrier airports having similar weather characteristics—Cincinnati, Cleveland, Columbus, and Syracuse—were analyzed, and it was found that the unit O and M costs at these medium-hub airports ranged from a low of $2.70 to a high of $6.10 per operation. O and M costs at several large-hub air carrier airports were also analyzed, and ranged from $8.70 per operation at Minneapolis-St. Paul to $16.10 per operation at Detroit. From the analysis of air carrier airport O and M costs, a value of $6.00 per aircraft operation was selected for use in the evaluation to account for the higher levels of activity that the regional air carrier airport could be expected to accommodate in the design year of the plan.

An estimate of the 1990 O and M cost for airports in each of the five alternative plans is presented in Tables 186 through 190. The O and M cost estimates were computed only for system airports located within the Region. These estimates could not be determined for airports outside the Region using this methodology because only the regional demand assigned to these airports was known.

Table 183

OPERATION AND MAINTENANCE COSTS PER AIRCRAFT OPERATION FOR THE MINNEAPOLIS-ST. PAUL METROPOLITAN AIRPORTS: 1968

Airport	Airport Classification	Operation and Maintenance Costs Per Operation
Holman Field	BT	$0.76
Flying Cloud	GU	0.25
Anoka County . . .	GU	0.44
Crystal	BU	0.28
Lake Elmo[a]	--	--
Weighted Average	--	$0.37

[a] *No detailed cost information was available for this airport.*

Source: R. Dixon Speas Associates, Inc.

Table 184

OPERATION AND MAINTENANCE COSTS PER AIRCRAFT OPERATION REPORTED IN THE CIVIL AVIATION RESEARCH AND DEVELOPMENT POLICY STUDY: 1971

Annual Aircraft Operations	Annual Operating and Maintenance Costs	Operation and Maintenance Costs Per Operation
100,000.	$ 91,500	$0.90
200,000.	119,000	0.60
300,000.	151,500	0.50
400,000.	180,750	0.45

Source: R. Dixon Speas Associates, Inc.

Table 185

OPERATION AND MAINTENANCE COSTS PER OPERATION FOR GENERAL AVIATION AIRPORTS IN THE REGION BY AIRPORT CLASSIFICATION: 1973

Airport Classification	Annual Aircraft Operations	Operation and Maintenance Costs Per Operation
BT	Less than 150,000	$0.80
	More than 150,000	0.65
GU	Less than 150,000	0.45
	More than 150,000	0.30
BU	Less than 150,000	0.35
	More than 150,000	0.20

Source: R. Dixon Speas Associates, Inc.

Table 191 shows the estimated annual O and M costs and the weighted average unit cost per operation under each of the five alternative plans. The total annual O and M costs range from a low of $2.7 million to a high of $3.6 million in 1990, a spread of over $900,000 per year, or 33 percent. The average unit O and M cost per operation ranges from a low of $1.14 under plan A to a high of $1.44 under plan D.

Since air carrier airport operating costs exert a great influence on system costs, the operations and O and M cost of the air carrier airport were deducted from each plan, and the average O and M cost for general aviation airports recomputed. The results of this analysis are shown in Table 192. A ranking of the alternative airport system plans under each of the O and M characteristics developed herein—annual system cost, average O and M cost per operation, and average system O and M cost per general aviation operation is shown in Table 193. The comparative rankings indicate that plan A may be expected to have the lowest annual O and M cost and the lowest average O and M cost per operation. In addition, the general aviation airports in plan A will require the least average unit O and M cost. Plan C and plan E have the same ranking but are expected to cost more to operate and maintain than airports under plan A. Plans D and F are the most costly alternative system plans to operate and maintain.

<u>Comparison of the Cost of Alternative Airport System Plans</u>: With the exception of the capital investment requirements, all of the cost data developed for the alternative system plan evaluation are annual costs for the design year of the plan. The capital costs reflect the total cost to develop each alternative system plan in response to the forecast demand over the design period.

To be comparative, these various cost factors must be reduced to average annual values over the plan design period. This requires estimating annual user costs, annual O and M costs, and annual capital investment over the entire 16-year period from 1974 through 1990. These annual costs must, in turn, be discounted to a present worth value. This was done using a 6 percent interest rate.

Recognizing that any airport system would develop gradually in response to increasing demand, the first step in this analysis involved estimating a phased development program for each airport under each plan. This was accomplished utilizing a 1980 demand assignment in conjunction with appropriate airport facility improvement standards. Once the phased development was defined, the total development cost was staged.

Equivalent annual average airport O and M costs were based primarily on the phased development program established to determine the incremental capital investment requirements. Using unit cost data similar to that applied for the 1990 analysis in conjunction with the forecast 1980 activity levels at each airport, a graphical representation of the increasing O and M costs was prepared. Cost estimates for individual years were then derived from this representation.

Table 186

OPERATION AND MAINTENANCE COSTS FOR AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN A—"NO BUILD": 1990

County	Airport	Airport Classification	Annual Aircraft Operations	Operation and Maintenance Cost Per Operation	Annual Operation and Maintenance Cost
Kenosha	Kenosha Municipal	GU	205,727	$0.30	$ 61,718
	Vincent.	<BU-I	52,332	0.35	18,316
Milwaukee	General Mitchell Field	SAT	327,608	6.00	1,965,648
	Timmerman Field	GU	334,654	0.30	100,396
Ozaukee	Ozaukee	<BU-I	54,379	0.35	19,033
Racine	Burlington Municipal	BU-II	106,800	0.35	37,380
	Fox River	<BU-I	58,473	0.35	20,465
	Hunt Field.	<BU-I	57,227	0.35	20,029
	Racine Commercial	BT	164,840	0.65	107,146
	Sylvania.	<BU-I	116,768	0.35	40,869
	Valhalla.	<BU-I	64,347	0.35	22,521
Walworth	East Troy Municipal.	<BU-I	60,253	0.35	21,885
	Big Foot	BU-I	33,019	0.35	11,557
	Gruenwald.	BU-I	45,657	0.35	15,980
	Playboy.	BU-II (Recreational)	18,067	0.35	6,323
	Lake Lawn Lodge	BU-II (Recreational)	9,523	0.35	3,333
Washington	Hartford Municipal	BU-I	118,281	0.35	41,398
	West Bend Municipal	GU	143,727	0.45	69,300
	Hahn's Sky Ranch.	<BU-I	36,401	0.35	12,740
Waukesha	Waukesha County	GU	318,293	0.30	95,488
	Capitol Drive	BU-I	56,337	0.35	19,718
Total	--	--	--	$ --	$2,711,243

Source: R. Dixon Speas Associates, Inc.

As in the case of the O and M costs, the costs to the aviation system users were annualized using a graphical interpolation method based upon a plot of the computed present, 1980, and 1990 costs. The ground travel costs for air carrier passengers and general aviation passengers and pilots were, however, derived separately and then summed once the discounting process was completed.

Table 194 summarizes the estimated capital costs, the 1990 O and M and system user costs, and the present worth values and equivalent annual cost for each of these cost factors. In comparing the four alternatives that involve any degree of overall system improvement, alternative E is the least costly to develop and operate. Additionally, plan E minimizes the surface travel costs to the system users. Alternative F is the most expensive system to construct and operate, and the resulting user costs are higher than the other alternatives. Alternative C is the second least costly system after plan E. Under plan C, the proposed construction of new airport sites rather than expansion of existing airports as proposed under plan E, accounts for the $0.8 million difference in the present worth of the two plans, and the $70,000 difference in equivalent annual costs. Alternative D is the second costliest program in all respects. In addition to considerably increasing the total ground travel costs for general aviation users, the cost to construct and operate the several new airports to replace the existing urban airports far exceeds that of all alternatives except F.

Environmental Considerations

Introduction: Potential environmental impacts are a most important consideration in the airport system planning process. Environmental effects often begin before a pro-

Table 187

OPERATION AND MAINTENANCE COSTS FOR AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN C—"IDEAL MODIFIED": 1990

County	Airport	Airport Classification	Annual Aircraft Operations	Operation and Maintenance Cost Per Operation	Annual Operation and Maintenance Cost
Kenosha	Kenosha Municipal	BT	281,924	$0.65	$ 183,251
Milwaukee	General Mitchell Field	SAT	302,082	6.00	1,812,492
	Timmerman Field	GU	263,892	0.30	79,168
Ozaukee	Ozaukee	GU	130,441	0.45	58,698
	Site A	BT	207,566	0.65	134,918
Racine	Burlington Municipal	BT	181,191	0.65	117,774
	Racine Commercial	BT	156,957	0.65	102,022
Walworth	Gruenwald	GU	143,590	0.45	64,616
Washington	Hartford Municipal	GU	122,235	0.45	55,005
	West Bend Municipal	BT	125,622	0.80	100,498
Waukesha	Waukesha County	BT	251,379	0.65	163,396
	Site D	GU	157,522	0.30	47,257
	Site F	GU	178,667	0.30	53,600
Total	--	--	--	$ --	$2,972,695

Source: R. Dixon Speas Associates, Inc.

posed project is built. Planning and designing a facility induce actions by individuals and private and governmental agencies, which in turn affects environmental and related social and economic conditions. Indeed, the short-term environmental effects of project execution may in some cases be greater than those of the completed and operational facility. In the case of some airports, the social and economic effects induced by community apprehensions toward the project may be out of proportion to the ultimate impact of the facility.

In the planning and design stage of an airport development project, the most significant impacts include land speculation, sale and acquisition of real property triggered by expected changes in land use, and the effects of uncertainty about the project on private, institutional, and governmental actions. It is generally not possible to estimate these impacts with any degree of accuracy at the system planning stage.

The impacts of airport construction tend to involve displacement of people and land uses with attendant disruption of the rural or urban communities involved, the physical processes of earth moving and construction, and materials acquisition. Temporary noise, air, and water pollution problems may be engendered. Economic consequences and land use changes may be escalated by firmer knowledge of the location and nature of the project. Most of these changes, except for land use and behavioral consequences, can be estimated with a relatively high degree of accuracy provided that construction methods and site characteristics are known.

When the airport facility enters the operational phase, the immediate impacts of usage such as increased storm water runoff, groundwater pollution from runway and taxiway drainage, noise and air pollution from aircraft operations, and changes in related surface traffic manifest themselves. Impact prediction here requires assumptions about the level and characteristics of use and about the operation and maintenance of the facility. The actions induced by the operation of the facility are derivative, but particularly important. It is here that most of the land use impact can be expected.

In addition to the direct impact that airport and aircraft operations may have upon adjacent land uses, the presence of major airport facilities has generated land uses which, in turn, induce a secondary impact upon surrounding areas. It is necessary to consider both the primary impact of the airport and its operation and the secondary impact of induced land uses in airport development proposals. Often these effects can be minimized or redirected through operational control as well as land acquisition or land use control, such as coordinated zoning. With the exception of noise, which directly impacts human and animal life,

Table 188

OPERATION AND MAINTENANCE COSTS FOR AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN D—"NONURBAN": 1990

County	Airport	Airport Classification	Annual Aircraft Operations	Operation and Maintenance Cost Per Operation	Annual Operation and Maintenance Cost
Kenosha	Kenosha Municipal	BT	297,307	$0.65	$ 193,250
Milwaukee	General Mitchell Field	SAT	420,417	6.00	2,522,502
Ozaukee	Ozaukee	GU	170,984	0.30	51,295
Racine	Burlington Municipal	GU	158,733	0.30	47,620
	Site C	GU	228,169	0.30	68,451
Walworth	Gruenwald	BT	127,142	0.80	101,714
	Site E	GU	74,689	0.45	33,610
Washington	Hartford Municipal	GU	155,762	0.30	46,729
	West Bend Municipal	BT	156,348	0.65	101,626
	Site G	BT	235,681	0.65	153,193
Waukesha	Site D	BT	247,560	0.65	160,914
	Site F	BT	247,789	0.65	161,063
Total	--	--	--	$ --	$3,641,967

Source: R. Dixon Speas Associates, Inc.

the potential environmental impacts associated with airport development and operation can most readily be considered in terms of the potential impacts on the natural resource base. Such direct impacts on the natural resource base will in turn impact human, animal, and plant life, and thereby affect the overall quality of the environment in the vicinity of the airport in various ways.

Aircraft Noise: The impact of aircraft noise on the development and use of land near airports has caused serious and continuing problems in many communities. A proper relationship of airport development to surrounding land use development has often been difficult to achieve because airport ownership and airport planning and zoning authority often rest in a different agency than does comprehensive planning and zoning authority. Technical problems of interpreting the noise levels in terms of probable effects on people and the varied activities of people are also involved in this problem.

Several procedures for estimating community exposure to noise from aircraft operations have been developed. One of these, the Composite Noise Rating (CNR) methodology, was selected for use in the regional airport planning program. The CNR methodology relates estimated noise exposure to the response of residential communities.[4] This procedure can, therefore, be used to estimate the probable public response to engine noise associated with existing levels of aircraft operation, as well as to forecast the probable effects of changes in aircraft operation, equipment, and facilities. It must be emphasized that this procedure is intended as a guide in systems planning, and it does not establish precise noise standards. Neither does it attempt to define tolerable community noise levels. The CNR methodology does, however, provide a logical, systematic approach for analyzing an important consideration in the evaluation of alternative airport system plans and the selection of a regional airport system plan.

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[4] *The Federal Aviation Administration has required that the Aircraft Sound Description System (ASDS) methodology be used in all airport studies to be completed after July 1, 1974. It has been understood that if studies, even though to be completed after July 1, 1974, have completed the noise analysis prior to July 1, 1974, the ASDS methodology would not be required. The CNR analysis was completed prior to July 1, 1974, at those airports considered under the regional airport system plan alternatives.*

Table 189

OPERATION AND MAINTENANCE COSTS FOR AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN E—"NO NEW SITES": 1990

County	Airport	Airport Classification	Annual Aircraft Operations	Operation and Maintenance Cost Per Operation	Annual Operation and Maintenance Cost
Kenosha	Kenosha Municipal	BT	252.4	$0.65	$ 164,060
Milwaukee	General Mitchell Field	SAT	308.2	6.00	1,849,200
	Timmerman Field	GU	316.8	0.30	95,040
Ozaukee	Ozaukee	BT	195.3	0.65	126,945
Racine	Burlington Municipal	BT	163.4	0.65	106,210
	Racine Commercial	BT	140.0	0.80	112,000
	Sylvania.	BU	161.3	0.20	32,260
Walworth	East Troy Municipal.	BU	194.4	0.20	38,880
	Gruenwald	GU	125.9	0.45	56,655
	Playboy.	BU-II (Recreational)	14.7	0.35	5,145
	Lake Lawn Lodge	BU-II (Recreational)	9.5	0.35	3,325
Washington	Hartford Municipal	GU	138.1	0.45	62,145
	West Bend Municipal	BT	148.4	0.80	118,720
Waukesha	Waukesha County	BT	299.9	0.65	194,935
Total	--	--	--	$ --	$2,965,520

Source: R. Dixon Speas Associates, Inc.

In addition, application of the CNR methodology under the regional airport system plan provides qualitative information relating to the impact of aircraft noise around those airports having enough aircraft operations to produce a 100 CNR isopleth that will extend beyond the airport boundaries for use in land planning in the vicinity of airports. The system plan results can be used until such time as more refined noise analyses are undertaken in airport master planning studies.

The exposure to aircraft noise which a given area can be expected to experience may be estimated by developing a composite noise rating for each runway of an airport and plotting the noise level contours on a map. The composite noise rating is the perceived noise in decibels corrected for operational factors such as frequency of landings and takeoffs, runway utilization, and time of day. The calculated CNR values are then related on an empirical basis to broad categories of expected community response, as indicated in Table 195. The degrees of community response which may be expected have been categorized as Zone 1—no serious adverse response; Zone 3—serious adverse response; and Zone 2, the middle zone, a grey area where varying degrees of adverse community response may be expected. This middle area 15-unit CNR range between the 100 and 115 CNR.

One of the objectives established by the advisory committee to guide preparation of airport system development in the Region is to achieve a regional airport system which will be compatible with existing land use patterns and adopted land use plans. One of the standards used to measure achievement of this objective relates land use development around airports to levels of noise as indicated by CNR criteria. To apply this standard in the alternative plan evaluation process, CNR isopleths were developed for the various airports included under each alternative system plan as listed in Table 196. These CNR isopleth overlays are on file in the Commission offices. The isopleths at airports in the recommended system plan will be shown graphically in relation to proposed airport development and adjacent land use in Chapter XII. CNR isopleths were computed based upon the activity levels forecast for the year 1980, the year in which aircraft related noise is expected to peak, rather than for the plan design year 1990. Improvements in aircraft engine design may be expected to reduce aircraft noise levels after 1980.

Table 190

OPERATION AND MAINTENANCE COSTS FOR AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLAN F—"RELOCATED AIR CARRIER": 1990

County	Airport	Airport Classification	Annual Aircraft Operations	Operation and Maintenance Cost Per Operation	Annual Operation and Maintenance Cost
Kenosha	Kenosha Municipal	BT	229,294	$0.65	$ 149,041
Milwaukee	General Mitchell Field	BT	303,828	3.00	911,484
	Timmerman Field	GU	253,642	0.30	76,093
Ozaukee	Ozaukee	GU	132,326	0.45	59,547
	Site A	BT	209,508	0.65	136,180
Racine	Burlington Municipal	BT	157,392	0.65	102,305
	Racine Commercial	BT	128,262	0.80	102,610
	Site C	SAT	200,974	6.00	1,205,844
Walworth	Gruenwald	GU	127,624	0.45	57,431
Washington	Hartford Municipal	GU	103,150	0.45	46,418
	West Bend Municipal	BT	108,226	0.80	86,581
Waukesha	Waukesha County	BT	247,843	0.65	161,098
	Site D	GU	122,827	0.45	55,272
	Site F	GU	169,190	0.30	50,757
Total	--	--	--	$ --	$3,200,661

Source: R. Dixon Speas Associates, Inc.

Table 191

ESTIMATED OPERATION AND MAINTENANCE COSTS FOR AIRPORTS IN THE REGION UNDER ALTERNATIVE SYSTEM PLANS A, C, D, E, AND F: 1990

Alternative Airport System Plan	Annual Operation and Maintenance Cost	Weighted Average Operation and Maintenance Cost Per Operation
A	$2,711,243	$1.14
C	2,972,695	1.19
D	3,641,967	1.44
E	2,965,520	1.20
F	3,200,661	1.28

Source: R. Dixon Speas Associates, Inc.

Table 192

AVERAGE OPERATION AND MAINTENANCE COSTS PER OPERATION AT GENERAL AVIATION AIRPORTS IN THE REGION UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1990

Alternative Airport System Plan	Operation and Maintenance Cost Per Operation
A	$0.36
C	0.52
D	0.53
E	0.52
F	0.87

Source: R. Dixon Speas Associates, Inc.

Table 193

RANKING OF ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F ACCORDING TO SELECTED OPERATION AND MAINTENANCE COST CHARACTERISTICS

Alternative Airport System Plan	Ranking			
	Annual Operation and Maintenance Costs	Average Operation and Maintenance Cost Per General Aviation and Air Carrier Operation	Average Operation and Maintenance Cost Per General Aviation Operation	Total
A	5	5	5.0	15.0
C	3	4	2.5	9.5
D	1	1	4.0	6.0
E	4	3	2.5	9.5
F	2	2	1.0	5.0

Source: R. Dixon Speas Associates, Inc.

Table 194

COMPARISON OF ESTIMATED COST FACTORS FOR ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1973 DOLLARS

Alternative Airport System Plan	Estimated Cost (Millions of Dollars)										
	Airport Sponsor			Present Worth (1974-1990)				Equivalent Annual Cost (1974-1990)			
				Airport Sponsor				Airport Sponsor			
	Capital Costs	1990 Operation and Maintenance	1990 Airport User—Ground Travel	Capital Costs	Operation and Maintenance	Total	Airport User—Ground Travel	Capital Costs	Operation and Maintenance	Total	Airport User—Ground Travel
A	$ 16.7	$2.71	$34.4	$ 13.04	$19.42	$ 32.46	$200.92	$ 1.29	$1.89	$ 3.18	$19.88
C	162.9	2.97	32.8	117.28	20.67	137.95	191.86	11.60	2.04	13.64	18.98
D	164.2	3.64	34.2	120.07	24.90	144.97	202.46	11.88	2.48	14.36	20.03
E	158.7	2.97	33.0	116.50	20.66	137.16	192.38	11.53	2.04	13.57	19.04
F	253.7	3.20	37.3	174.74	25.04	199.78	216.46	17.29	2.47	19.76	21.42

[a] *Includes airport development and attendant facilities costs but not hangar costs.*

Source: R. Dixon Speas Associates, Inc.

Table 195

COMPOSITE NOISE RATINGS USED TO ESTIMATE RESPONSE OF RESIDENTIAL COMMUNITIES TO AIRCRAFT NOISE

Composite Noise Rating (CNR) for Aircraft Takeoffs and Landings	Zone	Expected Response
Less than 100.	1	Essentially no complaints should be made by residents affected. The noise, however, may occasionally interfere with certain activities of residents.
100 to 115.	2	Individual residents may complain, perhaps vigorously. Concerted group action is possible.
More than 115	3	Individual resident reaction would likely include repeated, vigorous complaints. Concerted group action may be expected.

Source: "Land Use Planning Relating to Aircraft Noise," Bolt, Beranek, and Newman, Inc.; October 1964; U. S. Department of Commerce Clearinghouse, AD 615 015.

Table 196

STATUS OF PREPARATION OF CNR NOISE ISOPLETHS FOR AIRPORTS IN THE REGION INCLUDED UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F

County	Airport	Alternative System Plan				
		A	C	D	E	F
Kenosha	Kenosha Municipal	--[a]	--[a]	--[a]	--[a]	--[a]
	Vincent	--[b]	--	--	--	--
Milwaukee	General Mitchell Field	--[a]	--[a]	--[a]	--[a]	--[a]
	Timmerman Field	--[a]	--[a]	--	--[a]	--[a]
Ozaukee	Ozaukee	--[b]	--[b]	--[b]	--[a]	--[b]
	Site A	--	--[a]	--	--	--[a]
Racine	Burlington Municipal	--[b]	--[a]	--[a]	--[a]	--[a]
	Fox River	--[b]	--	--	--	--
	Hunt Field	--[b]	--	--	--	--
	Racine Commercial	--[a]	--[a]	--	--[a]	--[a]
	Sylvania	--[b]	--	--	--[b]	--
	Valhalla	--[b]	--	--	--	--
	Site C	--	--	--[b]	--	--[a]
Walworth	East Troy Municipal	--[b]	--	--	--[b]	--
	Big Foot	--[b]	--	--	--	--
	Gruenwald	--[b]	--[b]	--[a]	--[b]	--[b]
	Playboy	--[b]	--	--	--[b]	--
	Lake Lawn Lodge	--[b]	--	--	--[b]	--
	Site E	--	--	--[b]	--	--
Washington	Hartford Municipal	--[b]	--[b]	--[b]	--[b]	--[b]
	West Bend Municipal	--[b]	--[a]	--[a]	--[a]	--[a]
	Hahn's Sky Ranch	--[b]	--	--	--	--
	Site G	--	--	--[a]	--	--
Waukesha	Waukesha County	--[a]	--[a]	--	--[a]	--[a]
	Capitol Drive	--[b]	--	--	--	--
	Site D	--	--[b]	--[a]	--	--[b]
	Site F	--	--[b]	--[a]	--	--[b]

[a] *CNR isopleths prepared and analyzed.*

[b] *100 CNR isopleth does not extend beyond airport boundaries.*

Source: R. Dixon Speas Associates, Inc.

Once computed and drawn to the appropriate scale, the CNR isopleths were overlaid on aerial photographs of each airport and its environs, and the aircraft noise impact was assessed by identifying the various land uses, and more particularly the number of homes and other structures, encompassed within the various noise level contours. To better quantify the noise impact for use in comparing the alternative plans, an estimate of the population affected was computed by applying an average per dwelling unit occupancy for the particular area. Table 197 summarizes the number of homes and the estimated resident population which may be expected to be located between the 100 and 115 CNR isopleths for the general aviation airports within each alternative system plan.

Applications of the CNR methodology was also undertaken for General Mitchell Field assuming its operation as the regional air carrier airport under alternatives A, C, D, and E, and as a general aviation airport following the shift of air carrier activity to a new site under alternative F. Since the results of the CNR analysis assuming General Mitchell Field as the regional air carrier airport are provided in a later section of this chapter, Table 197 illustrates the noise impact which may be expected to result if general aviation operations only are conducted at General Mitchell Field.

In viewing the overall aircraft noise impact resulting from the general aviation aircraft operations, alternative D, the nonurban plan, is most favorable. This was to be expected, since alternative D would entail the abandonment of three airports located near highly developed urban areas, while the replacement airports would be located in more sparsely settled rural areas.

Alternative A is the second best system with respect to minimizing aircraft noise impact. This is because under this plan, operation of the noisiest aircraft would be limited to only two of the 21 airports in the plan.

Once the number of airports capable of accommodating larger general aviation aircraft—that is, twin-engine and jet aircraft—is increased, a significant increase in the number of people affected by aircraft noise results. This is the case with alternatives C, E, and F, under which the number of people affected by noise would increase about 50 percent over those people affected under alternative A. Of these three alternative plans, plan E produces the least impact, followed by alternative C.

Alternative F, even though it would provide the most severe aircraft noise impact in terms of the number of people affected by general aviation operations, is similar to alternative C with the exception of General Mitchell Field. Under alternative C, General Mitchell Field accommodates both general aviation and air carrier operations, and thus a single set of noise isopleths delineates the area of impact. In plan F, the air carrier activity is relocated to another site, while General Mitchell Field remains a general aviation airport.

Aircraft Operation Nuisance: The CNR methodology attempts to quantitatively identify the limits of the noise impacts of aircraft operations on land uses surrounding airports. Beyond actual noise levels as measured by the 100 CNR isopleth, a large number of aircraft operations may be perceived as a nuisance by some residents living under the approach and departure patterns associated with general aviation airports. This nuisance factor may take the form of interference to television reception, concern over a seemingly constant flow of relatively low-flying aircraft, and the intrusion of aircraft operations into normal outdoor activities in residential areas. In an effort to quantify this potential nuisance effect and to

Table 197

NUMBER OF HOMES AND RESIDENT POPULATION LOCATED BETWEEN THE 100 AND 115 CNR ISOPLETHS FOR GENERAL AVIATION AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE SYSTEM PLANS A, C, D, E, AND F

County	Airport	Alternative System Plan									
		A		C		D		E		F	
		Homes	Population	Homes	Population	Homes	Population	Homes	Population	Homes	Population
Kenosha	Kenosha Municipal. . . .	9	32	10	35	10	35	10	35	10	35
Milwaukee	General Mitchell Field. .	--	--	--	--	--	--	--	--	35	122
	Timmerman Field	113	407	113	407	--	--	113	407	113	407
Ozaukee	Ozaukee.	--	--	--	--	--	--	10	36	--	--
	Site A	--	--	35	123	--	--	--	--	35	123
Racine	Burlington Municipal . .	--	--	7	25	6	21	7	25	7	25
	Racine Commercial . . .	102	357	102	357	--	--	102	357	102	357
	Sylvania	--	--	--	--	--	--	--	--	--	--
Walworth	East Troy Municipal . . .	--	--	--	--	--	--	--	--	--	--
	Gruenwald	--	--	--	--	13	46	--	--	--	--
Washington	Hartford Municipal. . . .	--	--	--	--	--	--	--	--	--	--
	West Bend Municipal. . .	--	--	8	28	8	28	8	28	8	28
	Site G	--	--	--	--	2	7	--	--	--	--
Waukesha	Waukesha County	8	27	67	235	--	--	67	235	67	235
	Site D	--	--	--	--	7	25	--	--	--	--
	Site F	--	--	--	--	17	60	--	--	--	--
Total	--	232	823	342	1,210	63	222	317	1,122	377	1,332

Source: SEWRPC.

help identify potential remedial measures, an analysis of the land uses under the approach and departure patterns—that is, within a one mile radius of all existing and proposed basic utility airports and within a two mile radius of all existing and proposed general utility and basic transport airports—and of the number of aircraft operations expected to occur at each airport was made. Table 198 indicates the area planned to be devoted to residential land use within the above defined limits around each airport and the number of annual aircraft operations forecast under each alternative system.

The product of the annual operations and the number of acres of residential land was taken as the measure of the relative nuisance potential of each of the various airports under each of the alternative airport system plans. Remedial action can take the form of revised traffic patterns, institution of strict arrival and departure procedures, and elimination of nonessential operations such as touch-and-go training activities. General Mitchell Field, Timmerman Field, and the Waukesha County Airport exhibited the highest potential nuisance factors as determined herein. The sum of individual airport nuisance factors indicates that alternative F has the greatest aircraft operation nuisance and alternative D creates the least nuisance from general aviation aircraft operations.

Air Quality: Although aircraft movements presently constitute a less significant source of air pollution than surface transportation movements, industrial process losses, electric power generation, and even waste disposal, airports may be expected to increasingly become the object of air pollution surveillance and regulation. Increasing public concern about air pollution generated at major airports, particularly by jet aircraft, resulted in an investigation conducted nationally by the Secretary of Health, Education, and Welfare under the Federal Clean Air Act of 1967. The purpose of the investigation was to determine the feasibility and practicality of controlling air pollutant emissions from jet and piston aircraft engines and of establishing national emission standards with respect thereto.

Section 231 of the Clean Air Act Amendments of 1970 directed the U. S. Environmental Protection Agency to undertake an additional study of the emission of air pollutants by aircraft in order to determine the extent to which such emissions may affect air quality in air control regions throughout the United States, and of the technological feasibility of controlling such emissions. More recent federal legislation requires a review of environmental effects, including the impact on air quality, of all proposed airport developments for which federal assistance is to be used.

Table 198

NUISANCE FACTOR OF GENERAL AVIATION OPERATIONS AT AIRPORTS IN THE REGION INCLUDED IN ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F

County	Airport	Acres of Residential Land Within Nuisance Impact Area[a]—1990	Alternative System Plan									
			A		C		D		E		F	
			Number of General Aviation Operations	Nuisance Factor (NF)[b]	Number of General Aviation Operations	Nuisance Factor (NF)[b]	Number of General Aviation Operations	Nuisance Factor (NF)[b]	Number of General Aviation Operations	Nuisance Factor (NF)[b]	Number of General Aviation Operations	Nuisance Factor (NF)[b]
Kenosha	Kenosha Municipal . . .	2,102	205,700	432.4	281,900	592.6	297,300	624.9	252,400	530.5	229,300	482.0
	Vincent	337	52,300	17.6	--	--	--	--	--	--	--	--
Milwaukee	General Mitchell Field .	8,718	187,800	1,637.2	162,300	1,414.9	280,600	2,446.3	168,400	1,468.1	303,800	2,648.5
	Timmerman Field. . . .	6,975	334,600	2,333.8	263,900	1,840.7	--	--	316,800	2,209.7	253,600	1,768.9
Ozaukee	Ozaukee	1,083	54,400	58.9	130,400	141.2	171,000	185.2	195,300	211.5	132,300	143.3
	Site A.	989	--	--	207,600	205.3	--	--	--	--	209,500	207.2
Racine	Burlington Municipal. .	1,328	106,800	141.8	181,200	240.6	158,700	210.8	163,400	217.0	157,400	209.0
	Fox River	333	58,400	19.4	--	--	--	--	--	--	--	--
	Hunt Field	30	57,200	1.7	--	--	--	--	--	--	--	--
	Racine Commercial. . .	2,540	164,800	418.6	156,900	398.5	--	--	140,000	355.6	128,300	325.9
	Sylvania	45	116,800	5.2	--	--	--	--	161,300	7.3	--	--
	Valhalla	90	64,300	5.8	--	--	--	--	--	--	--	--
	Site C.	857	--	--	--	--	228,200	195.6	--	--	92,300	79.1
Walworth	East Troy Municipal . .	814	60,200	49.0	--	--	--	--	194,400	158.2	--	--
	Big Foot.	32	33,000	1.0	--	--	--	--	--	--	--	--
	Gruenwald	774	45,700	35.4	143,600	111.1	127,100	98.4	125,900	97.4	127,600	98.7
	Playboy	21	18,100	0.4	--	--	--	--	18,700	0.3	--	--
	Lake Lawn Lodge. . . .	374	9,500	3.6	--	--	--	--	9,500	3.6	--	--
	Site E.	122	--	--	--	--	74,700	9.1	--	--	--	--
Washington	Hartford Municipal . . .	415	118,300	49.1	122,200	50.7	155,800	64.7	138,100	57.3	103,200	42.8
	West Bend Municipal. .	1,006	143,700	144.6	125,600	126.3	156,300	157.2	148,400	149.3	108,200	108.8
	Hahn's Sky Ranch . . .	27	36,400	1.0	--	--	--	--	--	--	--	--
	Site G.	152	--	--	--	--	235,700	35.8	--	--	--	--
Waukesha	Waukesha County. . . .	4,378	318,300	1,393.5	251,400	1,100.6	--	--	299,900	1,313.0	247,800	1,084.9
	Capitol Drive.	694	56,300	39.1	--	--	--	--	--	--	--	--
	Site D.	1,755	--	--	157,500	276.4	247,600	444.5	--	--	122,800	215.5
	Site F.	2,445	--	--	178,700	436.9	247,800	605.9	--	--	69,200	413.7
Total System Nuisance Factor	--	--	--	6,789.1	--	6,935.3	--	5,078.4	--	6,778.8	--	7,921.5

[a] *The nuisance impact area is the quarter section approximation of land within a one mile radius of basic utility airports and within a two mile radius of general utility and basic transport airports.*

[b] *The nuisance factor (NF) =* $\frac{\text{Acres of Residential Land}}{1{,}000} \times \frac{\text{Annual Number of General Aviation Operations}}{1{,}000}$

Source: SEWRPC.

Aircraft engine exhaust gases contain essentially the same air pollutants associated with motor vehicle operation—carbon monoxide, particulate matter, hydrocarbons and organic gases (aldehydes), oxides of nitrogen, and sulfur oxides. Because turbine engines operate at an air-to-fuel mixture ratio that is 5 to 25 times greater than for piston engines, the relative proportions of these contaminants differ between piston engine and turbine power plants. That is particularly true during takeoff, where the rich mixture ratio of the piston engine results in comparatively high exhaust concentrations of carbon monoxide and organic gases and low concentrations of nitrogen oxides. The exhaust products of aircraft piston engines are similar to those of comparable motor vehicle power plants, and lead is the dominant particulate emitted.

Turbine engine fuel, on the other hand, contains relatively little lead, and the dominant particulate emitted is carbon. The primary products of jet engine exhaust are carbon dioxide, water vapor, carbon monoxide, hydrocarbons, particulates, nitrogen oxides, and sulfur oxides. The first two are not generally considered air pollutants. The emission of particulates, the only directly visible component of jet aircraft exhaust, is expected to decrease substantially during the present decade as new engines for the Boeing 747, Douglas DC-10, and Lockheed 1011 aircraft come into greater use and older engines are retrofitted with improved combustors.

By the end of 1973, the airlines completed installation of new combustors on about two-thirds of the engines powering the Boeing 727, Boeing 737, and Douglas DC-9 aircraft. Particulate emissions from these engines should be reduced by about 60 percent during idling and by about 25 percent during taxi and takeoff operations.

The procedure for evaluating the potential effect of flight operations and related ground morements on air quality under the alternative airport system plans is similar in some respects to the kind of analysis required to evaluate the air pollution potential of stationary sources and motor vehicle movements. The first step involves compiling an emission inventory based on the frequency and type of aircraft operations and related ground activities, and the types of pollutants and rates of emission characterized by the aircraft and ground vehicles operating at each airport under each alternative plan.

To evaluate the impact of airport generated emissions on ambient air quality requires understanding of the ambient air quality and atmospheric dispersion of the emissions under study. Use of simulation models permits this understanding and impact analysis. Once airport emission simulation and atmospheric dispersion models are in operation, they can be used to generate air pollution isopleth maps for the Region under each alternative plan and over a range of meteorological conditions characteristic of the Region and specific airport sites. The procedure and resultant output are directly analogous to the results obtained by applying equivalent atmospheric dispersion models to stationary or vehicular sources of air pollution. The air quality estimates of the dispersion model can be quantified for each alternative airport system plan, compared among alternatives, and compared with state and federal air quality standards for each pollutant to determine which alternative plans or specific airport sites, if any, constitute an unacceptable source of air pollution.

To date there is very limited emission inventory and meteorological data for describing current ambient air quality conditions within the Region. Moreover, no validated simulation models exist to evaluate impacts of potential sources of air pollution, such as airports, on ambient air quality within the Region. A regional air quality maintenance planning program presently being undertaken by the Commission in cooperation with the Wisconsin Departments of Transportation and Natural Resources and the U. S. Environmental Protection Agency will provide the quantitative analytic capabilities required for a meaningful understanding of the impact of alternative transportation and land use activities upon ambient air quality. In addition to the regional air quality study, the consultant undertaking the master planning work for General Mitchell Field is to use an atmospheric dispersion model to evaluate the impact of pollutants generated by aircraft and ground transportation on air quality near General Mitchell Field.

The only substantive air quality analyses undertaken on a mesa scale within the Region, subject to the limitations of the available data on emissions and meteorology previously described, were undertaken by the Wisconsin Department of Natural Resources in cooperation with the U. S. Environmental Protection Agency in preparing the State Implementation Plan (SIP), a control plan for attaining national ambient air quality standards. In preparing the SIP, a computer modeling effort was undertaken by the Division of Abatement of the National Air Pollution Control Administration with that agency's Air Quality Display Model (AQDM). The mean ambient air particulate levels calculated by application of the AQDM are shown on Map 4 in Chapter III, which indicates that ground level suspended particulates at General Mitchell Field do not exceed the presently established air quality standards. Map 4 also indicates that only Racine Commercial Airport is located in an area where particulate levels approach the secondary standard.

Field investigations conducted by the Wisconsin Department of Natural Resources, Division of Environmental Protection, Bureau of Air Pollution Control, indicate that the problem area located near the Village of North Bay in Racine County is a result of an isolated quarrying operation. It also appeared doubtful that the source emissions could affect areas as large as indicated by the dispersion model.

Map 5 in Chapter III indicated that sulfur dioxide concentrations over the Region do not appear to constitute an air quality problem at this time. Further, the limited monitoring of carbon monoxide throughout the Region has indicated that carbon monoxide does not currently constitute an air quality problem. The State of Wisconsin on June 21, 1974, submitted a proposal to the U. S. Environmental Protection Agency (EPA) for identifying the Southeastern Wisconsin Region as an Air Quality Maintenance Area for particulate matter, photochemical oxidants, and sulfur dioxide.

The EPA Administrator on June 2, 1975, modified the Wisconsin proposal to include the seven-county Southeastern Wisconsin Region as an interstate Air Quality Maintenance Area with parts of Illinois and Indiana to provide a formal mechanism for the three states to jointly address related pollution problems.

Thus, it appears that the pollutants currently generated by aircraft operations at the existing airports are being sufficiently dispersed horizontally and vertically so that no measurable deleterious impact on regional ambient air quality can be observed. The decrease in pollutant emissions which may be expected from implementation of federal pollution emission control requirements on aircraft and automotive vehicles should provide a positive measure toward maintaining specific ambient air pollutant concentrations at or below the present acceptable levels.

On a smaller scale, the Milwaukee County Department of Air Pollution Control included jet aircraft emission data in a report entitled 1970 Air Pollution Source Inventory for Milwaukee County. Analysis of scheduled air carrier service as provided in 1970 indicates that about 67 percent of all air carrier aircraft movements at General Mitchell Field are made by jet powered aircraft. General aviation movements, estimated to account for about 50 percent of the total operations at General Mitchell Field, also contribute to pollutant loading, but to a much lesser extent than air carrier aircraft because of the difference in engine size. The other potentially significant source of air pollution is from ground transportation movements generated by the airport, which may comprise up to 50 percent of total emissions from the largest airport in the Region—General Mitchell Field.

A comparison of the pollution emissions from jet aircraft, the only aircraft engine related data available for a one-year period at General Mitchell Field, and comparable figures for the entire Milwaukee County area are shown in Table 199. The table also indicates the proportion of the total pollutant emissions within the county that is contributed by jet aircraft operations. The land area of the airport represents about 1.27 percent of the total land area of Milwaukee County. For every category of pollutants, jet aircraft operations at General Mitchell Field contribute proportionally less pollutants to the county total emissions than, on the average, all other land use activities within the county. In addition, although pollutant concentrations may be relatively high in certain areas of the airport for short periods of time, such as in the immediate vicinity of taxiways and runways, atmospheric dispersion reduces the concentrations at the active airport boundaries to only 10 percent of that measured at the aircraft.

Unless a major industrial source of air pollutants is sited in the vicinity of the airport, the most significant secondary source of air pollutants is likely to be the movement of motor vehicles traveling into and out of the airport terminal and parking areas. In order to estimate the incremental pollution attributable to ground transportation movements, the carbon monoxide, hydrocarbons, and oxides of nitrogen which can be expected to be generated annually by surface transportation movements within the boundary of General Mitchell Field were computed. The computation was based on the assumptions that there are approximately 2.2 inbound vehicle trips per enplaning passenger,[5] and that each vehicle traverses one mile of roads within the airport boundary in the cruise mode, assumed to be an average speed of 25 miles per hour for passenger vehicles and 10 miles per hour for service vehicles.

At the 1970 enplaning passenger loading of 887,000 persons, ground motor vehicle operations at General Mitchell Field would, under the stated assumptions, generate approximately 110 tons of carbon monoxide, 14 tons of hydrocarbons, and eight tons of the nitrogen oxides per year within the airport site. These pollutant loadings from ground travel represent about 45 percent of the carbon monoxide, 11 percent of the hydrocarbons, and about 3 percent of the nitrogen oxide emissions produced by jet aircraft operations at General Mitchell Field. Thus, on the basis of available data, it would appear that the jet aircraft and attendant surface transportation emissions at the major air carrier airport within the Region should not create an adverse air quality condition. It can be assumed, therefore, that air pollution from the smaller airports located elsewhere in the Region should similarly not create a serious adverse impact. To

[5] *"Characteristics of Air and Ground Travel Generated by General Mitchell Field Airport Terminal—May 1968," SEWRPC Technical Record, Volume 3, No. 4, page 26.*

Table 199

AIR POLLUTANTS EMITTED BY JET AIRCRAFT AT GENERAL MITCHELL FIELD AND TOTAL EMISSIONS FROM ALL MAJOR SOURCES IN MILWAUKEE COUNTY: 1970

Category	Emissions (Tons)					
	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides	Sulphur Dioxide	Particulates	Total
Emissions from All Major Sources in Milwaukee County	404,823.6	90,049.3	82,704.1	231,132.8	44,913.7	853,623.5
Emissions from Jet Aircraft at General Mitchell Field	246.9	127.3	261.3	--	183.6	819.1
Jet Aircraft Emissions as Percent of Total Emissions	0.06	0.14	0.32	0.0	0.41	0.0

Source: Milwaukee County Department of Air Pollution Control, 1970 Air Pollution Source Emission Inventory for Milwaukee County.

further understand the impact upon air quality of general aviation activities a comparison was made of air pollutant emissions from motor vehicles and aircraft operations at a general utility airport with emissions from a similar sized medium density residential neighborhood. It was found that all pollutants except carbon monoxide may be expected to be produced in greater quantities in a medium residential neighborhood than by aircraft and motor vehicle operations at a general utility airport. Aircraft operations during 1973 at Timmerman Field, the busiest general aviation airport in the Region, have been estimated to produce a total of 0.89 tons of particulant matter, 0.62 tons of sulfur dioxide, 540.56 tons of carbon monoxide, 2.08 tons of nitrogen oxide and 17.72 tons of hydrocarbons. Automobile travel at the airport annually produced an estimated total of 0.03 tons of particulants, 0.01 tons of sulfur dioxide, 6.04 tons of carbon monoxide, 0.27 tons of nitrogen oxide, and 2.10 tons of hydrocarbons. The emissions from other sources such as terminal facilities, hangars and tower buildings at a general aviation are considered relatively insignificant. In the predominantly residential neighborhood immediately south of the airport, a medium density neighborhood equivalent in size to the airport with a residential density of 12.3 persons per net acre, the two largest sources of pollutant emissions, travel on collector and local streets and residential fuel uses, together have been estimated to produce 2.44 tons of particulant matter, 6.70 tons of sulfur dioxide, 1.54.73 tons of carbon dioxide 9.32 tons of nitrogen dioxide, and 54.06 tons of hydrocarbons annually. It may be concluded that aircraft operations and attendant ground travel by motor vehicles at general aviation airports have less impact upon regional air quality than medium density residential development.

Since each alternative airport system will serve the same number of aircraft operations and generate the same amount of ground vehicular movements, the airport system that minimizes ground travel and aircraft delay and accommodates the maximum number of aircraft at airports evenly distributed throughout the Region should create the minimum impact on ambient air quality in the Region, as shown qualitatively in Table 200. On this basis, alternative C may be expected to result in the least adverse impact upon regional air quality, whereas to do nothing or to move airports to less densely developed portions of the Region will generate a more severe impact on regional air quality.

The potentially deleterious lake breeze effects upon concentrations of pollutants from airport operations must be recognized in the case of the Ozaukee, General Mitchell Field, and Racine Commercial Airports, which are located near Lake Michigan. The lake breeze influence described in Chapter III may trap pollutants below the inversion layer and recirculate them over the lake and land near the lakeshore until relatively high concentrations accumulate. These concentrations may be many times higher than the normal concentrations within the Region, even though the pollutant emission rates in the area remain constant. It has been stated that "On the western shore of Lake Michigan, lake breezes develop on about 35 percent of the spring and summer days."[6]

However, based on observational records of the National Weather Service Office at General Mitchell Field, located about three miles west of the lake, lake breeze circulation of moderate to high strength which extends three miles or more inland occurs during only 7 to 10 percent of the warm season days. The most probable maximum development of the lake breeze effect is thought to extend inland about six miles, while the area that may experience the lake breeze effect more than 7 percent of the time is thought to extend three miles inland. The three airports

[6] *Dr. Henry S. Cole and Walter A. Lyons, "The Impact of the Great Lakes on the Air Quality of Urban Shoreline Areas: Some Practical Applications with Regard to Air Pollution Control Policy and Environmental Decision Making," Proceedings, 15th Conference, Great Lakes Research, 1972, International Association for Great Lakes Research, page 441.*

Table 200

RANKING OF ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F
WITH RESPECT TO IMPACT ON AIR QUALITY IN THE REGION

Alternative Airport System Plan	Ranking			
	Minimize Ground Travel Time	Minimize Delay to Aircraft Operations	Maximize Distribution of Aircraft Operations Within Region	Total
A	2	2	1	5
C	5	4	4	13
D	3	1	2	6
E	4	3	3	10
F	1	5	5	11

Source: SEWRPC.

mentioned earlier are within three miles of the lakeshore. The Kenosha Municipal Airport is located at the edge of the lake breeze effect, six miles from the lakeshore. The limited amount of ambient air quality and meteorological data within the Region and along the Lake Michigan shoreline makes quantitative statements relative to the effects of the lake breeze upon air pollution difficult. Thus, the increment of air pollution attributable to aircraft operations and surface transportation within the area of the potential deleterious lake breeze effect cannot be evaluated in detail at this time.

Natural Resource Base: Airport system development can have both positive and negative impacts on the natural resource base. Airports consist primarily of large, pervious, open space areas in which comparatively limited amounts of land are covered by permanent structures.[7] Airport operations and attendant activities do contribute, however, to air pollution, and may contribute to ground and surface water pollution through improperly designed storm water drainage facilities. Further, large airports may generate secondary effects through adjacent land use development with additional potential for air and water pollution. Large amounts of land are needed for the development of new airports and the expansion of existing airports. Consequently, the most serious impacts of airport system development upon the natural resource base—other than air pollution—can probably best be measured in terms of the required conversion of land from existing uses to airport use.

Land required to expand existing airports may already be in another urban use, so that while the expansion may have important socioeconomic effects attendant to the use conversion, the effects on the natural resource base may not be significant. More often, land for airport expansion and for new airport construction will be in agricultural or in woodland, wetland, or other natural open uses. The conversion of these uses to airport use may have important impacts on the natural resource base, affecting the amount and quality of surface water runoff, groundwater conditions, and wildlife as well as air quality.

The Regional Planning Commission has inventoried the significant elements of the natural resource base, and has found that they are concentrated in linear areas within the Region termed environmental corridors, which must be preserved in essentially natural open use in order to protect the natural resource base and the overall quality of the environment. These corridors encompass the lakes and streams of the Region, together with the associated undeveloped floodlands and shorelands; the best remaining woodlands, wetlands, and wildlife habitat areas; the best remaining sites having scenic, scientific, cultural, and recreational value; and the groundwater recharge areas of the deep aquifer underlying the Region. Any conversion of these corridors or the remaining prime agricultural land within the Region to other uses is considered to have an adverse impact upon the natural resource base and the overall quality of the environment.

The conversion of lands other than environmental corridor and prime agricultural land to airport use was not considered to have any more of an adverse impact upon the natural resource base or overall quality of the environment than would conversion of such land to other urban uses, which may occur as urban uses expand. In fact, airport development may, under certain conditions, provide a means for actually preserving environmental corridors and prime agricultural lands. In addition, it is possible to continue agricultural and other open space uses of much of the large open areas that exist within airport boundaries.

In identifying potential sites for new airports required under each alternative system plan as well as expansion area for existing sites, the potential impact upon the natural resource base was evaluated in terms of the land use conversions involved. In several instances, the proposed sites were shifted from an initial to a better location, and runways were reoriented to reduce the potential adverse impact upon the natural resource base, or more specifically, upon environmental corridor and prime agricultural lands.

Alternative Airport System Plan A: Since no new airport construction or existing airport expansion is required under alternative A, the impact upon the natural resource base is limited to the impact of increased air and ground travel generated by the airports on air quality, and by changes in land uses around the existing airports.

Alternative Airport System Plan C: Alternative C requires development of three new airports and the expansion of eight existing airports within the Region. The three new airports would require the conversion of extensive amounts of land currently in other uses.

Site A in southern Ozaukee County is the proposed location of a new basic transport airport. This site is located immediately adjacent to an area in the City of Mequon which is proposed to receive sanitary sewer service. The airport site would encompass lands currently and proposed to remain in rural uses, either agricultural or environmental corridor. The primary runway is proposed to be constructed parallel to a primary environmental corridor, but the crosswind runway would extend into the corridor. The proposed site boundaries encompass a total area of about 800 acres, 30 of which are presently in urban use, primarily transportation; about 250 are primary environmental corridor, and about 520 are prime agricultural land. Lands required for clear zones and lands over which easements would be obtained to

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[7] *For example, buildings, runways, taxiways, aprons, automotive parking areas, and other impervious surfaces cover only about 17 percent of the total site area of the Waukesha County Airport, a typical general utility airport in the Region. Such areas cover only about 20 percent of General Mitchell Field, the single air carrier airport in the Region. By comparison, impervious surfaces cover about 30 percent of the total land area of a typical, medium density residential neighborhood.*

control development would be comprised almost entirely of primary environmental corridor, and airport development would assist in maintaining these lands in open use.

Site D in western Waukesha County is proposed as the location of a new general utility airport under this alternative system plan. This site is located on prime agricultural land between two primary environmental corridors in the recharge area of the deep sandstone aquifer underlying the Region. The proposed site boundaries encompass a total area of about 780 acres, of which 475 are prime agricultural land, 230 are primary environmental corridor, and 75 are in urban use, primarily transportation. The site is located beyond any proposed sanitary sewer service areas, but is covered by soils generally well suited for urban development without sewer service.

Site F in southeastern Waukesha County is proposed as the location of a new general utility airport under this alternative system plan. This site is located on lands proposed to remain in agricultural use and is beyond any proposed sanitary sewer service area. Soils in this area are generally poorly suited for urban development without sanitary sewer service. The proposed site boundary encompasses a total area of about 640 acres, of which 480 are in agricultural use, 110 are primary environmental corridor, primarily wetlands, and 50 are in urban use, primarily transportation.

The West Bend Municipal Airport is proposed to be expanded to a basic transport airport under this alternative. Needed construction would encroach into the primary environmental corridor along the Milwaukee River. Commission engineering analyses indicate that the primary runway construction could be accommodated within the floodplain without significantly affecting flood flows and stages. Clear zone land takings and easements would extend into and above the primary environmental corridor, and aircraft operations would occur over the corridor. The airport site expansion would encompass a total area of about 165 acres, of which about 150 are in agricultural use, five are environmental corridor, and 10 are in urban use, primarily transportation.

The Hartford Municipal Airport is proposed to be upgraded to a general utility airport under this alternative system plan. Expansion of the site boundaries required to accommodate runway extension and clear zones will require conversion of about 120 acres of land currently in agricultural use. The Waukesha County Airport is proposed to be expanded to a basic transport airport, requiring the acquisition of about 220 acres of land, about 165 of which are in agricultural use and the remainder are in urban uses, including recreational and commercial as well as transportation. The Burlington Municipal Airport is also proposed to be expanded to a basic transport airport under this plan, without any encroachment on the adjacent primary environmental corridors. Extension of the primary and crosswind runways and the associated clear zones would require the conversion to airport use of a total of about 185 acres of land, of which about 170 are prime agricultural lands and the remaining 15 are in a primary environmental corridor.

The Kenosha Municipal Airport is proposed to be expanded to a basic transport airport under this alternative system plan. This expansion, consisting primarily of runway extensions and associated clear zones, will require the conversion to airport use of approximately 320 acres, of which about 290 are prime agricultural land, 20 are in urban use, both residential and transportation, and 10 are environmental corridor. No expansion is proposed at Timmerman Field in Milwaukee County under this alternative. Land use changes for clear zones and navigation easements at the Racine Commercial Airport would affect lands presently in urban use.

The privately owned Gruenwald Airport south of Elkhorn in central Walworth County is proposed to become a general utility airport under this alternative system plan. The site is located west of CTH H and north of the secondary environmental corridor along Jackson Creek. The site is generally covered by soils considered unsuitable for urban development without sanitary sewer service, and is beyond any area proposed to receive such service. The proposed airport site would be within a section of land that presently contains about 520 acres in agricultural use, 210 of which are prime agricultural land; 70 are secondary environmental corridor, primarily wetlands; and 50 are in urban use, primarily transportation, including the present airport. Construction of the primary runway could be undertaken without encroaching on the secondary environmental corridor, but construction of a crosswind runway would encroach on corridor lands because of the proximity of CTH H. Clear zones beyond both runways would extend into the secondary environmental corridor, assuring its preservation in open use within the airport site boundaries.

The privately owned Ozaukee Airport north of Port Washington in Ozaukee County is proposed to become a general utility airport under this alternative system plan. The site is located west of the primary environmental corridor along Sauk Creek and beyond any area proposed to receive sanitary sewer service. Soils covering this site are considered generally suitable for urban development without sanitary sewer service. The airport site would encompass a total area of about 640 acres, of which about 520 are agricultural lands, including 145 acres of prime agricultural land; 50 acres are primary environmental corridor; and 70 are urban lands, primarily transportation facilities, including the present airport. Runway construction could be undertaken without encroaching on the primary environmental corridor, but the crosswind runway clear zone would extend into the environmental corridor where STH 84 crosses Sauk Creek.

New airport development and existing airport expansion under this alternative plan would require the conversion of about 3,240 acres of land in agricultural use, of which 1,810 are prime agricultural lands, and about 740 acres of environmental corridor lands to airport site use. Much of this land, however, could remain in open space. Of the three new sites, one is located adjacent to a proposed sanitary sewer service area, one is covered by soils generally suitable for urban development without sanitary sewer service, and one is located on soils generally poorly suited for urban development without sanitary sewer service. In addition, about 360 acres of land presently in other urban uses would have to be converted to airport site use, of which about 280 acres are in transportation facility uses.

Alternative Airport System Plan D: Alternative D includes the development of five new airports, expansion of six existing airports within the Region, and abandonment of four urban area airports—Timmerman Field, Waukesha County, Racine Commercial, and East Troy Municipal. The land use changes required to encompass airport expansion under this alternative would be identical to those described under alternative C for the Kenosha Municipal, Hartford Municipal, West Bend Municipal, and Ozaukee Airports.

Under alternative D, the Burlington Municipal Airport is proposed to be expanded to a general utility airport, requiring less land conversion than described under plan C. The airports at Gruenwald, site D in western Waukesha County, and site F in southeastern Waukesha County would be expanded to basic transport airports, and require land takings greater than those described for these three sites under alternative C. Since quarter section approximations of land areas have been used to quantify the land use conversions required under the alternative plans, no adjustment to the land quantities discussed for these airports under alternative C were made. The abandonment of four urban airport sites will result in the conversion of 1,330 acres of lands currently in airport use to more intensive urban use.

Site C in north central Racine County is the proposed location of a new general utility airport under this alternative system plan. The site is located west of the Root River and is beyond any existing or proposed sanitary sewer service areas. It is located on soils generally poorly suited for urban development without sanitary sewer service. The proposed boundaries have a total area of about 490 acres, of which about 450 are prime agricultural lands, 25 are secondary environmental corridor, and 15 are in urban use, primarily transportation facilities. Crosswind runway construction would occupy floodplains, and would require careful design to minimize loss of storage and increases in flood discharges and stages.

Site E in north central Walworth County is proposed as a new general utility airport to serve as an alternative site to the present East Troy Municipal Airport. This proposed site is located north of Honey Creek, a primary environmental corridor, and in the groundwater aquifer recharge area underlying the Region. Soils covering this site and environs are generally suited for urban development without sanitary sewer service, and the site is located beyond areas proposed for sanitary sewer service. The proposed site boundaries encompass a total area of about 470 acres, of which about 415 are in agricultural use, about 50 are secondary environmental corridor, and five are in urban use, primarily transportation.

Site G in southeastern Washington County is proposed to be developed as a basic transport airport under this alternative system plan. This proposed site is a nonurban alternative to site A initially proposed under alternative C. This site is nearly encircled by primary environmental corridors, covered by soils considered generally unsuitable for urban development without sanitary sewer service and located beyond areas proposed for new sanitary sewer service. Although no physical airport development would encroach upon the primary environmental corridor, careful runway orientation would be required to minimize the impact of clear zone requirements on the woodlands that exist within the environmental corridors. The primary environmental corridor lying east of the airport site includes the Germantown swamp, a high value, transitional swamp forest and floodland hardwood forest. North of the airport site, the environmental corridor contains significant wetlands and medium value woodlands. The proposed site boundaries encompass a total area of about 640 acres, including 560 acres in agricultural use, 75 acres in primary environmental corridor use, and 15 acres in urban uses, primarily transportation.

New airport development and existing airport expansion under this alternative system plan would require the conversion of about 4,150 acres of agricultural land, including over 1,570 acres of prime agricultural lands, and about 640 acres of environmental corridor lands, to airport use. All five new airport sites would be located beyond existing or proposed sanitary sewer service areas, and three of the sites would be located in areas generally covered by soils considered unsuitable for urban land uses without sanitary sewer service. In addition, 310 acres of land presently in other urban uses would have to be converted to airport site use, of which 200 acres are in transportation and utility facility uses. Under this alternative system plan, four public use airports would be abandoned, making available 1,330 acres of land for more intensive urban development.

Alternative Airport System Plan E: Under alternative E, existing airports would be expanded to accommodate the probable forecast of future aviation demand within the Region. Except for expansion of the East Troy Municipal and Sylvania Airports, the impacts upon the natural resource base of expanding other existing airports considered under this alternative have also been considered and discussed under prior alternative plans. The expansion and upgrading of the West Bend Municipal, Waukesha County, Burlington Municipal, and Kenosha Municipal Airports to basic transport airports proposed under this alternative was discussed under alternative C. The expansion and upgrading of the Hartford Municipal and Gruenwald Airports to general utility airports proposed under this alternative was also discussed under alternative C. Although the Ozaukee Airport north of Port Washington is proposed to be expanded and upgraded to a basic transport airport under this alternative, the discussion regarding land conversions to upgrade this airport to general utility under the prior alternative also applies in quantifying the impact upon the natural resource base of an airport at this location under alternative E.

The East Troy Municipal Airport is proposed to be upgraded to a basic utility airport under this alternative plan. Runway construction would not encroach upon the environmental corridor adjacent to the airport site, but clear zone requirements would include corridor lands. The airport site would encompass a total of about 315 acres, including about 125 acres of primary environmental corridor, 145 in agricultural use, and 45 in urban use, primarily transportation and including the present airport.

The privately owned Sylvania Airport in southern Racine County immediately west of IH 94 is proposed to be included in the airport system and upgraded to a basic utility airport. The site is located beyond areas proposed to receive sanitary sewerage service, and is covered by soils considered to be generally unsuited for urban development without sanitary sewer service. The proposed site boundaries encompass a total area of about 270 acres, of which about 180 prime agricultural land and about 90 are in urban uses, primarily transportation facilities, and including the existing airport. Three other existing privately owned airports that are part of this alternative—Racine Commercial in the City of Racine and the Lake Lawn Lodge and Playboy airports in Walworth County—are not expected to be expanded, and therefore should not engender any new adverse impacts upon the natural resource base.

Expansion of existing airports to accommodate the probable forecast demands under this alternative would require the conversion of about 2,350 acres of agricultural land, including 825 acres considered to be prime agricultural land and about 275 acres of environmental corridor lands, to airport use. In addition, 340 acres of land presently in other urban uses, including 260 acres in transportation use, would have to be converted to airport site use.

Alternative Airport System Plan F: Alternative F is similar to alternative C with the addition of a new regional air carrier airport in north central Racine County. The impact on the natural resource base of land conversions of the general aviation airports in this alternative has been discussed under alternative C. The impact of a new air carrier airport on the natural resource base is described under the section of this chapter devoted to evaluation of alternative air carrier sites.

To evaluate the impact of alternative system plans on the natural resource base of the Region, each airport site under each alternative was analyzed in terms of land use conversion required to expand existing airports or develop new airports to accommodate the probable forecast demand for aviation services throughout the planning period. Significant elements of the natural resource base are comprised of prime agricultural and environmental corridor lands. The conversion of these two land uses required under each alternative plan is summarized in Table 201. The table also contains the ranking of each alternative system plan in terms of its impact upon the natural resource base. As expected, the alternative airport system plans which maximize use of the existing airports result in minimum adverse impact upon the natural resource base. Alternative F, the relocated air carrier airport plan, has the most adverse impact upon the natural resource base because of the need to develop a large air carrier airport and new airport sites within the Region, requiring the conversion of land now in agricultural and environmental corridor use to airport use. The impacts of alternative plans C and D on the natural resource base are quite similar based upon this analysis.

Evaluation of Air Carrier Airport Alternatives

The need to provide adequate airport facilities for scheduled commercial airline service is perhaps more readily recognized by the general public than the need to provide airports for general aviation activities. Although it has been determined that only one air carrier airport will be required to accommodate the probable future demand of enplaning passengers within the Region through 1990, and although the required air carrier airport is only one element of an overall system plan for the Region, results

Table 201

LAND IN THE REGION REQUIRED TO BE CONVERTED TO AIRPORT USE UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F

Alternative Airport System Plan	Acres of Land Required for Airport Use: Urban	Agricultural	Prime Agricultural	Environmental Corridor	Ranking According to Impact on Natural Resource Base
A	0	0	0	0	5
C	360	3,240	1,810	740	2
D	310[a]	4,150	1,570	640	3
E	340	2,350	825	275	4
F	200	6,740	2,670	1,060	1

[a] *1,330 acres of land currently in airport use would become available for other urban uses.*

Source: SEWRPC.

of the evaluation of the alternative locations for the air carrier airport are presented in this separate section of the chapter because of the major impact which aircraft operations at the air carrier airport have upon airspace, and because of the major potential impact which the air carrier airport and attendant air and service traffic operations may have upon land use, noise, air quality, and the natural resource base.

Four alternative locations within and adjacent to the Region were considered for the required air carrier airport: General Mitchell Field, the existing site; a new site in northern Racine County west of IH 94—South; the site of the abandoned Richard I. Bong Air Force Base in northwestern Kenosha County; and a new site in Jefferson County west of the Region along IH 94— West, considered as a potential joint use facility between the Madison urban area and the Southeastern Wisconsin Region.

Initial analysis of the four alternative air carrier sites was based upon satisfaction of the originating passenger demand, the primary reason for providing the air carrier airport. The centroid of air carrier passenger demand expected to exist in the Region in 1990 was identified as a point in western Milwaukee County near the intersection of S. 114th Street and W. Layton Avenue. An air carrier airport located on that site would minimize ground travel time and attendant costs to all originating passengers within the Region. General Mitchell Field is located less than eight miles from this regional centroid of air travel demand. An air carrier airport located in northern Racine County would be about 15 miles from the centroid of demand, and airports located at Bong and in Jefferson County would be located about 25 and 35 miles, respectively, from the centroid of demand.

The decision to select a particular airport for passenger service is considered primarily a function of available commercial air service and ground travel time. Regional residents have shown a willingness to travel further to achieve the improved schedules and service at O'Hare Field. Thus, the analysis undertaken to allocate the probable forecast of originating passenger demand to alternative air carrier sites recognized that the farther that sites were located away from the centroid of demand, the greater the likelihood that passengers would consider potentially greater travel distance to O'Hare Field. Relationships between travel time to O'Hare Field and the alternative regional air carrier sites were developed, based upon the existing travel time-diversion characteristics described in Chapter VIII, for use in allocating originating regional passengers to the alternative air carrier airports. Thus, it was found that increased diversion of in-Region-generated air transportation demand to Chicago's O'Hare Field may be expected with relocation of the air carrier airport further from the centroid of commercial air carrier service demand.

It was also found that the total time spent in ground travel by the fewer passengers allocated to any of the three new alternative air carrier airport sites would exceed total ground travel time of passengers using General Mitchell Field. Thus, the three alternative sites to General Mitchell Field could be expected to serve a smaller proportion of the Region-generated air passenger demand, and result in further increases in total ground travel time and associated costs than continued use of General Mitchell Field. The alternative site in Racine County is the best of the three in that it is closest to the centroid of demand, and thus could be expected to experience less diversion to Chicago and would result in less ground travel time and cost. A site located in Jefferson County west of the Region would provide the poorest service to air travel demand generated within the Region because of its relatively remote location with respect to regional population centers, and because of the location of Chicago's O'Hare Field with its high levels of airline service.

The Jefferson and Racine County sites are both located near IH 94, thus having convenient access to the regional freeway system. The abandoned Richard I. Bong site is not conveniently located with respect to the regional freeway system. Although an air carrier site in Jefferson County would be located between the major urban areas of Madison and Milwaukee, it would be about 39 miles from the central business district of Milwaukee and about 35 miles from the central business district of Madison, placing large concentrations of air passenger demand at the limits of desirable ground travel times to the air carrier airport. While use of improved high-speed ground transportation could conceivably reduce ground travel time between the urban concentrations served and isolated airport sites such as the Jefferson County and the Bong sites, the provision of such transportation would require commitments of extensive resources to narrow transportation corridors and for a very limited special purpose. Both General Mitchell Field and the Racine County site would better utilize existing and proposed surface transportation systems developed to meet the transportation needs of all people living and working within southeastern Wisconsin.

Ownership of the lands that initially comprised the Bong Air Force Base has been transferred from the federal government to various state and local units of government, primarily the Wisconsin Department of Natural Resources, for school, forest, park, and conservation purposes. Attempts to reassemble these lands for use as a regional air carrier airport site would encounter formidable legal constraints, as well as the political difficulty inherent in any action to convert park and open space land to transportation use. Of the original approximately 5,532 acres, 1,980 acres are held by the Department of Natural Resources for permanent conservation purposes.

Based upon this analysis, it was judged that only the Racine County site warranted further evaluation as a possible location for the regional air carrier airport.

Landing Area Demand/Capacity Analysis: If General Mitchell Field continues to serve as the regional air carrier airport, it can be expected to serve a total of about 140,000 annual air carrier and military operations by 1990. The present airfield capacity is sufficient to accommodate this level of service. In addition to air carrier and military aircraft, however, General Mitchell Field attracts, and may be expected to continue to attract, a significant portion of the regional general aviation demand. The amount of general aviation activity would vary under each alternative system plan.

Table 202 indicates the forecast aircraft operations at General Mitchell Field that may be expected under each of the five alternative system plans. The landing area capacity of General Mitchell Feld is about 290,000 annual aircraft operations, and therefore all plans will require either increased capacity or action to restrict general aviation or military operations at General Mitchell Field to accommodate the probable future traffic demand. Furthermore, the level of demand generated at General Mitchell Field under alternative D is well beyond the practical airfield expansion limits. Thus, this level of aircraft operations could not be satisfied at General Mitchell Field. Airfield expansion could be provided under alternative plans C and E by constructing a third parallel northeast and southwest runway to accommodate a portion of the general aviation demand. This runway should meet, at a minimum, general utility airport classification standards to accommodate type D aircraft. The C aircraft assigned to General Mitchell Field under this alternative could be accommodated on the principal runways.

Action to reassign general aviation operations to nearby reliever airports so that landing system capacity at an air carrier airport would not be exceeded can be taken as an alternative to constructing additional runways and taxiways, which may in some instances require additional land acquisitions to accommodate the landing area expansion. The fee to base and operate general aviation aircraft from the air carrier airport can be set to encourage use of adjacent reliever general aviation airports. The delay incurred by the general aviation operator in takeoff and landing movements at an air carrier airport operating at near capacity may also tend to encourage use of an adjacent general aviation airport. Because military operations represent less than 5 percent of the total forecast operations at General Mitchell Field, and because of the support facilities available to service the military aircraft at General Mitchell Field, relocation of military aircraft and their attendant operations was not considered as a method to match airfield supply and aircraft operations demand.

It should be noted that under alternative A, no airfield expansion would be contemplated at General Mitchell Field to increase capacity. Therefore, a portion of the aircraft demand assigned to General Mitchell Field cannot be accommodated within tolerable levels of delay criteria established for determining airfield capacity. Under alternative F, wherein commercial air carrier service would be relocated to a site in Racine County, General Mitchell Field would become a basic transport airport. Under this condition, the capacity of the landing area at General Mitchell Field would increase to about 502,000 operations per year because of the significant change in the mix of aircraft served. This capacity is well above the forecast number of operations, and no additional landing area capacity improvements would be required.

The expansion requirements for passenger and cargo terminal facilities at General Mitchell Field are identical for all alternative plans that retain this airport as the regional air carrier airport. Again, it should be noted that under alternative A, no terminal expansion at General Mitchell Field to accommodate the forecast passenger and cargo demands is contemplated, and demand could not be accommodated by existing facilities. Under alternative F, General Mitchell Field is proposed to become a basic transport airport, and the existing terminal and cargo facilities are considered to become available for other purposes.

Since aircraft operations to and from General Mitchell Field are given priority over general aviation aircraft movements to and from other regional airports in the terminal airspace above General Mitchell Field, use of the terminal airspace is not considered a constraint on operations to and from General Mitchell Field.

Table 202

FORECAST ANNUAL AIRCRAFT OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1990

Alternative Airport System Plan	Airport Classification	Aircraft Operations				Landing System Capacity (PANCAP)
		Air Carrier	Military	General Aviation	Total	
A	SAT	124,800	15,000	187,800	327,600	284,000
C	SAT	124,800	15,000	162,300	302,100	290,000
D	SAT	124,800	15,000	280,600	420,400	290,000
E	SAT	124,800	15,000	168,400	308,200	290,000
F	BT	--	15,000	288,800	303,800	501,700

Source: R. Dixon Speas Associates, Inc.

It must be assumed that sufficient airfield, terminal, and ground access capacity would be provided to meet forecast demands at a new airport if air carrier service were relocated. Consequently, facilities to accommodate 136 based aircraft, 108,700 air carrier operations, and 201,400 general aviation operations and attendant service demands would have to be provided at the new air carrier airport site. To provide a sufficient landing area with a PANCAP of 246,000 operations and attendant service facilities would require acquisition of a minimum site of 3,600 acres; relocation of about 90 families; provision of improved surface transportation facilities, comprised of a four-mile freeway connection to IH 94 and upgraded arterial streets in the vicinity of the airport site; and the provision of necessary utility services. Use of airspace is not considered a constraint on aircraft operations to and from the proposed new air carrier airport, since priority for space would be given to operations at this airport.

Costs Attributable to Alternative Air Carrier Airports: The costs attributable to the provision of aeronautical services at General Mitchell Field as the Region's only air carrier airport under alternatives A, C, D, and E, and the provision of aeronautical service at an air carrier airport located in northern Racine County under alternative F, are indicated in Table 203. The cost elements compared include the estimated capital investment required to upgrade General Mitchell Field and to develop a new air carrier airport; the estimated cost to annually operate and maintain these two air carrier airports in 1990; the cost of aircraft operation delay—that increment of the cost of aircraft operations above the cost of aircraft operations under free-flow conditions; and the ground transportation costs incurred by Region-generated air passengers in 1990.

The land costs estimated as part of the capital investment include the cost of land required to encompass the physical elements of the airport and the cost of acquiring the clear zones associated with each runway approach as required to meet current FAA clear zone size standards. In the case of General Mitchell Field, about 55 acres of additional land are required to provide a clear zone associated with the east end of runway 7R/25L, which extends beyond the present site boundary, and to accommodate lengthening of runway 1R/19L and its associated clear zones. All other lands comprising runway clear zones are presently owned by Milwaukee County. The FAA will participate in obtaining additional land interest beyond the site boundaries and runway clear zones that extends up to 5,000 feet beyond the runway end and up to 1,250 feet either side of the runway centerline extended to restrict the use of land to activities and purposes compatible with normal aircraft operations.

Meeting the forecast demand for air carrier and military operations at General Mitchell Field would require an estimated capital investment of about $109 million, most of which would be for new terminal facilities, under alternatives C, D, and E. This investment would result in increased terminal capacity and cargo and auto parking facilities, and would provide a landing system

Table 203

COMPARISON OF THE COST OF PROVIDING AERONAUTICAL SERVICES AT ALTERNATIVE AIR CARRIER SITES IN THE REGION UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1975-1990

Element	Cost (Millions of Dollars)				
	General Mitchell Field				Racine County
	A	C	D	E	F
Capital Costs					
Airport Construction	$ --	$ 13.3	$ 13.3	$ 13.3	$ 86.1
Terminal Facilities	--	76.3	76.3	76.3	77.0
Land	--	1.0	1.0	1.0	6.8
Engineering	--	18.1	18.1	18.1	34.1
Subtotal	$ --	$108.7	$108.7	$108.7	$204.0
Attendant Facilities	$13.1	$ 13.1	$ 13.1	$ 13.1	$ 9.0
FAA Costs	1.5	1.5	1.5	1.5	5.9
Total Capital Costs	$14.6	$123.3	$123.3	$123.3	$218.9
Annual Operation and Maintenance Costs	$ 2.0	$ 1.8	$ 2.5	$ 1.8	$ 1.2
Aircraft Operations Costs	4.1	3.3	6.7	3.2	1.2
User Costs	20.3	20.3	20.3	20.3	25.9

Source: R. Dixon Speas Associates, Inc.

capacity for 290,000 annual operations. This PANCAP will satisfy all forecast air carrier and military operations and about 150,000 annual general aviation operations. General aviation demand under alternative E—168,400 annual operations, and under alternative C—162,300 annual operations, is slightly more than this 150,000 figure. Additional investment for a third parallel northeast/southwest runway required under alternatives C and E to meet general aviation operations, if such operations were not reassigned to reliever airports, is not included as a cost attributable to air carrier service. Although alternative D also would require a landing area expansion at General Mitchell Field to satisfy probable forecast demands, expansion to meet these needs was not considered because of the more extensive runway system that would be necessitated. Therefore, only the cost increment of $109 million is included under this alternative plan. Since this expansion will not accommodate demands under alternatives A, C, D, and E, aircraft delay (and extensive aircraft delay under alternative D) could be expected to occur, the estimated cost of which is also noted in Table 203.

Development of a new air carrier airport would require an estimated total capital investment of about $204 million, nearly twice the cost of expanding General Mitchell Field to accommodate forecast aircraft operations. The provision of utilities and arterial highway service to the new airport site in Racine County was estimated to cost about $9 million. The $6 million cost of providing a freeway facility between the proposed new airport and IH 94 has been included in the cost of the airport development. General Mitchell Field already has all necessary major utility and arterial street services, and therefore only the cost of the proposed Airport Spur Freeway—$13.1 million—is included as an attendant cost to the development of General Mitchell Field.

In addition to the estimated capital investment required to expand General Mitchell Field or develop a new air carrier airport and provide attendant utility and ground transportation facilities, a capital investment by the Federal Aviation Administration for air traffic control and navigation aids is required. The FAA would be required to invest about $1.5 million at General Mitchell Field for a new control tower, and relocation of radar antenna, or about $6 million for navigational aids, air traffic control, and weather bureau facilities at a proposed new airport.

To operate and maintain General Mitchell Field as the Region's air carrier airport would require an estimated annual expenditure ranging from $1.8 million under alternatives C and E to $2.5 million under alternative D. Operating and maintaining the regional air carrier airport on the new site would require an estimated annual expenditure of about $1.2 million, or about 33 percent below the lowest estimated annual expenditure at General Mitchell Field. This reduction in cost is due to the lesser number of aircraft operations forecast at the new site—about 200,000—compared with approximately 300,000 forecast at General Mitchell Field.

The investment of annual aircraft operating costs attributable to delay under the operating conditions that will exist at General Mitchell Field in 1990 under each alternative plan is estimated to range from a low of $3.2 million under alternative E to a high of $6.7 million under alternative D. The inability of General Mitchell Field to accommodate the forecast demand of aircraft operations under alternative D is reflected in the higher cost of aircraft operations under the congested conditions forecast for General Mitchell Field under this plan. The increment of annual aircraft operating costs attributable to delay under the operating conditions that will exist at a new air carrier airport in 1990 under alternative F is estimated at $1.2 million. This lower cost at the new site reflects the improved operating characteristics of the new airport and the fewer number of airline operations required to serve the lesser forecast of demand.

The costs of ground travel incurred by regionally generated air passengers using General Mitchell Field in 1990 is estimated to be over $20 million, whereas the costs of ground travel to the same passengers using an air carrier airport in northern Racine County is estimated to be about $26 million in 1990. A total of 3.9 million originating passengers are forecast to use the Racine County air carrier airport in 1990. Thus, 13 percent fewer in-Region-generated air passengers would incur 20 percent higher costs in ground travel if air carrier service is provided in northern Racine County rather than at General Mitchell Field.

Environmental Considerations: *Aircraft Noise:* The noise related to air carrier aircraft operations, particularly jet-powered aircraft, has an adverse impact upon land use activities, particularly residential land uses, around air carrier airports. Several approaches are being undertaken to alleviate the impact of aircraft noise. Quieter aircraft engines are being developed and the entire commercial fleet is expected to be equipped with quieter engines after 1980. Aircraft operations at airports are being modified to reduce the noise attributable to takeoff and landing operations. Airport sponsors are encouraged to purchase noise sensitive land areas, and communities surrounding air carrier airports are encouraged to zone lands adjacent to the airports and under flight patterns for uses more compatible with the aircraft operations.

Composite noise rating (CNR) isopleths, based upon the anticipated operations of the future aircraft fleet in 1980 at General Mitchell Field, have been prepared and analyzed. The isopleths for General Mitchell Field are shown in relation to the airport and surrounding lands in Chapter XII. Analysis of the isopleths indicates that 35 acres of land beyond the airport boundary and in the runway approach clear zone would be considered to be seriously noise impacted, since they are within the 115 CNR isopleth. In the 12 square mile area lying between the 100 and 115 CNR isopleths, or the middle zone, where varying degrees of adverse community response may be expected, there are estimated to be about 13,700 residential dwelling units, 45,200 persons, 15 elementary schools, one high school, a YMCA, and a hospital.

One significant advantage of relocating the air carrier airport to less densely developed portions of the Region is the marked reduction in the impact of noise from air carrier aircraft operations on residential and related land uses under the flight paths. The CNR isopleth for aircraft operations anticipated at the relocated air carrier airport indicated that only 17 residences existed within the area defined by the 100 and 115 CNR isopleths. It is assumed that the airport site boundaries would be delineated to contain the lands defined by the 115 CNR isopleth. It is further assumed that lands adjacent to the new airport and under the runway approaches will be developed in a manner compatible with airport land uses and aircraft operations. The alleviation of adverse noise impact will be negated if incompatible residential or similar land uses are permitted to occur in noise sensitive areas.

Table 204 summarizes the aircraft noise impact, as defined by CNR noise isopleths, which may be expected to result from aircraft operations at General Mitchell Field and at a relocated air carrier airport. Under alternatives A, C, D, and E, which retain air carrier aircraft operations at General Mitchell Field, about 35 acres located within the 115 CNR isopleth are recommended to be acquired by the airport sponsor as part of the additional runway clear zone. The costs of acquisition of this land and other land most severely impacted by aircraft noise have been included in the cost to upgrade General Mitchell Field.

The impact of noise from aircraft operations on land uses between the 100 and 115 CNR isopleths remains the same under each alternative which retains General Mitchell Field as the regional air carrier airport. Under alternative F, air carrier operations are relocated to the new regional air carrier site in northern Racine County and General Mitchell Field is proposed to remain as a basic transport airport. Composite noise rating isopleths were prepared for aircraft operating conditions at General Mitchell Field under this alternative, and although the impact of noise is reduced, the land area between the 100 and 115 noise isopleth extends beyond the boundaries of General Mitchell Field and encompasses 35 housing units and 122 persons.

Air Quality: Although it cannot be shown at this time that the increase in air pollution resulting from jet aircraft operations and attendant ground transportation activity at General Mitchell Field causes the minimum air quality standards to be exceeded, it can be assumed that air pollutant emissions from aircraft operations and ground transportation activity generated by an air carrier airport located in northern Racine County would have a lesser impact upon regional air quality. This is because of the lesser number of aircraft operations and attendant ground travel forecast for the relocated air carrier site, and because a site west of IH 94 is beyond the potential effects of the lake breeze.

Natural Resource Base: The impact of continued air carrier operations at General Mitchell Field upon the natural resource base in this urbanized area of Milwaukee County is limited to the impact of the increased air and ground travel generated by the airport on air quality, and to the impact of changes that may occur in land uses adjacent to the airport. Development of a new regional air carrier airport would require not only the conversion of extensive amounts of land currently in other uses, but also the development of attendant urban facilities. A new air carrier airport could be expected to generate a heavy demand for new urban development with an attendant conversion of land from rural to urban use. The proposed air carrier site in Racine County is located beyond any areas proposed to be served by centralized public sanitary sewer service, and on soils considered unsuitable for urban development without sanitary sewer service. The proposed site boundaries encompass a total of 3,850 acres, including about 3,330 in agricultural use, 1,030 of which have been identified as prime agricultural land; 320 in environmental corridor use; and 200 in urban land uses, primarily transportation and residential uses.

Table 204

IMPACT OF NOISE AT ALTERNATIVE AIR CARRIER AIRPORTS UNDER ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F: 1980

Noise Response Area	General Mitchell Field					Racine County
	A	C	D	E	F	F
Within 115 CNR						
Acres of Land Beyond Airport Boundary	35	35	35	35	--	--
Between 110 and 115 CNR						
Population	45,200	45,200	45,200	45,200	122	55
Housing Units	13,700	13,700	13,700	13,700	35	17
Schools	16	16	16	16	--	--
Hospitals	1	1	1	1	--	--

Source: R. Dixon Speas Associates, Inc.; and SEWRPC.

In summary, the evaluation of alternative air carrier airports to serve the Region indicated the following:

- General Mitchell Field is located nearer the centroid of demand for air carrier service than the alternative site in Racine County, thus serving more passengers at less ground travel time costs.

- There are no airspace constraints to air carrier operations at either alternative air carrier airport.

- There are no substantial landing area capacity constraints at either air carrier airport site except at General Mitchell Field under alternative D.

- The capital investment required to provide a new regional air carrier airport is estimated to be about $204 million, nearly twice that of upgrading General Mitchell Field.

- The estimated cost of aircraft operations and airport operations and maintenance will be less at a new regional airport.

- The impact on regional ambient air quality from air pollutant emissions generated at the new air carrier airport may be expected to be less than at General Mitchell Field.

- The noise impact of aircraft operations on persons living near General Mitchell Field is significantly more adverse than the noise from aircraft operations at the alternative airport site, and the impact on the natural resource base from land conversions to create an alternative airport site is significantly greater than that required to upgrade General Mitchell Field.

Compatability With Other Regional Plan Elements

A regional airport system plan is only one element of a set of interlocking physical plan elements that comprise the comprehensive development plan for an urbanizing region. The Regional Planning Commission has prepared, or has under preparation, other important plan elements which bear upon airport system planning. These include the land use, surface transportation, and sanitary sewerage system plans. Certain aspects of other regional plan elements, such as the floodland and potential multiple- or special-purpose reservoir delineation in the Commission's comprehensive watershed plans, may also affect and be affected by airport development, and to this extent, they have been considered in the airport planning program. These plan elements together with the recommended regional airport system plan represent significant guidelines for the coordinated physical development of the Region, and provide for the efficient use of limited public financial resources and for the proper adjustment of regional development to the natural resource base of the Region.

In the formulation of the objectives and standards used to guide and evaluate preparation of alternative airport system plans, the objectives and standards formulated under other Commission planning programs were considered as relevant. These objectives and standards seek to maximize use of existing and proposed surface transportation and public utility systems, achieve a compatible arrangement of land uses, and protect the natural resource base of the Region. The land use, surface transportation facility, and public utility plans developed to meet these objectives have been relatively well received, have to date been reasonably well implemented, and as such, provide a sound basis for the regional airport system planning effort. It was recognized, however, that planning is a dynamic, continuing process, and that plans must be amenable to change in light of new information and in response to changing conditions. Consequently, the airport system plan finally selected for adoption may require certain changes in other adopted regional plan elements. The relationship of the various alternative airport system plans to other adopted regional plan elements was accordingly analyzed to identify the potential effects of the system plans on these other regional plan elements.

Alternative Airport System Plan A: Alternative A would maintain the existing airport system throughout the planning period. All of the existing publicly owned airports within the Region were recognized as significant special concentrations of land use activities in the preparation of the regional land use, surface transportation, and utility system plans. Further, two of the privately owned airports—Gruenwald and Racine Commercial—were also so recognized in prior regional planning efforts. Ten of the 12 privately owned airports included in alternative A are located beyond proposed sanitary sewer service areas, as is the Hartford Municipal Airport. All but two of the existing airports and all of the publicly owned airports are provided with relatively good surface transportation access by existing or proposed state trunk and county trunk highways. The commercial air carrier airport is to be served by a direct connection to the regional freeway system providing, both a high level of motor vehicle and mass transit service.

Alternative Airport System Plan C: Of the 13 airports within the Region in alternative C, 10 are existing public use airports that have been identified as significant special concentrations of land use activities in the adopted regional land use plan. The three proposed new sites would require changes in the adopted regional land use plan, and would also require some modification to the surface transportation plan in order to provide good arterial access to the airports. In addition, all three proposed new airports are located beyond areas proposed for sanitary sewer service. The Hartford Municipal, Ozaukee, and Gruenwald Airports are also located beyond sewer service areas. The three proposed new general aviation airports are sited on land recommended to remain as agricultural or open space. Being located near urbanizing areas, these airports may generate attendant urban land use development adjacent to their site boundaries.

Alternative Airport System Plan D: Alternative D was developed in an effort to overcome some of the adverse impacts of airport operations on adjacent urban land use development. Under this alternative, the existing Waukesha County, Racine Commercial, and Timmerman Field Airports, located in highly urbanized areas would be abandoned. The forecast air transportation service demands would be met by constructing new airports in less developed areas of the Region. Of the 12 airports proposed within the Region, only seven would be located on sites previously considered in preparing the regional land use plan. These seven sites are all existing airports, and their relationship to other regional plan recommendations has already been discussed.

The five proposed airport sites are located on lands recommended to remain in agricultural or other low density uses and beyond existing or proposed sanitary sewer service areas. Improved arterial highway access would be required to proposed site D near Oconomowoc. These new general aviation airports may be expected to generate some urban development in areas beyond those designated for urban use in the regional land use plan. The airport sites to be abandoned are located within already intensely developed urban areas, and would provide an opportunity for the development of well-planned residential, commercial, industrial, or institutional communities, effectively utilizing existing public utilities and community facilities readily available to the sites.

Alternative Airport System Plan E: Alternative E is compatible with prior regional land use, transportation, and sanitary sewerage system planning in that it proposes continued use and expansion of 14 existing airports within the Region, 10 of which were identified as airports in prior planning activities. All airports under this plan would be provided with good arterial highway access in accordance with adopted plans. Six of the existing public and privately owned airports are located beyond areas proposed for sanitary sewer service, and would have to rely on onsite sewage treatment and disposal facilities or require extension of sewer service to the terminal area. In addition to the existing privately owned airports that would become part of the regional airport system as discussed under prior alternatives, the recreation-related Playboy and Lake Lawn Lodge Airports in Walworth County, both expected to remain in private operation through the planning period, and the Sylvania Airport would be included in the alternative E system plan.

Alternative Airport System Plan F: This alternative is similar to alternative C, but would relocate the regional air carrier airport to a new site in northern Racine County. Relocation of a major facility of this type would represent a major departure from adopted plan elements, having a far greater impact on the regional development plans than all of the other changes identified as required for the alternative airport system plans. A relocated major air carrier airport would require provision of extensive urban services, and in turn can be expected to generate extensive adjacent urban land use development. Relocation of the airport to the site in Racine County, which is presently in agricultural and open space use, will necessitate the construction of a spur freeway to the site westerly from IH 94, and modification to other arterial highways in the area to accommodate the anticipated travel demands generated by the airport and attendant urban land use development. The relocated airport would also require extension of utility systems in an area not previously considered for such service. The impact on other regional plan elements of the other airports included in alternative F was discussed under alternative C.

In summary, alternatives A, C, and E are most nearly in accord with adopted regional land use, surface transportation, and utility plans, since the airports comprising these plans are located near sites considered in the prior planning efforts. Consequently, these systems would require minimum adjustment to, and reappraisal of, the adopted plans. Alternative D extends urban land uses, in the form of airports and attendant urban activities, further into areas previously recommended to remain as agricultural and open space. The surface transportation and sewerage systems required to support this plan would not be significantly different from those required under alternative C. Alterantive F, which includes a relocated air carrier airport, would require major revisions to the previously prepared and adopted regional land use and transportation plan elements, adjustments in other plan elements, and adjustments to financial resource allocations and implementation schedules to accommodate surface transportation and utility service needs generated by the relocated airport and attendant urban development.

Compatibility With Airport System Development Objectives and Supporting Standards

In Chapter VII, airport objectives, principles, and supporting standards were set forth to guide the design of alternative airport system plans and to provide a basis for evaluating the relative merits of each alternative plan. Analyzing the alternative plans on the basis of their ability to meet the specific development objectives and standards, and ranking each system plan relative to the others, facilitates an objective comparative evaluation. To accomplish this evaluation, however, it is necessary in some cases to rely on qualitative analyses to determine how well each plan satisfied each standard and objective.

To identify the relative ranking of one alternative with respect to all others, a simple rating scale of 1 through 5 was applied to each alternative system plan for each standard. Under this rating scale, the lower number represents the poorest condition and the higher number the best condition. Table 205 shows the comparative rating scale, and includes an interpretation of the rating system.

Following the rating of each alternative plan against each standard under the development objectives, a summary of the rating scores for each standard was prepared to provide a rating of each alternative with each objective. The comparative rating of each alternative system plan against the airport system development standards under each objective is listed in Table 206. The comparative rating of each alternative plan with each airport system development objective is summarized in Table 207. Based upon this analysis, alternative C has the highest

Table 205

RATING SCALE USED TO COMPARE ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F WITH REGIONAL AIRPORT SYSTEM DEVELOPMENT OBJECTIVES AND SUPPORTING STANDARDS

Type of Scale	Rating Scale				
Numerical	1	2	3	4	5
Qualitative	Not Met	Met to Slight Degree	Met to Moderate Degree	Met to Large Degree	Met
Comparative	Worst	Poorer than Average	Average	Better than Average	Best

Source: SEWRPC.

Table 206

COMPARATIVE RATING OF ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F WITH AIRPORT SYSTEM DEVELOPMENT OBJECTIVES AND SUPPORTING STANDARDS

Objectives and Standards		Rating of Alternative Airport System Plans				
		A	C	D	E	F
Objective No. 1.	Airport System to Serve Existing and Future Air Travel Demand					
Standard No. 1	Airport classification related to population served and aeronautical demand	1	5	3	4	4
Standard No. 2	Airport classification related to annual itinerant operations of critical aircraft	2	5	5	4	5
Standard No. 3	Airport facilities adequate to satisfy demand	1	5	3	4	5
Standard No. 4	Airport capacity provided to limit delays	1	4	3	4	5
Standard No. 5	Adequate air carrier service provided	5	5	5	5	5
Standard No. 6	Reliever airport provided within 30 minutes ground travel of air carrier airport	2	5	4	4	5
Total	--	12	29	23	25	29

Objectives and Standards		Rating of Alternative Airport System Plans				
		A	C	D	E	F
Objective No. 2.	An Airport System Which Minimizes Accident Exposure and Provides Increased Safety					
Standard No. 1	Airports in system must conform to design standards	1	5	4	4	5
Standard No. 2	Airport construction to conform to "standard specifications for construction of airports"	1	5	5	5	5
Standard No. 3	"Certification and Operations" regulations satisfied	1	5	5	4	5
Standard No. 4	Any structure in airport vicinity to conform to minimum obstruction clearance standards	1	5	5	4	5
Standard No. 5	Upgraded existing facilities to safe condition before building new sites	1	4	3	5	2
Standard No. 6	Height restriction zoning provided adjacent to airport to ensure airspace safety	1	5	5	4	5
Total	--	6	29	27	26	27

Table 206 (continued)

Objectives and Standards		A	C	D	E	F
		Rating of Alternative Airport System Plans				
Objective No. 3.	An Airport System Compatible with Existing Land Use Patterns and Plans					
Standard No. 1	Reduction of land use conflicts by acquisition of adjacent land	1	4	4	4	5
Standard No. 2	Land use controls to remove potential hazards and nuisances	3	4	4	4	5
Standard No. 3	Land use compatibility adjacent to airport	3	2	3	2	4
Standard No. 4	Serves to implement adopted land use plans	5	3	2	4	1
Total	--	12	13	13	14	15

Objectives and Standards		A	C	D	E	F
		Rating of Alternative Airport System Plans				
Objective No. 4.	An Airport System that Minimizes Adverse Effects on Natural Resource Base					
Standard No. 1	Soil suitable for urban development without sanitary sewer service	5	4	3	5	3
Standard No. 2	Airport development should not be subject to flood damage	4	4	4	4	4
Standard No. 3	Airport development should not obstruct waterways	5	4	4	5	4
Standard No. 4	Wetlands disturbance minimized	5	3	3	4	2
Standard No. 5	Woodland disturbance minimized	5	3	3	4	2
Standard No. 6	Natural habitat for wildlife maintained	5	3	3	4	2
Standard No. 7	Contribution to regional air pollution minimized	2	4	3	4	5
Total	--	31	25	23	30	22

Objectives and Standards		A	C	D	E	F
		Rating of Alternative Airport System Plans				
Objective No. 5.	An Airport System that Promotes Flexibility and Services Readily Adapted to Change					
Standard No. 1	Landing area system sized so that 1990 activities represent 60 percent PANCAP	2	3	2	3	4
Standard No. 2	Airport design will provide adequate land area for future development	2	4	3	3	5
Standard No. 3	Area for terminal construction adequate so that 1990 demand is 60 percent of capacity	3	4	3	3	5
Standard No. 4	Facilities to be constructed to meet minimum design standards for airport classification	2	4	4	3	5
Total	--	9	15	12	12	19

Table 206 (continued)

Objectives and Standards		Rating of Alternative Airport System Plans				
		A	C	D	E	F
Objective No. 6.	An Airport System Properly Related to and Integrated with Ground Transportation System					
Standard No. 1	Main airport entrance road connected or served in appropriate manner	5	5	5	5	5
Standard No. 2	Scheduled air transport airport connected with CBD by Type II transit facilities	5	5	5	5	1
Standard No. 3	Travel time between air carrier airport and CBD less than 30 minutes by auto and less than 1.5 times auto time for transit	5	5	5	5	2
Standard No. 4	Auto travel time to air carrier airport to be minimized	5	5	5	5	2
Standard No. 5	General aviation airport service within 40 minutes of all region residents	3	5	5	4	5
Standard No. 6	50 percent of retail, service, and industrial centers within 30 minutes of cargo facility	5	5	5	5	3
Total	--	28	30	30	29	18

Objectives and Standards		Rating of Alternative Airport System Plans				
		A	C	D	E	F
Objective No. 7	An Airport System Properly Related to Public Utility Systems					
Standard No. 1	Proposed sites for SAT, BT, and GU airports located in areas serviceable by sanitary sewers	5	4	3	4	2
Standard No. 2	Proposed sites for SAT, BT, and GU airports located in areas serviceable by public water supply	5	3	2	2	2
Total	--	10	7	5	6	4

Objectives and Standards		Rating of Alternative Airport System Plans				
		A	C	D	E	F
Objective No. 8	An Airport System Located and Designed to Maintain High Aesthetic Quality					
Standard No. 1	Airports located to avoid destruction of pleasing buildings, landmarks, and scenic vistas	2	4	5	4	4
Standard No. 2	Airport facility construction plans exhibit good architectural and landscape design standards	2	4	5	4	4
Total	--	4	8	10	8	8

Objectives and Standards		Rating of Alternative Airport System Plans				
		A	C	D	E	F
Objective No. 9	An Airport System that is Economical and Efficient, Meeting Other Objectives at Lowest Cost					
Standard No. 1	Airport operations and capital investment costs to be minimized	1	5	3	4	1
Total	--	1	4	2	3	1

Source: SEWRPC.

Table 207

COMPARATIVE RATING OF ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F WITH AIRPORT SYSTEM DEVELOPMENT OBJECTIVES

Objectives		Rating of Alternative System Plan				
		A	C	D	E	F
1	An Airport System to Serve Existing and Future Air Travel Demand	1	5	4	4	5
2	An Airport System which Minimizes Accident Exposure and Provides Increased Safety	1	5	4	4	4
3	An Airport System Compatible with Existing Land Use Patterns and Plans	2	3	3	4	3
4	An Airport System that Minimizes Adverse Effects on Natural Resource Base	4	3	2	4	2
5	An Airport System that Promotes Flexibility and Services Readily Adapted to Change	2	4	3	3	5
6	An Airport System Properly Related to and Integrated with Ground Transportation System	4	5	5	4	2
7	An Airport System Properly Related to Public Utility Systems	5	4	3	3	2
8	An Airport System Located and Designed to Maintain High Aesthetic Quality	2	4	5	4	4
9	An Airport System that is Economical and Efficient, Meeting Other Objectives at Lowest Costs	1	5	3	4	1
Total Rating	--	22	38	32	34	28
Maximum Rating Possible	--	45	45	45	45	45
Total Rating as Percent of Maximum Rating	--	49	84	71	76	62

Source: SEWRPC.

rating, indicating it best meets the system development objectives. Alternative E closely follows C in this analysis. Under this analysis, all standards and objectives were assumed to have equal weight.

Further, in addition to the evaluation factors considered herein and the comparison of alternative system plans with the airport system development objectives and standards, the probability of implementation must be considered. The feasibility of implementation may take into account the probability of public policy action to acquire or abandon airport sites, to assume new public airport sponsor responsibilities, and to allocate substantial new public financial resources to airport development and operation.

Other Considerations

In addition to specific site evaluation factors, other factors not readily amenable to quantification were considered in the alternative plan evaluation. These include:

- Privately Owned Airports—Although the privately owned, public use airports in the Region presently supplement the service provided by publicly owned airports, the continued availability of these privately owned airports cannot be relied upon. Since completion in 1971 of the inventory phase of the regional airport planning program, three privately owned, general aviation airports ceased operation or were expected to do so. With few exceptions, privately owned, public use general aviation airports are economically marginal operations. As other land use development opportunities with promise of greater financial return present themselves, abandonment is likely.

- Publicly Owned Airport Abandonment—All proposals involving the closing and abandonment of an existing publicly owned airport must take into consideration any penalties which may be imposed upon the public agency airport sponsor by the federal government as a result of the sponsor's violation of certain convenants and agreements with the federal government. At airports where federal money was used to finance project development, the airport sponsor, by acceptance of federal financial assistance, had to furnish the following assurances to the United States: "these covenants shall become effective upon acceptance by the sponsor of an offer of Federal aid for the Project or any portion thereof, made by the FAA, and shall constitute a part of the Grant Agreement thus formed. These covenants shall remain in full force and effect throughout the useful life of the facilities developed under this project, but in any event not to exceed twenty (20) years from the date of said acceptance of an offer of Federal aid for the Project. However, these limitations on the duration of the covenants do not apply to the covenant against exclusive rights. Any breach of these covenants on the part of the Sponsor may result in the suspension or termination of, or refusal to grant Federal assistance under, FAA administered programs, or such other action which may be necessary to enforce the rights of the United States under this agreement."[8]

Consequently, if closing of a publicly owned airport in the Region is anticipated, the candidate airport sponsor may be liable for repayment to the Federal government of federal grants previously awarded for the development of the airport. Since the covenant becomes effective on the date of the agreement, a pro rata share, based upon the project's useful life up to 20 years, may be levied.

For the purpose of plan evaluation, it was assumed that any such penalties to the airport's sponsor would be offset by the proceeds from the sale of the airport site for other land uses, such as residential, commercial, industrial, or institutional development.

- Airport Operating Restrictions—In developing and evaluating the various alternative system plans, the potential limitation or restriction of certain aircraft operations at selected airports in the Region was considered. In some cases these restrictions would merely be an extension of present operating practices, while in others, these restrictions would represent a new policy. Basically, two types of operating restrictions were considered: 1) restriction of operations by specific aircraft types, and 2) restriction of the type of operations permitted at an airport.

Restrictions of operations by specific aircraft types were assumed in two instances. One such restriction concerned Timmerman Field. Milwaukee County currently has an ordinance prohibiting jet aircraft operations at Timmerman Field. Restrictions imposed by this ordinance were assumed to remain in effect, and no C aircraft were assigned to this airport. This ordinance was developed to limit the noise impact upon the extensive urban development surrounding Timmerman Field. Perhaps in the future, when engine technology alters the effect of this jet aircraft noise, this restriction may be revised.

The second restriction concerned General Mitchell Field. Type E aircraft (the small, light, single-engine aircraft of the general aviation fleet) were not assigned to the air carrier airport unless the aircraft owner could not locate at another airport within 30 minutes ground travel time. In other words, it was assumed that the type E aircraft owner would prefer to base his aircraft at a possibly less convenient general aviation airport than at the air carrier facility. Type E aircraft were permitted to use General Mitchell Field under alternative F, which relocates the air carrier airport to northern Racine County and assumes General Mitchell Field will operate as a basic transport airport.

Many general aviation aircraft owners and users prefer to utilize predominantly general aviation service airports rather than mix with larger high performance aircraft. General aviation activity, particularly that generated by the pleasure flier, is discouraged at many of the air carrier airports in the United States. These airports, in an effort to reduce the potentially dangerous interaction between smaller aviation aircraft and larger air carrier equipment, have levied high landing and costly tie-down fees on general aviation aircraft. In planning for future aviation activity in southeastern Wisconsin, the intermingling of single-engine general aviation aircraft activity and air carrier operations should be minimized. The impact of the operating restrictions necessary to limit such intermingling is minimal, since the restricted aircraft can usually be adequately accommodated at other conveniently located airports.

In an effort to alleviate the adverse noise impact of air carrier operations at airports within intensively developed urban areas, special restrictions on aircraft operating patterns have been implemented. Specific approach and departure patterns have been instituted to minimize the noise impacts on urban areas. Jet aircraft operations have been prohibited after 10 p.m. or 11 p.m. to reduce the impact of noise surrounding residential areas. The use of steeper approach slopes is also being evaluated in an effort to limit the area exposed to the noise of arriving aircraft.

As noted earlier, some public nuisance may be created by the operating procedures followed at a particular airport. The traffic pattern of an airport prescribes the standard traffic flow for aircraft landing at and taking off from an airport. Normally, the airport owner or operator is responsible for establishing the pattern. However, the FAA does recommend certain minimum operating altitudes and procedures. At many general aviation airports around the nation, a standard "left turn" pattern is used, since it provides the pilot maximum visibility of adjacent traffic.

At some airports, nonstandard pattern procedures are used. These patterns, involving right turns or in some cases restricting operations to one side of the airport,

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[8] *Federal Aviation Administration, Form 5100-0, p. 5.*

have been instituted to eliminate conflict with obstructions or to minimize flights over heavily populated areas.

Another alternative to reducing the nuisance element of general aviation airports located near developed urban areas involves imposing restrictions on the flight training activity usually conducted within the airport's traffic pattern. This activity, especially the touch-and-go operations by which a pilot practices takeoffs and landings, may either be entirely banned or restricted to certain days or hours of the week.

Implementing such restrictions will reduce the attractiveness of the airport to certain users, since some aircraft owners will prefer to base their aircraft at another airport free of restrictions. Additionally, it must be recognized that even though the total operations demand at the airport is reduced, the estimated practical annual capacity of the airport will be decreased almost proportionately.

After the recommended regional airport system plan was identified, the noise and nuisance factor around particular airports maintained within the system plan was evaluated to develop specific recommendations regarding traffic operating procedures and restrictions to training activities. Restriction of flight training activity at selected airports in the regional airport system plan may require supplemental landing fields elsewhere to accommodate the demand, or an increase in operations at some of the airports in less densely developed areas may result. Satellite training facilities need only consist of a single paved runway with minimum ground services. Since the training sites are not intended to provide for based aircraft, they can be located away from areas of intensive urban development.

CONCLUDING REMARKS—DETAILED CONSIDERATION OF FEASIBLE ALTERNATIVES

The comprehensive evaluation of the five final alternative regional airport system plans developed through the iterative design process, which considered a total of 21 alternative airport system plans, revealed that three plans—C, "ideal modified"; D, "nonurban"; and E, "no new sites"—present the most feasible alternatives for meeting the air transportation service demand within the Region. The other two alternatives considered in alternative set 3 were found deficient. Alternative A, the "no build" alternative, failed to accommodate the forecast demand even though it included 12 privately owned, public use airports that may or may not be improved to minimum standards for safe aircraft operation, in addition to eight publicly owned airports. Alternative F, while comprising a system capable of meeting the forecast demand for air transportation services, required an excessive capital investment for development of a new regional air carrier airport within the Region which would not serve the existing and probable future demand as well as General Mitchell Field, the existing air carrier airport.

Each of the five alternatives of set 3 was subjected to a comprehensive evaluation, consisting of five categories of analysis and a comparison against the recommended airport system development objectives and supporting standards. The five analysis categories include the general structure of the airport system; landing area demand/capacity; the cost of airport system development, operation, and use; the potential impact of the airport system on the environment; and the compatibility of the airport system with other regional plan elements. The results of the evaluation are summarized in Table 208.

The general structure of the three most feasible airport systems consists of a similar total number of airports to accommodate the forecast demand and to serve aircraft operations under instrument flight rules. The significant difference among the three alternatives is that C and D require the development of new airports within the Region, whereas alternative E relies upon expansion of existing airports within the Region. Plan E includes six existing privately owned, public use airports in addition to the eight existing publicly owned airports. Under the other two alternatives, fewer existing privately owned airports are identified as elements of the system plan, and new airports requiring public sponsors are recommended for development to accommodate the forecast demand.

The landing area demand/capacity analysis indicated that, except for General Mitchell Field, all three alternative system plans consist of airports having the proper classification within the Region to meet the forecast demand of based aircraft and attendant aircraft operations. Demand slightly exceeds the existing capacity of the landing system at General Mitchell Field under two of the alternatives. Under alternative D, the demand at General Mitchell Field cannot be totally served through additional landing area improvements, whereas enough additional capacity at General Mitchell Field under alternatives C and E could, if necessary, be achieved to accommodate the demand by constructing a third parallel northeast-southwest runway.

It is also possible to reduce the demand to better relate to capacity through public policy action by restricting some general aviation operations at General Mitchell Field. This would result in the reassignment of some general aviation operations to adjacent reliever airports. Although the demand/capacity ratio at the general aviation airports under each of the three alternative plans is similar at those airports common to each alternative, three of the proposed new airports under alternative D—sites D, F, and G—may expect to experience demand approaching the runway system capacity. It may be concluded that both alternative plans C and E provide the best systems of airports with respect to effecting a balance between demand and landing area capacity.

The comparison of development, operating, and user costs indicates that the capital costs of developing airports under alternative E are less than under the other two feasible alternatives. Operating and maintenance costs for airports under alternative E are similar to those for airports under alternative C and less than those for airports under alternative D. On the other hand, the ground travel costs to users of the airport system are less under alternative C than under the other two alternatives.

Table 208

EVALUATION OF ALTERNATIVE AIRPORT SYSTEM PLANS A, C, D, E, AND F

Category	Alternative System Plans				
	A	C	D	E	F
General Structure					
Number of Airports	24	16	14	17	17
Number of Existing Privately Owned Airports	13	3	2	6	3
Number of Proposed New Airports	0	3	5	0	4
Number of IFR Airports Within Region	6	13	12	10	14
Number of Airports Outside Region	3	3	2	3	3
Landing Area Demand/Capacity Analysis					
Number of Based Aircraft Beyond 30-Minute Service Area	108	1	1	2	1
Type C Aircraft	92	1	1	2	1
Type D Aircraft	16	0	0	0	0
Number of Annual Aircraft Operations Over Capacity of System General Aviation Airports	43,500	0	0	0	0
Number of Annual Aircraft Operations Over Capacity of Air Carrier Airport	43,600	12,100	130,408	18,200	0
Minimum and Maximum Values—Demand as Percent of Capacity at System Airports	29-119	40-104	25-131	41-106	34-83
Cost (Millions of 1973 Dollars)					
Total System Construction Costs	$16.70	$162.90	$164.20	$158.70	$253.70
Equivalent Annual Construction Costs	1.29	11.60	11.88	11.53	17.29
Equivalent Annual Operation and Maintenance Costs	1.89	2.04	2.48	2.04	2.47
Equivalent Annual Sponsor Costs	3.18	13.64	14.36	13.57	19.76
Equivalent Annual Ground Travel Costs	19.88	18.98	20.03	19.04	21.42
Total Equivalent Annual Costs	23.06	32.62	34.39	33.61	41.18
1990 Delay Cost to Aircraft	4.31	3.59	7.09	3.61	1.55
Environmental Impact					
1980 Noise Impact—Number of People Within 100 CNR Isopleth					
General Aviation Airports	800	1,200	220	1,100	1,300
Air Carrier Airport	45,200	45,200	45,200	45,200	180
Impact on Regional Air Quality—Comparative Ranking (5 is Best)	2	5	2	4	4
Impact on Natural Resource Base—Comparative Ranking (5 is Best)	5	2	3	4	1
Compatibility With Other Regional Plans—Comparative Ranking (5 is Best)	5	4	2	5	1
Satisfying Airport System Objectives					
Total Rating (Higher Numbers Indicate Most Satisfaction)	22	38	32	34	28
Total Rating as Percent of Maximum Rating Possible (45)	49	84	71	76	62

Source: Wisconsin Department of Transportation; R. Dixon Speas Associates, Inc.; and SEWRPC.

In total, the equivalent annual cost to airport sponsors is slightly less and the ground travel cost to airport users slightly higher under alternative E than under alternative C. Although the total estimated equivalent annual costs attributable to the airport systems are less under alternative C than alternative E, this difference is so slight that it cannot be considered significant. Alternative D may be expected to generate the highest sponsor, user, and total costs of the three feasible alternatives.

The impact of the alternative airport system plans upon the environment was quantified in terms of noise and impact on the natural resource base. A comparative ranking of the impact on regional air quality was also prepared. The greatest noise impact is from aircraft operations at General Mitchell Field, the regional air carrier airport under each of the three feasible alternatives. The noise impact from operations at the general aviation airports under alternatives E and C is similar, and greater than the noise impact from operations at the general aviation airports under alternative D. Alternative E, which satisfies the probable forecast of demand through expansion of existing airports, requires the least conversion of the three of prime agricultural and environmental corridor lands. Such conversion was considered as the best measure of the impact of airport development on the natural resource base.

Alternative plans C and D require the conversion of nearly twice the amount of land presently classified as prime agricultural lands and environmental corridor to airport use than does alternative E. Much of the land on and around airport sites, however, can remain in open space and agricultural uses. In addition, under alternative D, over 1,000 acres of land currently in airport use would become available for other urban uses. The qualitative analysis undertaken to provide a comparative ranking of the impact of alternative airport system plans upon regional air quality considered the distribution of aircraft operations within the Region, the delay to aircraft operations, and the ground travel time. Alternative C was identified as the plan which would minimize the impact on regional air quality because of its near ideal distribution of airports throughout the Region and resultant minimizing of ground travel time and aircraft operations delay.

Alternative E, comprised of existing airports, is most compatible with the adopted regional land use, transportation, and sanitary sewerage system plans and with the adopted watershed plans. Development of new airport sites requires conversion of large open areas beyond present and planned urban areas and utility service areas, which may encourage further extension of urban activities into these areas planned for agricultural and open space needs.

The comparison of each alternative system plan with the regional airport system development objectives and supporting standards indicates that alternative C provides the best system of airports to serve the forecast aviation demand, and ranks high against other system objectives, ranking comparatively low only in relation to existing land use patterns and plans and impact upon the natural resource base. Alternative E, relying upon existing airports and their expansion, cannot provide the same levels of air transportation service as alternative C, but is able to meet the demand at an acceptable level of service, at a lesser cost to public sponsors, and with a lesser impact upon land use patterns and plans and the natural resource base.

Alternative D ranked lowest of the three feasible alternatives when compared with the development objectives and supporting standards. It provides an acceptable level of air transportation service except at General Mitchell Field, where demand greatly exceeds capacity, and would extend urban activities into less densely developed areas in an effort to alleviate the impact of aircraft operations upon urban land uses.

In addition to the alternative plan evaluation, the feasibility of plan implementation must also be considered. Under alternative C, public airport sponsors must be identified to develop three new airport sites within the Region, two of which are in Waukesha County, where a public agency at the county level is already the public sponsor of the Waukesha County Airport. In addition to obtaining public sponsors for the new airports, it may also be necessary for a public agency to assume responsibility for airport expansion and operation at the existing privately owned Ozaukee, Racine Commercial, and Gruenwald Airports.

Under alternative E, public agency sponsors may be required for continued operation of privately owned Ozaukee, Racine Commercial, Sylvania, and Gruenwald Airports. Under alternative D, five new airport sites would require three new public agency sponsors at site C in Racine County, site E in Walworth County, and site G in Washington County. This alternative can also result in an expanded airport role for public agencies to sponsor the two new airports proposed for Waukesha County, and requires public agency action to assure operations at the existing privately owned Ozaukee, Racine Commercial, and Gruenwald Airports. New airport sponsors would be required in Racine, Ozaukee, Walworth, and Washington Counties.

In summary, public agency action would be required in three counties—Ozaukee, Racine, and Walworth—to assure continued operation at existing airports made a part of the system plan under all three alternatives. One new public agency sponsor would be required to construct a new airport under alternative C, and three new public agency sponsors would be required to construct three new airports under alternative D.

While the regional airport system planning study was underway, significant regional, national, and international changes were taking place which have implications for decisions concerning airport system development within the Region and elsewhere in the nation. Rates of population and economic growth have been declining, both nationally and within metropolitan regions.[9] A motor fuel shortage caused at least temporary disallocations, and created concern about the inefficiencies of existing transportation systems. Citizen reaction to extensive public works projects showed greater concern over the allocation of scarce resources, and great reluctance to construct new public works relating to transportation. Implications of these changes upon the regional plans will be considered in the major land use and transportation study review initiated by the Commission in 1974.

Based on the foregoing evaluation and observations, it was recommended by the Technical Coordinating and Advisory Committee on Regional Airport Planning that

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[9] *SEWRPC Technical Report Number 10, The Economy of Southeastern Wisconsin, December 1972; and SEWRPC Technical Report Number 11, The Population of Southeastern Wisconsin, December 1972.*

alternative E, the "no new sites" plan, be adopted as the regional airport system plan and refined for public presentation, as set forth in Chapter XII of this report. Alternative E provides a system of airports adequate to meet forecast needs to the design year of the plan at the lowest public sponsor cost, and by utilizing existing airport sites, requires a minimum of new public sponsors. The impact of this alternative on the environment in terms of noise and air pollutants compares favorably with other alternatives, and requires the least amount of land conversion from other important natural resource base related uses to airport use.

In making this recommendation, the Committee recognized that the next best alternative, and the best in terms of satisfying demand for air transportation service, was alternative C, which provides a more flexible approach to providing air transportation services within the Region in that, should it not be possible to develop the new airport sites under alternative C, it may still be possible to develop the existing airport sites identified under alternative E. However, it is believed that under alternative E, the implementing factors of cost to public sponsors, requirements to obtain public sponsors to carry out plan implementation, and the reduced impact upon the natural resource base outweigh the advantages to aircraft users offered under alternative C.

During Committee consideration of the alternative system plans presented in this chapter, the Wisconsin Department of Transportation representatives on the Committee asked that a subalternative to plan E be considered. Under this subalternative, one new airport site located north or northwest of the Milwaukee urbanized area would be added to the existing airports under plan E, in order to provide relief for Timmerman Field and Waukesha County Airport. Site G in Washington County, initially identified under alternative D, was identified as the proposed new airport site. Following discussion of this proposal, the Committee reaffirmed its decision to recommend alternative E as the regional airport system plan for presentation at public hearings, and indicated that should response from the public hearings support the addition of a new airport to the recommended system plan, the plan could be revised.

In order to properly prepare for the public hearings, the consultant was requested to analyze the suggested subalternative. Results of the demand distribution and demand/capacity analysis of this subalternative and a comparison with alternative plans C and E, the two most feasible alternatives, are presented in Table 209. Addition of a new airport northwest of the Milwaukee area may be expected to reduce the based aircraft demand at several of the existing airports—particularly, Timmerman Field, down 17 percent; Ozaukee, down 19 percent; West Bend Municipal, down 22 percent; and Waukesha County, down 12 percent.

Traffic demand as a percent of capacity may also be expected to be reduced at these airports with the addition of the new airport. Except for the Waukesha County Airport, where the demand may be expected to approximate 89 percent of capacity, the demand at the remaining three airports affected may be expected to be at or below 75 percent of capacity under alternative E. Thus, the addition of a new airport to this system plan, while providing an improved level of service, would not be required to eliminate a forecast capacity deficiency. If necessary, improved levels of service or additional airport and airport system capacity could also be obtained at the four airports affected by expanding the landing area system within the airport boundaries.

Development of a new airport at site G was estimated to cost $5,100,000, which, when added to the cost of alternative E, would result in a total subalternative plan E system cost of $163,800,000, an increase of about 3 percent over the costs under alternative E and about the same as the estimated cost for alternative C. Addition of another airport to those in alternative E may be expected to reduce both aircraft operating delay costs and user ground travel costs. With the addition of the new airport at site G, system operating and maintenance costs under subalternative E may be expected to decrease slightly below those of alternative E.

Development of an airport at site G would require conversion of about 560 acres of agricultural land and 75 acres of primary environmental corridor, and may generate attendant urban land uses in an area covered by soils generally considered unsuitable for urban development without sanitary sewer service and located beyond areas proposed for new sanitary sewer service.

Following analysis of the suggested subalternative and comparison with alternative E and the other most feasible plan, plan C, the consultant and the Commission staff concluded that addition of site G to the airports comprising alternative E would not produce a sufficiently improved plan to alter the findings of the evaluation of the basic alternatives described in this chapter. Therefore, based on the Committee action, alternative E was detailed for presentation at public hearings.

SUMMARY

Under the regional airport planning program, a series of alternative regional airport system plans was designed, tested, and evaluated. Each of the alternative system plans was designed to meet the airport development objectives and supporting standards set forth in Chapter VII of this report under the forecast probable future demand for air transportation within the Region set forth in Chapter VIII.

The alternative airport system plan design process was initiated by assigning the probable future demand for air transportation to the existing system of public use airports within the Region, in order to identify deficiencies in that and to obtain an understanding of the characteristics of the unsatisfied demand. The development of alternative system plans to overcome identified deficiencies was one of evolution through successive iterations. Three sets, and a total of 21 alternative airport system plans, consisting of various combinations of airports were

Table 209

COMPARISON OF AIRCRAFT ASSIGNED AND LANDING AREA DEMAND/CAPACITY ANALYSIS FOR ALTERNATIVE AIRPORT SYSTEM PLANS C AND E AND SUGGESTED SUBALTERNATIVE TO PLAN E

County	Airport	Alternative System Plans								
		C			E			Subalternative E		
		Airport Classification	Aircraft Assigned	Demand as Percent of Capacity	Airport Classification	Aircraft Assigned	Demand as Percent of Capacity	Airport Classification	Aircraft Assigned	Demand as Percent of Capacity
Kenosha	Kenosha Municipal. . .	BT	329	83	BT	294	75	BT	278	71
Milwaukee	General Mitchell Field.	SAT	239	104	SAT	249	106	SAT	237	104
	Timmerman Field . . .	GU	306	52	GU	370	63	GU	319	55
Ozaukee	Ozaukee.	GU	153	42	BT	231	77	BT	187	62
	Site A	BT	247	82	--	--	--	--	--	--
Racine	Burlington Municipal .	BT	213	71	BT	194	65	BT	188	63
	Racine Commercial . .	BT	179	62	BT	163	55	BT	160	55
	Sylvania	--	--	--	BU	188	51	BU	195	55
Walworth	East Troy Municipal . .	--	--	--	BU	218	61	BU	201	56
	Gruenwald	GU	169	47	GU	150	41	GU	139	38
	Playboy[a]	--	--	--	BU-II (Recreational)	16	--	BU-II (Recreational)	22	--
	Lake Lawn Lodge[a]. . .	--	--	--	BU-II (Recreational)	11	--	BU-II (Recreational)	11	--
Washington	Hartford Municipal. . .	GU	144	40	GU	166	45	GU	148	40
	West Bend Municipal. .	BT	150	50	BT	178	59	BT	139	46
	Site G	--	--	--	--	--	--	BT	267	89
Waukesha	Waukesha County . . .	BT	297	75	BT	356	89	BT	308	77
	Site D	GU	185	51	--	--	--	--	--	--
	Site F	GU	203	58	--	--	--	--	--	--
Outside the Region	--	--	185	--	--	214	--	--	199	--
Aircraft Unassigned	--	--	1	--	--	2	--	--	2	--
Total	--	--	3,000	--	--	3,000	--	--	3,000	--

[a] *Restricted use, private recreation airports. The airport capacity was artificially limited to limit demand assignment.*

Source: R. Dixon Speas Associates, Inc.

analyzed, including systems consisting of only existing publicly owned airports, of existing publicly and privately owned airports, of airports located only within the Region, of airports located both in and outside the Region, and various combinations of proposed new airports in conjunction with all or some of the existing airports. Through this iterative process, alternative airport system plans evolved which could meet the forecast demand at increasingly higher levels of service.

The first set consisted of eight alternative system plans, four of which contained publicly owned airports only and four of which contained both publicly and privately owned public use airports. The initial alternative system plan of each subset represented the existing system of airports within the Region—the eight publicly owned airports in the instance of alternative system plan 1A and the 25 existing publicly and privately owned airports in the instance of alternative system plan 1E. Subsequent alternative system plans within this set were developed through the addition of airports in proximity to the Region and new airports within the Region, through changes in existing airport classification, and consideration of two scheduled air carrier feeder services in an effort to meet the forecast demand.

Based upon preliminary results of the evaluation of alternative set 1, a second set of alternative system plans, comprised of five basic alternative system plans and two subsystem alternatives, was prepared. Under alternative set 2, all air carrier service was assigned to one regional air carrier airport, the ground travel time standard used to define the service area for general utility and basic utility airports was increased from the maximum of 20 minutes originally used under alternative set 1 and found to be too constraining to 30 minutes for use in demand allocation, and three publicly owned airports adjacent to the Region were included in each alternative system plan. Alternative set 2 explored the effect of improving existing airports and of constructing new airports to meet the forecast demand. The subset of alternative system plans was prepared to analyze the effect of either expanding Timmerman Field to a basic transport airport or to eliminate it and another major airport in an urban area, Racine Commercial, from the system of regional airports.

Following preliminary review and evaluation of the initial sets of 15 alternative system plans, the Technical Coordinating and Advisory Committee selected a set of six alternative system plans for comprehensive evaluation: alternative airport system plan 3A, the "no build" system plan; alternative system plan 3B, the "ideal" system plan; alternative system plan 3C, the "ideal modified" system plan; alternative system plan 3D, the "nonurban" system plan; alternative system plan 3E, the "no new sites" system plan; and alternative system plan 3F, the "relocated air carrier" airport system plan.

Alternative A, the "no build" system plan, was prepared to evaluate the effects of not expanding the existing publicly owned airports nor developing any new publicly owned airports within the Region. The only capital investment considered under this alternative was that necessary to bring the eight publicly owned airports and the privately owned basic transport airport in Racine County to the minimum runway and navigation aid standards recommended for each airport classification. This system plan is comprised of 24 existing public use airports, 21 of which are located within the Region and three of which are located outside of the Region at Waukegan, Illinois, and at Watertown and in the Fort Atkinson-Whitewater area in Jefferson County.

Alternative system plan B, the "ideal" system plan was prepared to evaluate the effects of ideally locating airports to serve the needs of the air transportation user without regard to other considerations. A system including a minimum number of airports, each sized to accommodate approximately 300 based aircraft and attendant operations and each located at the center of a set of air service demand areas developed to minimize ground travel time, was developed. Under this alternative, the single regional air carrier airport needed to serve the forecast demand would be located at the centroid of the regionally generated originating passenger demand, found to be near the intersection of W. Layton Avenue and S. 114th Street in the City of Franklin, Milwaukee County.

This airport system contains 11 general aviation airports and one air carrier airport. Five of the airports, including the air carrier airport, would be located in areas already devoted to other intensive urban uses in Milwaukee County and eastern Waukesha County. Although none of the airport sites are located where airports presently exist, four major existing airports—Kenosha Municipal, Racine Commercial, Burlington Municipal, and General Mitchell Field—are located within four miles of the ideally located sites. In addition, the existing privately owned, public use Gruenwald Airport is located within one mile of a centroid of general aviation demand identified in Walworth County. General Mitchell Field is located less than eight miles from the centroid of air carrier passenger demand within the Region.

The direct and indirect costs attendant to acquiring land for ideally located airport development in highly urbanized areas of the Region would be absolutely prohibitive. Moreover, the adverse impact of airport development and operation upon the surrounding urban land uses would be extreme. Because of the obvious impracticality of constructing most of the airports identified under this alternative, and because of the availability of existing publicly owned airports reasonably well located with respect to the identified centers of air service demand areas, this plan was not evaluated further. This alternative, however, was a valuable guide in the preparation of alternative C, which was intended to represent a practical modification of the ideal airport system plan.

Alternative C, the "ideal modified" system was prepared to evaluate the effects of expanding existing airports and developing new airports at locations as near to the centroids of air transportation demand as practical. This system plan is comprised of 16 airports, 13 within the Region and three outside the Region. Of the 13 airports within the Region, 10 are existing airports and three are proposed new airports. The 10 existing airports include General Mitchell Field, six of the seven publicly owned general aviation airports, and three existing privately owned, public use airports. The East Troy Municipal Airport would not be a part of the system plan under this alternative. The three new airport sites are located in southern Ozaukee County and southeastern and western Waukesha County.

To accommodate the forecast mix of aircraft types, basic transport airports capable of handling the larger, heavier, and jet aircraft portion of the general aviation fleet would be required at West Bend, the proposed new site in southern Ozaukee County, Waukesha, Burlington, Kenosha, Racine, and the proposed new site between Fort Atkinson and Whitewater in Jefferson County. All other airports under this alternative would be classified as general utility airports. All airports would be expanded to become larger in size except Timmerman Field, which would remain a general utility airport.

Alternative D, the "nonurban" system plan, was prepared to evaluate the effects of locating airports in less intensely developed areas of the Region away from urban and urbanizing areas. This system plan consists of 14 airports, two of which are located outside the Region. Seven of the 12 airports located within the Region are existing airports and five are proposed new airports located in nonurban areas. In addition to the two airports identified under alternative C in southeastern and western Waukesha County, three new sites are proposed, one in northcentral Racine County, one in northern Walworth County, and one in southeastern Washington County.

Five of the urban airports considered in previous alternatives—Timmerman Field, Waukesha County, Racine Commercial, East Troy, and Watertown—would be abandoned and the vacated sites made available for alternative urban land uses. General Mitchell Field would remain as the Region's scheduled air carrier airport.

Alternative E, the "no new sites" system plan, was prepared to evaluate the effects of only expanding selected existing publicly and privately owned airports to accommodate the forecast demands, and therefore requiring no new airports within the Region. Based upon analysis of prior system plans, these critically located privately owned public use airports within the Region were added to the publicly owned airports to comprise this airport system alternative.

Under this alternative, continued private operation of these airports would have to be assured throughout the plan design period, or they would have to be acquired by a public body to assure their continued existence as airport facilities. Seven existing publicly owned general aviation airports, General Mitchell Field, and six privately owned airports within the Region and three airports outside the Region comprise alternative E. The airport classification and therefore the landing areas and other physical facilities at many of these existing airports were changed to accommodate the probable forecast general aviation fleet and aircraft operations.

Alternative F, the "relocated air carrier" system plan, was prepared to evaluate the effects of relocating commercial air carrier service from General Mitchell Field. Based on analysis of an air carrier site in Jefferson County west of the Region capable of potentially serving both the Madison and Milwaukee areas; the abandoned Richard I. Bong site in Kenosha and Racine Counties; and a site in northcentral Racine County, the Racine County site was selected for evaluation as the most practical alternative to retaining General Mitchell Field as the regional air carrier airport. Under alternative F, a new commercial air carrier airport would be developed in northern Racine County and General Mitchell Field would be reclassified to a basic transport airport to serve only general aviation and military aviation activity. Plan F contains 17 airports, including 14 inside the Region and three outside the Region.

The five alternative airport system plans were evaluated on the basis of their ability to satisfy the forecast demand for aviation service, their potential impact on the land use patterns and natural resource base of the Region, their relationship to other regional development plan elements, and against the airport system development objectives and supporting standards. The evaluation process included analyses and comparisons in the following six major categories: landing area demand/capacity relationship; direct capital, operation and maintenance, and user costs; environmental considerations; compatibility with other regional planning elements; compatibility with regional airport system development objectives and supporting standards; and other considerations.

Analysis of the assignment of forecast demand, in terms of the number of based aircraft and attendant operations, to airports comprising alternative A revealed that owners of several types of aircraft, particularly the larger and heavier aircraft within the general aviation fleet, could not be accommodated within the 30 minute travel time standard of an airport capable of serving their aircraft demands. Under alternative A, only General Mitchell Field and the Racine Commercial Airport can accommodate the type C, or business jet and heavier multiengine propeller driven, aircraft. The analysis also indicated that this system of airports was deficient in landing area capacity to accommodate the number of operations forecast, even though many airports could be expected to be underutilized. Except for General Mitchell Field, which has a practical annual landing area system capacity of 284,000 operations and which would be expected to serve 327,600 operations in 1990 under alternative A, the airports which could accommodate operations under instrument flight rules within the system—Waukesha County, Kenosha Municipal, Racine Commercial, Timmerman Field, and West Bend Municipal—could be expected to operate at about 70 percent of their capacity in 1990. Many of the smaller, privately owned airports could be expected to be overloaded because of their limited runway facilities.

The other four alternative plans were designed to overcome these two deficiencies by locating the number and type of airports so that an airport of the proper classification would be within 30 minutes ground travel time of the general aviation users within the Region, and provide landing system capacity to serve the forecast demands. Except for the inability of General Mitchell Field to accommodate forecast operations under alternative D, each other alternative would overcome these deficiencies and accommodate the forecast demand for aviation services.

Airspace controls to maintain proper separation of aircraft arrival and departure patterns at adjacent airports would be necessary at some airports under all alternatives. For the most part, these procedural controls take the form of altitude separations and limiting departures or arrivals to two rather than three paths, and they would not significantly restrict airport or system capacity. Airspace limitations at one airport in alternatives D and F could be expected to adversely affect landing area capacity and aircraft operations. New airport site C in Racine County under alternative D would have to be restricted to visual flight rule operations because of potential conflicts with aircraft operations at General Mitchell Field and new airport site F in southeastern Waukesha County. Under alternative F, site F could be expected to have a landing area capacity constraint because of conflicts with aircraft arrivals and departures at the proposed new air carrier airport in northcentral Racine County.

An estimate of the costs attendant to each alternative system plan was prepared, including the capital investment required to develop each airport within each system, the costs required to operate and maintain the airports within each system, the delay costs borne by aircraft operating under each system, and the ground travel costs borne by aircraft users. The capital investment required under alternative A is the lowest of the five alternatives, consisting primarily of the cost of completing the Airport Spur Freeway to General Mitchell Field, and the cost of upgrading Racine Commercial to minimum basic air transport airport standards through provision of clear zones to permit full use of the existing runways. The capital investment required under alternative F is the highest of the alternatives because of the costs entailed in relocating the major air carrier airport within the Region. The capital costs associated with developing the other three alternatives are similar, ranging from $158.7 million under alternative E to $164.2 million under alternative D. The equivalent annual construction cost of developing these three airport systems ranges between $11.5 and $11.9 million dollars.

The costs to operate and maintain the airport systems under alternatives A, C, and E are similar, about $2 million annually through the planning period. The cost associated with the high levels of aviation demand at General Mitchell Field under alternative D, and the cost of operating and maintaining a new air carrier airport in Racine County and General Mitchell Field as a general aviation facility under alternative F, results in operating and maintenance costs that are nearly 25 percent greater, or about $2.5 million annually.

Ground travel costs provide an indication of airport location efficiency with respect to system users. Alternatives E and C place airports nearest the users. Ground travel to airports under alternative D is estimated to require that system users spend about an additional $1 million annually in ground travel to reach airports located away from urban concentrations. An additional $1 million annually is also estimated to be spent to reach airports in alternative A because of the longer ground travel time to reach the limited number of general utility and basic transport airports in the Region. Added time incurred by region-generated commercial airline passengers to reach the air carrier airport in northern Racine County results in the highest ground travel costs under alternative F.

Comparison of the delay costs borne by aircraft operating under each alternative system provides another relative indicator of system efficiency. These costs have been estimated to range from about $1.5 million per year in 1990 under alternative F to over $7.0 million per year in 1990 under alternative D. The relatively low costs under alternative F reflect improved operations at General Mitchell Field as a general aviation airport, and more efficient but fewer air carrier aircraft operations at the relocated air carrier airport. The high costs under alternative D reflect the congestion that may be expected at General Mitchell Field under this plan, which relocates several major general aviation airports away from urban areas.

The equivalent annual cost to public airport sponsors to construct, operate, and maintain the airport system plans is estimated to range from about $3.2 million under alternative A to nearly $19.8 million under alternative F. The equivalent annual cost for those alternatives that continue commercial air carrier service at General Mitchell Field and expand general aviation facilities ranges from about $13.6 million under alternative E to about $14.4 million under alternative D.

Each alternative system plan was evaluated in terms of noise impact, impact upon regional air quality, and impact upon other elements of the natural resource base. Composite noise rating (CNR) isopleths were prepared for plan airports that were expected to have aircraft operations by 1980 such that the 100 CNR isopleth extended beyond the site boundaries. Forecast 1980 aircraft operations were used because aircraft noise is expected to peak in that year, after which the aircraft will increasingly have newer, significantly quieter engines.

Analysis of the CNR isopleths indicated that the most severe noise impact may be expected from 1980 aircraft operations at General Mitchell Field. Over 45,000 people may be expected to live between the 100 and 115 CNR isopleths, the transitional noise area where some individual response and group action against noise may be expected. Land beyond the present airport boundary but within the 115 CNR isopleth, totaling about 35 acres, was assumed to be acquired for airport purposes in order to eliminate sensitive land uses from this seriously impacted area. The noise from aircraft operations at general aviation airports may be expected to be substantially less, involving only about 800 persons living within the 100 CNR isopleths at all general aviation airports under alternative A, and about 1,300 persons under alternative F.

Aircraft operations at airports in urban and urbanizing areas generate the greatest noise impact on other land uses and create the greatest nuisance. Aircraft operations at Timmerman Field and the Waukesha County Airport have been identified as creating the greatest nuisance over residential land uses of all general aviation airports in the Region. Remedial action in the form of revised traffic patterns, strict arrival and departure procedures, and elimination of nonessential operations warrants careful consideration under any recommended plan which includes these airports, in order to alleviate some of the adverse impacts of aircraft operation noise and nuisance.

Data on ambient air quality and meteorological conditions within the Region are limited. Analysis of existing information, however, indicates that generally the pollutants from aircraft operations at existing airports are sufficiently dispersed horizontally and vertically so that no measurable deleterious impact on regional air quality can be discerned. The decrease in pollutant emissions which may be expected from implementation of federal pollution emission control requirements on aircraft and automotive vehicles should be a positive step toward maintaining specific ambient air pollutant concentrations at or below the presently acceptable level.

Since each alternative airport system will serve the same number of aircraft operations and generate the same number of ground vehicle movements, the system that minimizes ground travel and delay to aircraft operations and accommodates the maximum number of aircraft operations at airports evenly distributed throughout the Region may be expected to produce the minimum impact on ambient air quality. Alternative C is expected to have the least impact on regional air quality, and alternative A, the most severe impact.

The impact of alternative airport system plans on other elements of the natural resource base within the Region was evaluated by analyzing the required conversion of lands from their existing or proposed use to airport use. Land uses considered particularly important to the protection and preservation of the natural resource base include prime agricultural lands and primary environmental corridors. The latter contain almost all of the best remaining woodlands, wetlands, and wildlife habitat areas within the Region, as well as lakes, rivers, and streams and their undeveloped shorelands and floodlands, significant geological formations and physiographic features, and wet or poorly drained soils.

The system plans requiring new airport construction have the most severe impact on the natural resource base, even though all new airports were located to minimize this impact. Alternatives D and C require conversion of 2,210 acres and 2,550 acres of prime agricultural and environmental corridors lands, respectively. Expanding existing airports under alternative E requires only about 1,100 acres of prime agricultural lands and environmental corridor, nearly half that of the plans requiring construction of new airports.

The need to provide adequate airport facilities for scheduled commercial airline service is perhaps more readily recognized by the general public than the need to provide adequate airports for general aviation activity. Although it was determined that only one air carrier airport will be required to accommodate the probable future demand of enplaning passengers in the Region through 1990, and although the required air carrier airport is only one element of an overall system plan, alternative air carrier airports were evaluated separately.

Initially, three alternative air carrier sites to General Mitchell Field were analyzed—the Richard I. Bong Air Force Base in northwestern Kenosha County, a site in northcentral Racine County, and a site in Jefferson County located between the Madison urban area and the Region. Based on an analysis of service to originating passengers and of relationships to existing transportation facilities and land uses, it was judged that only the Racine County site warranted further evaluation.

The two sites were compared in terms of landing area demand/capacity, cost, and environmental considerations. With limited landing area improvements, General Mitchell Field has the capacity to meet the forecast air carrier demand under each alternative plan. It will be unable to meet the total forecast air carrier, military, and general aviation demand under alternative D, and will be slightly over capacity under alternatives C and E. The cost to develop an alternative air carrier airport, estimated at about $204 million, and construct the attendant arterial and utility facilities, estimated at about $9 million, is almost twice that of expanding General Mitchell Field, estimated at about $109 million, to accommodate the forecast passenger demands. The major cost of expanding General Mitchell Field is the terminal improvement, estimated at $76 million. The cost of operating and maintaining a regional air carrier airport at General Mitchell Field is estimated to be about $1.8 million annually, about 50 percent more than to operate and maintain the new air carrier airport under alternative F. The cost of ground travel to passengers using air carrier service is estimated to be about 20 percent less at General Mitchell Field than at the new air carrier site, even though more passengers would use General Mitchell Field than an airport located in northern Racine County.

The impact of noise from aircraft operations, particularly jet powered air carrier aircraft, may be expected to be substantially more severe at General Mitchell Field than in rural Racine County. Development of a regional air carrier airport in northern Racine County requires conversion of approximately 3,300 acres of agricultural land, 1,000 acres of which are prime agricultural land; 320 acres of primary environmental corridor lands; and 200 acres of lands in urban uses.

The alternative plans were also evaluated in relation to their compatability with other physical facility development plans being implemented within the Region. Alternatives A, C, and E are most compatible with adopted regional land use, surface transportation, and utility plans, since the airports that comprise these systems are located at or near sites considered as terminal facilities and concentrations of traffic generation in earlier regional planning efforts. Consequently, these alternative systems would require minimal adjustment or reappraisal of the adopted plans.

Alternative D extends urban land uses in the form of airports and attendant urban activities further into areas previously recommended to remain in agricultural and open space uses. The surface transportation and sanitary sewerage systems required to support alternative D, however; would not be significantly different from those required under alternative C. Alternative F, which includes a relocated air carrier airport, would require major revisions to the adopted land use and transportation plans, adjustments in other plan elements, and modifications to financial resource allocation and implementation schedules to accommodate surface transportation and utility service needs generated by the relocated air carrier airport and attendant urban development.

The nine airport system development objectives and supporting standards used to guide the design of alternative airport system plans were also used as a basis for evaluating the relative merits of each alternative plan. Each alternative system plan was comparatively rated with respect to the supporting standards under each objective using quantitative and subjective analyses reported in this chapter. Based upon a simple rating scale, alternatives C and E had the highest ratings, indicating that they best satisfy the airport development objectives.

The feasibility of plan implementation was also considered. Under alternatives C and D, public airport sponsors must be identified to develop new airport sites within the Region, in addition to the potential assumption of airport expansion and operation responsibilities at existing privately-owned airports included in the system plan alternatives. Under alternative E, public agency sponsors may be required for continued operation and expansion of four existing privately owned airports.

While the regional airport system planning study was underway, significant regional, national, and international changes occurred which have implications for decisions concerning airport system development within the Region and elsewhere in the nation. Rates of population and economic growth have been declining nationally and within metropolitan regions. Motor fuel and other energy related concerns are being raised about the inefficiencies of existing transportation systems, and citizen reaction to extensive public works projects indicates greater concern over the allocation of scarce resources and a reluctance to support new public works related to transportation.

Based on the extensive evaluation and foregoing observation, the Technical Coordinating and Advisory Committee on Regional Airport Planning recommended that alternative E, "no new sites," be adopted as the regional airport system plan and be refined for presentation to the public. Alternative E provides a system of airports capable of meeting the forecast needs at the lowest public sponsor cost, and by utilizing existing airport sites, requires a minimum of new public sponsor responsibility.

The impact of this alternative on the environment in terms of noise and air pollutants compares favorably with other alternatives, and requires the least amount of land conversion from other important natural resource base uses to airport use.

In making this recommendation, the Committee recognized that the next best alternative, and the best from the standpoint of satisfying demand for air transportation service was alternative C. This alternative provides a more flexible approach to the provision of air transportation services within the Region in that, should it not be possible to develop the new airport sites under alternative C, it may still be possible to develop the existing airport sites identified under alternative E. During consideration of the alternative system plans by the Committee, the Wisconsin Department of Transportation representatives on the Committee asked that a subalternative to plan E be considered that would add one new airport site north or northwest of the Milwaukee urbanized area to relieve Timmerman Field and the Waukesha County Airport.

The subalternative was compared with alternative E and the other most feasible alternative, plan C. It was concluded that addition of the new site would not produce a sufficiently improved plan to alter the Committee findings. Thus, the Committee reaffirmed its decision to recommend alternative E as the regional airport system plan for presentation to the public, and indicated that, should the public hearing response be such to support the addition of a new airport to the recommended plan, the plan could be revised prior to submission to the Regional Planning Commission for adoption.

Chapter XII

RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN

INTRODUCTION

Previous chapters of this report have presented in summary form the basic data essential to sound regional airport system planning. These have included data on existing airport facilities and use; the airspace environment and navigation and air traffic control facilities; the characteristics and travel habits of commercial passengers and pilots and passengers of general aviation aircraft; existing population and economic activity levels and distributions as related to the demand for air travel; the location and intensity of existing land uses; the configuration, capacity, and service levels of the existing and proposed surface transportation systems; and the natural resource base; all as related to airport location and development. Forecasts of future population and economic activity levels, land use, and demand for aviation services, along with regional airport system development objectives, principles, and standards, were also presented as a necessary basis for the preparation and evaluation of alternative airport system plans.

The forecasts of demand for aviation services were translated into the number of aircraft operations by aircraft type to permit development of specific airport facility requirements. The forecast of demand for aviation service in terms of originating commercial air passengers and owners of general aviation aircraft based within the Region was allocated to subareas of the Region on the basis of existing and probable future population, economic activity levels, and land use development for assignment to airports comprising the alternative system plans. Finally, a series of alternative regional airport system plans was designed, evaluated, and presented for public review. These alternatives included such broad conceptual approaches as the relocation of the Region's air carrier airport to a less densely developed area of the Region; the expansion of selected existing airports within the Region to accommodate the forecast demand; the elimination of airports within intensely urbanized areas of the Region with the development of new airports in less densely developed areas of the Region; and a combination of the expansion of existing airports and the development of new airports located as near the centroids of aviation demand as practical.

Following extensive evaluation of the alternative system plans—which included evaluation of airport development and attendant facility costs, annual airport operating and maintenance costs, cost to system users, airspace and landing system demand/capacity analyses, impact upon the environment and the natural resource base, the relationship to other regional comprehensive plan elements, and the relationship to the airport system development objectives and standards—the Technical Coordinating and Advisory Committee recommended that a regional airport system plan, comprised of existing publicly and privately owned airports appropriately developed to accommodate the forecast aviation demand, be presented for public review and comment. This recommended system of general aviation and single air carrier airports within the seven counties—identified as the "no new sites alternative" in Chapter XI—is more fully described within this chapter.

In the more detailed description of the recommended system plan presented in this chapter, consideration is given to the impact of airport facilities and aircraft operations on adjacent land uses. The necessary onsite airport facilities and attendant capital costs are presented in graphic, tabular, and narrative form; generalized proposals for off-airport land use development and height control zoning are mapped and discussed as necessary to encourage compatible land use development in the vicinity of the recommended airports; and restrictions on aircraft operations considered necessary or desirable to abate the adverse noise and nuisance effects of aircraft operations upon adjacent land uses are described. A development program is outlined for each airport to stage required facility improvements in accordance with forecast needs.

Most importantly, the recommended system plan is tested against both the possibility of unplanned land use development within the Region and against a revised forecast of demand prepared in recognition of changes in forecasts of national aviation demand and of regional population growth developed as the airport system planning process was underway.

THE REGIONAL AIRPORT SYSTEM

Overview

The airport system plan recommended to serve the aviation needs of the Southeastern Wisconsin Region over the next two to three decades is comprised of a system of eight public and six privately owned airports, and does not envision the development of any new airport sites within the Region. The plan, however, does recommend that all eight of the Region's publicly owned airports undergo considerable improvement during the plan design period. Additionally, the plan recommends that steps be taken to assure the continued availability for public use and improvement of four currently privately owned airports as important elements of the regional airport system. Two other private airports included in the system plan are assumed to remain available for public use as private airports without any particular public action in order to accommodate the special aviation needs generated by and associated with recreational developments in Walworth County. Three public airports located outside and adjacent to the Region are recognized in the plan as providing a supportive role in meeting the total existing and forecast demand. These three airports are Waukegan Memorial in Illinois, Fort Atkinson-Whitewater, and Watertown Municipal in Jefferson County.

The airports included in the recommended regional airport system are located within the Region as shown on Map 45. In addition to maintaining General Mitchell Field as the only scheduled air transport airport within the Region, the plan includes five basic transport airports (Burlington Municipal Airport, Kenosha Municipal Airport, Racine Commercial Airport, Waukesha County Airport, and West Bend Municipal Airport), four general utility airports (Gruenwald Airport, Hartford Municipal Airport, Ozaukee Airport,[1] and Timmerman Field), two basic utility airports (East Troy Municipal Airport and Sylvania Airport), and two basic utility restricted airports (Playboy and Lake Lawn Lodge), as shown on Map 45. The existing publicly owned airports located outside of the Region in Waukegan, Illinois, and Fort Atkinson, Wisconsin were both assumed to relieve the regional demand as general utility airports, while an existing publicly owned airport located outside of the Region in Watertown, Wisconsin, was assumed to relieve demand as a basic utility airport.

The airport in Waukegan, Illinois, is a basic transport airport. The Wisconsin airport system plan has recommended that the airports at Watertown and Fort Atkinson be upgraded to basic transport airport classification. In addition, the state airport system plan recommends that the airport at Palmyra be upgraded to a general utility airport classification.

The recommended system of 14 airports located within the seven counties and three supporting airports located outside of but adjacent to the Region, all available for public use, contrasts to the 26 public-use airports presently located within the Region. The 26 existing airports include one scheduled air transport airport, one basic transport airport, four general utility airports, and 20 basic utility airports having varying levels of service capability. While some of the existing privately owned airports may continue to operate through the planning period and may, in fact, be expanded to serve a growing portion of the total demand for aviation service, the recommended system plan does not depend upon the continued availability of these private airports nor does it preclude their continued operation. To the extent that such private airports remain in operation, the aviation demand at the public airports may be expected to be reduced and the need for improvements delayed. The plan does define the minimum number of airports, by service capabilities, considered necessary to accommodate the probable future aviation demand within the Region.

[1] *Ozaukee Airport was initially identified as a basic transport airport but was reclassified as a general utility airport upon review of the revised air activity forecasts.*

General Mitchell Field may be expected to continue to serve the commercial airline requirements of the Region throughout the planning period and for an indefinite period thereafter. Additionally, this airport is expected to accommodate much of the Region's future military aviation activity and important segments of the general aviation activity, particularly corporate aviation activity. The General Mitchell Field airport service area, represented by the 60-minute ground travel time isopleth shown on Map 46, encompasses about 78 percent of the Region's geographic area, 96 percent of the 1972 resident population of the Region, and 97 percent of the forecast 1990 population of the Region. It is estimated that less than 1 percent, or about 32,000 of the forecast annual 1990 originating passengers, would live within the Region but beyond the 60-minute ground travel time service area of General Mitchell Field.

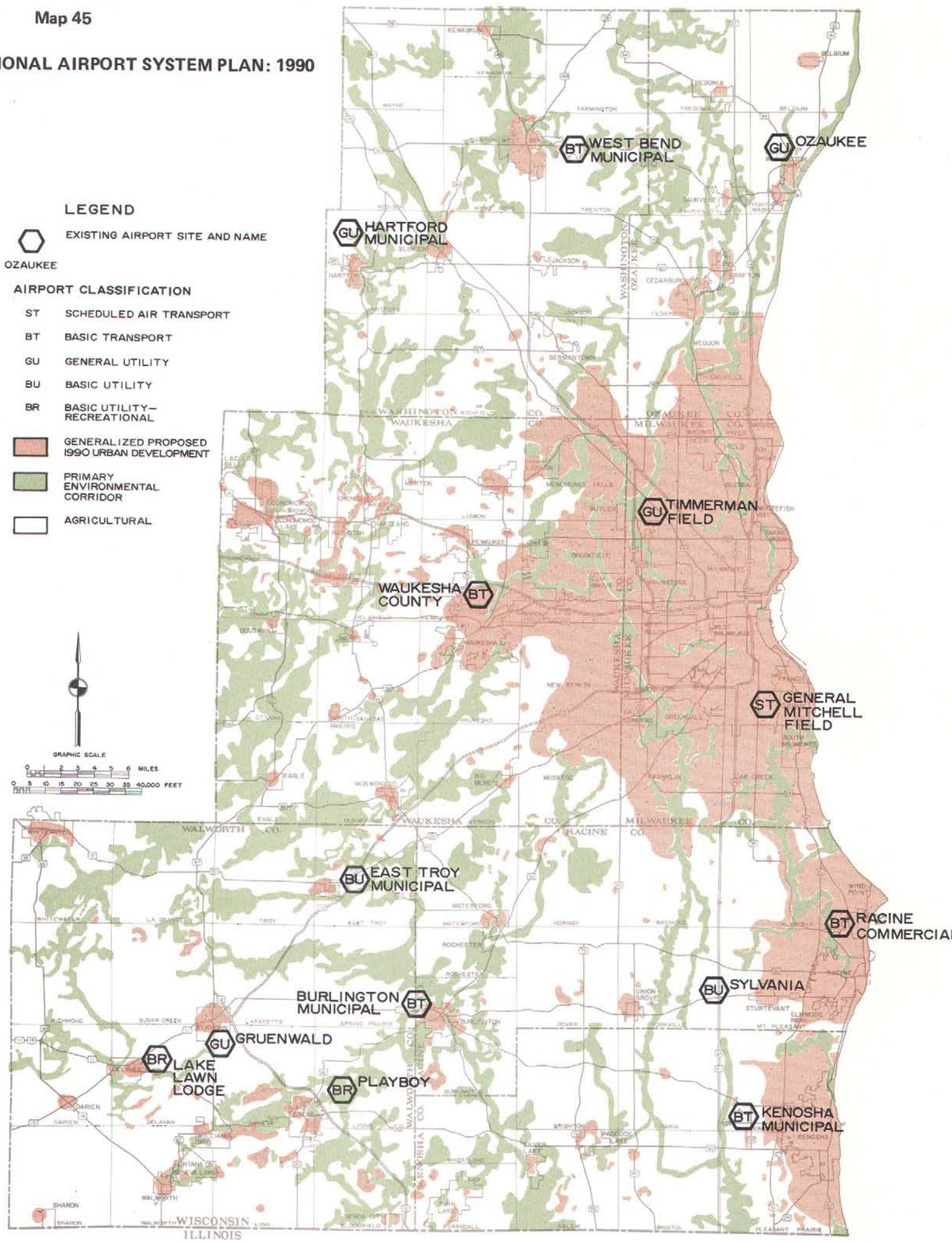
The remaining airports within the system plan are general aviation airports. Three existing publicly owned general utility airports—Kenosha Municipal, West Bend Municipal, and Waukesha County—are recommended for expansion by the plan design year to a basic transport airport classification capable of accommodating the heavier twin engine and jet aircraft in the general aviation fleet. It is also recommended that the Burlington Municipal Airport be expanded from its present basic utility classification to a basic transport airport by the plan design year. One existing privately owned airport—Racine Commercial Airport—is also recommended for improvement and expansion to basic transport classification standards by the plan design year. This airport, presently classified as a limited basic transport airport and used by some business jets, will require limited improvement to achieve the operating standards of a basic transport airport classification. Public action may be required to assure the continued availability for public use of this existing privately owned airport.

Supplementing the services of the five basic transport airports, which are capable of serving all elements of the forecast general aviation fleet, are four general utility airports, which will accommodate all but the jet aircraft and heavier twin-engine aircraft in the general aviation fleet. These four general utility airports consist of Timmerman Field in Milwaukee County, which is recommended to retain its present classification; the existing Hartford Municipal Airport, which would be improved from a basic utility airport; the existing privately owned Gruenwald Airport near Elkhorn, which would be improved from a basic utility classification; and the existing privately owned Ozaukee Airport[2] near Port Washington, which would be improved from a basic utility classification. The continued operation of both the Gruenwald and Ozaukee Airports for public use may have to be assured by appropriate public action. The East Troy Municipal Airport and the existing privately owned Sylvania Airport, both presently classified as less than

[2] *Ibid.*

Map 45

RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN: 1990

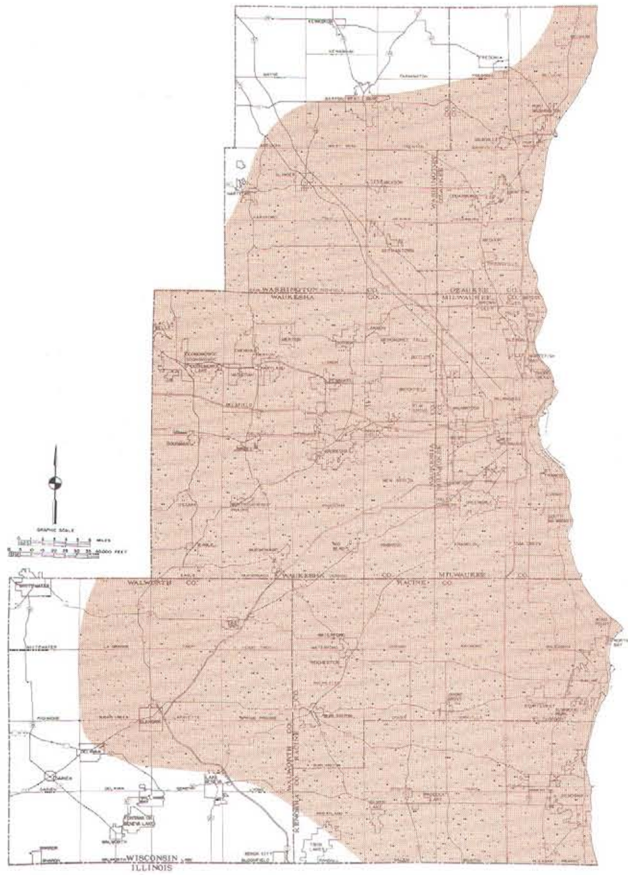


The preliminary recommended regional airport system plan contains 14 public use airports, including one air carrier airport, five basic transport airports, four general utility airports, two basic utility airports, and two basic utility-recreation airports. While some of the existing privately owned airports may continue to operate through the planning period, the recommended system of airports does not depend upon the continued availability of these airports nor does it preclude their continued operation.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 46

SERVICE AREA OF
GENERAL MITCHELL FIELD



The desirable service area of the Region's only air carrier airport is defined as the area encompassed within 60 minutes driving time of General Mitchell Field. In 1971, the average ground travel time of originating passengers was 23 minutes, and 78 percent of all regional passengers enplaning at General Mitchell Field traveled 30 minutes or less, while 90 percent traveled 40 minutes or less. It is estimated that less than one percent of the airline passengers originating within the Region will live more than 60 minutes ground travel time from General Mitchell Field in 1990.

Source: SEWRPC.

basic utility airports, are recommended to be improved to basic utility airports. Public action may be required to assure the continued availability for public use of the Sylvania site.

The two recreation-oriented airports included in the final plan, Playboy and Lake Lawn Lodge, are recommended to retain their existing basic utility classification. Both airports, because of their special nature, are expected to remain open to public use as private airports. Although the continued existence of these two airports will enhance the total capabilities of the regional airport system, their use may be considered limited to recreation-oriented air travel. No public agency action to assure continued availability and operation of airports at these two locations is, therefore, recommended.

The service area for the 12 airports in the system available for all general aviation air travel is represented by 30-minute ground travel time isopleths as shown on Map 47. It can be seen that many resident aircraft owners and operators may be expected to be located within overlapping service areas of several airports, and that only very small portions of the Region would be located beyond 30 minutes travel time of a general aviation airport. Consequently, less than 0.1 percent of the forecast 3,000 resident aircraft owners within the Region would not be accommodated within the 30 minutes ground travel time.

Each airport comprising the recommended system was considered in terms of: 1) onsite improvements required to accommodate the assigned share of total regional aviation activity, 2) potential modification to or restriction on standard aircraft operations to abate adverse impacts from such operations on adjacent land uses, 3) height zoning requirements to assure safe aircraft approach and departure conditions under visual and instrument flight rules, and 4) offsite land use development desirable to achieve compatibility between adjacent land use activities and the airport layout and attendant aircraft operations.

Onsite Improvements

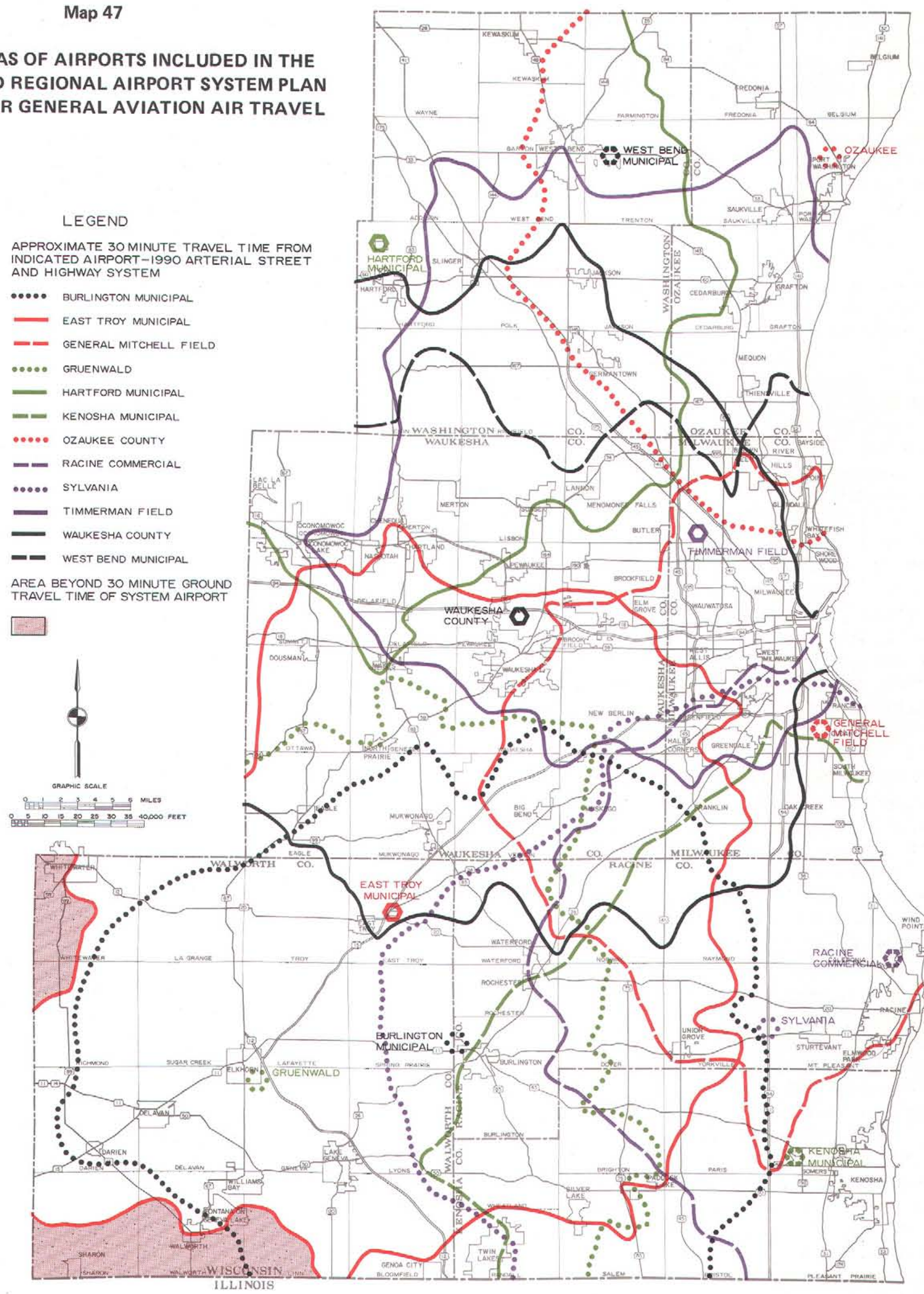
A description of the type and extent of airport facility development required to improve each system airport to adequately accommodate the forecast aviation demand is provided herein in graphic and tabular format. The site development as presented herein generally describes the facility improvements needed to improve each airport from its present operational capability, as described in Chapters IV and X, to the airport classification recommended in the regional system plan. The precise siting and delineation of facilities is a function of the airport master planning efforts to be undertaken to further refine, detail, and implement the recommended sytem plan.

The airport site requirements discussed herein concern the six basic elements of an airport—that is, the land or site location, area, and configuration; the aircraft operational area, including runways and taxiways; the terminal facilities, the hangar facilities; the supporting surface transportation access facilities; and the supporting utilities.

Land: The land requirements for any given airport in the system as described herein consist of the additional land that should be acquired in fee simple to accommodate the recommended expansion and improvement of the existing airport facilities, such as runways, taxiways, and aircraft parking aprons; the additional land in which sufficient interest should be acquired to protect runway clear zones; and the land area over which aviation easements should be acquired to assure safe operations. For purposes of this regional system planning study, and except for the intensely developed urban areas adjacent to

Map 47

SERVICE AREAS OF AIRPORTS INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN AVAILABLE FOR GENERAL AVIATION AIR TRAVEL



Most of the Region would be encompassed within a 30 minute ground travel time of one or more of the recommended 12 airports available for all general aviation air travel. Less than one percent of the anticipated 3,000 general aviation aircraft owners within the Region would be located beyond the recommended general aviation airport service areas.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

General Mitchell Field, Racine Commercial Airport, and Timmerman Field, it was assumed that the airport sponsor would acquire full title to the land required to accommodate expansion of the airport-related physical facilities; to provide the appropriate runway clear zones for the type of approach recommended; and to control development in the land areas beneath those portions of the transitional surfaces which are less than 50 feet above the ground, which surfaces define the airspace surrounding each airport which should be kept free of obstructions.

The assumptions concerning land acquisition for the runway clear zones were modified at the three above-referenced urban airports to provide a more realistic and representative land cost estimate. A specific discussion of each modification is provided in the narrative related to each of these three airports. It should be noted that additional influence areas related to each runway exist beyond the airport boundaries, within which it may be desirable to exercise some control over land use and for which state and federal funds may be used to obtain interest in the land concerned. The limits of this airport influence area are shown on the airport development diagrams reproduced in this chapter, but no land acquisition has been assumed to be required in this area and, therefore, no costs have been included for such acquisition. Determination of the precise areas in which some interest is to be acquired and the nature of that interest—whether in the form of fee simple acquisition, clear zone easement to control development from the ground up, or avigation easement to control development above a specific elevation above the ground—must be the subject of additional study and evaluation during the master planning process. In those instances where an existing privately owned airport may need to be acquired by a public agency to assure continued availability for public use, the land and improvements of the existing site, as well as the additional area necessary to accommodate the proposed airport expansion, are herein identified and included in the system plan cost estimates.

Aircraft Operational Area: The operational facility requirements for any given airport in the system as described herein consist of the runway and taxiway development required to improve each airport to the operational standards of the airport classification recommended within the regional system plan; the landing aids considered appropriate for the forecast level of aviation activity at each airport, such as air traffic control tower, visual approach slope indicators (VASI), and precision and nonprecision instrument landing and approach and runway lighting systems; and the amount of aircraft parking apron necessary to accommodate the forecast demand. Runway and taxiway alignment, length, width, strength, and lighting details are identified. It is assumed that the Federal Aviation Administration will maintain and operate instrument landing and approach lighting systems and other navaids regardless of whether they were initially installed under federal government or local sponsor contract. The aircraft parking apron area is considered to include the apron adjacent to the administration/terminal building as well as the paved public aircraft tie-down areas.

The improvement of an existing runway landing aid system that can accommodate aircraft operations under visual flight rules according to Federal Aviation Administration (FAA) standards to one that can accommodate operations under instrument flight rules, or from one that can accommodate operations under nonprecision instrument flight rules to one that can accommodate operations under precision instrument flight rules, greatly increases the land area required for runway clear zones as well as the separation requirements between runways and taxiways and physical obstructions. In addition, the width of the runways and runway safety area criteria are also related to the type of runway landing aid system as well as to the anticipated aircraft fleet mix at the airport.

For example, the FAA recommends that no buildings be located within a 750-foot wide area on both sides of the centerline of a runway equipped with a precision instrument landing system. For visual flight rule and nonprecision instrument runways, this width is only 250 feet and 300 feet, respectively. Further, the FAA suggests a 400-foot separation between runway centerlines and parallel taxiway centerlines for runways equipped with a precision instrument landing system whereas only a 200-foot separation is required at general utility and basic transport airports without precision instrument landing systems. Runway widths of 150 feet are suggested for those runways equipped with precision instrument landing systems, whereas lesser runway widths can be used where precision instrument landing systems are not recommended. These and other related standards have been identified to guide development of the regional airport system plan, and are documented in Chapter VII of this report.

In view of the potential high costs that would otherwise be required to meet the standards that relate airport facility improvements to provision of a recommended precision instrument landing system at existing airports within the Region, such as removal of existing buildings, relocation of existing taxiways, and widening of existing runways; with knowledge that less restrictive criteria have been used and accepted by the FAA elsewhere in expansion of existing airport facilities, since the Facilities Branch of the FAA is presently reviewing the possibility of reducing the separation standards for precision instrument runways; and with changing technology in the instrumentation of precision instrument approaches, such as the microwave system, that may permit the addition of precision instrument approach systems to existing runway systems without requiring substantial changes in separation and clearance standards; the future facility needs at the airports in this system plan have been developed on the assumption that, except for General Mitchell Field and Kenosha Municipal, only VFR and IFR nonprecision instrument runway criteria will be met in terms of runway width, runway-taxiway separation, and runway-physical facility separation.

The land requirements for runway clear zone and the airspace zoning controls affecting height obstructions around airports, however, have been developed through use of the criteria suggested for the appropriate VFR, IFR nonprecision instrument runway, and IFR precision instrument runway conditions. Use of the less restrictive separation criteria is not expected to adversely affect the operational capabilities nor the safety of any airport within the recommended system plan. By the time the installation of the precision instrument landing system would be considered at some of the system airports, development of new instrument approach equipment may eliminate the need for the wide separation standards or the decision that the advantages of having precision instrument capabilities do not justify the additional land cost, building removal, or runway-taxiway reconstruction required to meet the separation standards.

Further, the anticipated mix of aircraft expected at Region airports is such that the probability of critical-sized aircraft landing or passing each other on the runway and taxiway in inclement weather is relatively slight, and provision of the wider runway or relocation of existing taxiways to satisfy wider runway and increased separation standards cannot be justified in all instances. Further review of these sizing criteria can be made in master plan studies and in facility engineering at the time of actual facility development. It should be noted that, where possible in the planning and design of specific airport facility improvements, particularly in the development of new buildings such as terminal and hangar facilities, the proper separation standards related to recommended runway instrumentation should be accommodated in development of the master plan and facility engineering, but, for purposes of this system planning study, development of the land and physical facility requirements are based upon VFR and IFR nonprecision instrument landing criteria except for the runway clear zones, which are sized to the criteria consistent with the recommended landing aid system.

Terminal Area: The terminal area requirements for any given airport in the system as described herein consist of the general location and size of the passenger terminal building required to accommodate the various services and amenities normally available to airport users, the airport administrative offices, and the attendant automobile parking facility. Terminal area requirements were determined by application of general sizing criteria to the forecast of aviation demand for each airport, and will require refinement in the subsequent master planning efforts growing out of system plan implementation.

Hangar Area: The hangar area requirement for any given airport in the system as described herein consists of the general location and gross area of hangar facilities required for aircraft storage, service, and maintenance. Although the particular hangar type for aircraft storage is not specified, gross area requirements, as determined by applying general sizing criteria to the aircraft fleet forecast to be based at the airport, provide sufficient space to facilitate either multiple T-hangars or individual hangars.

Ground Access: Ground access requirements for any given airport in the system as described herein consist of the surface transportation facilities required to connect the airport terminal and attendant automobile parking facilities to the existing and proposed arterial street and highway network. Improvements or modification to both onsite and off-site street and highway facilities are identified.

Utilities: The utility requirement for any given airport in the system as described herein consists only of appropriate sanitary sewerage and public water supply facilities. Both onsite utilities and off-site connections are identified.

Aircraft Operation Restrictions

In addition to the onsite improvements previously identified, and as one of three important aspects to be considered in development of the comprehensive regional airport system plan to achieve more compatible land use in the airport environs, the operational patterns of aircraft can be restricted, where possible and as practical, to alleviate certain adverse effects of aircraft operation, primarily noise.

As noted in Chapter XI, some public nuisance may be created by the aircraft operating procedures followed at a particular airport, that is, by the established traffic pattern and the amount of flight training activity permitted at or near the airport. As expected, this nuisance may become particularly objectionable when a large number of aircraft operations occur over intensively developed residential areas. Revising the operating patterns and levels of flight activity may reduce the nuisance element otherwise generated by a particular airport.

Revised Traffic Pattern: The traffic pattern of an airport prescribes the standard, or usual, path to be followed by aircraft landing at and taking off from the airport. Normally, the airport owner or operator is responsible for establishing the traffic pattern. The Federal Aviation Administration, however, recommends certain minimum operating altitudes and procedures.[3] At most general aviation airports around the nation, a standard left-turn pattern is used since it provides the pilot with maximum visibility of adjacent air traffic. At some airports, however, nonstandard air traffic patterns are followed. These nonstandard patterns involve right turns or, in some cases, restriction of aircraft operations to one side of the airport, and have been instituted to eliminate conflict with obstructions or to minimize flights over heavily populated areas. Caution must be exercised in the development of changed operation patterns in that, unless otherwise informed, pilots will enter the airport pattern assuming the standard left-turn pattern. For this reason, it would be suggested that changes to aircraft operation patterns be instituted only at those airports having tower control for operation surveillance and advisory services.

The noise analysis conducted for system airports, as documented in Chapter XI, identified the rather severe noise impact of aircraft operations at General Mitchell

[3] *FAA Order 7110.14, Airport Traffic and Taxi Patterns, January 10, 1968.*

Field upon the surrounding land uses. In addition, it was also found that a comparative nuisance from general aviation aircraft operations may be considered to exist around General Mitchell Field and the general aviation airports at Timmerman Field, Waukesha County, and Kenosha Municipal.

The nuisance factor for each system airport, determined by multiplying the number of acres of residential land by the annual number of general aviation aircraft operations and dividing by 1,000, is a comparative number used to identify those airports having operations that may create a nuisance over lands surrounding the airport. The comparative nuisance factors computed for several airports were: General Mitchell Field, 1,468.1; Timmerman Field, 2,209.7; Waukesha County, 1,312.9; Kenosha Municipal, 530.5; Racine Commercial, 355.6; Burlington Municipal, 217.0; and West Bend Municipal, 149.3. By comparison, the nuisance at General Mitchell Field, Timmerman Field, Waukesha County, and Kenosha Municipal may be considered the greatest among the system airports.

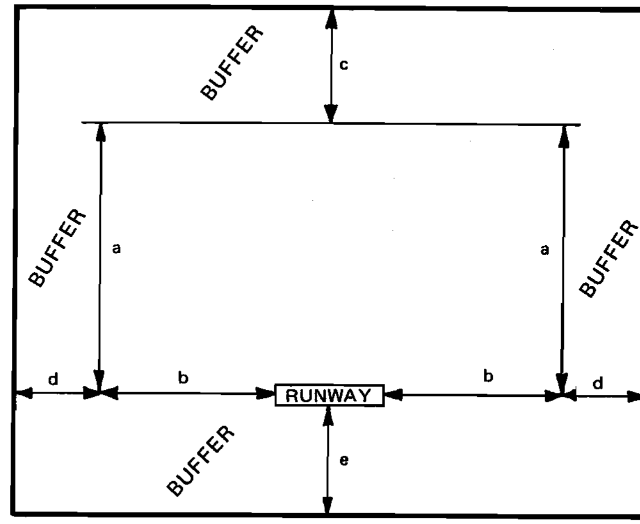
An analysis of the airspace requirements for safe operations under visual flight rules was undertaken to determine what actions to control or modify aircraft operations, if any, could be taken to alleviate the potential nuisance created by a large number of aircraft operations over densely developed residential areas.

The airspace requirements for operations under visual flight rules are of particular concern, since the designated flight paths under these conditions encompass those used for more than 90 percent of the total aircraft operations at an airport, including the touch-and-go operations by which student pilots practice takeoffs and landings. The airspace required around each airport to support landing and takeoff operations under visual flight rule traffic patterns is depicted in Figure 73. The types of aircraft that can be expected at most general aviation airports in the Region are those in Categories 1 and 2 listed in the figure. Although the dimensions shown describe the airspace needed for a specific air traffic pattern for a given runway orientation, the criteria can be used to define airspace requirements under other runway systems. For example, the airspace needed for operations at an airport with parallel runways that serve simultaneous operations would be determined through application of the dimensional criteria to both sides of the runway system, and would include the distance or lateral separation between the parallel runways.

<u>Restricting Flight Training</u>: Another means of reducing the potential nuisance effects of aircraft operations generated by airports located adjacent to urban development involves restricting certain kinds of flight activity at the airport. Such restrictions could involve either a complete ban or the limitation of certain activities, such as flight training, to selected days or hours of the week. It must be recognized, however, that by implementing such restrictions, the attractiveness of the airport to some users will be impaired because they will prefer to base their aircraft at another airport free of restrictions. Such restrictions may also affect fixed based operator and

Figure 73

AIRSPACE REQUIREMENTS FOR VISUAL FLIGHT RULE TRAFFIC PATTERNS AROUND AIRPORTS



LEGEND

a. Base leg and crosswind.
b. Final and departure. (measure from end of runway)
c. Downwind buffer area.
d. Base leg and crosswind buffer area.
e. Final and departure buffer area.

The above traffic pattern airspace should be increased by one-half the length of "b" (final and departure dimensions) when more than four aircraft of same category are anticipated operating in the traffic pattern at any one time.

Aircraft Category Types[a]	Distance in Nautical Miles				
	a	b	c	d	e
1	0.75	0.75	0.5	0.5	0.25
2	1.00	1.00	0.5	0.5	0.25
3	1.75	1.75	0.5	0.5	0.50
4	3.00	2.00	1.0	1.0	0.50

[a] *Aircraft Category Types*

1. *Speed less than 91 knots, weight less than 30,001 pounds. This category includes civil single-engine aircraft, light twins, and some of the heavier twins, such as Aero Commander, Cessna 310C, Beechcraft Queenair 65, and Douglas DC-3.*

2. *Speed 91 knots or more but less than 121 knots; weight 30,001 pounds or more but less than 60,001 pounds. This category includes most of the heavier twin-engine types, such as Grand Commander, Beechcraft 80, Cessna 411C, Convair 340 and 580, and F-27.*

3. *Speed 121 knots or more but less than 141 knots; weight 60,001 pounds or more but less than 150,001 pounds. This category includes four-engine propeller types and two and three-engine turbojets, such as Boeing 727-100, Douglas DC-4, 6, 7, Jet Commander, Lear Jet, and Jetstar.*

4. *Speed 141 knots or more but less than 166 knots; weight 150,001 pounds or more. This category includes the large four-engine turbojet types, such as 707, 720, Convair 990, Douglas DC-8, 747, 1011, and DC-10.*

airport revenues. Additionally, it must be recognized that even though the total operations demand at the airport can be reduced, the practical annual capacity of the airport will also be decreased almost proportionately.

Further, restriction of flight training activity at selected airports in the regional airport system will either require supplemental landing fields elsewhere in the Region or outside of the Region to accommodate the demand, or an increase in operations at other airports in less developed portions of the Region. Satellite training facilities need only consist of a single paved runway with minimum ground services, and because such facilities are not intended to accommodate based aircraft, can be located away from areas of intensive urban development. These remote facilities, however, are not revenue generators and in addition to requiring a public agency sponsor to construct the facility, they require the sponsor to maintain the landing strip.

In this regard, consideration was given to use of the abandoned Bong Air Force site in western Kenosha County. Before the Air Force base was abandoned in 1959, construction was initiated on the approximately 12,000-foot runway and associated taxiways, and had reached the stage of base course and drainage facility completion. With an estimated additional expenditure of $625,000, a paved 5,500-foot landing strip and attendant taxiway could be provided to accommodate general aviation flight training activity within the Region at this site. The strip would be designed to operate under visual flight rules. Presently, the land encompassing the abandoned Air Force landing facility is owned by the Wisconsin Department of Natural Resurces. This facility could be maintained and operated by the state and also used to provide air access to the Bong recreational area. No other flight training landing strips were identified within the Region, since capacity does exist at several airports away from the more densely developed areas.

The implementation of nonstandard aircraft operating procedures is recommended at six of the general aviation airports included in the recommended system plan and at General Mitchell Field. All would involve aircraft operating at airports equipped with an air traffic control tower and personnel for operations surveillance and advisory services.

General Height Restrictions in the Vicinity of Airports

While land use planning and related comprehensive zoning can be used in the attempt to achieve land use activities more compatible with aircraft operations, specific height restrictions are necessary around system airports to assure safe aircraft operations in the proximity of the airports. It is herein recommended that the Federal Aviation Administration obstruction criteria be used to define the general height restrictions attendant to all airports in the regional system. These general restrictions can be revised, where necessary, to conform with the specific operating procedures as evolved at each airport. Whenever an object is found to occupy an elevation in excess of that indicated as safe by application of the obstruction criteria, operating procedures can be reviewed to determine whether the object in question in fact represents a safety hazard. Chapter 114.136 of the Wisconsin Statutes provides the necessary state legislation enabling public airport owners to protect the airspace around airports from the intrusion of hazards to aircraft operations. This statute permits any county, city, village, or town that owns an airport site to establish zoning height criteria within three miles of that airport boundary to prevent new construction of most tall objects that would endanger safe aircraft operation. The statute further allows the airport owner to negotiate the purchase of, or acquire by eminent domain or other means, the air rights to any property which might contain structures or objects which endanger safe airport operations.

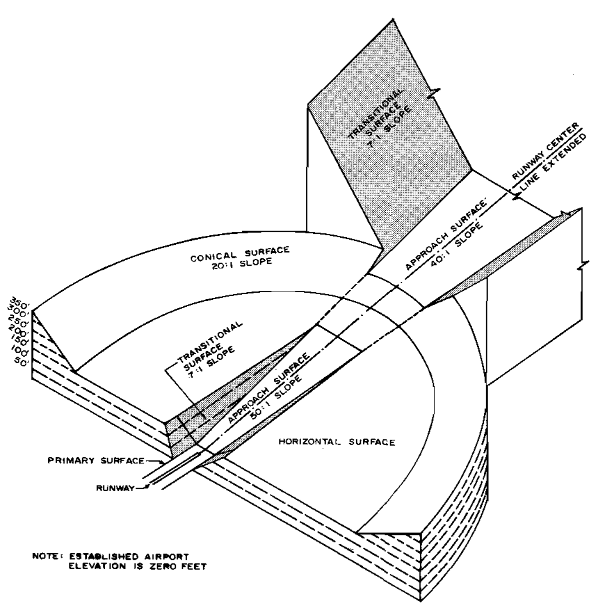
The criteria used to determine the shape, location, and slope of the various surfaces through which no obstruction should penetrate are outlined in Part 77 of the Federal Aviation Regulations, dated May 16, 1971, as amended. A typical set of imaginary surfaces is shown in Figure 74, and its components are defined as follows:

> The **horizontal surface** is a horizontal plane 150 feet above the established airport elevation. The perimeter of the horizontal surface is established by arcs of specified radii from the center of each end of the primary surface of each runway and connections between the adjacent arcs by lines tangent to those arcs. The radius of each arc is 5,000 feet for all runways designated as utility or visual and 10,000 feet for all runways designated as precision or nonprecision. The radius of the arc specified for each end of the runway will be the same as the largest determined by the above-mentioned runway designations. When an arc is encompassed by another arc, arcs, or tangents connecting adjacent arcs, the encompassed arc shall be disregarded in the determination of the perimeter of the horizontal surface.
>
> The **conical surface** extends outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.
>
> The **primary surface** is a surface longitudinally centered on the runway. It extends to each end of unpaved runways and 200 feet beyond each end of paved runways. For airports within the regional system it has a width of 250 feet for runways having only visual approaches, 500 feet for runways having nonprecision instrument approaches, and 1,000 feet for runways having a precision instrument approach. The width of the primary surface of a runway will be that width prescribed for the most precise approach existing or planned for either end of the runway, and the elevation of any point on the primary surface is the same elevation of the nearest point on the runway centerline.
>
> The **approach surface** is a surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface. Slope and configuration of the

runway approach surface are based upon the type of approach available or planned for the runway end. The length, measured horizontally, and slope of the approach surfaces are 5,000 feet at a slope of 20 to 1 for all runways with visual approaches, 10,000 feet at a slope of 34 to 1 for runways with nonprecision instrument approaches, and 10,000 feet at a slope of 50 to 1 with an additional 40,000 feet at a slope of 40 to 1 for all runways with precision instrument approaches. The inner edge or runway level width of the approach surface is the same width as the primary surface, and it expands uniformly to a width of 1,250 feet for all visual approach surfaces if located at the opposite end of runways with visual approaches or to a width of 1,500 feet if located at the opposite end of runways with nonprecision instrument or precision instrument approaches; to a width of 3,500 feet for all runways with nonprecision instrument approaches and to a width of 16,000 feet for all runways with precision instrument approaches.

The **transitional surfaces** are surfaces extending outward and upward at right angles to the runway centerline and the runway centerline extended at a slope of 7 to 1 from the edges of the primary and approach surfaces. Transitional surfaces for those portions of the precision approach surface which project through and beyond the limits of the conical surface extend a distance of 5,000 feet measured horizontally from the edge of the approach surface and at right angles to the runway centerline.

PERSPECTIVE VIEW OF IMAGINARY SURFACES USED TO DEFINE AIRSPACE IN VICINITY OF AIRPORTS



Land Use Adjacent to Airports

In addition to specific recommendations relating to aircraft operating restrictions and to the control of height obstructions in the vicinity of each airport, adjustments in the use of land adjacent to the airport offers another potential for achievement of greater compatibility between the airport and its surrounding area. Coordinated planning of airport facilities and adjacent land uses will result in the best combination of compatible uses. Only when airport and comprehensive community planning are fully coordinated can land adjacent to the airport be used to achieve community goals while accommodating airport operations. Where necessary to eliminate incompatible uses, direct control of land by the airport sponsor is required either through outright purchase or the purchase of easements granting the right to fly over properties.

Consideration was given in the system planning to effecting an adjustment of land use activities in areas surrounding the airports comprising the recommended system to the aircraft operations attendant to the airport. The composite noise rating isopleth developed for forecast aircraft operations at each airport was used to identify the more critical noise impact areas affected by aircraft operations. Two isopleths were prepared for each airport. One was the 100 CNR isopleth; the other, the 115 CNR isopleth. The latter falls inside the 100 CNR and encompasses the most severely noise impacted area in the vicinity of each airport. These two contours identify the land areas most affected by noise, and thus the areas where efforts to develop noise-compatible land uses should be considered. This information was analyzed together with existing land use data, zoning ordinances, and community plans, and recommendations for land use development around each of the airports in the system plan were prepared.

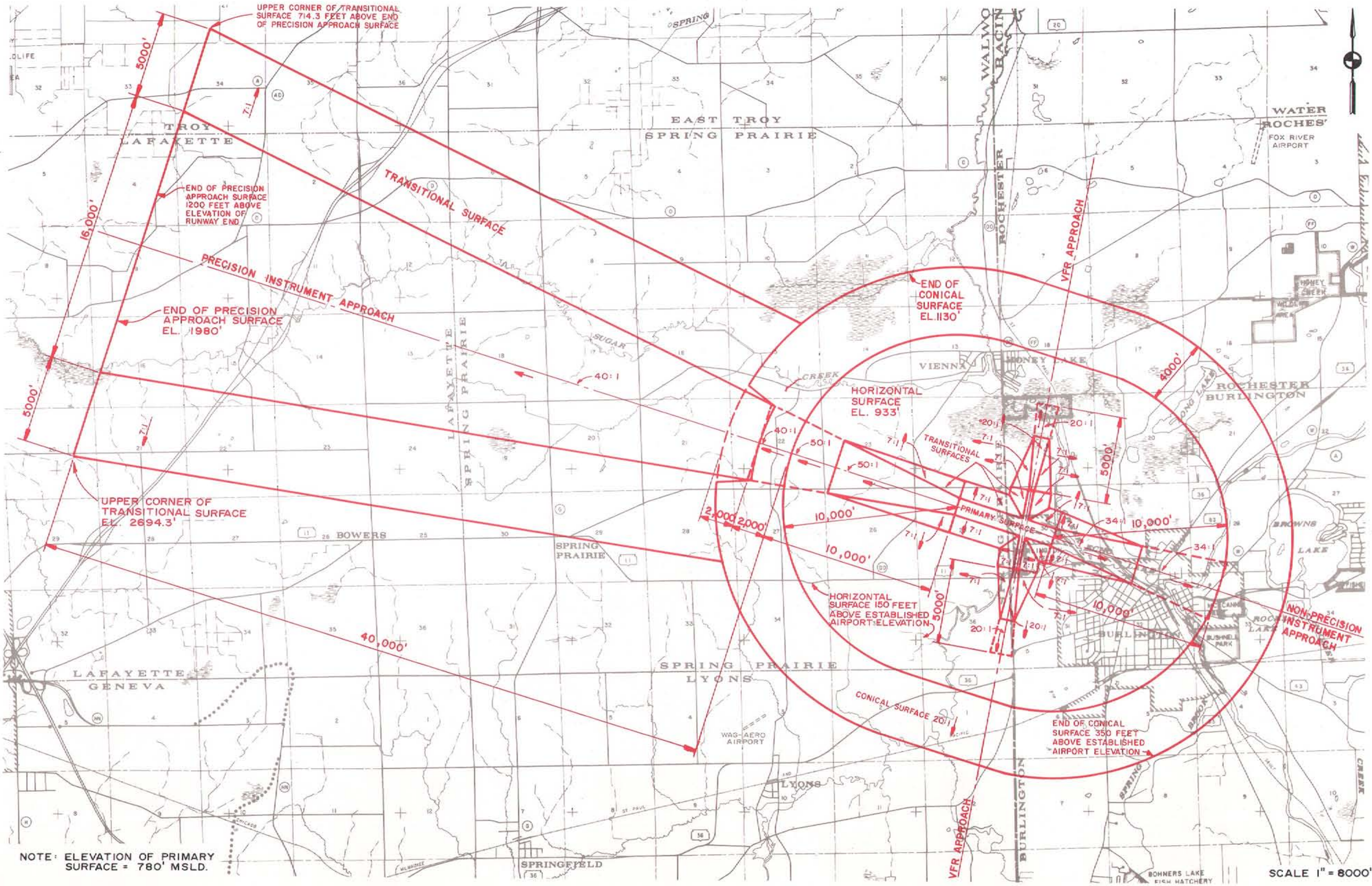
Recommended Airport Improvements

The recommended site requirements, aircraft operating patterns and restrictions, height restrictions, and adjacent land use adjustments for each airport in the regional system plan are detailed in the following paragraphs.

Burlington Municipal Airport: Improvements required to expand this airport from its existing basic utility classification to a basic transport airport include an 1,800-foot extension of Runway 11/29, construction of a paved crosswind Runway 1/19, purchase of additional land to accommodate the site expansion, runway extensions, clear zone protection, and installation of an air traffic control tower and other lighting and visual aids. Installation of a precision instrument landing and approach lighting system on approach to Runway 11 is also recommended. Ground access to the terminal area can continue to be conveniently provided by STH 11, which is less than one-half mile via Bieneman Road from the airport access road. Improvements to existing STH 11, recommended to become a county trunk highway under the Racine County jurisdictional highway system plan, have been identified and staged in the jurisdictional system plan. Improvements to Bieneman Road on its existing alignment and at its present cross section should be anticipated during the plan design period. The airport terminal area is within the proposed Burlington sewer service area, and will be connected to the sanitary sewerage system proposed for the service area as facilities are

Figure 74

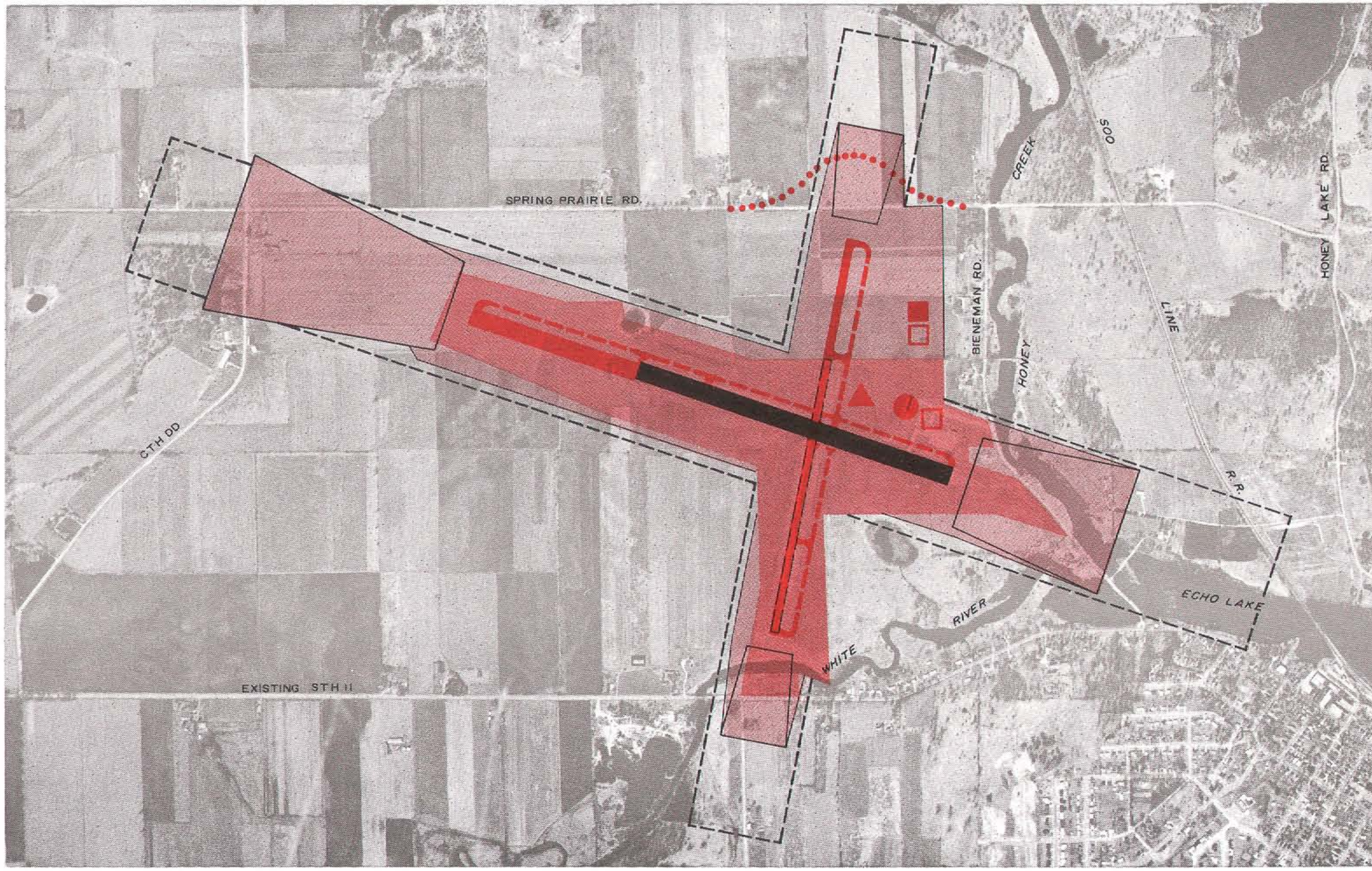
COMPONENTS OF IMAGINARY SURFACES USED TO DEFINE OBSTRUCTION FREE AIRSPACE AND TO ESTABLISH HEIGHT RESTRICTIONS ZONING AROUND SYSTEM AIRPORTS (BURLINGTON MUNICIPAL AIRPORT)



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 48

SITE IMPROVEMENT PLAN FOR THE BURLINGTON MUNICIPAL AIRPORT



LEGEND

- LANDS CURRENTLY (1975) OWNED BY THE CITY OF BURLINGTON FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- EXISTING TURF RUNWAY
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING EXPANSION
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- PROPOSED ROAD REALIGNMENT
- AIRPORT INFLUENCE AREA—LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

GRAPHIC SCALE
0 800 1600 FEET

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 49

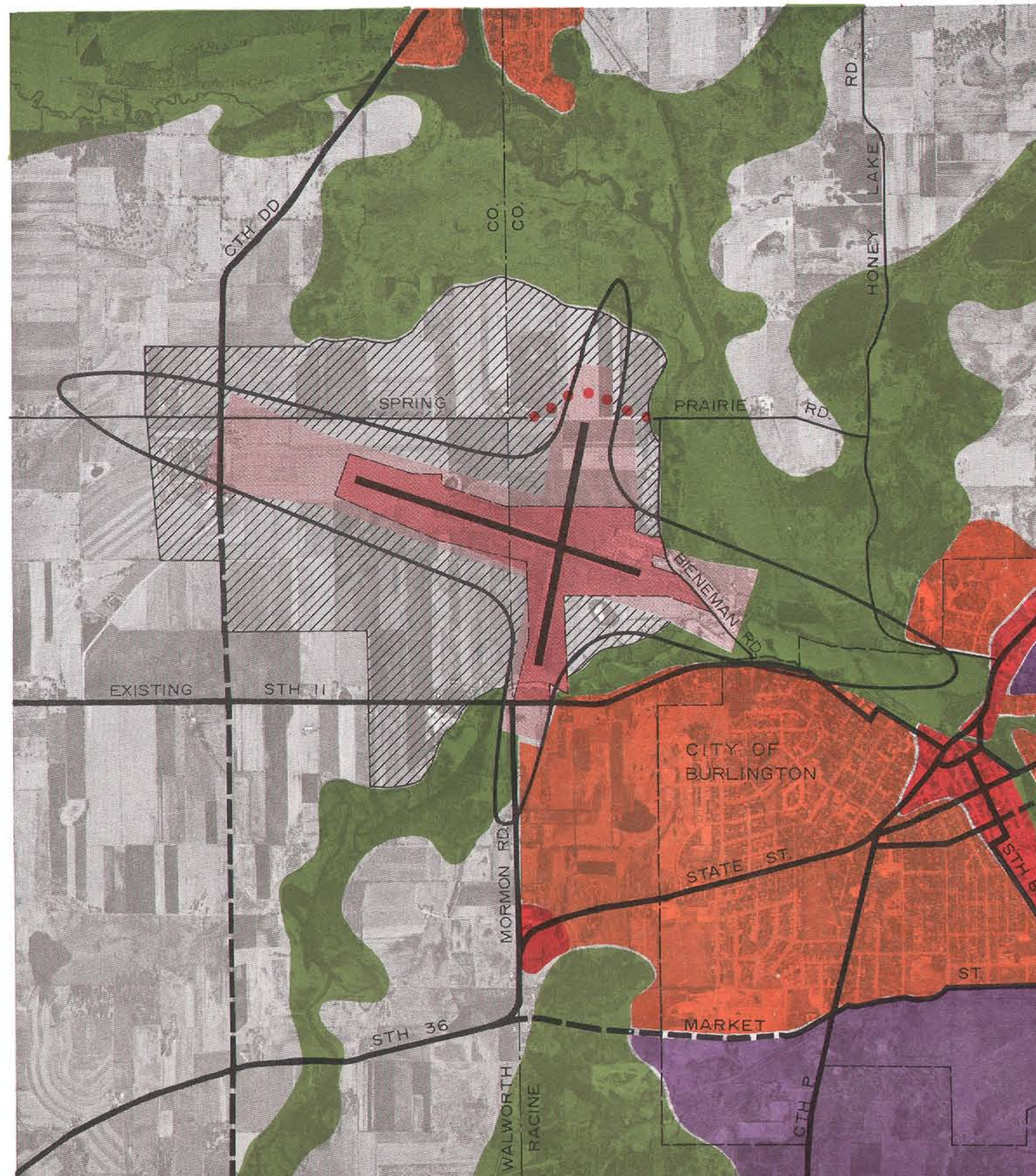
AREA LAND USE PLAN FOR THE BURLINGTON MUNICIPAL AIRPORT

LEGEND

- LANDS CURRENTLY (1975) OWNED BY THE CITY OF BURLINGTON FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENT OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- LANDS ADJACENT TO AIRPORT PROPOSED TO REMAIN IN AGRICULTURAL OR OTHER OPEN SPACE LAND USES, OR BE UTILIZED FOR NON-RESIDENTIAL URBAN LAND USES COMPATIBLE WITH AIRPORT ACTIVITY
- MEDIUM DENSITY RESIDENTIAL AND RELATED (7.3–22.8 PERSONS PER NET RESIDENTIAL ACRE)
- COMMERCIAL
- INDUSTRIAL
- PRIMARY ENVIRONMENTAL CORRIDOR
- AGRICULTURAL
- PROPOSED ROAD REALIGNMENT
- MUNICIPAL LIMITS — 1975
- 100 CNR – NOISE RATING ISOPLETH

ARTERIAL STREET OR HIGHWAY

- EXISTING
- PROPOSED



GRAPHIC SCALE

0 2000 4000 FEET

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 210

SITE REQUIREMENT RECOMMENDATIONS FOR THE BURLINGTON MUNICIPAL AIRPORT

General Conditions	
Airport Classification	Existing—Basic Utility—Stage II Proposed—Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory—8,000 1990 Forecast—163,400
Based Aircraft	1971 Inventory—38 1990 Forecast—194
Runway System Capacity (PANCAP)	Existing—133,000 Proposed—253,300
IFR Capability	Precision Instrument Approach[a]
Land Requirements	
Site Expansion (Acres)	88
Clear Zone Protection (Acres)	145
Residential Units	6
Total Estimated Cost	$ 607,500
Operational Area Improvements	
Extend Runway 11/29 to 5,400 feet	
Runway: 200 feet x 1,800 feet	
Remove Obstruction, 29 End	
Pave Runway 1/19	
Runway: 100 feet x 4,300 feet	
Realign Town Road	
Widen and strengthen existing Runway 11/29 to accommodate 60,000 pounds gross weight aircraft	
Runway 11/29: 25 feet x 3,600 feet	
Runway 11/29: 4" overlay, 75 feet x 3,600 feet	
Construct taxiway system	
Taxiway 11/29: 40 feet x 5,900 feet	
Taxiway 1/19: 40 feet x 4,800 feet	
Construct additional paved aircraft parking apron: 36,700 square yards	
Install lighting and visual aids	
MIRL Runway 1/19: 4,300 feet	
HIRL Runway 11/29: 5,400 feet	
Taxiway Exit Lights—Both Runways	
VASI-4 Runway 11/29, 11 End	
REILS Both Runways, Both Ends	
Construct air traffic control tower	
Install precision instrument landing and approach lighting system on approach to Runway 11	
Total Estimated Cost	$2,558,500
Terminal Area Improvements	
Expand administration/terminal building: 6,500 square feet	
Expand auto parking and service roads: 12,600 square yards	
Total Estimated Cost	$ 540,400
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 22,400 square yards	
Total Estimated Cost	$2,470,000
Ground Access Facilities	
Improve Bieneman Road between terminal area and STH 11	
Total Estimated Cost	$ 75,000
Utility Services	
Airport terminal within proposed service area—cost of connections considered nominal	
Total Estimated Capital Investment	$6,251,400

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

extended. Details of these improvements are shown on Map 48, and are listed together with their estimated capital cost in Table 210.

If and as the nuisance element from general aviation operations at the airport becomes significant, nonstandard right-turn traffic patterns can be implemented for operations using Runways 19 and 29. Much of this impact could be minimized prior to any change in the standard operating procedures if pilots of the local training flights are encouraged by the air traffic control tower to avoid flying over residential developments. Additionally, once Runway 11/29 is extended, many flight training operations will use the longer runway and achieve higher altitudes by the time they fly over developed areas.

The imaginary surfaces used to identify airspace which must be kept free of obstructions to assure safe aircraft operations around the Burlington Municipal Airport were depicted in Figure 74. In addition to the height obstruction zoning required to protect the airspace identified by the imaginary surfaces, the generalized land uses considered compatible with aircraft operations around the airport are shown on Map 49.

East Troy Municipal Airport: The major improvements necessary to bring this less than basic utility airport to the basic utility airport standards consist of constructing paved primary and crosswind runways, acquisition of land for runway construction and clear zone protection, and provision of lighting and visual aids. Ground transportation access is provided directly to the East Troy Municipal Airport by STH 24, which is recommended to become a county trunk highway in the Walworth County jurisdictional highway system plan. No ground access road improvements are therefore identified as necessary under the airport system plan. The airport terminal area is also encompassed within the East Troy and Potters Lake sewer service area and will be connected into the sanitary sewerage system proposed for the service area as facilities are extended. These and other improvements are shown on Map 50 and listed in Table 211. Generalized land uses considered compatible with the airport are also shown on Map 51 and the imaginary surfaces to define airspace necessary for safe aircraft operations are depicted in Figure 75.

General Mitchell Field: Major improvements recommended for the only air carrier airport required to serve the Region under the system plan include major renovation of the airline passenger terminal; construction of a new cargo terminal area; extension of Runway 1L/19R to 11,500 feet to accommodate international flights; completion of Runway 1R/19L to 7,000 feet to accommodate commercial air carrier traffic, with land reserved to permit extension to 9,000 feet beyond the design year of the system plan; realignment of general aviation Runway 7L/25R to make it parallel with the longer air carrier Runway 7R/25L; extension of Runway 7R/25L to 9,000 feet; and the acquisition of additional land for clear zone protection and the elimination of land use conflicts in the most severe noise impact areas. In addition to these improvements, it will be necessary to strengthen and overlay existing runways and taxiways to permit continued operation prior to construction of the expanded runway facilities. The airport is presently served by public utilities, and improved ground access is proposed with construction of the Airport Spur Freeway as recommended in the adopted Milwaukee County jurisdictional highway system plan. These improvements are shown on Map 52 and listed together with their estimated capital cost in Table 212.

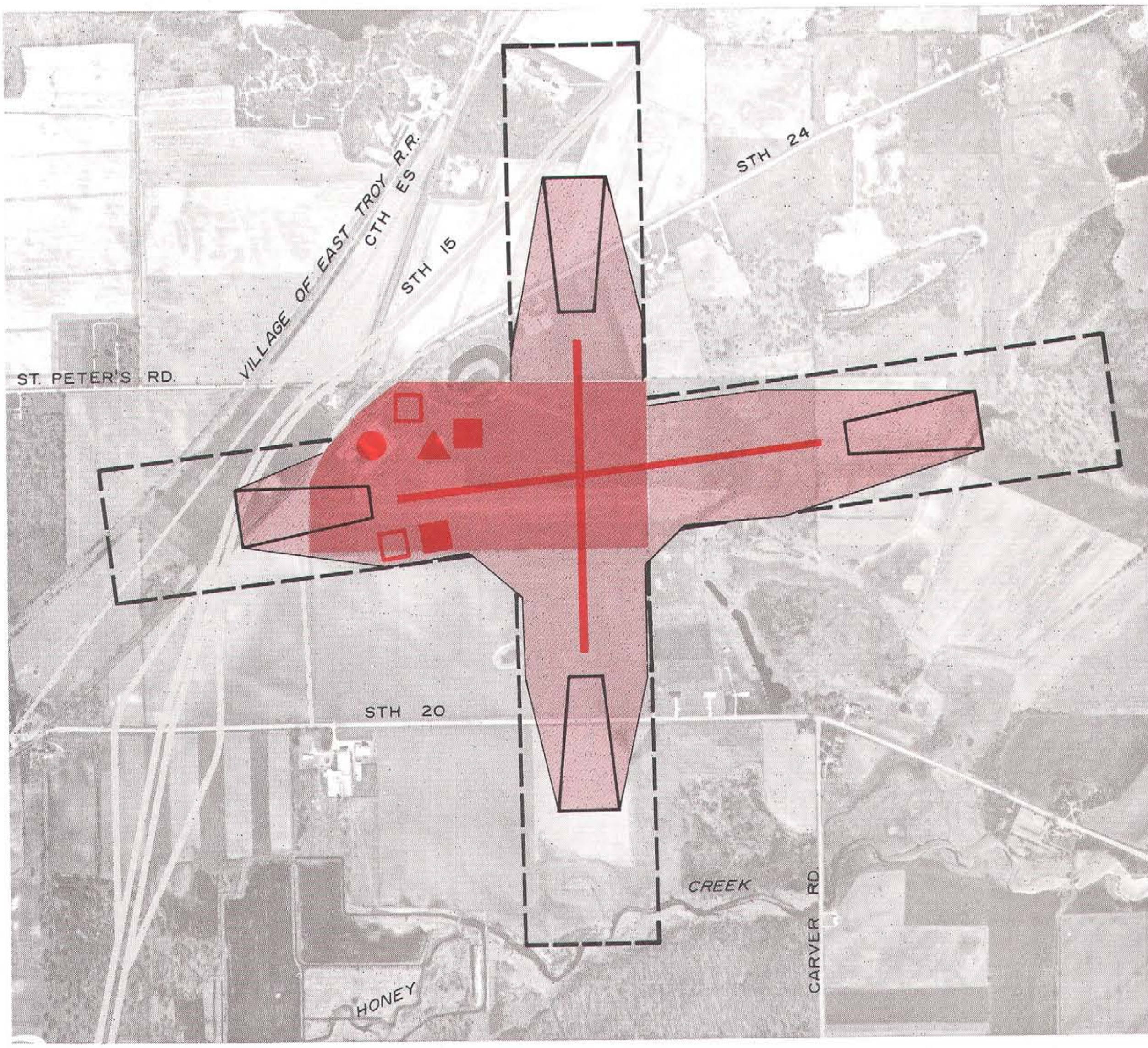
Milwaukee County already has substantial land interest in runway clear zone areas. The precision instrument approach runway clear zones associated with Runway 1L/19R, Runway 1R, and all but 18 acres of clear zone associated with Runway 7R are already owned by Milwaukee County. Of the 18 acres of clear zone related to Runway 7R not in county ownership, 13 acres are presently used as a junk yard. It is recommended that the county immediately obtain avigation easements over this area and acquire the additional acreage if, and as, it comes upon the market. Approximately five acres of the clear zone associated with new Runway 7L lie beyond the airport boundaries west of S. Howell Avenue and are presently used for commercial purposes. Acquisition of avigation easements only over this land, all of which is located at least 700 feet beyond the end of the runway, is recommended. Required clear zones associated with Runway 19L, the north end of the north-south runway, and 25R, the east end of the general aviation runway proposed to be realigned and lengthened, overlap beyond the present airport boundaries and will require acquisition of 11 acres of land and 25 residential dwelling units. The clear zone associated with Runway 25L, the east end of the east-west air carrier runway, comprises 22 acres of land beyond the airport boundary and is encompassed within the 115 CNR isopleth. In addition, about 35 acres of land and three residential dwelling units within the 115 CNR isopleth extending beyond the clear zone are recommended to be acquired.

The imaginary surfaces relating to the runway approaches recommended within the system plan are shown in Figure 76. Generalized land uses considered compatible with aircraft operations at General Mitchell Field are shown on Map 53 and should be refined as part of the General Mitchell Field master plan study. Most general aviation aircraft operations at General Mitchell Field do not create a significant noise impact on surrounding land uses in that flight training activities are limited and higher altitudes are reached before the aircraft cross the airport boundaries. It is recommended that the business jet aircraft within the general aviation fleet be restricted to the longer runways used by the air carrier aircraft only, and not be permitted on the proposed lengthened and realigned Runway 7L/25R.

The noise from air carrier operations, however, has a severe impact upon surrounding land uses. In addition to recommending that all land within the 115 CNR isopleth be acquired by Milwaukee County to eliminate noise conflicts in areas where noise levels are clearly unacceptable, continued efforts to improve aircraft operating procedures to modify the noise impacts upon the airport environs are recommended. Cooperative arrangements between the airport manager, FAA, and

Map 50

SITE IMPROVEMENT PLAN FOR THE EAST TROY MUNICIPAL AIRPORT



LEGEND

LANDS CURRENTLY (1975) OWNED BY THE VILLAGE OF EAST TROY FOR AIRPORT PURPOSES

LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT

PROPOSED PAVED RUNWAY

CLEAR ZONE TRAPEZOID

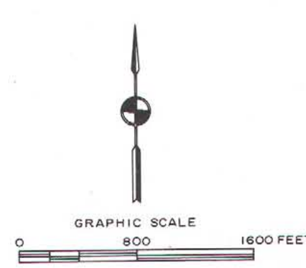
PROPOSED TERMINAL BUILDING EXPANSION

PROPOSED AIRCRAFT PARKING APRON AREA

PROPOSED AIRCRAFT HANGAR AREA

PROPOSED AUTOMOBILE PARKING AREA

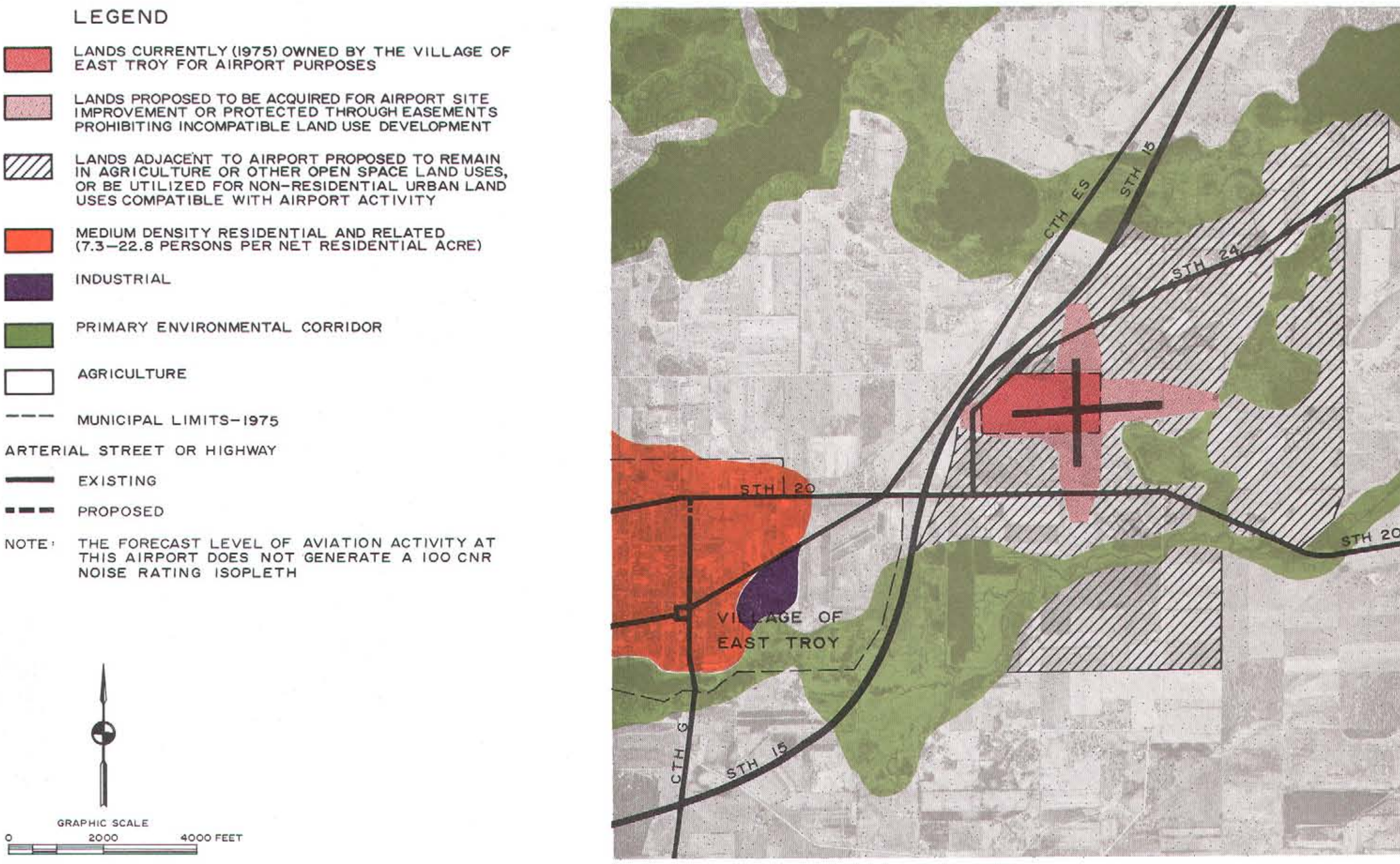
AIRPORT INFLUENCE AREA–LIMIT OF AREA ELIGIBLE FOR FEDERAL AID



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 51

AREA LAND USE PLAN FOR THE EAST TROY MUNICIPAL AIRPORT



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

airline personnel have been able to achieve some improved operating procedures, but they require constant surveillance. Pilots are instructed to remain on runway headings until reaching an elevation of 1,500 feet above the ground before turning to their destination heading. Tower personnel are directed to disperse operations insofar as possible among the runways to reduce concentrations of traffic over any one of the neighboring areas. Although the use of steeper approach slopes which permit approaching aircraft to remain at higher altitudes until they are nearer the runway are under study, this practice cannot be recommended until all aspects of the impact upon flight operations, particularly safety, are understood and accepted. Airline schedule adjustments to reduce the late evening-early morning operations and concentrations of operations in peak hours should receive careful consideration to minimize the noise impact. Even with these aircraft operating adjustments and compatible land use planning, aircraft noise may be expected to remain a serious problem until quieter engines are installed on a significant portion of the fleet.

Gruenwald Airport: Improving this existing, less than basic utility, privately owned airport to the general utility airport standards recommended in the system plan will require land acquisition for site development and runway clear zone protection; construction of a 4,000-foot northeast-southwest primary and 3,200-foot northwest-southeast secondary runway and associated taxiways; and the installation of a traffic control tower, a nonprecision instrument landing system approach to the southwest end of the primary runway, and runway lighting and other visual aids.

Although the number of forecast aircraft operations supports qualification of this airport for installation of a precision instrument landing system, such installation is not recommended at the proposed general utility airports within the Region because of the more extensive land requirements to obtain clear zone protection and the need for wider runways. The nonprecision approach system is judged sufficient for all but a few adverse weather conditions occurring annually. Under those adverse conditions, aircraft can use the Burlington Municipal Airport, which is recommended to have precision instrument approach capabilities.

The cost of acquiring the existing airport site has also been listed, recognizing that it may become necessary for public agency action to assure continued airport availability. The airport site is adjacent to CTH H but is beyond the sewer service area proposed to encompass most of the City of Elkhorn. It will be necessary, therefore, to provide a sewer service extension to connect the

Table 211

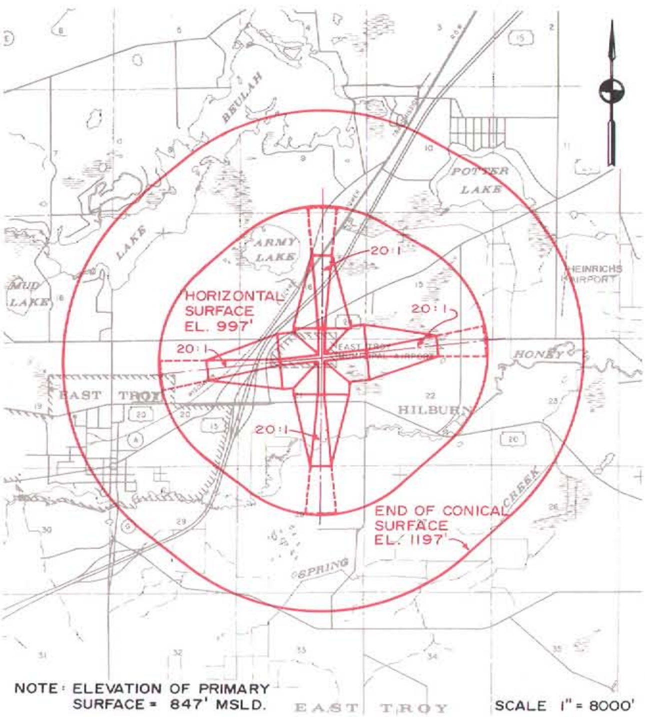
SITE REQUIREMENT RECOMMENDATIONS FOR THE EAST TROY MUNICIPAL AIRPORT

General Conditions	
Airport Classification	Existing—Less Than Basic Utility—Stage I Proposed—Basic Utility
Aviation Demand	
Annual Operations	1971 Inventory—5,700 1990 Forecast—194,400
Based Aircraft	1971 Inventory—18 1990 Forecast—218
Runway System Capacity (PANCAP)	Existing—86,000 Proposed—319,000
IFR Capability	None (VFR)
Land Requirements	
Site Expansion (Acres)	70
Clear Zone Protection (Acres)	50
Residential and Commercial Units	1
Total Estimated Cost	$ 194,000
Operational Area Improvements Pave Runway 9/27: 60 feet x 3,200 feet Pave Runway 18/36: 60 feet x 2,560 feet Construct additional paved aircraft parking apron: 32,800 square yards Install lighting and visual aids MIRL Runway: 9/27 MIRL Runway: 18/36 VASI-2 Runway: 9/27, 9 End REILS Both Runways, Both Ends	
Total Estimated Cost	$ 886,800
Terminal Area Improvements Construct new administration/terminal building: 7,600 square feet Expand auto parking and service roads: 13,500 square yards	
Total Estimated Cost	$ 556,900
Hangar Area Improvements Expand aircraft hangar storage and service area: 18,800 square yards	
Total Estimated Cost	$1,467,000
Ground Access Facilities No additional facilities required	
Utility Services Airport terminal is within proposed service area—cost of connections considered nominal	
Total Estimated Capital Investment	$3,104,700

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Figure 75

EAST TROY MUNICIPAL AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

airport terminal area in the sanitary sewerage system proposed for the Delavan, Delavan Lake, and Elkhorn sewer service area. These site improvements are shown on Map 54, and are listed in greater detail, including estimated capital costs for improvement items, in Table 213.

The imaginary surfaces related to the proposed runway configuration are shown in Figure 77 to guide establishment of height zoning regulations, and proposed generalized land uses around the airport considered compatible with the forecast of aircraft operations are shown on Map 55.

Hartford Municipal Airport: The major improvements recommended to improve the existing basic utility Hartford Municipal Airport to general utility standards include the extension of Runway 11/29 800 feet to the northwest; construction of a 3,000-foot paved crosswind Runway 2/20; land acquisition for runway improvements and clear zone protection; and installation of a traffic control tower, a nonprecision instrument landing system approach to Runway 11, and additional lighting and visual aids. Although the number of forecast aircraft operations supports qualification of this airport for installation of a precision instrument landing system, such installation is not recommended at the proposed general utility airports within the Region because of the more extensive land requirements to obtain clear zone protection and the need for wider runways. The nonprecision approach system is judged sufficient for all but a few adverse weather conditions occurring annually. Under those adverse conditions, aircraft can use the West Bend Municipal Airport, which is recommended to have precision instrument approach capabilities.

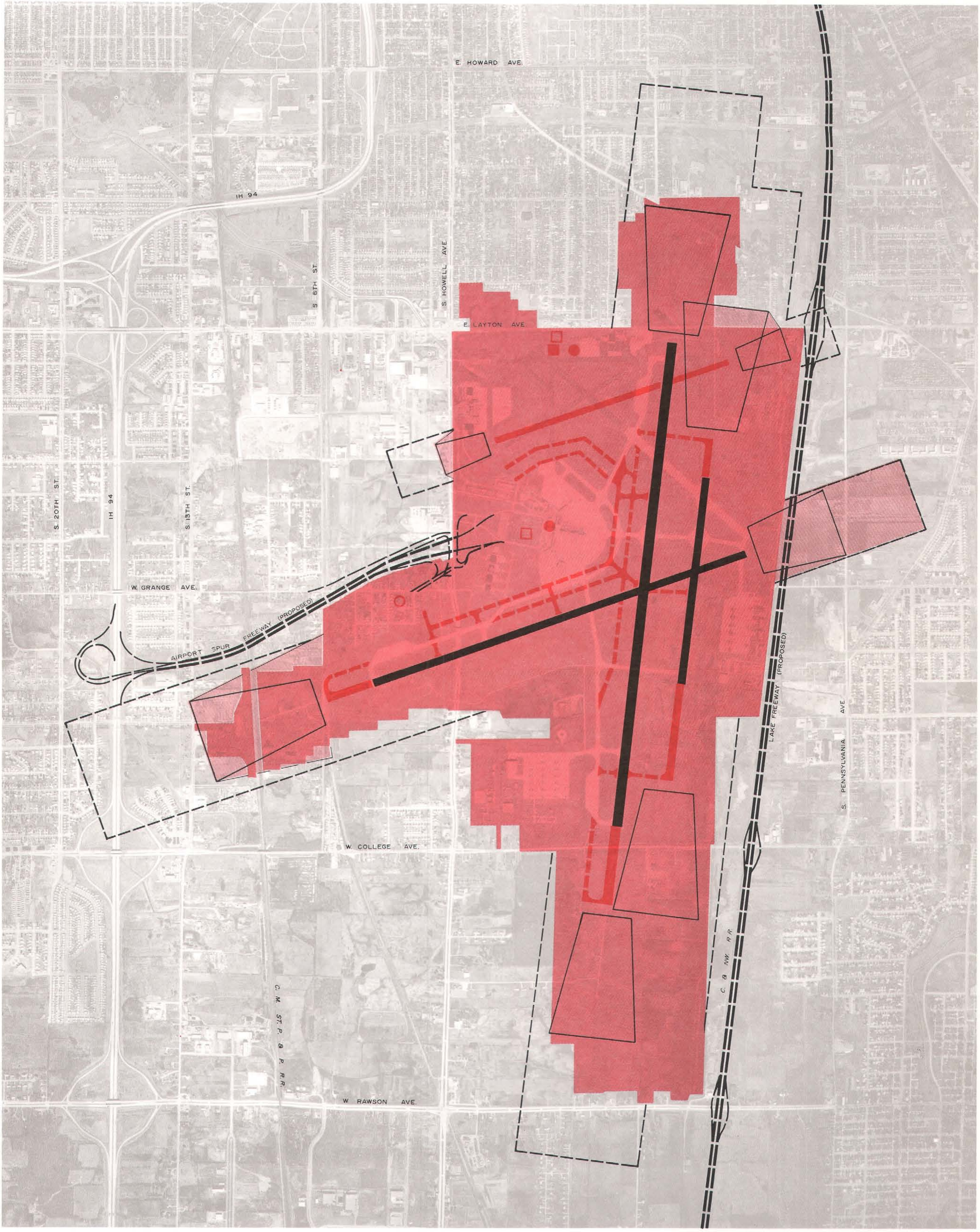
County trunk highway U is recommended to become a local trunk arterial facility in the Washington County jurisdictional highway system plan to provide direct arterial system service to the Hartford Municipal Airport terminal area. This facility will be terminated at the airport since the Runway 11/29 extension will force closing of the road between the airport and Arthur Road. Resurfacing the existing facility during the plan design period is recommended, staged, and costed in the jurisdictional highway system plan. It will be necessary to extend sanitary sewerage service from the proposed Hartford and Pike Lake sewer service area to the airport terminal. Such sewer service extension will also serve the anticipated urban growth areas between the airport and the City of Hartford. These recommended site and facility improvements are shown on Map 56 and listed together with their estimated capital costs in Table 214. The imaginary surfaces relating to the proposed runway configuration and instrumentation are shown in Figure 78. The generalized land uses around the airport considered compatible with aircraft operations and community development are shown on Map 57.

Kenosha Municipal Airport: Of all the recommended basic transport airports in the Region, the Kenosha Municipal Airport has the best potential for expansion. It is considered desirable to have one general aviation airport within the Region capable of accommodating all of the aircraft within the general aviation fleet operating under near capacity loads; and since the local interests have proposed construction of a longer runway at this airport, the Kenosha Municipal Airport site was analyzed to identify not only the improvements required to upgrade this facility from its existing general utility classification to a basic transport classification, but also to provide one capable of handling all of the general aviation fleet at 90 percent of the aircraft load capabilities. The site could accommodate a runway 7,000 feet long, meeting full precision instrument landing system separation-obstruction clearance and airspace criteria. Such a runway would also provide sufficient length for most air carrier operations, and could, therefore, provide the Region with an alternative airport for air carrier operations under emergency conditions.

With provision of a properly designed 7,000-foot-long runway to serve heavier aircraft and provision of precision instrument capability, the Kenosha Municipal Airport would meet the criteria for a general transport airport. Consideration was given to the development of a general transport airport. However, since no aircraft of the type necessitating development of a general transport airport are forecast to be based within the Region, and with recognition that General Mitchell Field is centrally located with respect to demand served by the larger aircraft of the general aviation fleet, the development of the runway system at Kenosha capable of handling the heaviest general aviation and commercial aircraft is not recommended. The major improvements recommended

Map 52

SITE IMPROVEMENT PLAN FOR GENERAL MITCHELL FIELD



LEGEND

- LANDS CURRENTLY (1975) OWNED BY MILWAUKEE COUNTY FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED PASSENGER TERMINAL BUILDING EXPANSION
- PROPOSED CARGO TERMINAL AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- AIRPORT INFLUENCE AREA - LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

GRAPHIC SCALE
0 2000 4000 FEET
0 800 1600 FEET

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 53

AREA LAND USE PLAN FOR GENERAL MITCHELL FIELD

LEGEND

- LANDS CURRENTLY (1975) OWNED BY MILWAUKEE COUNTY FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENT OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- MEDIUM DENSITY RESIDENTIAL AND RELATED (7.3-22.8 PERSONS PER NET RESIDENTIAL ACRE)
- HIGH DENSITY RESIDENTIAL AND RELATED (22.9-59.2 PERSONS PER NET RESIDENTIAL ACRE
- COMMERCIAL
- INDUSTRIAL
- GOVERNMENT AND INSTITUTIONAL
- PRIMARY ENVIRONMENTAL CORRIDOR
- MUNICIPAL LIMITS - 1975
- 100 CNR - NOISE RATING ISOPLETH
- 115 CNR - NOISE RATING ISOPLETH

ARTERIAL STREET OR HIGHWAY

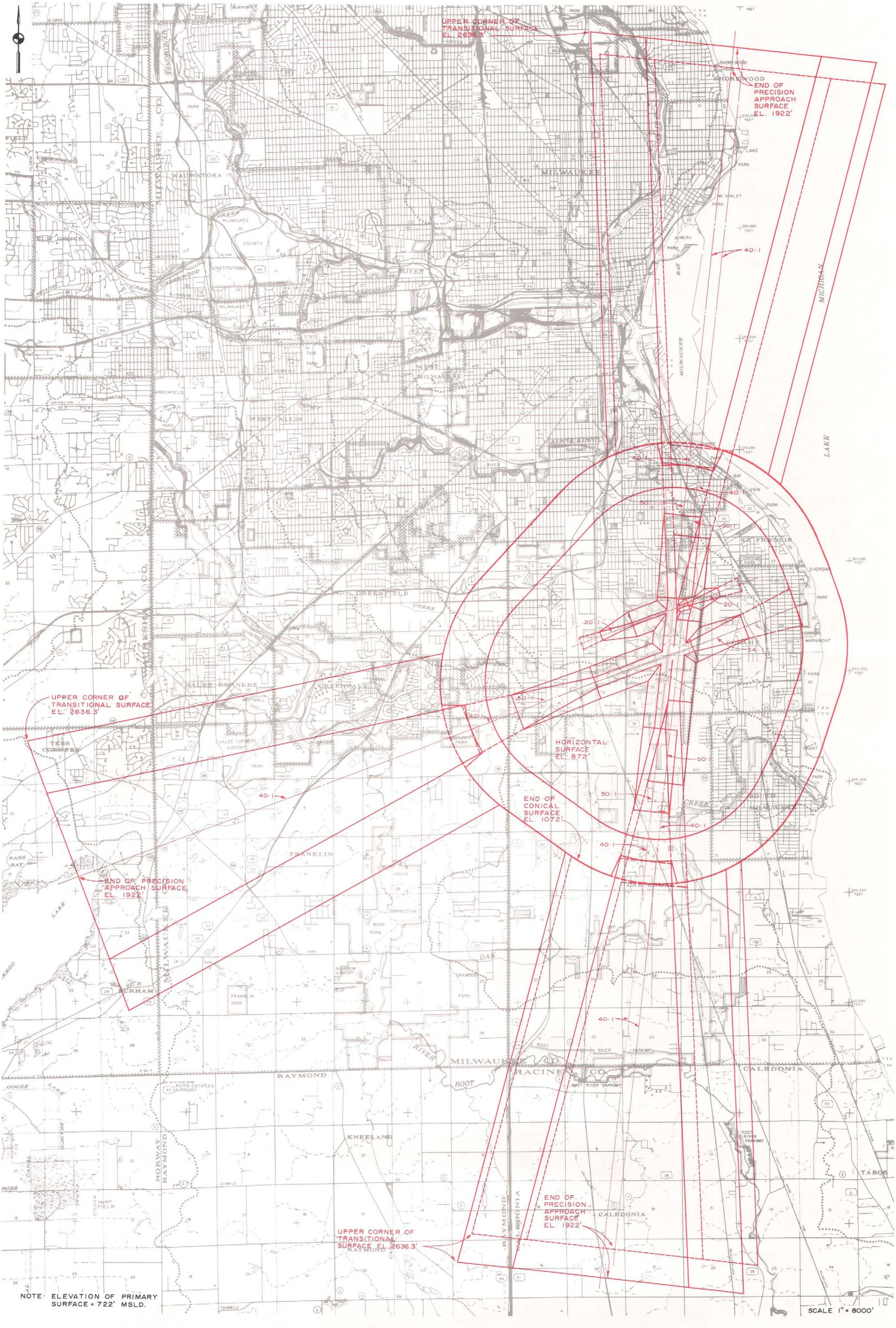
- EXISTING
- PROPOSED

GRAPHIC SCALE
0 2000 4000 FEET

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Figure 76

GENERAL MITCHELL FIELD AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 212

SITE REQUIREMENT RECOMMENDATIONS FOR GENERAL MITCHELL FIELD

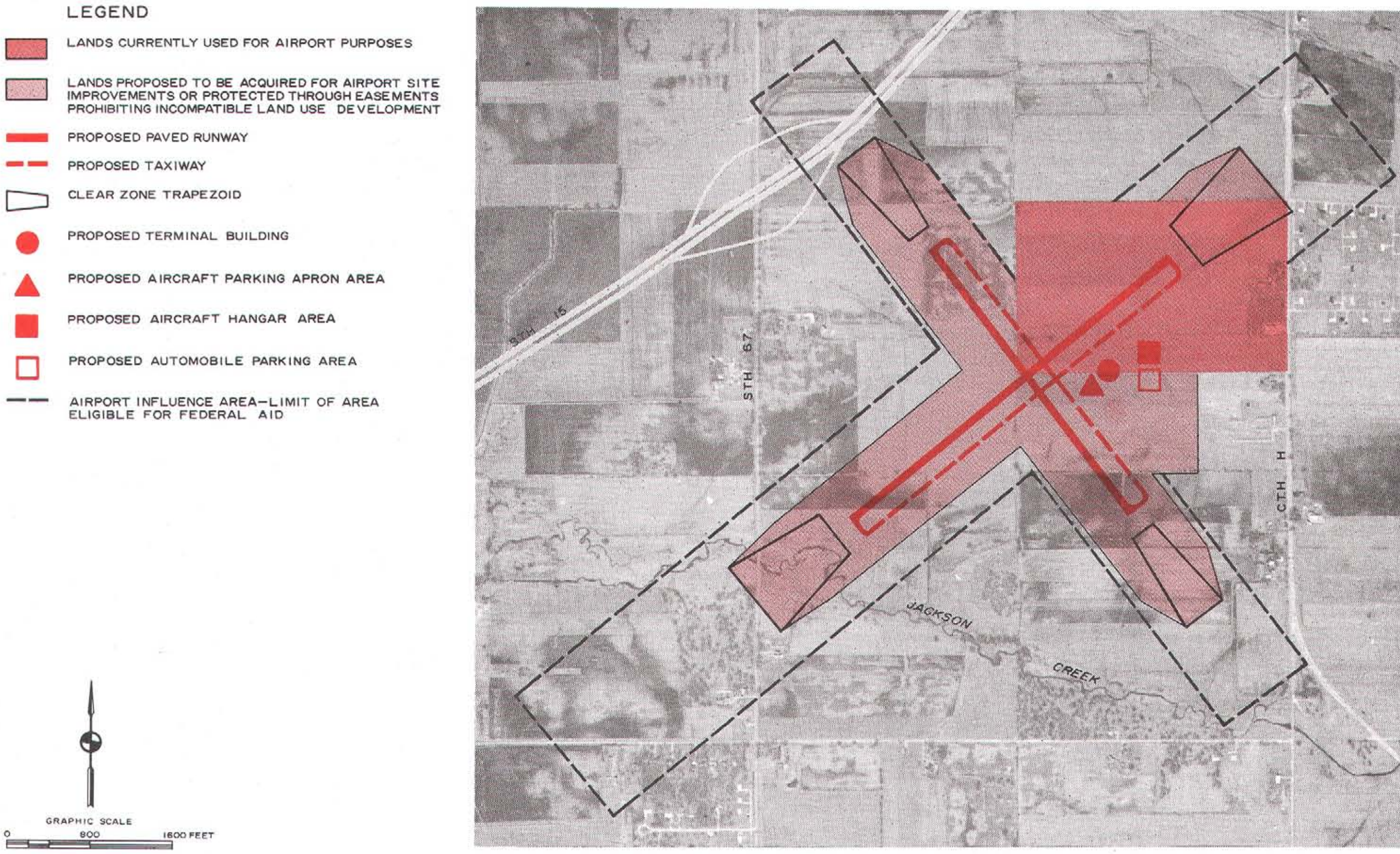
General Conditions	
Airport Classification	Existing—Scheduled Air Transport Proposed—Scheduled Air Transport
Aviation Demand	
Annual Operations	
Total	1971 Inventory—230,810 1990 Forecast—308,200
Air Carrier	1971 Inventory—78,550 1990 Forecast—124,800
Military	1971 Inventory—14,000 1990 Forecast—15,000
General Aviation	1971 Inventory—138,260 1990 Forecast—168,400
Based Aircraft	1971 Inventory—183 1990 Forecast—249
Runway System Capacity (PANCAP)	Existing—341,000 Proposed—400,000
IFR Capability	Precision Instrument Approach[a]
Land Requirements	
Site Expansion (Acres)	0
Clear Zone Protection (Acres)	57
Noise Impact Elimination (Acres)	35
Residential and Commercial Units	30
Total Estimated Cost	$ 2,060,000
Operational Area Improvements	
Resurface Runways 1L/19R and 7R/25L	
Resurface Taxiways 1L/19R and 7R/25L	
Extend Runway 1L/19R to 11,500 feet	
Runway: 200 feet x 1,584 feet	
Taxiway: 75 feet x 2,000 feet	
Extend Runway 1R/19L to 7,000 feet	
Runway: 150 feet x 2,800 feet	
Taxiway: 75 feet x 2,875 feet	
Extend Runway 7R/25L to 9,000 feet	
Runway: 150 feet x 1,000 feet	
Taxiway: 75 feet x 1,288 feet	
Realign and Extend Runway 7L/25R to 5,000 feet	
Runway: 100 feet x 5,000 feet	
Mark and light or remove obstructions	
Total Estimated Cost	$22,800,000
Terminal Area Improvements	
Expand airline passenger terminal and auto parking facilities	
Construct cargo terminal area	
Construct maintenance yard and shop and firehouse	
Expand general aviation terminal facilities	
Total Estimated Cost	$59,770,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area (22,300 square yards)	
Total Estimated Cost	$ 2,922,000
Ground Access Facilities	
Airport Spur Freeway recommended as state trunk highway under jurisdictional highway system plan for Milwaukee County	
Utility Services	
Airport is within existing utility service area	
Total Estimated Capital Investment	$87,552,000

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 54

SITE IMPROVEMENT PLAN FOR GRUENWALD AIRPORT



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

at the Kenosha Municipal Airport consist of the construction of a new 7,000-foot southeast-northwest parallel Runway 6L/24R to serve all aircraft and the fleet that can be accommodated at a basic transport airport at 90 percent load capability; installation of a precision instrument landing and approach lighting system for Runway 6 and nonprecision instrument landing system for Runways 24 and 14; construction of a 300-foot extension to Runway 14/32; runway widening, taxiway lengthening, and runway and taxiway strengthening to accommodate the heavier aircraft; and improvement of lighting and other visual aids. New terminal facilities are proposed which require the construction of an onsite access road between the new terminal and STH 158. Land acquisition will be necessary to accommodate airport site expansion and the runway extensions and clear zones. This airport is located near IH 94 and has direct access to STH 158. The airport site is within the proposed Kenosha-Racine subregional sanitary sewer service area, and will be connected to the sanitary sewerage system proposed for that area when facilities are extended. The recommended site improvements are shown on Map 58 and further detailed, with supporting estimated capital costs, in Table 215.

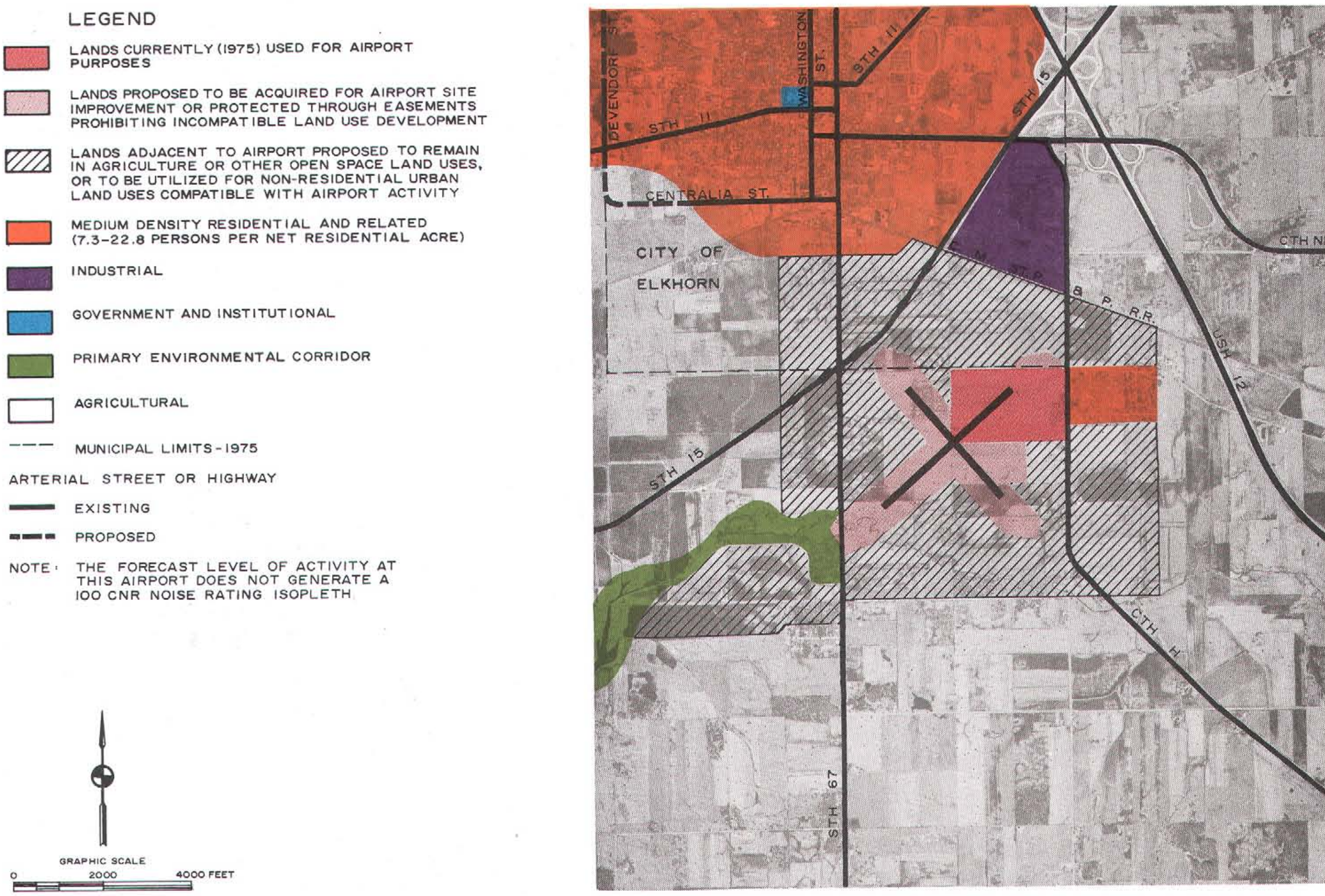
Once the new primary Runway 6L/24R is operational at the Kenosha Municipal Airport, a right-hand traffic pattern to the northeast of existing Runway 6, which will become Runway 6R, will be required to maintain adequate separation between operations on Runway 6L. Similarly, for operations to the southwest, a right-hand pattern will be required for new Runway 24R, while a standard left-hand pattern will remain in use on existing Runway 24L. With this revised traffic pattern, the urbanized areas east and southeast of the airport should benefit from reduced noise, since the larger, higher-performance aircraft would use the new runway and traffic patterns on the northwest side of the airport. Establishment of a right-turn pattern for operations using Runway 14 to the southeast is recommended to reduce aircraft operations over the urban areas east of the airport.

The imaginary surfaces related to the proposed runway alignment and instrumentation are depicted in Figure 79. Generalized land use categories recommended to achieve land uses and activities considered to be most compatible with aircraft operations at the airport are shown on Map 59.

Ozaukee Airport: To improve this existing privately owned, less than basic utility airport to the basic transport standards recommended in the plan will require acquisition of land for site development and clear zone

Map 55

AREA LAND USE PLAN FOR GRUENWALD AIRPORT



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

protection; construction of a 5,600-foot primary north-south and a 4,000-foot secondary east-west runway and associated taxiways; installation of an air traffic control tower, a precision instrument landing and approach lighting system on approach to the north end of the primary runway, and lighting and visual aids; and construction of an administrative/terminal building and aircraft hangar storage areas.

Expansion at this site, particularly construction of the secondary runway to basic transport airport standards, necessitates termination of existing CTH B. The adopted jurisdictional highway plan for Ozaukee County recommends that STH 84 become a county trunk highway and that a new local arterial facility be constructed between existing STH 84 and Mink Ranch Road as an extension of Lover's Lane Road. This proposed arterial facility can effectively replace existing CTH B between old USH 141 and STH 84, and permit termination of the present highway facility to allow construction of the crosswind runway. The terminated facility can be used to continue providing access to the airport terminal, however. This airport is beyond the proposed Port Washington sewer service area, and will, therefore, require a sewer extension from the sanitary sewerage system proposed for that area to the airport terminal. These site-related improvements are shown on Map 60[4] and listed in greater detail, including estimates of capital cost, in Table 216.

[4] *Map 60 shows the Ozaukee Airport developed to general utility standards, not the basic transport standards initially recommended. This airport was the only system airport whose classification was altered following analysis of revised air activity forecasts. Therefore, only the recommended classification was graphically prepared. However, the improvements and costs for developing a basic transport are listed in Table 216. Similar data are presented for the recommended general utility airport in Table 241.*

Table 213

SITE REQUIREMENT RECOMMENDATIONS FOR GRUENWALD AIRPORT UNDER THE REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing—Basic Utility—Stage I Proposed—General Utility
Aviation Demand	
Annual Operations	1971 Inventory—1,600 1990 Forecast—125,900
Based Aircraft	1971 Inventory—4 1990 Forecast—150
Runway System Capacity (PANCAP)	Existing—95,000 Proposed—306,300
IFR Capability	Nonprecision Instrument Approach[a]
Land Requirements Acquire existing privately owned airport (90 acres) and improvements	
Total Estimated Cost	$ 169,000
Site Expansion (Acres)	150
Clear Zone Protection (Acres)	66
Total Estimated Cost	$ 280,800
Operational Area Improvements Construct new NE-SW primary runway: 75 feet x 4,000 feet Construct new NW-SE secondary runway: 75 feet x 3,200 feet Construct taxiway parallel to NE-SW runway: 40 feet x 4,400 feet Construct taxiway parallel to NW-SE runway: 40 feet x 3,600 feet Install lighting and visual aids MIRL NW-SE Runway MIRL NE-SW Runway Taxiway Exit Lights VASI-2 NE-SW Runway, SW End REILS Both Runways, Both Ends Construct additional aircraft parking apron: 28,000 square yards Construct air traffic control tower Install nonprecision instrument landing system on approach to SW end of primary runway	
Total Estimated Cost	$1,466,500
Terminal Area Improvements Construct new administration/terminal building: 7,000 square feet Construct auto parking and service road: 13,100 square yards	
Total Estimated Cost	$ 512,200
Hangar Area Improvements Construct new aircraft hangar storage area: 18,000 square yards	
Total Estimated Cost	$1,358,000
Ground Access Facilities No additional facilities necessary	
Utility Services Extend utility service from City of Elkhorn service area	
Total Estimated Cost	$ 18,000
Total Estimated Capital Investment	$3,804,500

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

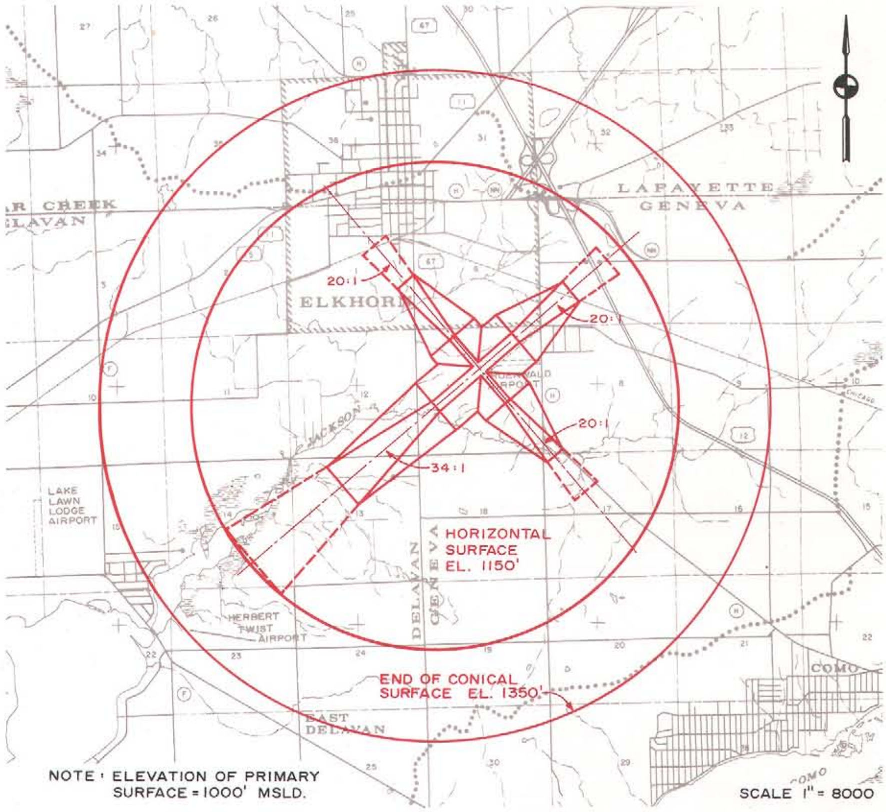
Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Operations at this airport have been forecast at a level equaling 77 percent of the landing system capacity at the end of the plan design period. Consideration should be initiated to providing additional capacity when operations reach about 60 percent of the landing system capacity. The addition of a parallel north-south runway will provide a significant increase in runway system capacity.

The imaginary surfaces which define the airspace necessary for safe aircraft operations under the proposed runway alignment and instrumentation for the Ozaukee Airport are shown in Figure 80. Recommended generalized land uses considered compatible with aircraft operations and community objectives are shown on Map 61.

Figure 77

GRUENWALD AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Racine Commercial Airport: The basic improvements required at this privately owned basic transport airport are the provision of runway lighting and other navigation aids, construction of an air traffic control tower and parallel taxiways to provide increased safety and capacity, and land acquisition and street realignment to obtain runway clear zone protection. Installation of a precision instrument landing system approach to Runway 22 is also recommended. Should it become necessary to acquire the airport to maintain its operation in the public system, the cost attendant to such acquisition has been estimated. Existing runways have displaced landing thresholds to force aircraft operations to achieve adequate clearance over abutting streets and properties. Although airport operations can continue under these restricted conditions, it is recommended that adequate clear zones be provided so that use of the full runways can be made. This action will require purchase of 51 homes and commercial units beyond the ends of Runway 14/32 and the relocation of Green Bay Road to achieve the required 15-foot vertical separation between the approach surface and street. Since the land falls off beyond both ends of Runway 4/22, it was judged unnecessary to purchase the commercial structures presently located within the clear zone limits, but cost estimates for obtaining height easements above the elevation of the runway have been included. It will be necessary to realign Green Bay Road at the end of Runway 4. It is further recognized that, at such time as Melvin Avenue is constructed as an arterial street, consideration must be given to an alignment south of present Melvin Avenue through the clear zone in order to achieve the required 15-foot vertical separation between the approach surface of Runway 32 and the street. Alternatively, it may be feasible to depress Melvin Avenue on the present alignment. Ground access and public utility service are already available to the Racine Commercial Airport. The onsite improvements are shown on Map 62 and listed together with estimated capital costs in Table 217.

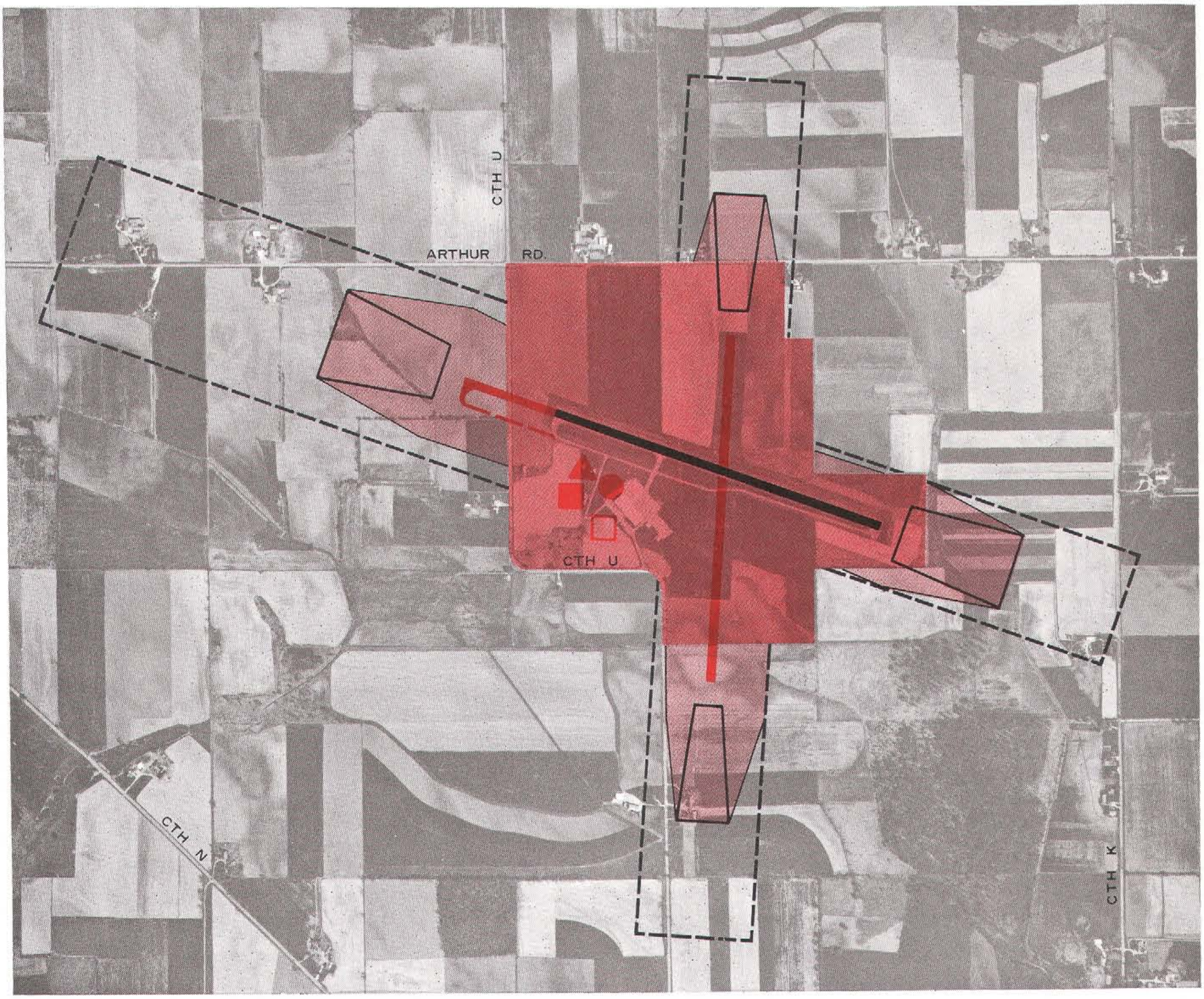
Because of the extensive urban development nearly surrounding the airport, any change to existing left-hand traffic operating patterns would do little to alleviate the nuisance effects of aircraft operations. To minimize this nuisance, it is recommended that all "touch and go" flight training activities be discouraged at this urban airport and be encouraged to divert to nonurban airports such as East Troy Municipal, Sylvania, or Gruenwald.

The imaginary surfaces related to safe aircraft operation under recommended conditions at the Racine Commercial Airport are shown in Figure 81, and a generalized land use plan around the airport is shown on Map 63.

Sylvania Airport: To improve this privately owned, less than basic utility airport to the basic utility standards recommended in the system plan will require widening and extending the existing runway to the west to provide a runway 3,200 feet long having a full clear zone to the east end, construction of a 2,560-foot north-south secondary runway, and the vacation of that portion of Sorensen Road north of the airport to permit runway construction.

Map 56

SITE IMPROVEMENT PLAN FOR THE HARTFORD MUNICIPAL AIRPORT



LEGEND

LANDS CURRENTLY (1975) OWNED BY THE CITY OF HARTFORD FOR AIRPORT PURPOSES

LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT

EXISTING PAVED RUNWAY

PROPOSED PAVED RUNWAY

PROPOSED TAXIWAY

CLEAR ZONE TRAPEZOID

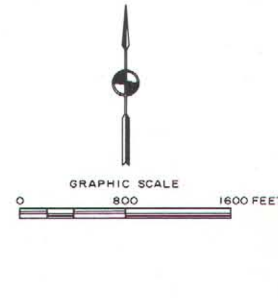
PROPOSED TERMINAL BUILDING EXPANSION

PROPOSED AIRCRAFT PARKING APRON AREA

PROPOSED AIRCRAFT HANGAR AREA

PROPOSED AUTOMOBILE PARKING AREA

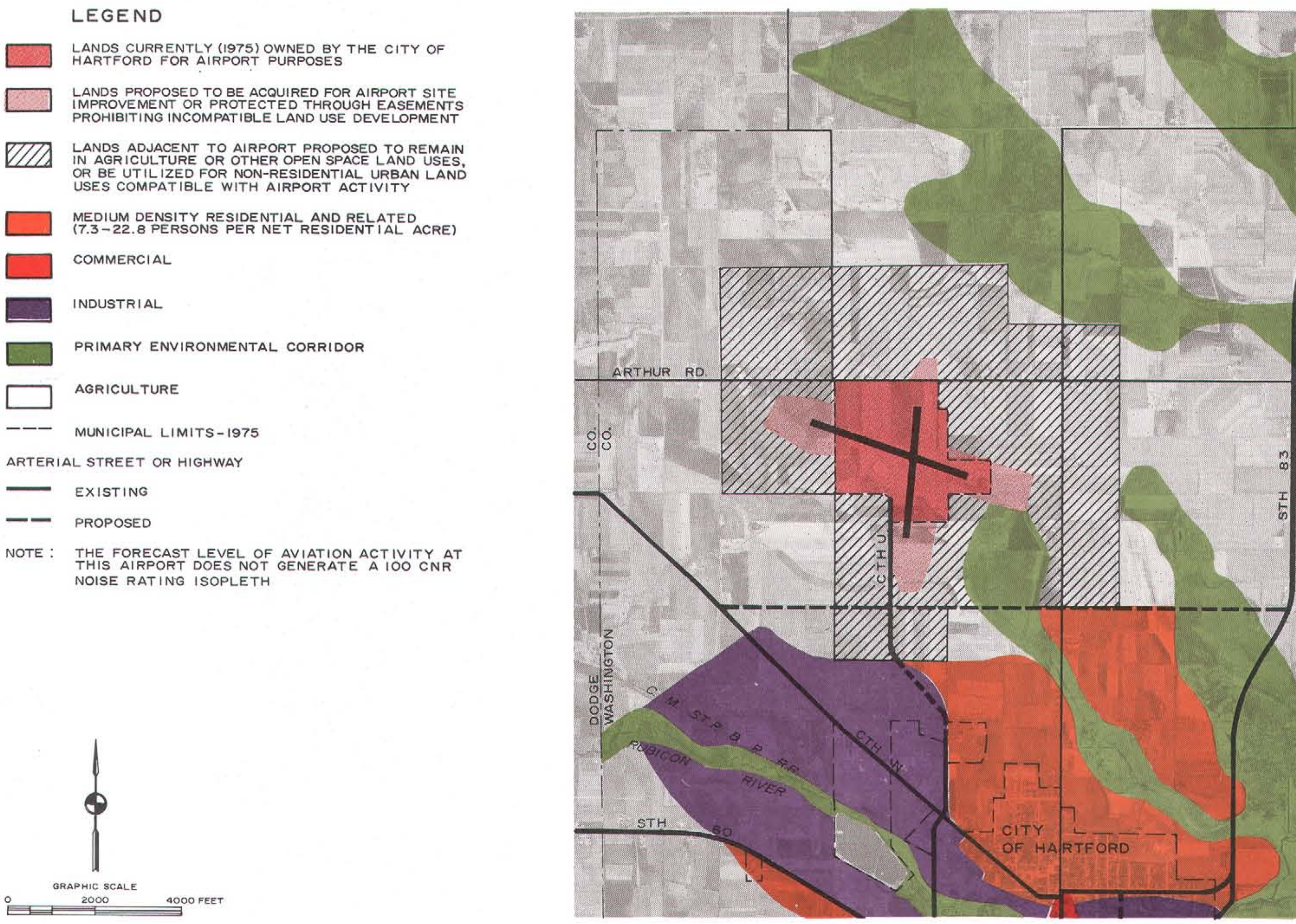
AIRPORT INFLUENCE AREA—LIMIT OF AREA ELIGIBLE FOR FEDERAL AID



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 57

AREA LAND USE PLAN FOR THE HARTFORD MUNICIPAL AIRPORT



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Additional land will be required to accomplish the airport site expansion, runway construction, and clear zone protection. Should it become necessary to acquire the airport to maintain its operation in the public system, the cost attendant to such acquisition has been estimated. Ground access is provided directly from the frontage road west of and paralleling IH 94 which connects to STH 11. The airport site is beyond any existing or proposed sanitary sewer service area; therefore, continued use of onsite sewage disposal facilities is expected. These airport site-related improvements are shown on Map 64 and listed in Table 218. The imaginary surfaces used to delineate airspace for assured safe aircraft operations relating to this airport are shown in Figure 82, and the recommended generalized compatible land uses around the airport are shown on Map 65.

Timmerman Field: Recommended improvements to this general utility airport, designated by the FAA as a reliever airport to General Mitchell Field, include runway widening, paving existing turf runways, installing additional runway lighting and other navigation aids, and improving terminal and hangar facilities. No improvements to provide capability to serve jet aircraft are recommended because of the additional land requirements necessitated by longer runways in an intensely developed urban area, the increased noise impact upon the adjacent urban areas that would be generated by the current generation of jet aircraft, and the availability of nearby basic transport airports that can be more readily developed to handle the larger aircraft with less impact upon surrounding land uses. Two runways, 4L and 15L, are already equipped for nonprecision instrument approaches. Although the airport qualifies for installation of a precision instrument landing system in terms of the number of aircraft operations, such installation is not recommended because of the intensely developed urban areas surrounding the airport, the cost to acquire adequate approach protection, and the availability of airports having this capability nearby at both General Mitchell Field and at Waukesha.

Table 214

SITE REQUIREMENT RECOMMENDATIONS FOR THE HARTFORD MUNICIPAL AIRPORT

General Conditions	
Airport Classification	Existing–Basic Utility–Stage I Proposed–General Utility
Aviation Demand	
Annual Operations	1971 Inventory–57,600 1990 Forecast–138,100
Based Aircraft	1971 Inventory–53 1990 Forecast–165
Runway System Capacity (PANCAP)	Existing–211,000 Proposed–306,300
IFR Capability	Nonprecision Instrument Approach[a]
Land Requirements	
Site Expansion (Acres)	30
Clear Zone Protection (Acres)	65
Residential Units	2
Total Estimated Cost	$ 333,500
Operational Area Improvements	
Extend Runway 11/29 to 3,800 feet	
Runway: 75 feet x 800 feet	
Taxiway: 30 feet x 1,000 feet	
Construct Runway 2/20	
Runway: 75 feet x 3,000 feet	
Construct additional paved aircraft parking apron: 25,200 square yards	
Install lighting and visual aids	
MIRL Both Runways: 6,800 feet	
Taxiway Exit Lights–Runway: 11/29	
VASI-2 Runway: 11/29, Both Ends	
REILS Both Runways, Both Ends	
Construct air traffic control tower	
Install nonprecision instrument landing system on approach to Runway 11	
Total Estimated Cost	$ 761,300
Terminal Area Improvements	
Construct new administration/terminal building: 7,100 square feet	
Expand auto parking and service roads: 12,300 square yards	
Total Estimated Cost	$ 518,200
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 27,700 square yards	
Total Estimated Cost	$2,086,000
Ground Access Facilities	
Terminal access road recommended as county trunk highway under jurisdictional highway system plan for Washington County	
Utility Services	
Extend utility services from proposed City of Hartford sewer service area	
Total Estimated Cost	$ 29,000
Total Estimated Capital Investment	$3,728,000

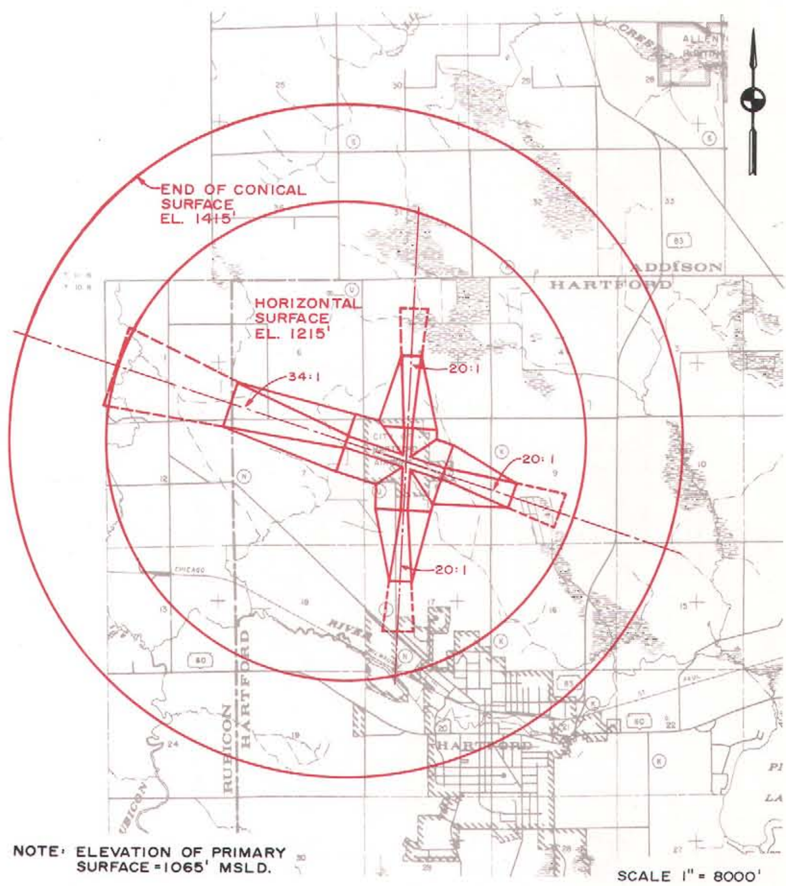
[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Although no substantive improvements are planned at this airport that affect airport operations beyond those occurring today, acquisition of additional land interest in clear zone protection is recommended. Milwaukee County already owns the land encompassed by clear zones associated with Runway 22R, the northeast end of the paved northeast-southwest runway, and Runways 33L and 33R, the southeast ends of the northwest-southeast runways. The clear zone associated with turf Runway 22L, proposed for paving herein, does cross W. Appleton Avenue and encompasses off-street parking areas related to adjacent multifamily dwelling units. Acquisition of avigation easements within the clear zone boundaries is recommended. Avigation easements, rather than property taking and land clearing, are also recommended within the clear zones associated with Runways 4L and 4R. Much of the land has been developed for multifamily housing and commercial activities since 1963 with awareness of airport activity. Eleven acres of the single-family development northwest of the airport are encompassed within the runway clear zones and transitional areas associated with Runways 15L and 15R, a condition that has existed for some time. It is recommended that Milwaukee County acquire these properties—totaling 50 residences—if, and as, they come onto the market over the planning period. This urban airport is already supplied with adequate ground transportation and public utility services. The recommended onsite facility improvements are shown on Map 66 and listed together with estimated capital costs in Table 219.

Figure 78

HARTFORD MUNICIPAL AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Because the airport already is surrounded by intense urban development, no changes to the existing air traffic pattern at this airport are recommended. To minimize aircraft operation nuisance at Timmerman Field, it is recommended that all "touch and go" flight training activities be discouraged at this urban airport and be encouraged to divert to non-urban airports such as Hartford and West Bend Municipal.

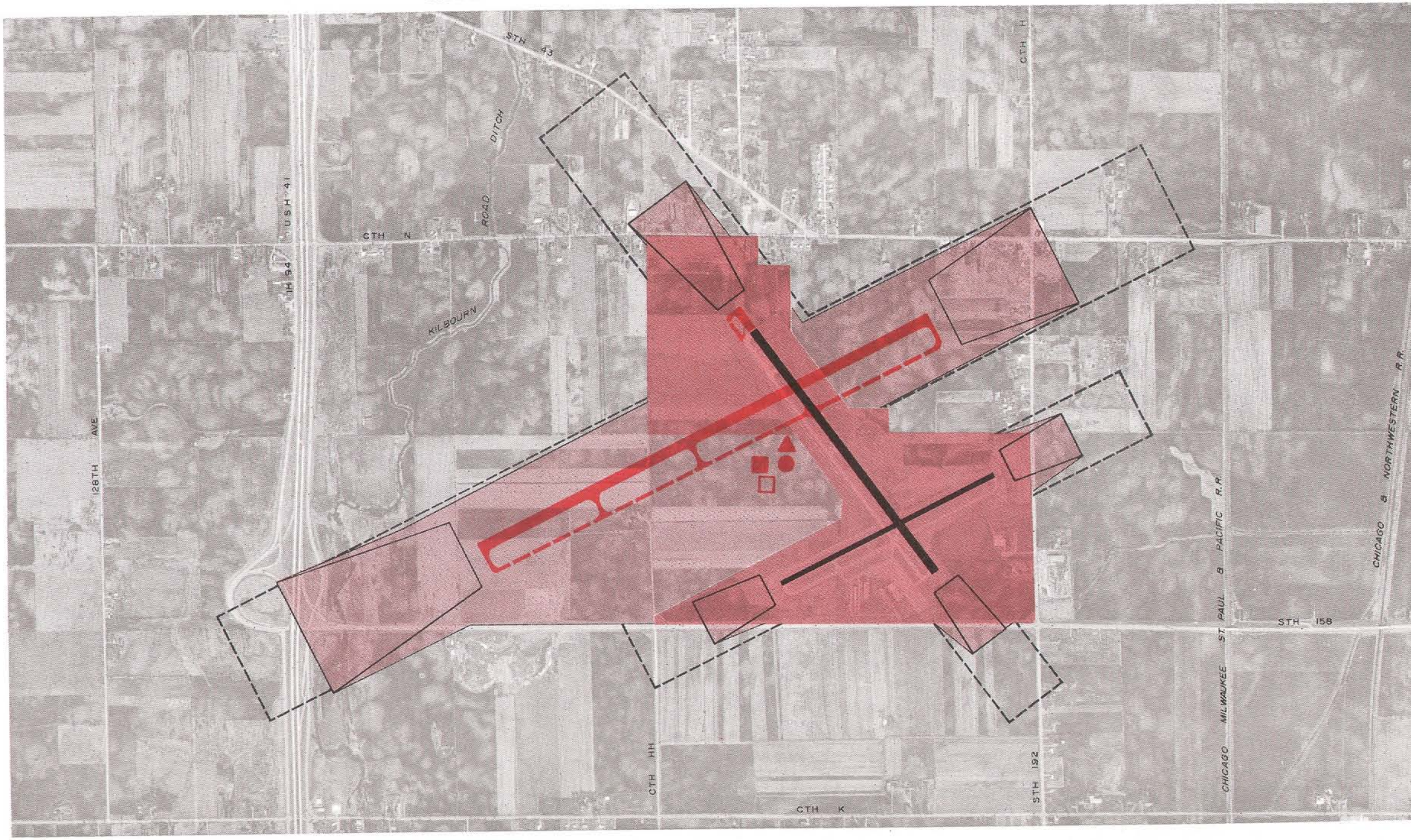
The imaginary surfaces used to identify clear zone and height restrictions beyond the airport site are shown in Figure 83, and the recommended land uses considered compatible with airport and aircraft operations and adjacent land use demands are shown on Map 67.

Waukesha County Airport: The basic improvements required to expand this general utility airport to the basic transport airport standards recommended in the system plan include a 1,400-foot extension of Runway 10L/28R; construction of a parallel basic utility Runway 10R/28L having a length of 3,300 feet to replace the existing turf runway which is occupying land needed for terminal and hangar facility development; installation of a traffic control tower, a precision instrument landing and approach lighting system on approach to Runway 10R, and additional lighting and navigation aids; and runway and taxiway widening, lengthening, and strengthening. To accomplish the site expansion, runway lengthening, and clear zone protection will necessitate land acquisition and realignment of CTH TJ. Since the airport terminal and auto parking facilities are located adjacent to CTH JJ and CTH F, access is easily and conveniently provided. The airport is within the proposed public sanitary sewerage system service area of the City of Waukesha system, and should be connected to that system as facilities are extended. These improvements are shown on Map 68 and further detailed, including estimates of capital cost, in Table 220.

Presently, the standard left-hand traffic pattern exists on all runways except 18R and 36R which require right-hand turns to maintain separation between operations on parallel runways. To direct flight traffic away from the

Map 58

SITE IMPROVEMENT PLAN FOR THE KENOSHA MUNICIPAL AIRPORT



LEGEND

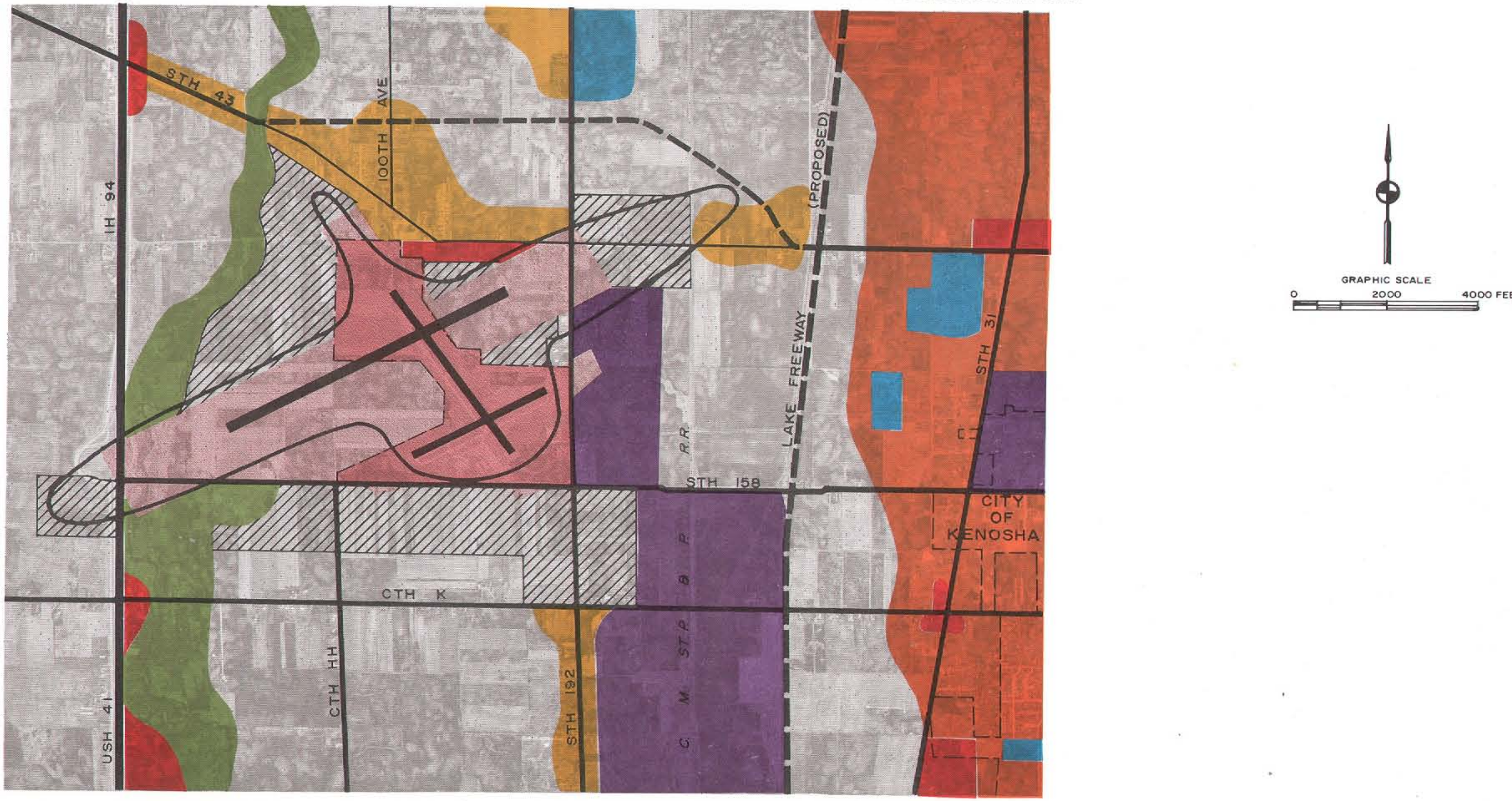
- LANDS CURRENTLY (1975) OWNED BY THE CITY OF KENOSHA FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- AIRPORT INFLUENCE AREA–LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

GRAPHIC SCALE
0 800 1600 FEET

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 59

AREA LAND USE PLAN FOR THE KENOSHA MUNICIPAL AIRPORT



LEGEND

- LANDS CURRENTLY (1975) OWNED BY THE CITY OF KENOSHA FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENT OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- LANDS ADJACENT TO AIRPORT PROPOSED TO REMAIN IN AGRICULTURE OR OTHER OPEN SPACE LAND USES, OR BE UTILIZED FOR NON-RESIDENTIAL URBAN LAND USES COMPATIBLE WITH AIRPORT ACTIVITY
- LOW DENSITY RESIDENTIAL AND RELATED (0.5-7.2 PERSONS PER NET RESIDENTIAL ACRE)
- MEDIUM DENSITY RESIDENTIAL AND RELATED (7.3-22.8 PERSONS PER NET RESIDENTIAL ACRE)
- COMMERCIAL
- INDUSTRIAL
- GOVERNMENT AND INSTITUTIONAL
- PRIMARY ENVIRONMENTAL CORRIDOR
- AGRICULTURAL
- MUNICIPAL LIMITS-1975
- 100 CNR-NOISE RATING ISOPLETH

ARTERIAL STREET OR HIGHWAY

- EXISTING
- PROPOSED

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 215

SITE REQUIREMENT RECOMMENDATIONS FOR THE KENOSHA MUNICIPAL AIRPORT

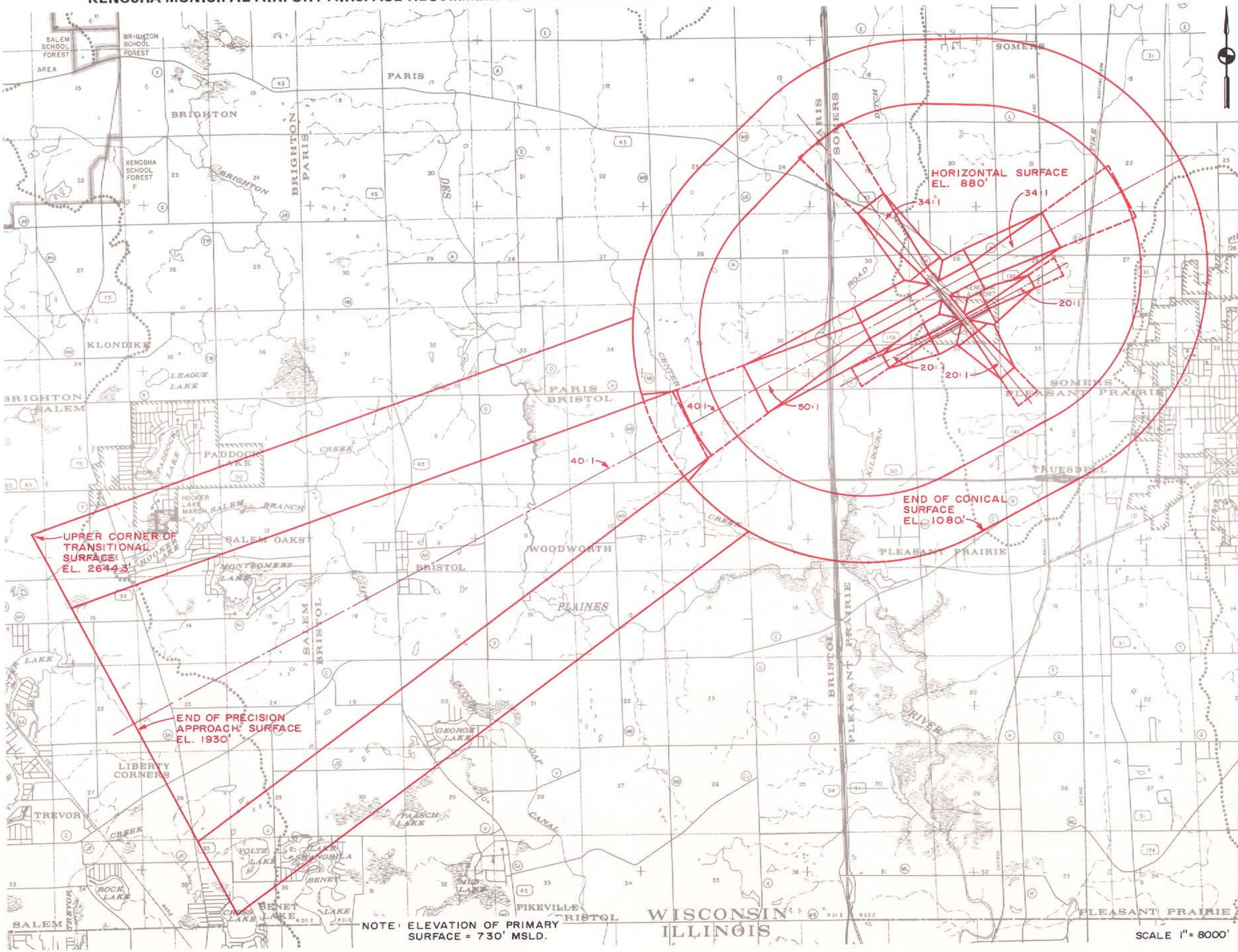
General Conditions	
Airport Classification	Existing—General Utility Proposed—Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory—64,500 1990 Forecast—252,400
Based Aircraft	1971 Inventory—82 1990 Forecast—294
Runway System Capacity (PANCAP)	Existing—181,000 Proposed—337,600
IFR Capability	Precision Instrument Approach[a]
Land Requirements	
Site Expansion (Acres)	315
Clear Zone Protection (Acres)	185
Residential Units	24
Total Estimated Cost	$1,782,000
Operational Area Improvements	
Construct new parallel Runway 6L/24R	
Runway: 150 feet x 7,000 feet	
Taxiway: 50 feet x 8,100 feet	
Extend Runway 14/32 to 4,500 feet	
Runway: 100 feet x 300 feet	
Taxiway: 40 feet x 500 feet	
Widen Runways	
Runway 14/32: 25 feet x 4,200 feet	
Strengthen runways and taxiways to accommodate 60,000 pounds gross weight aircraft	
Runway 6R/24L—3 1/2 inch overlay (75 feet x 3,300 feet)	
Runway 14/32—1 1/2 inch overlay (75 feet x 4,200 feet)	
Taxiway 6R/24L—3 1/2 inch overlay (40 feet x 3,400 feet)	
Taxiway 14/32—3 1/2 inch overlay (40 feet x 1,900 feet)	
3 1/4 inch overlay (40 feet x 1,500 feet)	
1 1/2 inch overlay (40 feet x 1,350 feet)	
Construct additional paved aircraft parking apron: 42,300 square yards	
Install lighting and visual aids	
MIRL Runway 14/32 (Extension—300 feet)	
(Relocation—4,200 feet)	
HIRL Runway 6L/24L (7,000 feet)	
Taxiway Exit Lights—Runway 6L/24R	
Runway 6R/24L	
Runway 14/32	
VASI-4 Runway 14/32, 14 End	
REILS Runway 6L/24R, Both Ends	
Runway 6L/24R, Both Ends	
Runway 14/32, Both Ends	
Construct air traffic control tower; install precision instrument landing and approach lighting system on approach to Runway 6	
Total Estimated Cost	$4,593,000
Terminal Area Improvements	
Construct new terminal building: 8,900 square feet	
Expand auto parking and service roads: 14,650 square yards	
Total Estimated Cost	$ 731,400
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 28,100 square yards	
Total Estimated Cost	$2,710,000
Ground Access Facilities	
No additional facilities required	
Utility Services	
Airport within proposed service area—cost of connections considered nominal	
Total Estimated Capital Investment	$9,816,400

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

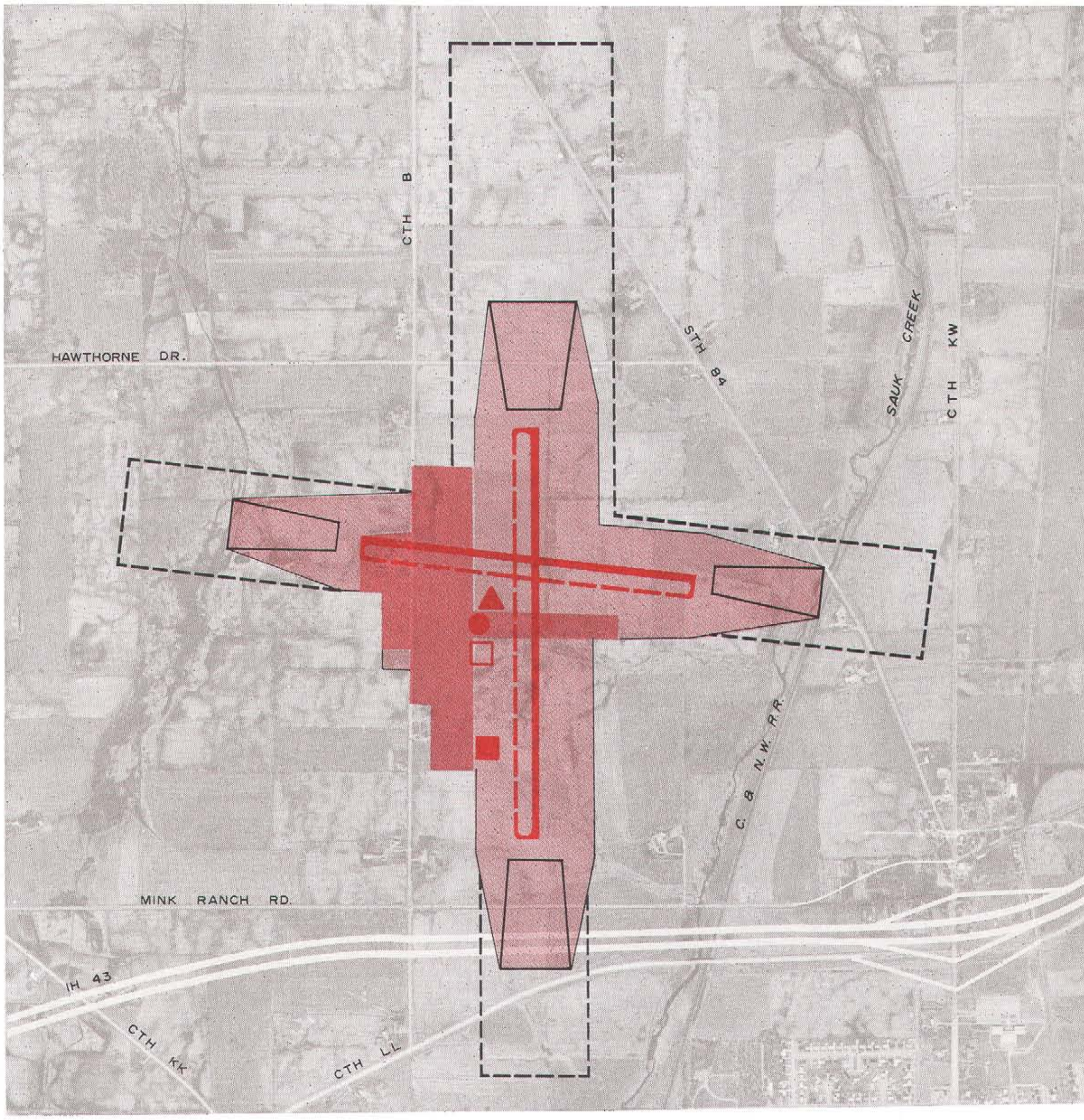
Figure 79

KENOSHA MUNICIPAL AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



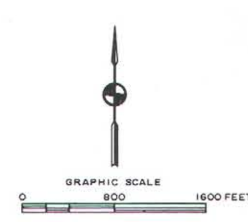
Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 60
SITE IMPROVEMENT PLAN FOR THE OZAUKEE AIRPORT



LEGEND

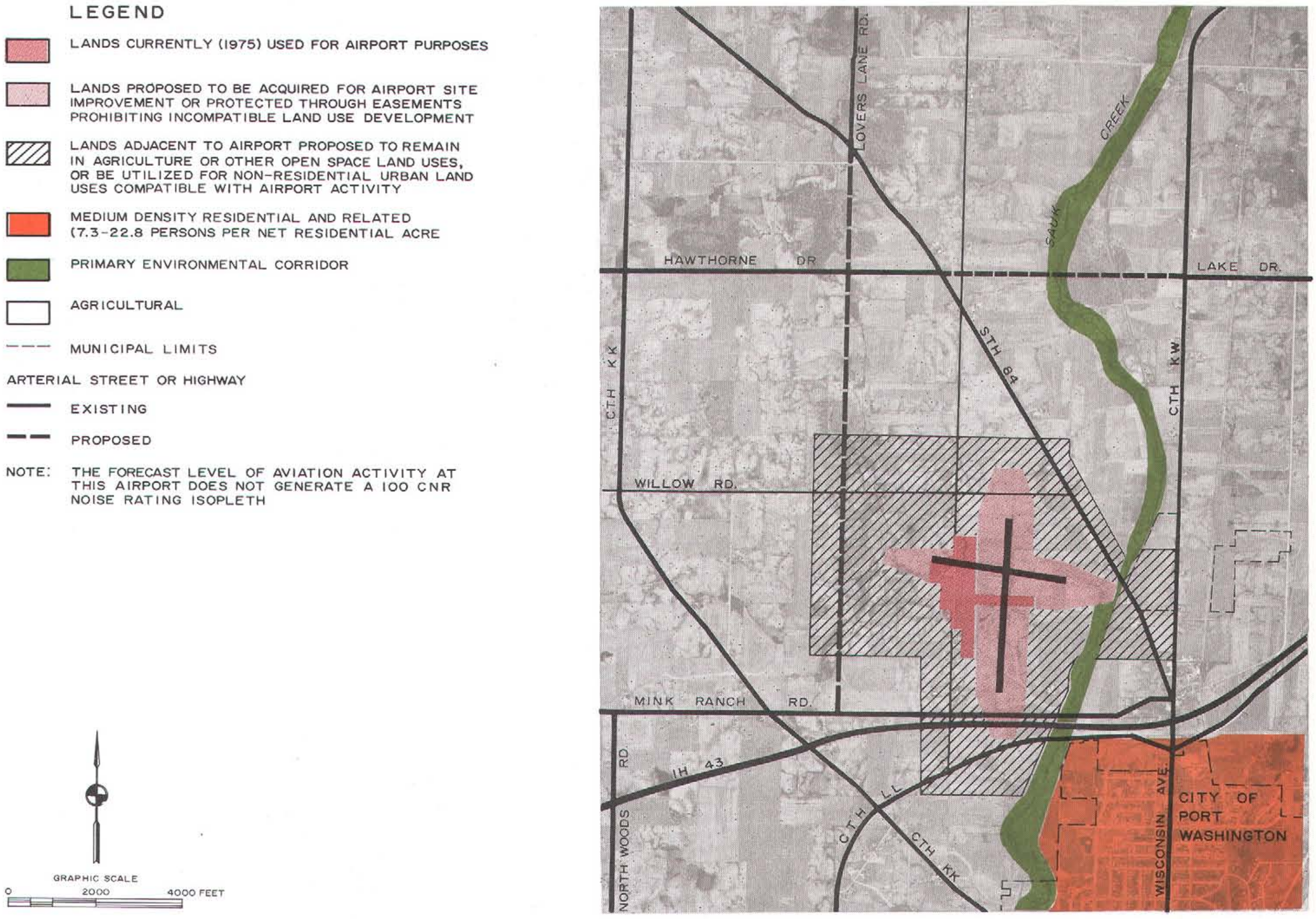
- LANDS CURRENTLY (1975) USED FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- AIRPORT INFLUENCE AREA—LIMIT OF AREA ELIGIBLE FOR FEDERAL AID



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 61

AREA LAND USE PLAN FOR THE OZAUKEE AIRPORT



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

residential development located south and southwest of the airport, a right-hand traffic pattern should be established for operations on Runway 28. Since operations on Runway 10 already use the standard left-hand pattern, all traffic using Runway 10/28 would then remain north of the airport. A change of the traffic pattern for aircraft operating off the parallel 18/36 runways is not considered practical. To further reduce aircraft operation nuisance, it is recommended that all "touch and go" flight training activities be discouraged at this urban airport and be encouraged to divert to nonurban airports such as Hartford and East Troy Municipal. Under air traffic control tower operation, these changes in operating pattern and restrictions to operation can be monitored and enforced, and should result in alleviation of much of the nuisance generated by aircraft operations over the residential areas.

The imaginary surfaces which define the airspace necessary for safe aircraft operations under the runway alignment and instrumentation proposed for the Waukesha Airport are depicted in Figure 84. In addition to the impact of off-airport operations on height controls depicted by the imaginary surfaces, recommended land uses around the Waukesha Airport considered compatible with the forecast operations are shown on Map 69.

West Bend Municipal Airport: To expand the existing general utility airport to basic transport airport standards will require runway lengthening to provide one runway having a total length of 5,500 feet; acquisition of land to achieve the site expansion and clear zone protection; widening and strengthening of runways and taxiways; and installation of an air traffic control tower, a precision instrument landing and approach lighting system, and other lighting and visual aids. Either of the existing runways can be lengthened to the east; one involving the relocation of STH 33 and the other involving either the bridging or relocation of the Milwaukee River. For cost purposes, Runway 6/24 was extended 1,600 feet

Table 216

INITIAL SITE REQUIREMENT RECOMMENDATIONS FOR THE OZAUKEE AIRPORT

General Conditions	
Airport Classification	Existing—Less Than Basic Utility—Stage I Proposed—Basic Transport[a]
Aviation Demand	
Annual Operations	1971 Inventory—3,500 1990 Forecast—175,300
Based Aircraft	1971 Inventory—3 1990 Forecast—231
Runway System Capacity (PANCAP)	Existing—91,000 Proposed—253,300
IFR Capability	Precision Instrument Approach[b]
Land Requirements	
Acquire existing privately owned airport (90 acres) and improvements	
Total Estimated Cost	$ 135,000
Site Expansion (Acres)	210
Clear Zone Protection (Acres)	145
Residential Units	0
Total Estimated Cost	$ 445,000
Operational Area Improvements	
Construct new north-south primary runway: 100 feet x 5,600 feet	
Construct new east-west secondary runway: 100 feet x 4,000 feet	
Construct taxiway parallel to north-south runway: 40 feet x 6,000 feet	
Construct taxiway parallel to east-west runway: 40 feet x 4,500 feet	
Install lighting and visual aids	
MIRL East-West Runway	
HIRL North-South Runway	
Taxiway Exit Lights	
VASI-4 North-South Runway, North End	
REILS Both Runways, Both Ends	
Construct aircraft parking apron: 51,400 square yards	
Construct air traffic control tower	
Install precision instrument landing and approach lighting system on approach to north end of primary runway	
Total Estimated Cost	$3,016,100
Terminal Area Improvements	
Construct new administration/terminal building: 7,900 square feet	
Construct auto parking and service roads: 14,900 square yards	
Total Estimated Cost	$ 657,100
Hangar Area Improvements	
Construct new aircraft hangar storage and service area: 23,800 square yards	
Total Estimated Cost	$2,330,000
Ground Access Facilities	
No additional facilities necessary	
Utility Services	
Extend utility service from proposed Port Washington sewer service area	
Total Estimated Cost	$ 29,000
Total Estimated Capital Investment	$6,612,100

[a] *This airport was initially classified as a basic transport airport as listed in this table. Upon analysis of revised air activity forecasts, the airport was classified as a general utility. Data for development of the Ozaukee Airport as a general utility airport is listed in Table 241 and the recommended development as a general utility airport is shown graphically in Map 60.*

[b] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

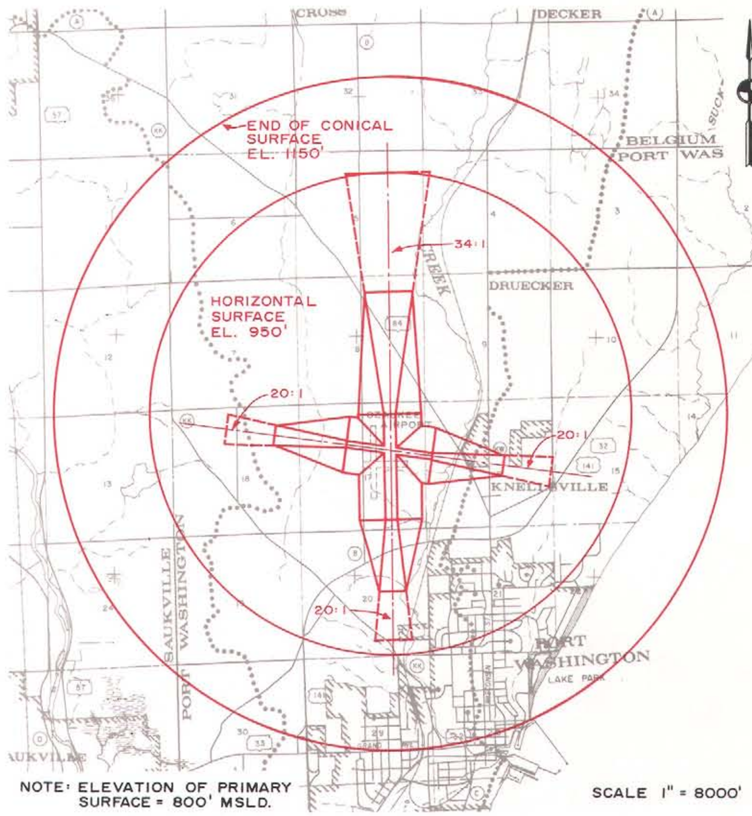
Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

to the northwest, requiring a relocation of STH 33. Under this assumption, the precision instrument landing system approach is recommended on approach to Runway 24 from the northeast; and a nonprecision approach is recommended on approach to Runway 31. Airport terminal access will be continued from STH 33. The airport is located beyond the proposed West Bend and Tri-Lakes sewer service area and downriver from the treatment plant serving the area; therefore, an appropriate sewer connection will be required to serve the airport. These site-related improvements are shown on Map 70 and listed together with estimates of capital improvement costs in Table 221.

The existing standard left-hand traffic patterns in use at the West Bend Municipal Airport can be maintained until the adjacent lands become more highly developed. As the areas west of the airport continue to urbanize, the aircraft traffic pattern can be revised to maintain flight paths southeast of Runway 6/24 and northeast of Runway 13/31 to further reduce the noise impact upon the urban areas. The recommended land use plan considered compatible with development of the West Bend Municipal Airport as recommended in the system plan is shown on Map 71, and the imaginary surfaces related to the runway alignment and instrumentation are shown in Figure 85.

Figure 80

OZAUKEE AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

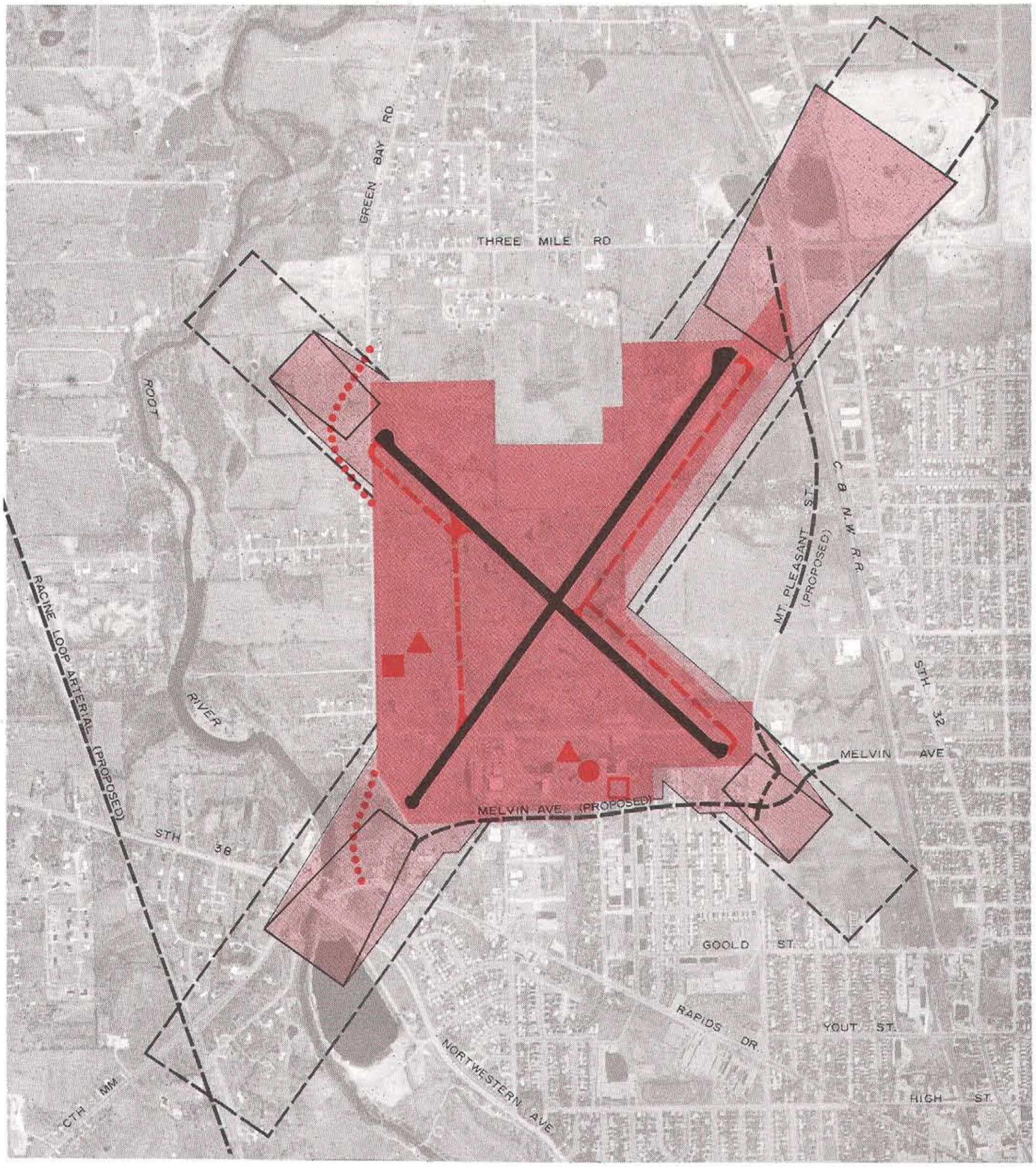
RELATIONSHIP OF RECOMMENDED AIRPORT SYSTEM PLAN TO UNPLANNED LAND DEVELOPMENT

As a check on the flexibility of the recommended airport system plan to serve a regional land use pattern radically different from that proposed in the adopted regional land use plan, the system plan was tested under conditions of unplanned land development—or the continued diffusion of low density urban development throughout the Region as considered in the Commission's initial land use and transportation study. Two allocations of regional aviation demand, in terms of originating passengers and owners of general aviation aircraft based within the Region, to traffic analysis zones were thus made, one based on a distribution of population and land use characteristics that would occur with implementation of the recommended regional land use plan, and another based on a distribution of population and land use characteristics that might be expected under a diffusion of unplanned land use development within the Region. Although the recommended airport system plan was specifically designed to serve the regional aviation demand which could be expected to be generated by the recommended planned land use pattern, the regional aviation demand, distributed on the basis of population and land use characteristics under an unplanned land use development pattern, was also assigned to the recommended airport system plan for evaluation. The results of that assignment and a comparison with an assignment under the 1990 planned land use conditions are shown in Table 222.

Comparative analysis of the two allocations of aviation demand and subsequent assignment to the recommended airport system plan indicates that seven of the 14 airports within the regional airport system plan may be expected to serve a lesser number of based aircraft in 1990 under an unplanned land development pattern than under that land development pattern for which the regional airport system plan was designed: Kenosha Municipal, General Mitchell Field, Timmerman Field, Ozaukee, Racine Commercial, Sylvania, and Waukesha County. The decrease in number of based aircraft is less than 15 percent at five of the seven airports and ranges up to 27 percent at Kenosha Municipal Airport and 30 percent at General Mitchell Field. The Waukesha County Airport would be expected to experience only a 1 percent decrease in the number of based aircraft, and therefore could be expected to operate under very similar conditions under either planned or unplanned land use development. The increase in the number of based aircraft that would be expected at seven of the 14 system airports—Burlington Municipal,

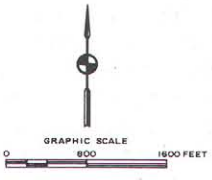
Map 62

SITE IMPROVEMENT PLAN FOR THE RACINE COMMERCIAL AIRPORT



LEGEND

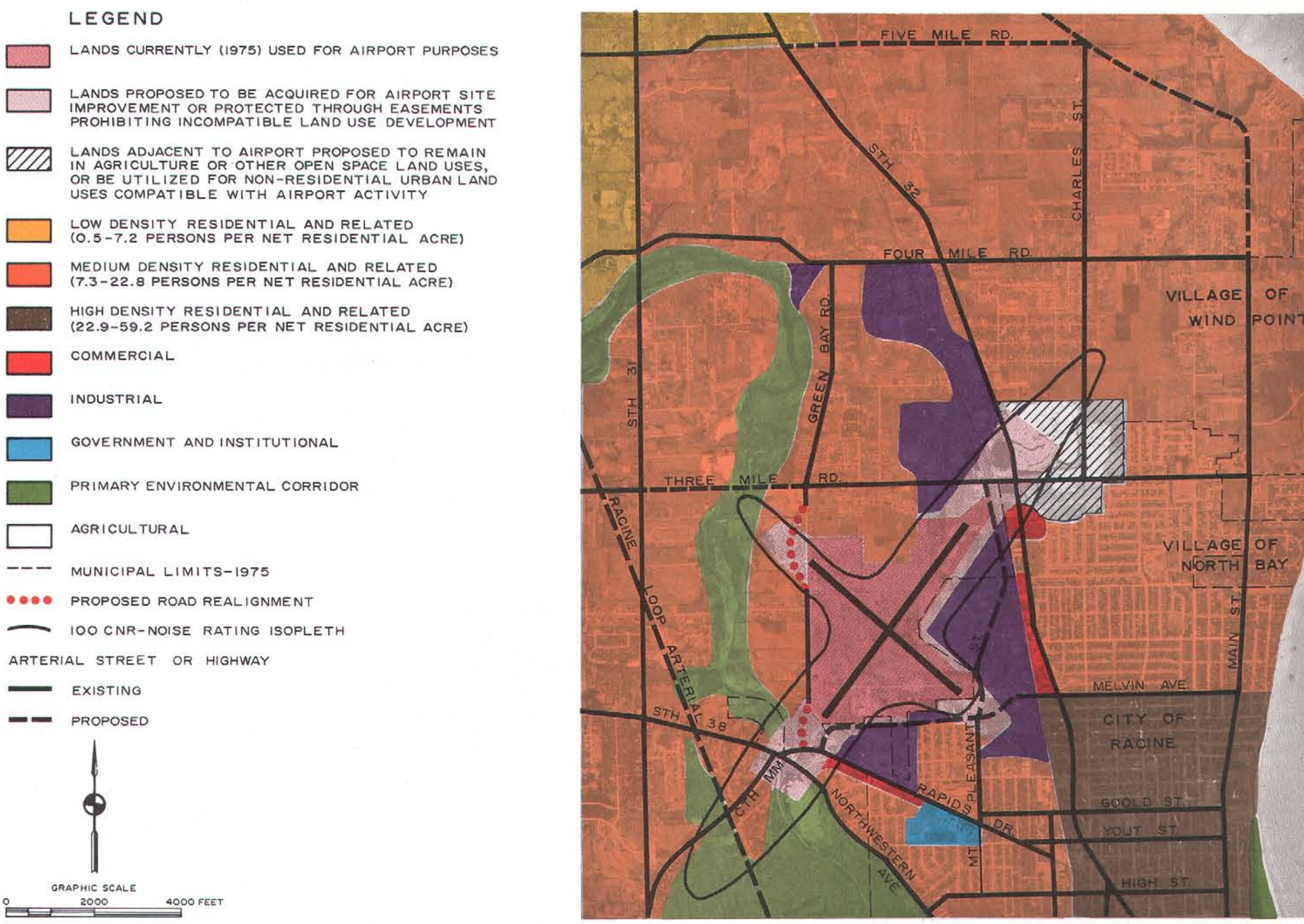
- LANDS CURRENTLY (1975) USED FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENT OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING EXPANSION
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- PROPOSED ROAD REALIGNMENT
- AIRPORT INFLUENCE AREA—LIMIT OF AREA ELIGIBLE FOR FEDERAL AID



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 63

AREA LAND USE PLAN FOR THE RACINE COMMERCIAL AIRPORT



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

East Troy Municipal, Gruenwald, Playboy, Lake Lawn Lodge, Hartford Municipal and West Bend Municipal—ranged up to 23 percent at the Gruenwald Airport, 28 percent at the Hartford Municipal Airport, and 37 percent at the West Bend Municipal Airport. The increases forecast at both Playboy and Lake Lawn Lodge were nominal in that these two airports have been considered to serve only a limited amount of Region generated traffic. A 32 percent increase in the number of regionally generated aircraft based at airports outside the Region can be expected under the uncontrolled land use pattern.

Further analysis of Table 222 indicates that implementation of the recommended regional airport system plan would actually better serve the forecast of aviation demand if land patterns developed as described under the unplanned alternative rather than under the planned alternative, because the forecast based aircraft and annual operations would be more uniformly distributed among the system airports. Under either land use condition, only the Waukesha County Airport is expected to operate in 1990 at above 80 percent capacity—89 percent of capacity under the planned land use condition and 87 percent under the unplanned land use condition. Under the unplanned land use condition, only five of the airports are expected to operate in the range of 60 to 80 percent of capacity in 1990 in contrast to the seven under the planned land use condition. The airport development standards suggest that when aircraft operations at an airport exceed 60 percent of the airport's capacity, the airport sponsor initiate considerations for the provision of added capacity. Thus, under the unplanned land use condition, a lesser number of the airports would be expected to achieve operations during the planning period, necessitating consideration of additional runway system capacity.

Table 217

SITE REQUIREMENT RECOMMENDATIONS FOR THE RACINE COMMERCIAL AIRPORT

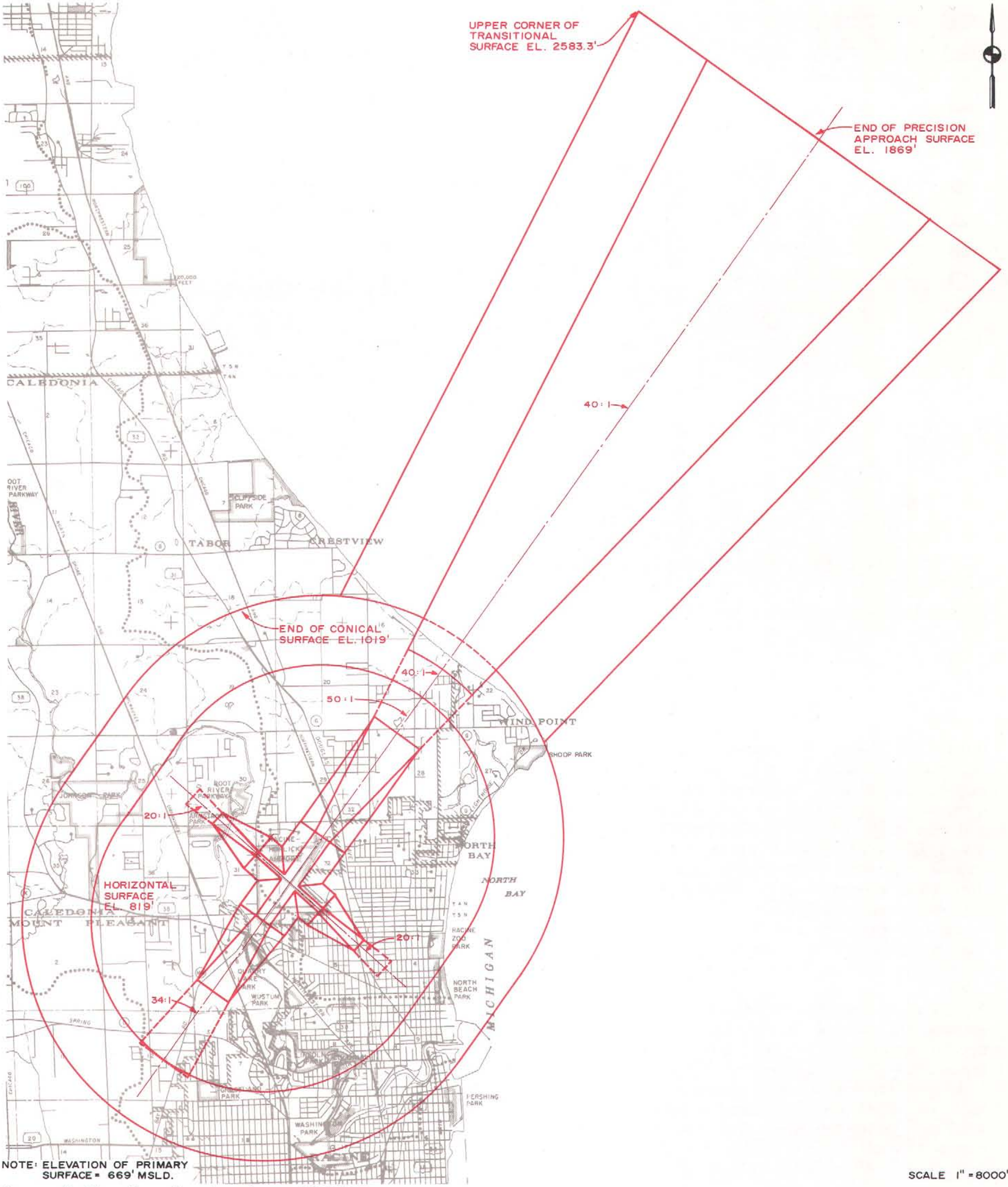
General Conditions	
Airport Classification	Existing—Basic Transport Proposed—Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory—35,000 1990 Forecast—140,000
Based Aircraft	1971 Inventory—34 1990 Forecast—163
Runway System Capacity (PANCAP)	Existing—145,000 Proposed—253,300
IFR Capability	Precision Instrument Approach[a]
Land Requirements	
Acquire existing privately owned airport (490 acres) and improvements (runways, taxiways, and apron)	
Total Estimated Cost	$3,250,000
Site Expansion (Acres)	45
Clear Zone Protection (Acres)	130
Residential and Commercial Units	51
Total Estimated Cost	$2,494,000
Operational Area Improvements	
Strengthen runways to accommodate 60,000 pound gross weight aircraft	
Runway 4/22—4" overlay: 100 feet x 5,800 feet	
Runway 14/32—4" overlay: 100 feet x 4,600 feet	
Construct parallel taxiways	
Taxiway 4/22: 40 feet x 5,500 feet	
Taxiway 14/32: 40 feet x 3,100 feet	
Construct additional paved aircraft parking apron: 22,600 square yards	
Install lighting and visual aids	
MIRL Runway 14/32	
HIRL Runway 4/22	
Taxiway Exit Lights	
VASI-4 Runway 4/22, 22 End	
REILS	
Mark and light obstructions	
Relocate hangars	
Construct air traffic control tower	
Install precision instrument landing and approach lighting system on approach to Runway 22	
Total Estimated Cost	$1,724,125
Terminal Area Improvements	
Construct administration/terminal building: 7,200 square feet	
Construct auto parking facilities: 13,500 square yards	
Total Estimated Cost	$ 598,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 14,400 square yards	
Total Estimated Cost	$1,300,000
Ground Access Facilities	
Realign portions of Green Bay Road to achieve separation between aircraft and vehicles	
Total Estimated Cost	$ 200,000
Utility Services	
Airport is within existing utility service area	
Total Estimated Capital Investment	$9,576,125

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Figure 81

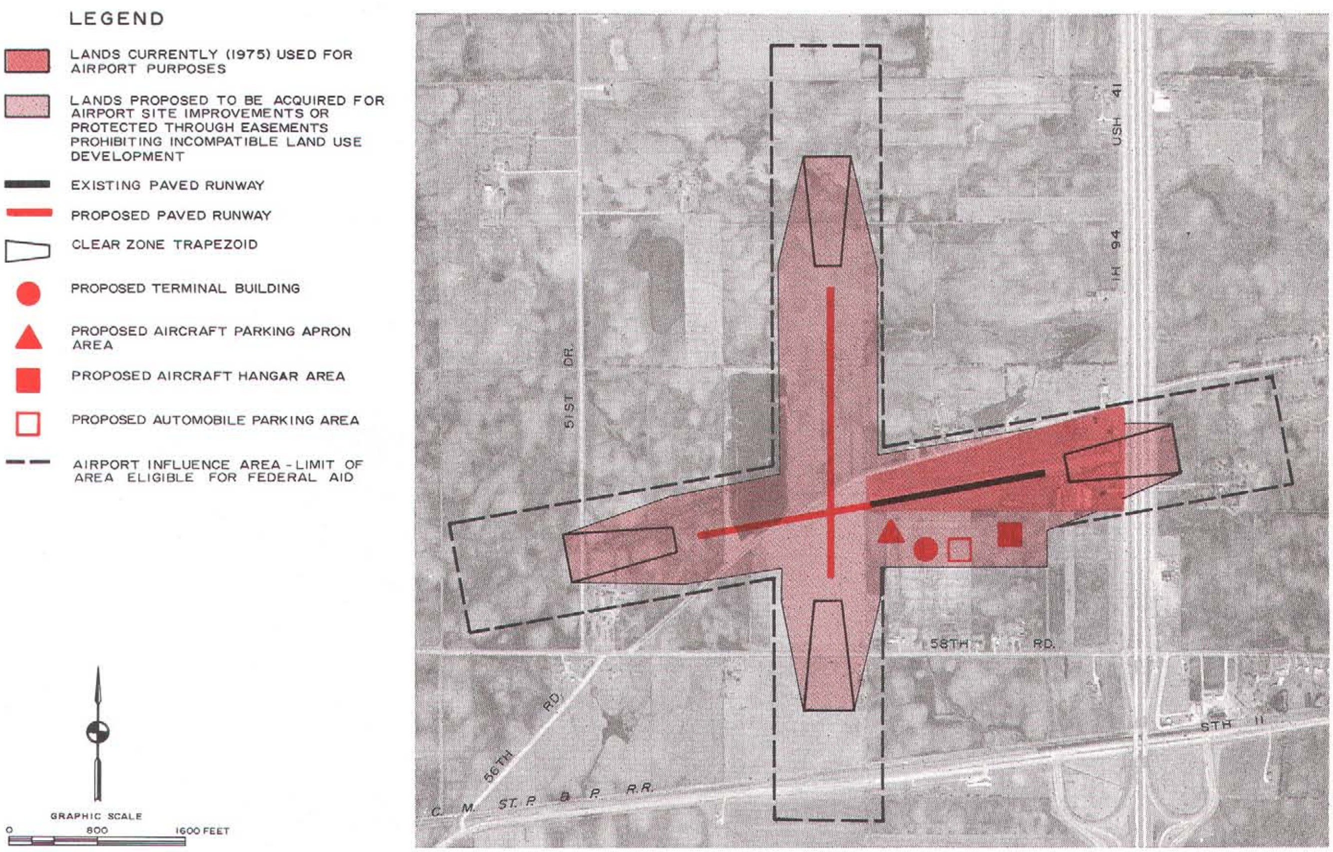
RACINE COMMERCIAL AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 64

SITE IMPROVEMENT PLAN FOR THE SYLVANIA AIRPORT



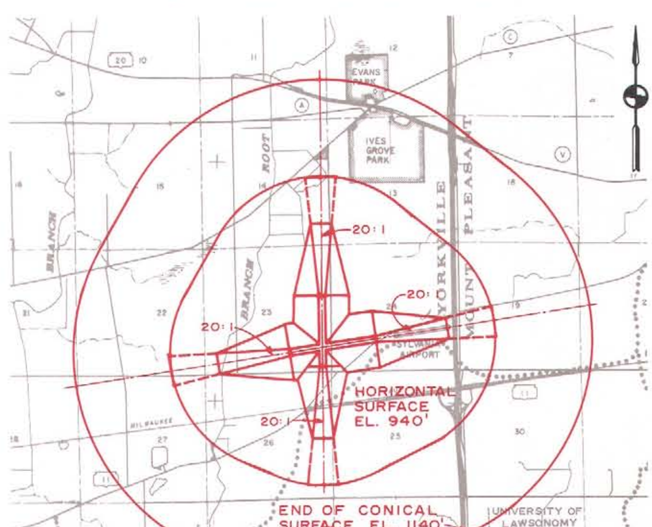
Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Should the Region develop in an unplanned manner rather than in response to the recommended land use patterns, the change in demand distribution, and thus demand for airport facilities such as terminals, hangars, and aprons, would have to be carefully monitored to assure that such facilities would not be provided in excess of demand at the seven airports forecast to have more based aircraft under planned rather than unplanned land use conditions. Similarly, it may become necessary to provide more terminal, hangar, and apron facilities than recommended in the airport system plan at five of the airports should land develop in the unplanned manner.

Since only one regional air carrier airport was identified as necessary, it would have to serve under any land use development within the planning period. The amount of ground travel time and associated costs could be expected to increase for originating passengers under an unplanned land use development pattern because more of the originating passengers would be spread further from the centrally located airport. Under the planned land use pattern, the 5.47 million passengers originating within the

Figure 82

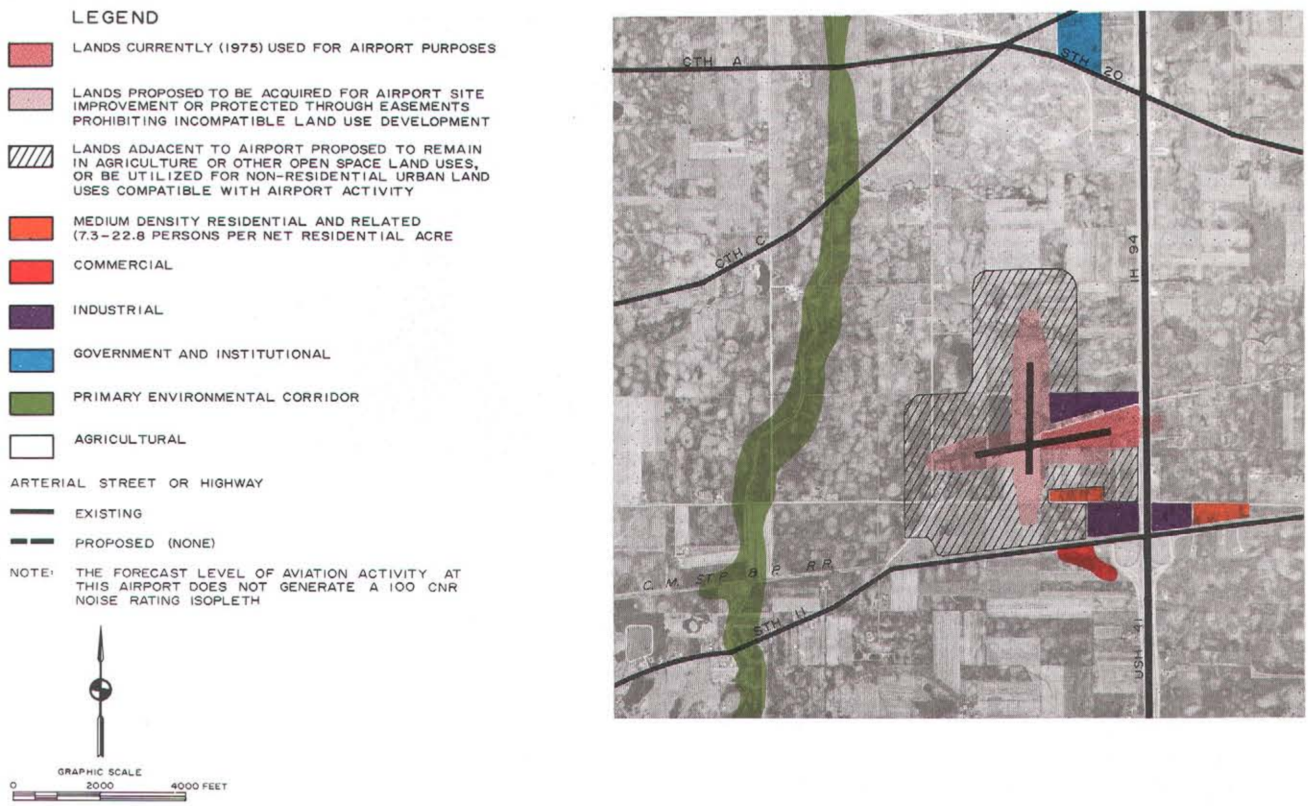
SYLVANIA AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 65

AREA LAND USE PLAN FOR THE SYLVANIA AIRPORT



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Region in 1990 may be expected to spend 4.06 million hours in ground travel time to reach the two major air carrier airports, General Mitchell Field and O'Hare Field, or about 45 minutes ground travel time per passenger. Of this 5.47 million total, the 3.9 million passengers expected to use General Mitchell Field may be expected to travel an average of 27 minutes per passenger. Under the unplanned land use patterns, a lesser number of originating passengers expected to use General Mitchell Field—3.82 million—may be expected to travel an average of 30 minutes per passenger, an 11 percent increase in travel time per originating passenger using General Mitchell Field. Table 223 sets forth the forecasts of passenger originations and related ground travel time for each airport and for each land use configuration.

In conclusion, it would appear that the recommended airport system plan would continue to function well, if not better, under the unplanned land use pattern than under the planned pattern. The number, location, and classification of airports within the system plan is such that the forecast regional demand can be more uniformly accommodated under the unplanned land development.

RELATIONSHIP OF RECOMMENDED AIRPORT SYSTEM PLAN TO REVISED AVIATION ACTIVITY FORECAST

As the regional airport system planning program was being undertaken, significant changes in regional and national demographic and economic conditions were being experienced. These include dramatic decreases in birthrates, rapid price inflation, sharp declines in economic activity and employment, and importantly, energy shortages, including shortages in aviation fuel with attendant rapidly rising costs of aircraft operation. Analyses indicated that these changes could affect not only the original regional population and employment forecasts on which the plan was based in part, but also the national aviation activity forecasts on which the plan was also based in part.

The regional population forecast of 2.67 million persons in 1990, prepared in 1963 under the initial land use-transportation study, was used together with independently prepared national forecasts of aviation demand to prepare forecasts of required aviation demand as a basis

Table 218

SITE REQUIREMENT RECOMMENDATIONS FOR THE SYLVANIA AIRPORT

General Conditions	
Airport Classification	Existing—Less Than Basic Utility—Stage I Proposed—Basic Utility
Aviation Demand	
Annual Operations	1971 Inventory—12,000 1990 Forecast—167,300
Based Aircraft	1971 Inventory—38 1990 Forecast—188
Runway System Capacity (PANCAP)	Existing—172,000 Proposed—319,000
IFR Capability	None (VFR)
Land Requirements	
Acquire existing privately owned airport (34 acres) and improvements	
Total Estimated Cost	$ 299,000
Site Expansion (Acres)	78
Clear Zone Protection (Acres)	50
Total Estimated Cost	$ 175,500
Operational Area Improvements	
Extend and widen existing runway: 60 feet x 3,200 feet	
Construct new north-south secondary runway: 60 feet x 2,560 feet	
Construct additional paved aircraft parking apron: 26,100 square yards	
Install lighting aids	
Install REILS on both runways, both ends	
Install MIRL on both runways: 5,760 feet	
Install VASI 2, east-west runway, west end	
Total Estimated Cost	$ 850,000
Terminal Area Improvements	
Construct new administration/terminal building: 7,300 square feet	
Construct new auto parking and service road: 13,700 square yards	
Total Estimated Cost	$ 533,900
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 17,200 square yards	
Total Estimated Cost	$1,296,000
Ground Access Facilities	
No additional facilities required	
Utility Services	
Airport is beyond proposed service areas; continued use of onsite facilities	
Total Estimated Cost	$ 18,000
Total Estimated Capital Investment	$3,172,400

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

for the preparation of the recommended regional airport system plan. The distribution of population and related employment activity within the Region used to assign this demand to alternative airport systems was based upon the recommended land use plan prepared under that initial study and adopted by the Commission in 1966.

In 1972, the Commission, in recognition of the changing socioeconomic conditions and trends, initiated a major land use and transportation plan reevaluation. As a part of this major plan reevaluation effort, the Commission prepared new population and economic activity level forecasts and extended its plan design year to the year 2000. The new population forecast selected for the year 2000, after careful consideration of 15 alternative projections, is 2.22 million people, down from the earlier forecast of 2.67 million for the year 1990. In contrast to the change in the population forecast brought about by a rather dramatic change in fertility rates and migration rates into and from the Region, economic activity within the Region is expected to occur substantially in compliance with the forecast prepared under the initial land use and transportation planning program. This would, of course, indicate a substantial change in the labor force participation rate.

The Commission will use the new population and employment forecasts and the additional nearly ten years of development history to reevaluate the adopted land use plan and to prepare a revised land use plan for the Region for the design year 2000. While the Commission believes that the adopted regional land use plan has been instrumental in guiding development of the Region, and can demonstrate that several of the more significant land use development recommendations contained in the plan are being implemented—namely, preservation of environmental corridors and prime agricultural lands and development of the major regional activity centers (industrial centers, commercial centers, and regional park sites), the residential land development pattern is developing in areas beyond, and at densities below, those recommended in the land use plan. This departure, however, is not occurring to the extent that would result in the uncontrolled land use pattern described elsewhere in this report.

These developments all indicated that the recommended regional airport system plan be evaluated in terms of the changing conditions occurring within the Region with respect to population growth and distribution. Accordingly, the Commission decided to develop new forecasts of regional aviation activity demand and to evaluate the impact of the forecast of changed conditions upon the recommended facilities developed under the airport system planning program as documented earlier in this chapter. This section of Chapter XII describes the new aviation forecasts, compares these new forecasts with those developed and documented in Chapter VIII of this report, and evaluates the impact of the changes in the forecast demand for air transportation facilities and services upon the recommended airport system plan.

Further, and in accordance with good public works construction and planning practice and FAA guidelines, the forecasts and subsequent facility development recommendations were prepared for a 20-year time horizon which will extend the planning period from 1990 used thus far in the airport planning process to 1995. Therefore, the revised forecasts will be compared with the initial forecasts for the time periods through 1990, and will be used to evaluate the plan recommendations for the time period to 1995. Thus, the airport system plan recommended herein is a plan for airport development between 1975 and 1995.

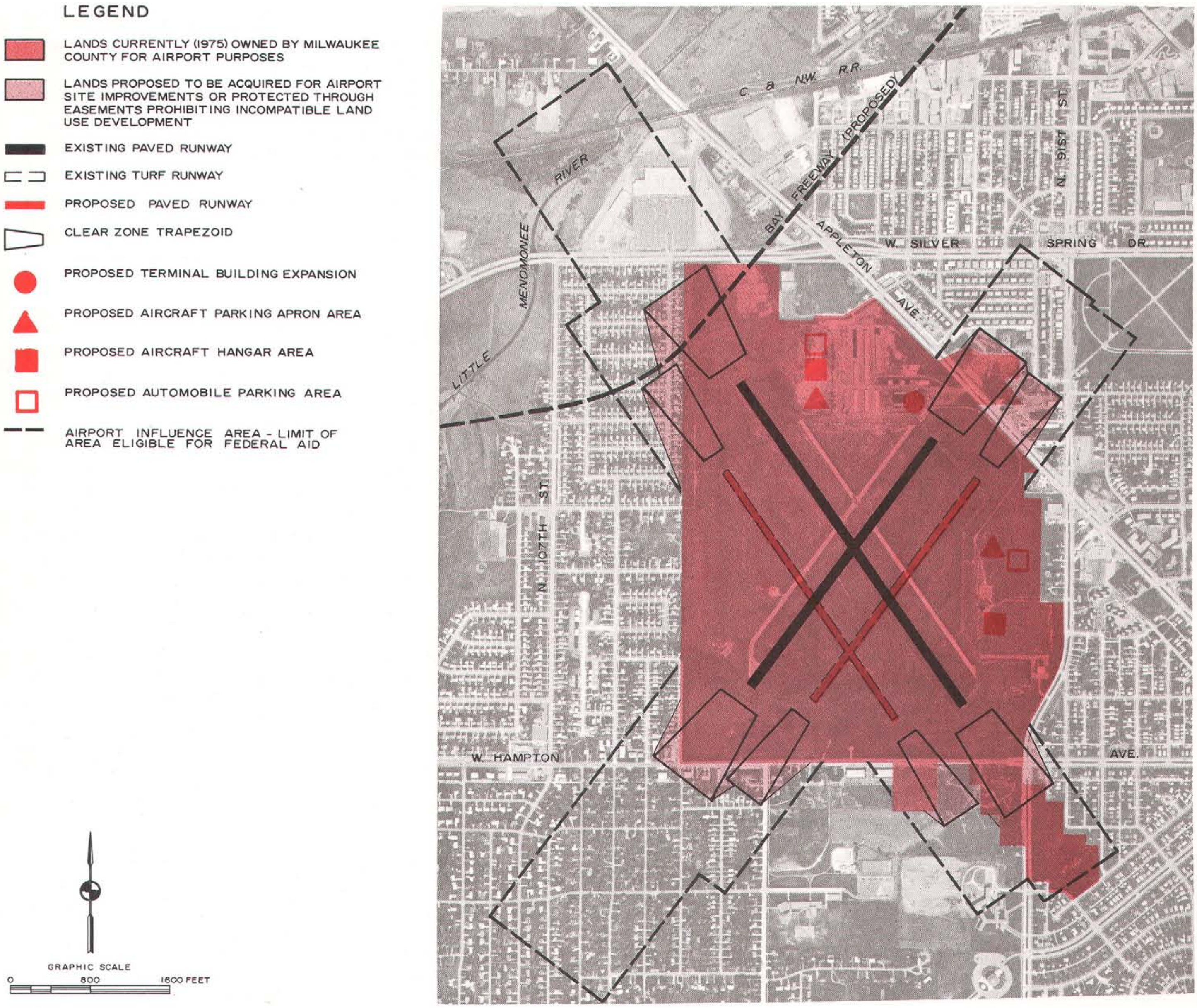
Air Carrier Demand Reforecast

New forecasts of regional air carrier and general aviation activity were prepared using the methodology documented in Chapter VIII, in which regional demands were initially forecast as a proportion of forecast national aviation activity and then refined through analyses of regional socioeconomic characteristics and forecasts. An additional three years of national and regional trend data and the new regional forecasts of demographic and economic activity were available for use in developing the new regional aviation forecasts. The Commission's consultant had developed new national projection's of domestic air passenger activity for use in the preparation of private corporate aviation planning as well as in public airport system and airport master planning efforts. This projection is expressed in terms of revenue passenger miles, passenger originations, and passenger enplanements on domestic trunk and regional air carriers. More specifically, the projection model used incorporates three independent variables: 1) real yield of passenger revenue and tax per revenue passenger mile, 2) per capita disposable income, and 3) government purchases of goods and services. The dependent variable in the model is revenue passenger miles per capita. The resulting projection of revenue passenger miles per capita was then combined with a forecast of the number of persons age 16 and over expected to be in the national population in the design year, as prepared by the National Planning Association, and a projection of average trip length to obtain a forecast of originating passengers. Application of a projected connection factor yielded a forecast of passenger enplanements. Projected trip length and connection factors were based upon careful analyses of long-term historical trends in these factors.

Results of the model application in the form of high and medium range national projections of enplaning passengers and a comparison with the similar forecast set forth in Chapter VIII are shown in Table 224. The table indicates that the revised median range national projection for 1990 is expected to be approximately 48 percent below the old forecast, reflecting the dramatic changes

Map 66

SITE IMPROVEMENT PLAN FOR TIMMERMAN FIELD



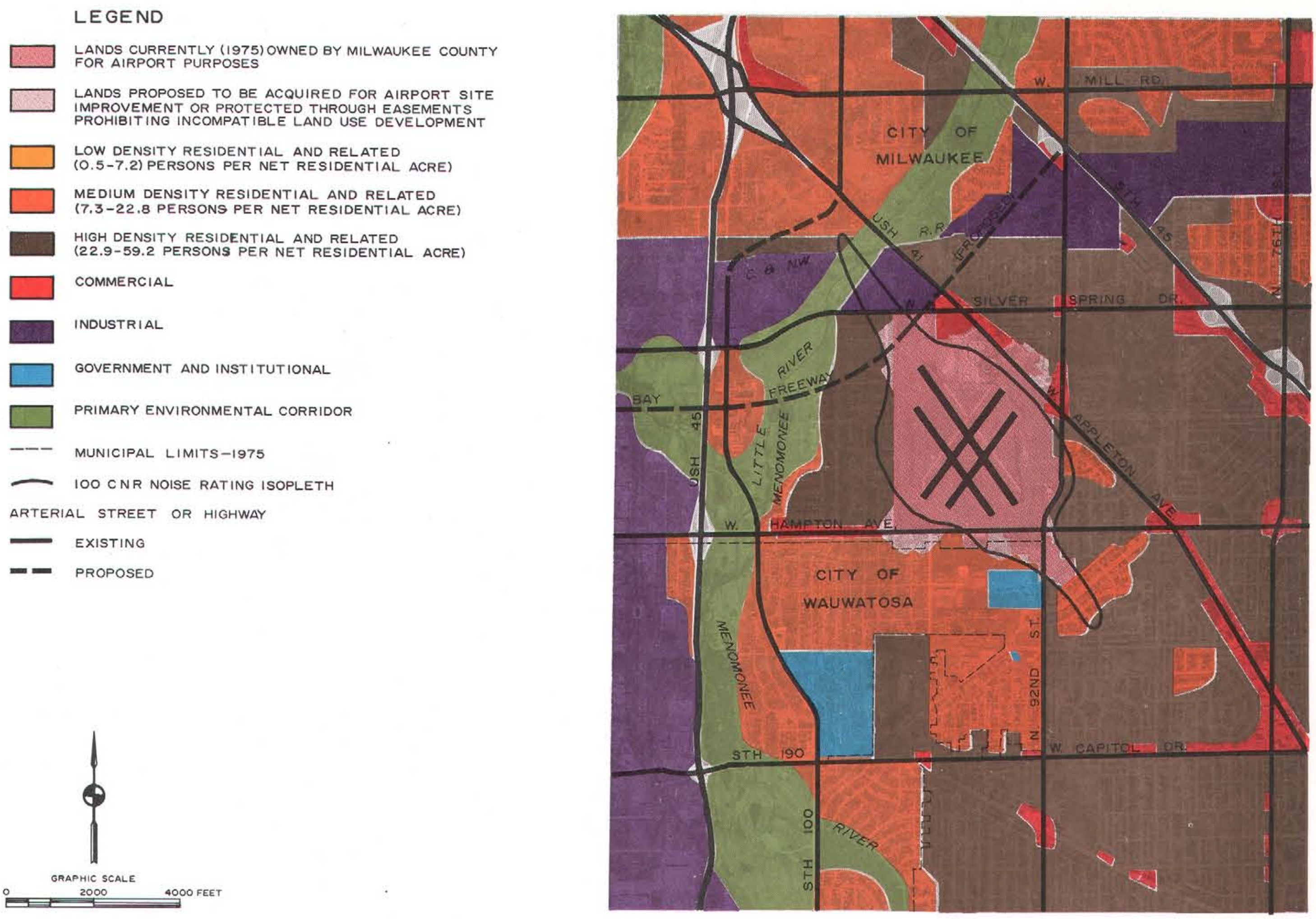
Source: R. Dixon Speas Associates, Inc. and SEWRPC.

in demographic, economic, and energy availability and cost conditions that have occurred in the United States in the last several years. A comparison of four independently prepared industry forecasts of enplaning passengers and the new national forecast, set forth in Table 225, indicates that aviation demand nationally can be expected to grow at a much slower rate than formerly.

Passenger enplanements at General Mitchell Field increased from 399,000 annually in 1963 to 1,105,000 annually by 1973, an average annual increase of almost 11 percent. Since 1969, the rate of increase has been about 7 percent annually, and between 1972 and 1973, the rate of increase was about 5 percent. As shown in Table 226, General Mitchell Field traffic has remained relatively stable as a proportion of national traffic since 1963, ranging between 0.63 and 0.68 percent. This relationship may be expected to continue to remain relatively stable. Following analysis of the regional forecast of socioeconomic factors and the relationship of these factors to aircraft passenger originations, the regional share of the national market was projected to range from 0.62 to 0.64 percent,

Map 67

AREA LAND USE PLAN FOR TIMMERMAN FIELD



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

as shown in Table 226. This share of the national market, applied to the median- and high-range national projections, produced the median- and high-range projections of air passenger originations at General Mitchell Field also shown in Table 226.

The initial regional forecast of originations at General Mitchell Field was based upon the projections of a constant 0.66 percent share of the national market through the planning period. Application of this percent to the new national median-range projection would produce a projection of General Mitchell Field originations between the median- and high-range projections shown for General Mitchell Field in Table 226. The median-range projection of originations developed under the revised forecast effort has been adopted as the forecast upon which the other components of the revised air carrier activity forecast were developed.

Between 1963 and 1973, the ratio of passenger enplanements to passenger originations at General Mitchell Field increased from 1.21 to 1.32. The history and projection of originations, enplanements, and the related connection factor ratio of air passenger traffic on scheduled certificated air carrier service at General Mitchell Field are summarized in Table 227.

Passengers on nonscheduled service provided by trunk and regional carriers have averaged approximately 0.8 percent of scheduled service since 1963, as shown in Table 228, with above average activity in the later years. With increased charter activity by the airlines, it is expected that nonscheduled enplanements boarded by these certificated carriers will increase to about 2 percent of the scheduled enplanements projected by 1995, as also shown in Table 228.

Table 219

SITE REQUIREMENT RECOMMENDATIONS FOR TIMMERMAN FIELD

General Conditions	
Airport Classification	Existing—General Utility Proposed—General Utility
Aviation Demand	
Annual Operations	1971 Inventory—173,900 1990 Forecast—316,700
Based Aircraft	1971 Inventory—180 1990 Forecast—370
Runway System Capacity (PANCAP)	Existing—302,000 Proposed—501,700
IFR Capability	Nonprecision Instrument Approach[a]
FAA Designation	Reliever Airport to General Mitchell Field
Land Requirements	
Site Expansion (Acres)	0
Clear Zone Protection (Acres)	33
Residential and Commercial Units	50
Total Estimated Cost	$1,540,000
Operational Area Improvements	
Pave existing turf Runway 15R/33L: 75 feet x 3,150 feet	
Pave existing turf Runway 4R/22L: 75 feet x 3,000 feet	
Widen existing Runway 15L/33R: 25 feet x 4,100 feet	
Widen existing Runway 4L/22R: 25 feet x 3,200 feet	
Install lighting and visual aids	
VASI-2: Runway 15L/33R, Both Ends	
Runway 4L/22R, Both Ends	
REILS: Runway 15L/33R, 33R End	
Runway 4L/22R, 22R End	
Construct additional paved aircraft parking apron: 40,300 square yards	
Total Estimated Cost	$1,287,700
Terminal Area Improvements	
Expand administration/terminal building: 8,700 square feet	
Expand auto parking and service roads: 10,500 square yards	
Total Estimated Cost	$ 613,500
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 21,700 square yards	
Total Estimated Cost	$1,635,000
Ground Access Facilities	
No additional facilities required	
Utility Services	
Airport is within present utility service area	
Total Estimated Capital Investment	$5,075,700

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

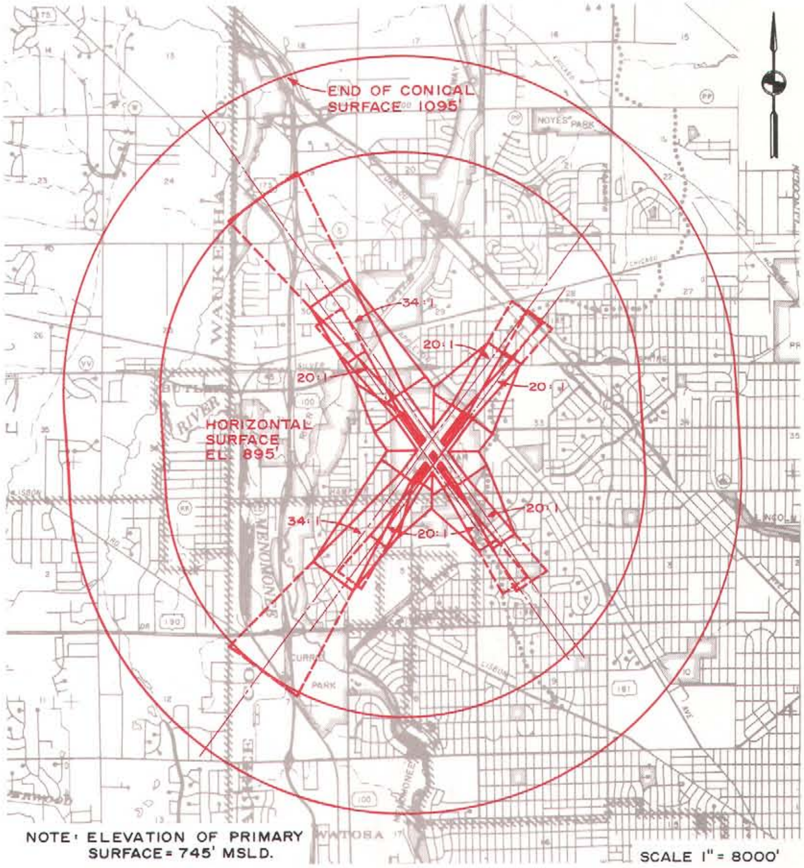
Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

The total enplanements to certificated air carriers in scheduled and nonscheduled operations resulting under this new forecast are set forth in Table 229 by five-year increments from 1975 to 1995. Analysis of the initial and revised forecasts of enplaning passengers, also shown in Table 229, indicates that enplanements at General Mitchell Field may now be expected to approximate 2.36 million in 1990, 48 percent below the initial forecast of 4.54 million passenger enplanements. This decline in regional aviation activity parallels the decline forecast in national air passenger activity.

Through use of projected enplaning passenger load factors and average aircraft size, a forecast of air carrier operations was developed from the forecast of enplaning passengers. The enplaning load factors are similar to those used in the initial forecast, and project a gradually improved enplaning load factor commensurate with the past history of air carrier activity at General Mitchell Field and with expected national trends. The enplaning load factor represents a percentage of out-bound seats filled by locally boarding passengers. The total airline operating load factor is higher in that it would include the through-passengers remaining on board in addition to those enplaned at General Mitchell Field. It is significant to note that the revised forecast includes a reduction in the anticipated average aircraft size below that forecast initially. Economic conditions and maturing of the air passenger market, which became apparent in the early 1970s, have resulted in less optimistic industry forecasts relating to the use of larger aircraft. In addition, a higher frequency of service to and from General Mitchell Field can be maintained through use of smaller aircraft than through use of larger aircraft.

Figure 83

TIMMERMAN FIELD AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION



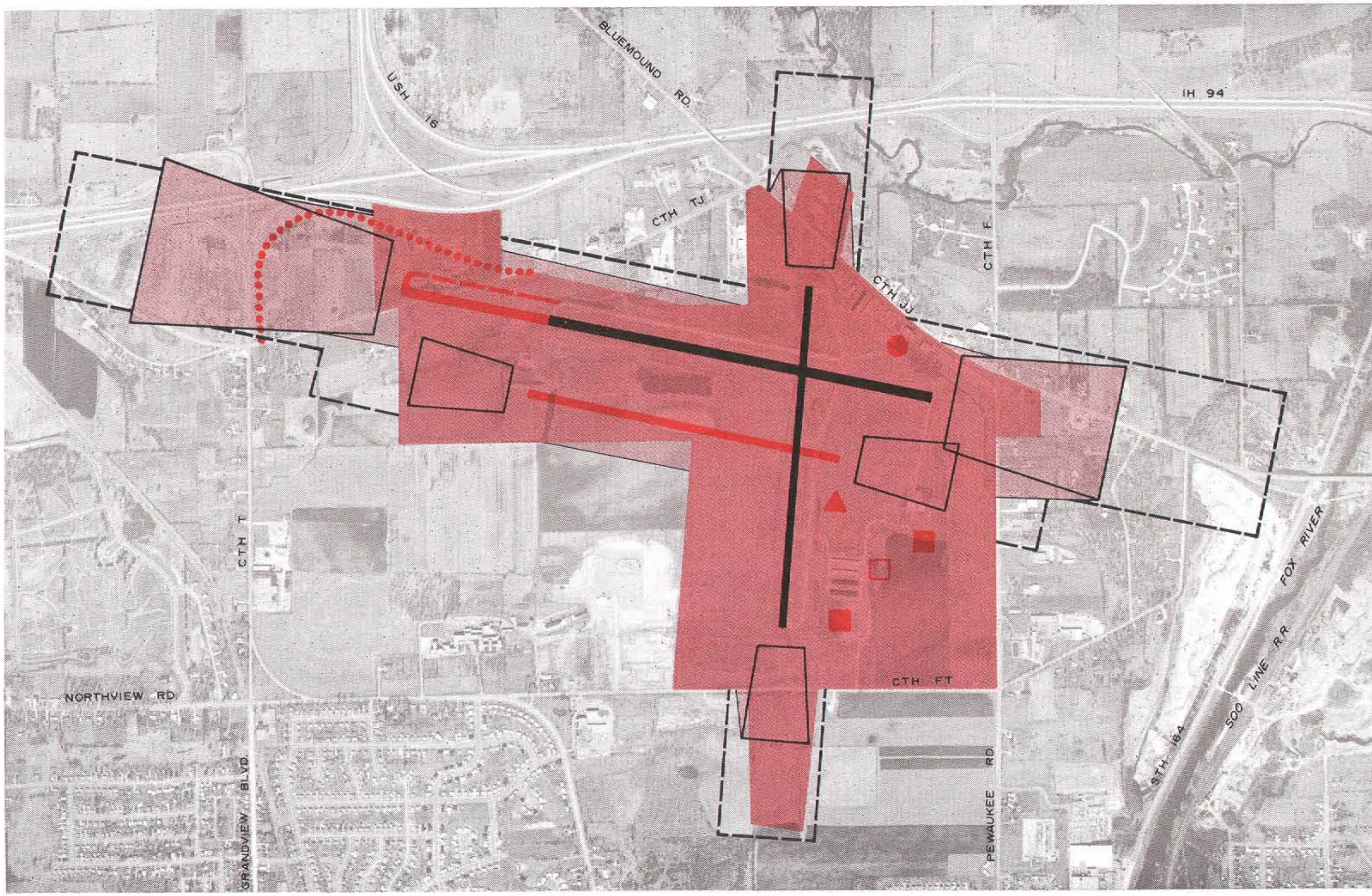
Source: R. Dixon Speas Associates, Inc. and SEWRPC.

The initial forecast anticipated that the new generation of wide-body aircraft, that is, the B-747, DC-10, and L-1011, would comprise about 60 percent of the total aircraft fleet using General Mitchell Field by 1990. The revised forecast indicates that only about 32 percent of the fleet may be expected to be large capacity aircraft, while the smaller two- and three-engine aircraft with 90 to 135 seats may be expected to continue to predominate. The mix of aircraft expected to provide air carrier service through General Mitchell Field under this revised forecast is shown by aircraft group and five-year forecast increment to 1995 in Table 230. The average aircraft size anticipated at General Mitchell Field is expected to be smaller than forecast initially. Nevertheless, the sizes of aircraft serving the Region are expected to increase through the time period from an average of 80 seats per aircraft in the early 1970s to 120 in 1985 and 160 seats per aircraft in 1995. The actual and revised forecast data regarding air carrier operations are summarized in Table 231.

Through a similar analysis, the number of enplaning passengers and aircraft operations represented by supplemental air carrier activity and commuter service was developed for addition to the certificated air carrier service forecast to represent a total forecast of commercial air activity. A summary of the revised forecast of enplaning passengers and aircraft operations by category of air carrier service is shown in Table 232. The revised demand forecast for 1990 reflects an approximate 50 percent decrease in annual passenger enplanements but only a 19 percent decrease in annual aircraft operations, from 124,700 to 101,360, when compared with the initial forecast documented in Chapter VIII. Total aircraft operations as set forth in Table 232 include not only those required to serve passenger activity, but other air

Map 68

SITE IMPROVEMENT PLAN FOR THE WAUKESHA COUNTY AIRPORT



LEGEND

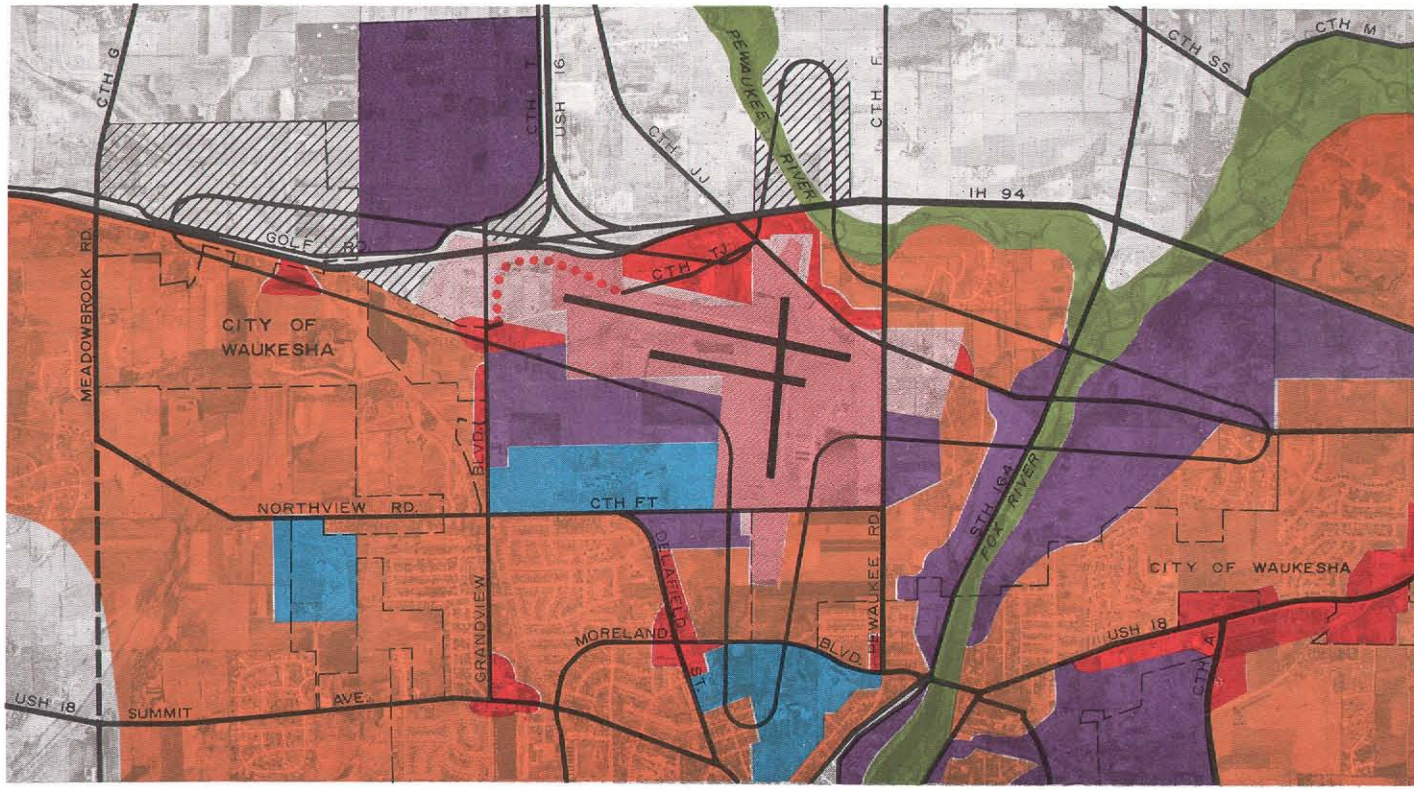
- LANDS CURRENTLY (1975) OWNED BY WAUKESHA COUNTY FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING EXPANSION
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- PROPOSED ROAD REALIGNMENT
- AIRPORT INFLUENCE AREA—LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

GRAPHIC SCALE
0 800 1600 FEET

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 69

AREA LAND USE PLAN FOR THE WAUKESHA COUNTY AIRPORT



LEGEND

LANDS CURRENTLY OWNED BY WAUKESHA COUNTY FOR AIRPORT PURPOSES

LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENT OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT

LANDS ADJACENT TO AIRPORT PROPOSED TO REMAIN IN AGRICULTURE OR OTHER OPEN SPACE LAND USES, OR TO BE UTILIZED FOR NON-RESIDENTIAL URBAN LAND USES COMPATIBLE WITH AIRPORT ACTIVITY

MEDIUM DENSITY RESIDENTIAL AND RELATED (7.3–22.8 PERSONS PER NET RESIDENTIAL ACRE)

COMMERCIAL

INDUSTRIAL

GOVERNMENT AND INSTITUTIONAL

PRIMARY ENVIRONMENTAL CORRIDOR

AGRICULTURAL

PROPOSED ROAD REALIGNMENT

MUNICIPAL LIMITS–1975

100 CNR NOISE RATING ISOPLETH

ARTERIAL STREET OR HIGHWAY

EXISTING

PROPOSED

GRAPHIC SCALE

0 2000 4000 FEET

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 220

SITE REQUIREMENT RECOMMENDATIONS FOR THE WAUKESHA COUNTY AIRPORT

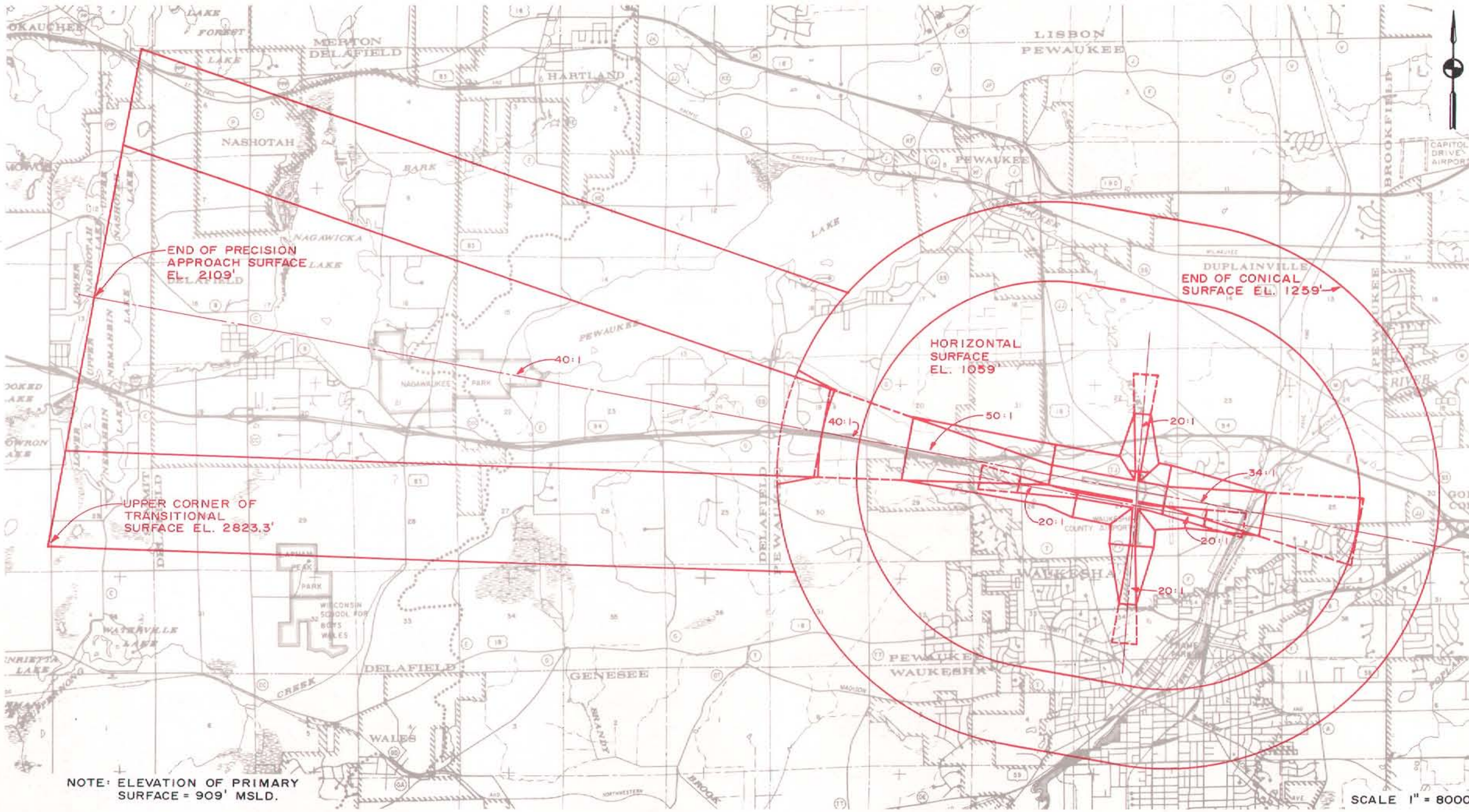
General Conditions	
Airport Classification	Existing—General Utility Proposed—Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory—117,400 1990 Forecast—299,900
Based Aircraft	1971 Inventory—167 1990 Forecast—356
Runway System Capacity (PANCAP)	Existing—284,000 Proposed—337,600
IFR Capability	Precision Instrument Approach[a]
FAA Designation	Reliever Airport to General Mitchell Field
Land Requirements	
Site Expansion (Acres)	20
Clear Zone Protection (Acres)	120
Residential Units	12
Commercial Units	8
Total Estimated Cost	$1,535,000
Operational Area Improvements	
Extend Runway 10L/28R to 5,600 feet	
Runway: 100 feet x 1,600 feet	
Taxiway: 40 feet x 1,800 feet	
Construct Runway 10R/28L: 75 feet x 3,300 feet	
Strengthen runways and taxiways to accommodate 60,000 pounds gross weight aircraft	
Runway 10L/28R—3 1/2 inch overlay: 100 feet x 4,000 feet	
Runway 18L/36R—2 1/2 inch overlay: 75 feet x 3,400 feet	
Taxiway 10L/28R—3 1/2 inch overlay: 40 feet x 4,000 feet	
Taxiway 18L/36R—2 inch overlay: 40 feet x 3,900 feet	
Construct additional paved aircraft parking aprons: 78,900 square yards	
Install lighting and visual aids	
MIRL Runway 18L/36R: 3,400 feet	
HIRL Runway 10L/28R: 5,600 feet	
Taxiway Exit Lights—Both Runways	
VASI-4 Runway 10L/28R, 10L End	
REILS Runway 10L/28R, 28R End	
Runway 18L/36R, 36R End	
Runway 10L/28R, Relocate 10L, End	
Replace air traffic control tower	
Install precision instrument landing and approach lighting system on approach to Runway 10	
Total Estimated Cost	$2,181,900
Terminal Area Improvements	
Expand terminal building: 7,500 square feet	
Expand auto parking and service roads: 8,200 square yards	
Total Estimated Cost	$ 596,200
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 28,900 square yards	
Total Estimated Cost	$3,095,000
Ground Access Facilities	
Relocate CTH TJ to permit runway extension	
Total Estimated Cost	$ 187,000
Utility Services	
Airport within proposed service area—cost of connections considered nominal	
Total Estimated Capital Investment	$7,595,100

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Figure 84

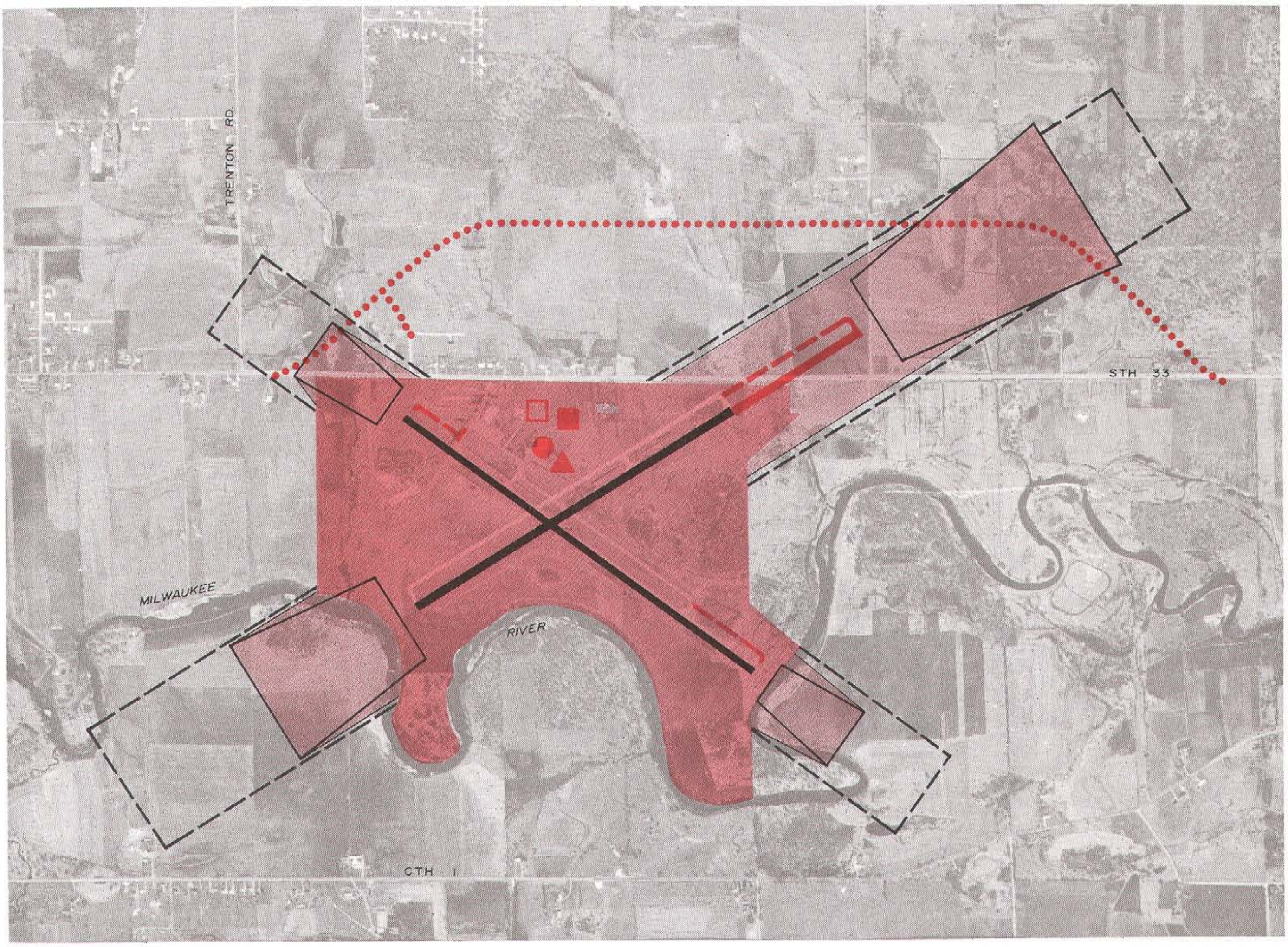
WAUKESHA COUNTY AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

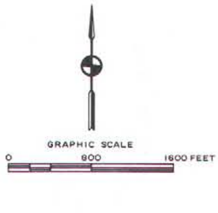
Map 70

SITE IMPROVEMENT PLAN FOR THE WEST BEND MUNICIPAL AIRPORT



LEGEND

- LANDS CURRENTLY (1975) OWNED BY THE CITY OF WEST BEND FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING EXPANSION
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- PROPOSED ROAD REALIGNMENT
- AIRPORT INFLUENCE AREA - LIMIT OF AREA ELIGIBLE FOR FEDERAL AID



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 71

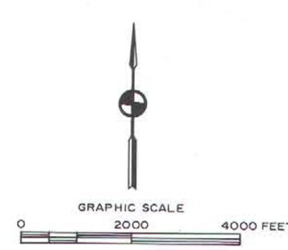
AREA LAND USE PLAN FOR THE WEST BEND MUNICIPAL AIRPORT

LEGEND

- LANDS CURRENTLY (1975) OWNED BY THE CITY OF WEST BEND FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENT OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- LANDS ADJACENT TO AIRPORT PROPOSED TO REMAIN IN AGRICULTURE OR OTHER OPEN SPACE LAND USES, OR TO BE UTILIZED FOR NON-RESIDENTIAL URBAN LAND USES COMPATIBLE WITH AIRPORT ACTIVITY
- MEDIUM DENSITY RESIDENTIAL AND RELATED (7.3–22.8 PERSONS PER NET RESIDENTIAL ACRE)
- COMMERCIAL
- GOVERNMENT AND INSTITUTIONAL
- PRIMARY ENVIRONMENTAL CORRIDOR
- AGRICULTURE
- PROPOSED ROAD REALIGNMENT
- MUNICIPAL LIMITS–1975
- 100 CNR–NOISE RATING ISOPLETH

ARTERIAL STREET OR HIGHWAY

- EXISTING
- PROPOSED



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 221

SITE REQUIREMENT RECOMMENDATIONS FOR THE WEST BEND MUNICIPAL AIRPORT

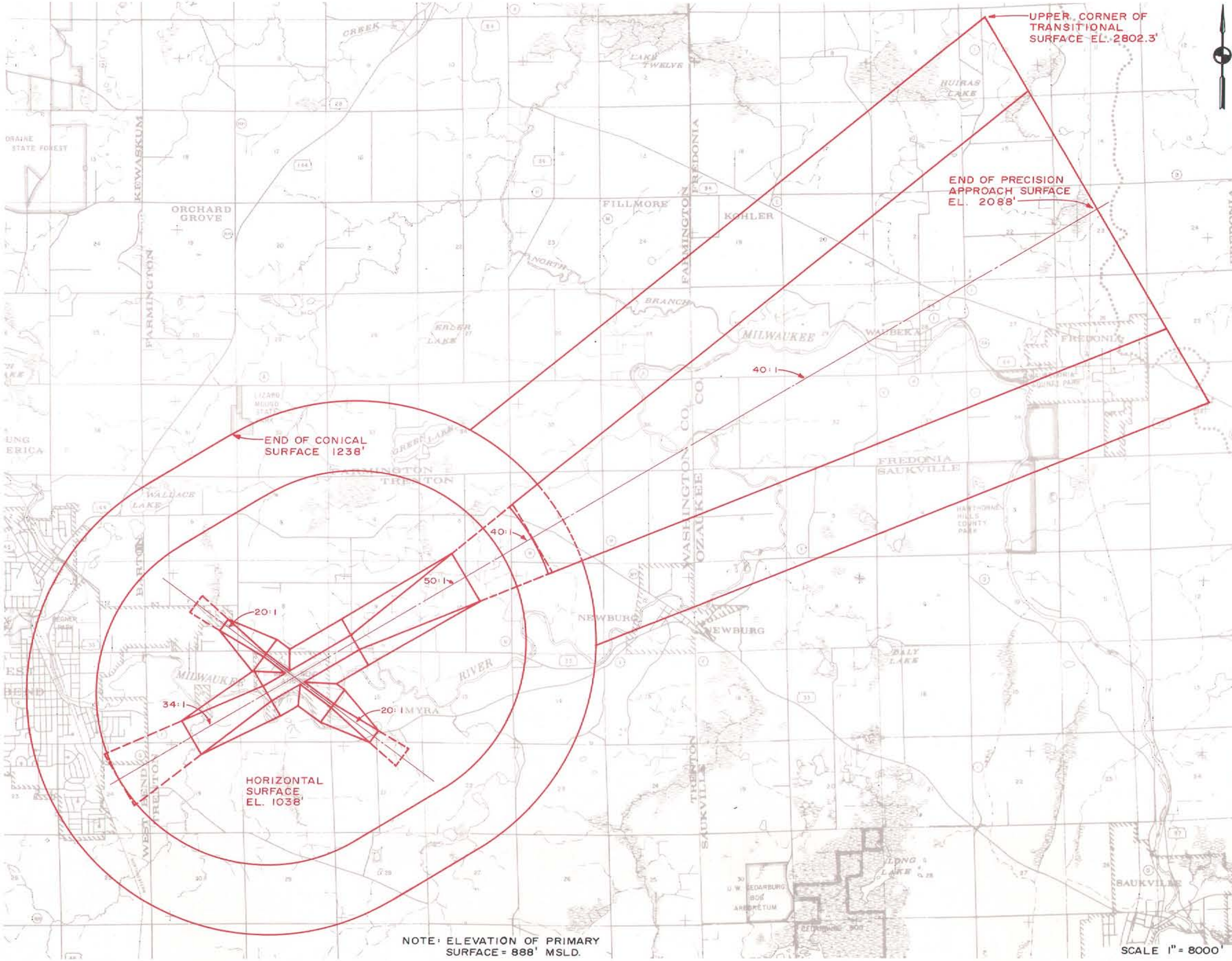
General Conditions	
Airport Classification	Existing—General Utility Proposed—Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory—71,200 1990 Forecast—148,400
Based Aircraft	1971 Inventory—92 1990 Forecast—177
Landing System Capacity (PANCAP)	Existing—175,000 Proposed—253,300
IFR Capability	Precision Instrument Approach[a]
Land Requirements	
Site Expansion (Acres)	67
Clear Zone Protection (Acres)	148
Residential Units	5
Total Estimated Cost	$ 542,100
Operational Area Improvements	
Extend Runway 6/24 to 5,500 feet	
Runway: 100 feet x 1,600 feet	
Taxiway: 40 feet x 1,800 feet	
Relocate or encase oil pipeline	
Remove obstruction, 24 End	
Extend Taxiway 13/31	
13 End: 40 feet x 600 feet	
31 End: 40 feet x 900 feet	
Widen runways and taxiways	
Runway 6/24: 25 feet x 3,900 feet	
Runway 13/31: 25 feet x 4,500 feet	
Taxiway 6/24: 10 feet x 2,900 feet	
Taxiway 13/31: 10 feet x 3,850 feet	
Strengthen runways and taxiways to accommodate 60,000 pounds gross weight aircraft	
Runway 6/24—3.75 inch overlay: 75 feet x 3,900 feet	
Runway 13/31—2 inch overlay: 75 feet x 4,500 feet	
Taxiway 6/24—3.75 inch overlay: 30 feet x 2,900 feet	
Taxiway 13/31—2 inch overlay: 30 feet x 3,850 feet	
Construct additional paved aircraft parking apron: 41,200 square yards	
Install lighting and visual aids	
MIRL Runway 13/31: 4,500 feet	
HIRL Runway 6/24: 5,500 feet	
Taxiway Exit Lights—Both Runways	
VASI-4 Runway 6/24, 24 End	
REILS Runway 6/24, Both Ends	
Relocate REILS Runway 13/31, Both Ends	
Construct air traffic control tower	
Install precision instrument landing system approach to Runway 24	
Total Estimated Cost	$2,029,000
Terminal Area Improvements	
Construct new administration/terminal building: 7,400 square feet	
Expand auto parking and service roads: 10,000 square yards	
Total Estimated Cost	$ 600,900
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 13,600 square yards	
Total Estimated Cost	$1,520,000
Ground Access Facilities	
Realign STH 33	
Total Estimated Cost	$ 519,000
Utility Services	
Extend utility services from proposed City of West Bend sewer service area	
Total Estimated Cost	$ 29,000
Total Estimated Capital Investment	$5,240,000

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Figure 85

WEST BEND MUNICIPAL AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING



Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 222

COMPARISON OF AIR ACTIVITY FORECASTS UNDER ALTERNATIVE REGIONAL LAND DEVELOPMENT CONDITIONS

County	Airport	Airport Classification	Airport Runway System Capacity-PANCAP (In Thousands)	1990 Planned Land Use			1990 Unplanned Land Use		
				Aircraft Assignment	Annual Operations (In Thousands)	Demand as Percent of Capacity	Aircraft Assignment	Annual Operations (In Thousands)	Demand as Percent of Capacity
Kenosha	Kenosha Municipal . . .	BT	337.6	294	252.4	75	215	183.0	54
Milwaukee	General Mitchell Field .	ST	400.0	249	308.2[b]	77	175	258.7[c]	65
	Timmerman Field. . . .	GU	501.7	370	316.8	63	342	291.9	58
Ozaukee	Ozaukee	BT	253.3	231	195.3	77	216	181.3	72
Racine	Burlington Municipal . .	BT	253.3	194	163.4	65	212	176.7	70
	Racine Commercial . . .	BT	253.3	163	140.0	55	146	125.2	50
	Sylvania	BU	319.0	188	161.3	51	162	143.7	45
Walworth	East Troy Municipal . .	BU	319.0	218	194.4	61	229	203.4	64
	Gruenwald	GU	306.0	150	125.9	41	184	152.9	50
	Playboy[a]	BU-R	--	16	14.7	--	18	15.8	--
	Lake Lawn Lodge[a] . . .	BU-R	--	11	9.5	--	14	12.8	--
Washington	Hartford Municipal . . .	GU	306.3	165	138.1	45	212	175.7	57
	West Bend Municipal . .	BT	253.3	177	148.4	59	242	202.5	80
Waukesha	Waukesha County. . . .	BT	337.6	356	299.9	89	351	292.1	87
Outside the Region	Waukegan Memorial . .	GU	--	115	--	--	84	--	--
	Fort Atkinson-Whitewater.	GU	--	26	184.7	--	53	243.6	--
	Watertown Municipal. .	BU	--	73	--	--	144	--	--
Unassigned	--	--	--	2	1.8	--	3	2.0	--
Total	--	--	--	3,000	2,654.8	--	3,000	2,661.3	--

[a] *Private airports assumed to serve a limited amount of general aviation demand.*

[b] *Includes forecast of 168,400 general aviation, 124,700 air carrier, and 15,100 military operations.*

[c] *Includes forecast of 118,900 general aviation, 124,700 air carrier, and 15,100 military operations.*

Source: R. Dixon Speas Associates, Inc.

Table 223

COMPARISON OF REGIONAL AIR CARRIER ORIGINATIONS AND ASSOCIATED GROUND TRAVEL TIME UNDER PLANNED AND UNPLANNED LAND USE PATTERNS: 1990

Airport	Land Use Pattern		Percent Change
	Planned	Unplanned	
General Mitchell Field			
Originating Passengers.	3,901,000	3,821,000	- 2.1
Ground Travel Time (Hours)	1,784,000	1,896,000	6.3
Average Travel Time Per Passenger (Minutes).	27	30	11.1
O'Hare Field			
Originating Passengers.	1,568,000	1,647,000	5.0
Ground Travel Time (Hours)	2,277,000	2,540,000	11.6
Average Travel Time Per Passenger (Minutes).	87	93	6.9
Region Total			
Originating Passengers.	5,469,000	5,469,000	0.0
Ground Travel Time (Hours)	4,061,000	4,436,000	9.2
Average Travel Time Per Passenger (Minutes).	45	49	8.9

Source: R. Dixon Speas Associates, Inc.

carrier operations such as training and positioning and cargo operations. The forecast number of aircraft operations by aircraft group is shown in Table 233.

Average day, peak day, average hour, and peak or busy hour operations and passenger loadings have been determined from the forecast of annual air carrier operations based upon an extensive review of historic hourly, daily, and annual traffic relationships and of past, existing, and forecast airline schedule patterns. The analysis of hourly, daily, and annual traffic relationships indicated that the ratio of peak to average day can be expected to remain as initially forecast, 1.39, but that the busy hour as a percent of average day may be expected to approximate 14 percent rather than 11 percent as initially forecast.

Table 224

COMPARISON OF NATIONAL PROJECTIONS OF DOMESTIC ORIGINATING AIRLINE PASSENGERS DEVELOPED UNDER THE REGIONAL AIRPORT SYSTEM PLANNING PROGRAM SELECTED YEARS 1975-1995

Forecast Year	Initial Forecast	Revised Projections		Percent Decrease[a]
		Median Range	High Range	
1975	171,000,000	142,900,000	152,200,000	16
1980	278,000,000	188,540,000	202,360,000	32
1985	412,000,000	241,250,000	261,790,000	44
1990	579,000,000	299,600,000	330,230,000	48
1995	--	368,750,000	414,580,000	--

[a] $\frac{\textit{Initial Forecast - Median Range Projection}}{\textit{Initial Forecast}} \times 100$

Source: R. Dixon Speas Associates, Inc.

A summary of the analysis results in terms of hourly, daily, and annual operations and passenger loadings is set forth in Table 234. When compared with the initial forecast, a decline in busy hour passengers of 34 percent but an increase of busy hour aircraft operations of about 10 percent by 1990 is noted.

General Aviation Revised Forecast

Development of the revised forecast of general aviation activity within southeastern Wisconsin was initiated by review and reevaluation of the projections of general aviation registrations at the national level. The two independent variables found to be significant and logical in explaining general aviation ownership—gross national product expressed in constant 1958 dollars and population 16 years of age and over—are experiencing dramatic change, both nationally and regionally, and are now foreseen by economists and demographers as growing at a much lesser rate than earlier forecast. The new forecasts of general aviation registrations within the United States are shown and compared with revised forecasts in Table 235. It can be noted that the forecast of national general aviation registrations is about one-third less in 1990 than that documented initially in Chapter VIII, down from 424,000 to 282,310 registered aircraft.

The forecast of general aviation aircraft registrations for the Region was developed through application of a multivariate analysis relating population, employment, and per capita income within the Region to general aviation ownership. The revised forecast results in the Wisconsin share of U. S. registrations increasing from 1.89 percent in 1975 to 2.22 percent in 1990. In contrast, the original forecast based upon a "top-down" methodology assumed that the Wisconsin share would be only 1.77 percent in 1975 and would decrease to 1.72 percent in 1990.

Table 225

COMPARISON OF NATIONAL FORECASTS OF DOMESTIC ENPLANING PASSENGERS: SELECTED YEARS 1975-1995

Forecast Year	Forecast of Enplaning Passengers (Millions)					
	Speas Revised Projections[a]					
	Median Range	High Range	ATA[b]	Boeing	General Electric	Lockheed
1975	200.1	213.1	194.3	194.6	224.8	183.8
1980	264.1	283.3	254.6	261.1	275.6	254.7
1985	333.8	366.5	320.8	333.3	319.4	343.2
1990	419.4	462.3	394.5	410.0	--	--
1995	516.2	580.4	479.8	493.7	--	--

[a] *R. Dixon Speas Associates, Inc.*

[b] *Air Transportation Association.*

Source: R. Dixon Speas Associates, Inc.; Air Transportation Association, July 1974; and Boeing, General Electric, and Lockheed, September 1974.

Table 226

ACTUAL AND PROJECTED ANNUAL PASSENGER ORIGINATIONS FOR THE UNITED STATES AND GENERAL MITCHELL FIELD: SELECTED YEARS 1963-1995

Year	United States (Thousands)	General Mitchell Field	General Mitchell Field Total as Percent of United States Total
Actual			
1963	49,047	327,980	0.67
1964	55,697	360,620	0.65
1965	65,593	437,970	0.67
1966	75,069	488,690	0.65
1967	88,435	599,000	0.68
1968	103,746	652,080	0.63
1969	111,697	705,830	0.63
1970	107,952	714,530	0.66
1971	108,267	729,990	0.67
1972	119,267	770,230	0.65
1973	127,474	825,830	0.65
Projected	Median-High	Median-High	General Mitchell Field Total as Percent of United States Total
1975	142,930 - 152,210	915,000 - 974,000	0.64
1980	188,540 - 202,360	1,207,000 - 1,295,000	0.64
1985	241,250 - 261,790	1,520,000 - 1,649,000	0.63
1990	299,600 - 330,250	1,888,000 - 2,080,000	0.63
1995	368,750 - 414,580	2,286,000 - 2,570,000	0.62

Source: Civil Aeronautics Board, Origin-Destination Survey, 1963-1973; and R. Dixon Speas Associates, Inc.

Table 227

ACTUAL AND PROJECTED ANNUAL PASSENGER TRAFFIC ON SCHEDULED AIR CARRIER SERVICE AT GENERAL MITCHELL FIELD: SELECTED YEARS 1963-1995

Year	Scheduled Certificated Service		
	Originations	Enplanements	Connection Factor
Actual			
1963	327,980	397,120	1.21
1964	360,620	434,605	1.21
1965	437,970	492,832	1.13
1966	488,690	533,592	1.09
1967	599,000	674,297	1.13
1968	652,080	798,076	1.22
1969	705,830	834,002	1.18
1970 (Fiscal Year)	724,510	863,791	1.26
1971 (Fiscal Year)	703,950	887,232	1.26
1972	770,230	1,040,777	1.35
1973	825,830	1,093,828	1.32
Projected			
1975	915,000	1,199,000	1.31
1980	1,207,000	1,545,000	1.28
1985	1,520,000	1,915,000	1.26
1990	1,888,000	2,322,000	1.23
1995	2,286,000	2,789,000	1.22

Source: Civil Aeronautics Board, Origin-Destination Survey, 1963-1973; Federal Aviation Administration, Airport Activity Statistics, 1963-1973; and R. Dixon Speas Associates, Inc.

Table 228

ACTUAL AND FORECAST PASSENGER ENPLANEMENTS IN SCHEDULED AND NONSCHEDULED CERTIFICATED AIR CARRIER SERVICE IN THE REGION SELECTED YEARS 1963-1995

Year	Passenger Enplanements		Nonscheduled as Percent of Scheduled
	Scheduled	Nonscheduled	
Actual			
1963	397,120	2,273	0.6
1964	434,605	3,601	0.8
1965	492,832	2,937	0.6
1966	533,592	3,090	0.6
1967	674,297	5,376	0.8
1968	798,076	7,337	0.9
1969	834,002	6,756	0.8
1970 (Fiscal Year)	863,791	6,376	0.7
1971 (Fiscal Year)	887,232	8,238	0.9
1972	1,040,777	10,876	1.0
1973	1,093,828	11,552	1.1
Revised Forecast			
1975	1,199,000	13,000	1.1
1980	1,545,000	19,000	1.2
1985	1,915,000	26,000	1.4
1990	2,322,000	36,000	1.6
1995	2,789,000	49,000	1.8

Source: Federal Aviation Administration, Airport Activity Statistics, 1963-1973; and R. Dixon Speas Associates, Inc.

The additional historic data available since 1969 do not support the original assumption of a decrease in Wisconsin's share of the nation's total. In fact, conditions within Wisconsin suggest that a slight increase in Wisconsin's percent share of the nation's total may be expected. Further, the Region's share of Wisconsin general aviation registrations may be expected to increase under this revised forecast from 37 percent in 1975 to 44 percent in 1990. The prior forecast also indicated a similar but slower growth in the share of the Wisconsin market, increasing from nearly 39 percent in 1975 to 41 percent in 1990. Together, the effect of these two factors—an increased percentage share of national

Table 229

FORECAST OF TOTAL TRUNK AND REGIONAL CERTIFICATED ENPLANEMENTS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY SELECTED YEARS 1975-1995

Year	Certificated Enplanements				
	Initial Forecast	Revised Forecast			Percent Decrease
		Scheduled	Nonscheduled	Total	
1975	1,344,000	1,199,000	13,000	1,212,000	10
1980	2,184,000	1,545,000	19,000	1,564,000	28
1985	3,236,000	1,915,000	26,000	1,941,000	40
1990	4,547,000	2,322,000	36,000	2,358,000	48
1995	--	2,789,000	49,000	2,838,000	--

Source: R. Dixon Speas Associates, Inc.

Table 230

REVISED FORECAST OF AIR CARRIER FLEET DISTRIBUTION AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY SELECTED YEARS 1972-1995

Aircraft Group[a]	Percent Distribution by Group					
	1972	1975	1980	1985	1990	1995
I . . .	2	2	5	6	11	12
II . . .	--	2	4	8	12	17
III . .	--	1	4	8	10	17
IV . .	7	3	3	2	2	2
V . . .	52	58	55	53	48	43
VI . .	39	34	29	23	17	9

[a] *The aircraft groups include the following aircraft types:*

Aircraft Group	*Aircraft Type*	*Examples of Current Aircraft Type*	*Seat Range*	*Average Number of Seats*
I	*AA . .*	*B-747*	*300 - 400*	*340*
II	*AA . .*	*DC-10, L-1011*	*220 - 250*	*230*
III	*AA . .*	*A-300, New Wide Body, DC-8 Stretch*	*170 - 200*	*180*
IV	*A . . .*	*DC-8, 707, B-720*	*130 - 140*	*135*
V	*B . . .*	*B-727, B-727 Stretch, DC-9, DC-9 Stretch*	*90 - 135*	*100*
VI	*C . . .*	*CV-580, F-27*	*40 - 52*	*48*
VII	*--*	*Commuter Equipment*	*Equal to or Less Than 30*	*20*

Source: R. Dixon Speas Associates, Inc.

Table 231

ACTUAL AND REVISED FORECAST OF CERTIFICATED AIR CARRIER OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: SELECTED YEARS 1967-1995

Year	Enplanements	Average Aircraft Size (Seats)	Enplaning Load Factor	Enplanements Per Departure	Aircraft Departures
Actual					
1967	679,673	70.66	30.88	21.82	31,152
1968	805,413	81.91	22.70	18.60	43,313
1969	840,758	80.30	29.96	24.06	34,949
1970 (Fiscal Year)	870,167	80.71	29.89	24.13	36,068
1971 (Fiscal Year)	895,470	76.01	34.93	26.55	33,724
1972	1,051,653	79.07	37.14	29.37	35,805
1973	1,105,380	86.25	34.35	29.63	37,306
Revised Forecast					
1975	1,212,000	90.00	34.00	30.61	39,600
1980	1,564,000	104.00	35.00	36.37	43,000
1985	1,941,000	120.00	36.00	43.13	45,000
1990	2,358,000	139.00	37.00	51.48	45,800
1995	2,838,000	160.00	38.00	60.77	46,700

Source: R. Dixon Speas Associates, Inc.

Table 232

REVISED FORECAST OF PASSENGER ENPLANEMENTS AND AIR CARRIER AND COMMUTER OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: SELECTED YEARS 1975-1995

	Air Carrier							Commuter		Total	
	Certificated-Scheduled and Nonscheduled		Supplemental-Nonscheduled		Other	Subtotal					
Year	Enplanements	Operations[a]	Enplanements	Operations[a]	Operations[a]	Enplanements	Operations[a]	Enplanements	Operations[a]	Enplanements	Operations[a]
1975	1,212,000	79,200	15,000	750	2,450	1,227,000	82,400	2,800	2,240	1,229,800	84,640
1980	1,564,000	86,000	28,300	1,030	3,070	1,592,300	90,100	5,000	2,800	1,597,300	92,900
1985	1,941,000	90,000	47,000	1,340	3,660	1,988,000	95,000	8,300	3,240	1,996,300	98,240
1990	2,358,000	91,600	75,000	1,780	4,220	2,433,000	97,600	12,200	3,760	2,445,200	101,360
1995	2,838,000	93,400	120,000	2,400	4,800	2,958,000	100,600	14,500	4,020	2,972,500	104,620

[a] *Operations include departures and arrivals, which have been assumed to be equal.*

Source: R. Dixon Speas Associates, Inc.

aircraft registrations for Wisconsin and an increasing regional percentage share of Wisconsin registrations—modified the rather dramatic decline in the forecast of national registrations such that the revised forecast of 2,735 general aviation aircraft registered within the Region in 1990 is only 9 percent below the 3,000 registered aircraft initially forecast for 1990. The comparison between the initial and the revised forecast is shown in Table 236.

The forecast of regionally based aircraft was subdivided by aircraft type, and the probable number of aircraft operations that may be expected to be carried out by the forecast aircraft types was determined. Growth rates for each of nine aircraft types were applied to base year 1973 registrations by type for each county, and subsequently aggregated to obtain a Region total. These forecast growth rates were derived from existing regional growth rates, reviews of independent projections prepared by general aviation aircraft manufacturers relative to the future growth of various aircraft types, and prior work by the Commission's consultant in the general aviation area. The revised forecast of general aviation registrations by aircraft type is shown in Table 237.

This revised forecast by aircraft type represents certain changes from the initial forecast as documented in Chapter VIII of this report. A summary comparison of the two forecasts by major aircraft type for the year 1990 is provided in Table 238. A significant decrease, from 220 to 45, is indicated only in the forecasts of C Type aircraft, the business jet and heavier propeller-driven aircraft. In the past few years, medium- to light-weight turboprop-powered business aircraft have achieved a good market acceptability in the general aviation community. The development of small, reliable turboprop engines, such as the Allison 250 series, as well as new aircraft, such as the Cessna 441, a light twin turboprop aircraft, suggests that few new piston-powered aircraft, formerly classified as greater than 12,500 pounds and 600 horsepower, and therefore C Type aircraft, will be manufactured in the future. The new forecast of air-

Table 233

FORECAST OF ANNUAL AIR CARRIER AND COMMUTER AIRCRAFT OPERATIONS BY TYPE OF AIRCRAFT[a] AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY SELECTED YEARS 1975-1995

Air Carrier Aircraft

Aircraft		Year				
Group	Type	1975	1980	1985	1990	1995
I	AA . .	1,291	3,517	6,163	10,254	12,508
II	AA . .	1,206	3,874	7,513	11,969	17,303
III	AA . .	1,558	4,191	7,360	10,116	17,021
IV	A . . .	2,711	2,850	2,341	1,916	1,964
V	B . . .	47,815	49,795	49,792	47,085	42,819
VI	C . . .	27,819	25,873	21,831	16,260	8,985
Total	--	82,400	90,100	95,000	97,600	100,600

Air Carrier and Commuter Aircraft

Aircraft		Year				
Group	Type	1975	1980	1985	1990	1995
I	AA . .	1,291	3,517	6,163	10,254	12,508
II	AA . .	1,206	3,874	7,513	11,969	17,303
III	AA . .	1,558	4,191	7,360	10,116	17,021
IV	A . . .	2,711	2,850	2,341	1,916	1,964
V	B . . .	47,815	49,795	49,792	47,085	42,819
VI	C . . .	27,819	25,873	21,831	16,260	8,985
VII[b]	--	2,240	2,800	3,240	3,760	4,020
Total	--	84,640	92,900	98,240	101,360	104,620

[a] *Includes scheduled, nonscheduled, supplemental, and other air carrier operations.*

[b] *Commuter air carrier category—equal to or less than 30-seat aircraft.*

Source: R. Dixon Speas Associates, Inc.

Table 234

REVISED FORECAST OF DAILY AND BUSY HOUR PASSENGER ENPLANEMENTS AND AIR CARRIER OPERATIONS AT GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: SELECTED YEARS 1975-1995

Air Activity	Year				
	1975	1980	1985	1990	1995
Certificated and Supplemental Air Carrier					
Passengers					
Annual Enplaning and Deplaining	2,454,000	3,184,600	3,976,000	4,867,200	5,916,000
Average Day	6,723	8,725	10,893	13,335	16,208
Busy Hour	961	1,258	1,540	1,872	2,294
Operations					
Annual	82,400	90,100	95,000	97,600	100,600
Average Day	226	247	260	267	276
Peak Day	314	343	361	371	384
Busy Hour	32	35	36	37	39
Busy Hour as Percent of Average Day	14	14	14	14	14
Commuter					
Passengers					
Annual Enplaning and Deplaining	5,600	10,000	16,600	24,400	29,000
Average Day	15	27	45	67	79
Busy Hour	6	8	15	21	21
Operations					
Annual	2,240	2,800	3,240	3,760	4,020
Average Day	6	8	9	11	11
Peak Day	8	11	13	15	15
Busy Hour	0	1	2	2	1
Total Air Carrier and Commuter					
Passengers					
Annual Enplaning and Deplaining	2,459,600	3,194,600	3,992,600	4,891,600	5,945,000
Average Day	6,740	8,800	10,900	13,400	16,300
Busy Hour	967	1,266	1,555	1,893	2,315
Operations					
Annual	84,640	92,900	98,240	101,360	104,620
Average Day	232	255	269	278	287
Peak Day	322	354	374	386	399
Busy Hour	32	36	38	39	40
Busy Hour as Percent of Average Day	14	14	14	14	14

Source: R. Dixon Speas Associates, Inc.

Table 235

COMPARISON OF INITIAL AND REVISED FORECASTS OF GENERAL AVIATION AIRCRAFT REGISTRATIONS IN THE UNITED STATES: SELECTED YEARS 1975-1995

Year	Initial United States Forecast	Revised United States Forecast	Percent Decrease
1975	178,000	163,860	8
1980	241,000	201,580	16
1985	319,000	239,110	25
1990	424,000	282,310	33
1995	--	332,380	--

Source: R. Dixon Speas Associates, Inc.

Table 236

COMPARISON OF INITIAL AND REVISED FORECASTS OF GENERAL AVIATION AIRCRAFT REGISTRATIONS IN THE REGION: SELECTED YEARS 1975-1995

Year	Forecast		Percent Decrease
	Initial	Revised	
1975	1,220	1,150	6
1980	1,670	1,560	7
1985	2,220	2,085	6
1990	3,000	2,735	9
1995	--	3,500	--

Source: R. Dixon Speas Associates, Inc.

Table 237

ACTUAL AND FORECAST GENERAL AVIATION REGISTRATIONS IN THE REGION
SELECTED YEARS 1973-1995

Aircraft Type	Number of Registered Active Aircraft						
	Actual	Revised Forecast					Average Annual Growth Rate
	1973	1975	1980	1985	1990	1995	1973-1995
Single-Engine Reciprocating							
1-3 Place	413	441	563	700	827	945	3.8
4 or More Place	454	505	714	981	1,341	1,768	6.4
Multi-Engine Reciprocating							
12,500 Pounds and Under	114	128	177	242	324	420	6.1
12,500 Pounds and Over	11	6	--	--	--	--	--
Turboprop							
12,500 Pounds and Under	20	25	47	85	144	238	11.9
12,500 Pounds and Over	--	1	3	6	9	15	14.5
Jet	12	14	19	25	35	46	6.3
Rotor	8	9	14	20	27	39	7.5
Other	21	21	23	26	28	29	1.5
Total	1,053	1,150	1,560	2,085	2,735	3,500	5.6

Source: Federal Aviation Administration, Master Aircraft Registration Tape, 1973; and R. Dixon Speas Associates, Inc.

Table 238

INITIAL AND REVISED FORECASTS
OF GENERAL AVIATION FLEET MIX
IN THE REGION: 1990

Aircraft Type	Forecast				Percent Change
	Initial		Revised		
	Number	Percent of Total	Number	Percent of Total	
C	220	7	45	2	- 80.0
D	472	16	478	18	0.1
E	2,308	77	2,212	80	- 4.0
Total	3,000	100	2,735	100	- 9.0

Source: R. Dixon Speas Associates, Inc.

craft registration also reflects a state of attrition in this particular class of aircraft, the Beach D-18, Lodestar, Areo Commander, and Piper Navajo. The light-weight turboprop-powered aircraft are also expected to reduce the demand for the heavier-weight turboprop aircraft, further reducing the number of C Type aircraft and tending to increase the number of the lighter weight, multi-engine turboprop, D type aircraft over that forecast initially. In addition, acceptability of the less expensive, lightweight turboprop aircraft is also expected to reduce the demand for the business jet such that its use in the revised forecast is only half of that developed in the initial forecast. This change in fleet mix of based aircraft within the Region, especially the reduction in the larger C Type aircraft, suggests reconsideration of the number of the larger basic transport airports required to accommodate the needs of the owners of the C Type aircraft.

The revised forecast of general aviation operations is based upon different aircraft utilization relationships as determined from the most recent FAA records of aircraft use and the number of movements per hour of operation. The comparison in Table 239 shows the variation in aircraft utilization, in terms of annual operations per aircraft type, developed in both forecasts. This table indicates that C and E Type aircraft may be expected to experience a reduced number of annual operations per aircraft, while D Type aircraft may be expected to experience an increased number of operations per aircraft over the operations initially forecast. Since the D Type aircraft is

Table 239

INITIAL AND REVISED FORECASTS OF ANNUAL GENERAL AVIATION OPERATIONS IN THE REGION BY AIRCRAFT TYPE: 1990

Aircraft Type	Forecast	
	Initial	Revised
C	730	690
D	650	800
E	890	800

Source: R. Dixon Speas Associates, Inc.

expected to represent only 18 percent of the total general aviation aircraft mix, the net effect of this modification is an overall 11 percent reduction of annual operations below that initially forecast within the Region. Thus, while the new forecasts indicate that nationally general aviation registrations may be expected to be 33 percent below the initial forecasts, the number of aircraft forecast to be based within the Region in 1990 is only 9 percent below, and the number of operations only 11 percent below, those initially forecast for the Region, as documented in Chapter VIII of this report. Significantly, however, the mix of the general aviation fleet is forecast to be somewhat different than initially developed in that only a relatively limited number of the larger general aviation aircraft are expected to be based at airports within the Region.

Impact of Revised Forecasts Upon System Plan Recommendations

The distribution of the revised forecast of regionally based general aviation aircraft owners to traffic analysis zones was performed through a new application of the demand distribution model developed for the study and described in Chapter IX of this report. New land use information, based upon the revised regional socioeconomic forecasts, was provided by the Regional Planning Commission as input to the demand distribution model. Once the owner address of general aviation aircraft was allocated to a traffic analysis zone for the forecast years 1985 and 1995, the assignment of aircraft to the airports within the recommended regional airport system plan was made through application of the same methodology used throughout the system plan effort, whereby aircraft allocated to each traffic analysis zone are assigned to the closest airport capable of handling the aircraft type. A comparison of air activity forecasts, in terms of based aircraft and annual operations, developed under the initial forecast conditions and the revised forecast conditions is shown in Table 240.

Although the revised forecast of aviation activity indicates less activity than initially forecast for 1990, the extension of the planning period to 1995 under the conditions of revised aviation activity and regional demographic and economic forecasts does result in the assignment of more aircraft and related aircraft operations to the system airports than initially forecast for 1990. The increased total regional demand for based aircraft, aircraft operations, and the redistribution of aircraft owners based upon the new population, economic, and land use factors for 1995 results, as shown in Table 240, in an increased based aircraft assignment to each of the 14 system airports except Kenosha Municipal and General Mitchell Field. The number of aircraft operations increased at only 10 of the 14 system airports, and the airport capacity was not exceeded at any of the airports. However, whereas only the Waukesha County airport was forecast to operate at near 90 percent of capacity in 1990 under the prior forecasts, three system airports—Ozaukee, West Bend, and Waukesha—may be expected to operate near 90 percent of capacity in 1995 under the revised forecast conditions.[5]

Demand as a percent of airport runway system capacity in 1995 is expected to be less than initially forecast for 1990 at the Kenosha Municipal and General Mitchell Field airports; is expected to remain the same at the Racine Commercial airport; and is expected to increase from 1 to 5 percent at three airports, from 6 to 10 percent at three airports, 12 percent at one airport, and over 15 percent at two airports—Hartford Municipal (22 percent) and West Bend Municipal (34 percent). Nine of the 14 system airports are expected to operate above 60 percent of capacity in 1995. This is in contrast to seven airports expected to operate above 60 percent of capacity in 1990 under the initial forecasts and only four in 1990 under the revised forecasts.

The airport development standards suggest that planning for added runway capacity be initiated when operations exceed 60 percent of capacity of the airport. Of the nine system airports in this category by 1995, only the Waukesha County Airport is expected to operate above 65 percent of capacity in 1990, and only the West Bend and Waukesha County Airports may be expected to operate above 75 percent of capacity in 1995. Although the Ozaukee Airport may be expected to operate at 89 percent of capacity in 1995 as a basic transport airport, as shown in Table 240, for reasons described later the airport is recommended to be reclassified as a general utility airport and may be expected to operate at 73 percent of its runway system capacity in 1995 as a general utility airport. Based upon this and further analysis relating to the assignment of C Type aircraft and evaluation of forecasts of annual instrument approaches, the implications of the new forecast of demand for general aviation activity for the recommended airport system plan may be summarized as follows:

[5] *This analysis reflects classification of the Ozaukee Airport as basic transport. Based upon subsequent analysis, the classification was changed to general utility, and demand as a percent of capacity was reduced to 73 percent.*

Table 240

INITIAL AND REVISED FORECASTS OF GENERAL AVIATION AIR ACTIVITY AT AIRPORTS INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN: 1990

County	Airport	Airport Classification	Airport Runway System Capacity-PANCAP (In Thousands)	Initial Forecast—1990			Revised Forecast—1990			Revised Forecast—1995		
				Aircraft Assigned	Annual Operations (In Thousands)	Demand as Percent of Capacity	Aircraft Assigned	Annual Operations (In Thousands)	Demand as Percent of Capacity	Aircraft Assigned	Annual Operations (In Thousands)	Demand as Percent of Capacity
Kenosha	Kenosha Municipal . . .	BT	337.6	294	252.4	75	213	170.2	51	286	232.8	69
Milwaukee	General Mitchell Field .	ST	400.0	249	308.2[b]	77	180	258.8[c]	65	211	300.9[d]	75
	Timmerman Field. . . .	GU	501.7	370	316.8	63	379	303.2	60	419	341.5	68
Ozaukee	Ozaukee	BT	253.3	231	195.3	77	208	165.6	65	277	225.0	89
Racine	Burlington Municipal . .	BT	253.3	194	163.4	65	163	130.6	52	231	188.5	74
	Racine Commercial . . .	BT	253.3	163	140.0	55	118	94.0	47	170	138.2	55
	Sylvania	BU	319.0	188	161.3	51	170	135.7	43	205	165.4	52
Walworth	East Troy Municipal . .	BU	319.0	218	194.4	61	200	160.0	50	253	203.8	64
	Gruenwald.	GU	306.3	150	125.9	41	142	113.6	37	180	147.4	48
	Playboy[a]	BU-R	--	16	14.7	--	21	17.0	--	20	15.8	--
	Lake Lawn Lodge[a] . . .	BU-R	--	11	9.5	--	14	10.9	--	16	13.1	--
Washington	Hartford Municipal . . .	GU	306.3	165	138.1	45	191	153.1	50	249	205.1	67
	West Bend Municipal . .	BT	253.3	177	148.4	59	200	159.1	63	290	236.3	93
Waukesha	Waukesha County	BT	337.6	356	299.9	89	342	272.4	83	397	322.0	95
Outside the Region	--	--	--	214	--	--	194	--	--	295	--	--
Unassigned	--	--	--	2	--	--	0	--	--	1	--	--
Total	--	--	--	3,000	--	--	2,735	--	--	3,500	--	--

[a] *Private airports assumed to serve a limited amount of general aviation demand.*

[b] *Includes forecast of 168,400 general aviation, 124,700 air carrier, and 15,100 military operations.*

[c] *Includes forecast of 142,300 general aviation, 101,400 air carrier, and 15,100 military operations.*

[d] *Includes forecast of 181,200 general aviation, 104,600 air carrier, and 15,100 military operations.*

Source: SEWRPC.

- Ozaukee Airport—the new demand forecast offers little justification for improving this airport to a basic transport classification during the planning design period, since only five C Type aircraft are assigned to this airport in contrast with the 18 assigned under the initial forecast. It is believed that these aircraft could easily be relocated to other airports in the system without serious inconvenience to the owners. Under these circumstances, the Ozaukee Airport is recommended to remain classified as a general utility airport throughout the planning period rather than be expanded to the basic transport airport as recommended earlier in this chapter. Table 241 updates Table 216 and sets forth the improvements recommended for the Ozaukee Airport resulting from the reanalysis effort.

- Racine Commercial Airport—This basic transport airport was recommended for full instrument landing system based upon a forecast of instrument operations that exceeded the FAA eligibility minimum. The new forecast is below the entry criteria in 1990. Therefore, the current forecast level of activity at Racine Commercial suggests that planning for a precision instrument landing system should be deferred until after 1990.

- Kenosha Municipal Airport—the new demand forecast assigns only five C Type aircraft to this airport in 1990, in contrast to the prior forecast assignment of 26 C Type aircraft, which assignment supported the classification of the Kenosha Municipal Airport as a basic transport airport. The new forecast indicates that development to this classification can be deferred until 1990 in view of the limited demand for the larger aircraft in the general aviation fleet.

Other than the above-mentioned changes, no significant adjustments to the recommended airport classifications or runway systems and instrumentation were identified

Table 241

REVISED SITE REQUIREMENT RECOMMENDATIONS FOR THE OZAUKEE AIRPORT

General Conditions	
Airport Classification	Existing—Less Than Basic Utility—Stage I Proposed—General Utility
Aviation Demand	
Annual Operations	1971 Inventory—3,500 1995 Revised Forecast—221,500
Based Aircraft	1971 Inventory—3 1995 Revised Forecast—272
Runway System Capacity (PANCAP)	Existing—91,000 Proposed—306,300
IFR Capability	Nonprecision Instrument Approach[a]
Land Requirements	
Acquire existing privately owned airport (90 acres) and improvements	
Total Estimated Cost	$ 135,000
Site Expansion (Acres)	150
Clear Zone Protection (Acres)	80
Total Estimated Cost	$ 299,000
Operational Area Improvements	
Construct new north-south primary runway: 75 feet x 4,000 feet	
Construct new east-west secondary runway: 75 feet x 3,200 feet	
Construct taxiway parallel to north-south runway: 40 feet x 4,400 feet	
Construct taxiway parallel to east-west runway: 40 feet x 3,600 feet	
Install lighting and visual aids	
MIRL—north-south runway	
MIRL—east-west runway	
Taxiway exit lights	
VASI-2—north-south runway, north end	
REILS—both runways, both ends	
Construct additional aircraft parking apron: 38,700 square yards	
Construct air traffic control tower	
Install nonprecision instrument landing system approach to north end of primary runway	
Total Estimated Cost	$1,560,000
Terminal Area Improvements	
Construct new administration/terminal building: 7,400 square feet	
Construct auto parking and service road: 12,200 square yards	
Total Estimated Cost	$ 542,500
Hangar Area Improvements	
Construct new hangar storage and service area: 21,000 square yards	
Total Estimated Cost	$1,580,000
Ground Access Facilities	
No additional facilities necessary	
Utility Services	
Extend utility service from proposed Port Washington sewer service area	
Total Estimated Cost	$ 18,000
Total Estimated Capital Investment	$4,134,500

[a] *See the section entitled "Aircraft Operational Area" for a discussion on the relationship between physical facilities and IFR capabilities.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

in the analysis of the impact of a revised forecast of aviation activity upon the recommended general aviation airports within the system plan. It should be noted, however, that the demand for terminal facilities, hangar space, and apron areas requires some adjustment in the plan and monitoring prior to construction to reflect the changes in based aircraft assignment. Further, the demand-capacity relationships at particularly the Waukesha County and West Bend Municipal Airports should be carefully monitored to determine the need for adding capacity beyond the planning period. A summary of airport facility recommendations and associated costs, revised in response to the reanalysis, for each of the airports within the Region is shown in Table 242.

The modifications to the forecast air carrier demand has a varied impact upon facility recommendations for the regional air carrier airport at General Mitchell Field. The decrease in forecast passenger enplanements, both on an annual and busy hour basis, may affect "people-related" airport facility recommendations, such as terminal and auto parking facilities. The "airside" improvements must take into account the reduced number of annual operations, a changed fleet mix, and an increased number of busy hour operations. Basic runway system recommendations remain the same as developed initially to provide facilities for the air carrier movements. The change in fleet mix results in an increased runway system capacity, and would thus permit operations by E Type aircraft. Under conditions of increased capacity, it should not be necessary to use Runway 7L/25R for business jet traffic, and thus not subject new areas of the neighboring communities to adverse noise impacts from aircraft operations. A similar number of terminal gate facilities will be required to accommodate the busy hour demands of the air carriers. The 1985 stage of the terminal area development plan for General Mitchell Field prepared by Herbert H. Howell, Airport Consultant, has been used as representative of the conditions forecast for 1990-1995 under the revised forecast conditions listed in Table 242.

Summary of the Recommended Airport System Improvements

A summary of the recommended regional airport system plan developed from the extensive evaluation of alternative system plans, refined and detailed and further adjusted through analysis of the impact of revised aviation activity and population forecasts in this chapter, is provided in Table 243. The table shows the recommended classification of, and the probable future aviation activity forecast at, each airport comprising the recommended regional airport system plan. The airport development standards described in Chapter VII of this report have been used as a basis for the development of the airport facility improvements recommended to serve the revised forecast demand. The recommended runway facilities and associated IFR capability for each airport and a comparison of the recommended improvements with the development standards are also shown in Table 243. All design standards generally have been met in developing needed improvement proposals to the airport contained in the regional airport system plan. It can be noted that the minimum standard for basic transport airports requires provision of a nonprecision instrument approach to the airport. For each of the basic transport airports within the regional airport system plan, the forecast of aviation activity is such that the requirements for installation of a precision instrument approach system are met, and such instrumentation is recommended.

Provision of 150-foot wide runways and high-intensity runway lighting are also recommended with installation of a precision instrument landing system. However, as has been noted elsewhere in this chapter, increasing runway width and achieving associated separation standards with installation of a precision instrument landing system may be unjustified at existing airports. Table 243 indicates that, except for the new runway at the Kenosha Municipal Airport, which is proposed to be developed in accordance with criteria relating to precision instrument landing systems, all other runways at proposed basic transport airports are recommended to be 100 feet wide, which runway width is related to nonprecision approach criteria. It is assumed that the separation standards which are sufficient for nonprecision instrumentation will be met in the expansion of existing airports to the basic transport criteria. Table 243 also indicates that high-intensity runway lighting is recommended to be provided for the primary runway at the basic transport airports with precision instrument approach facilities, and that medium-intensity runway lighting is recommended for the secondary runways at the basic transport airports and for the primary and secondary runways at the general utility airports, thus providing full nighttime capability on both runways. Except for the crosswind runway at the Waukesha County Airport, which cannot be extended because of adverse topography, all of the runways meet or exceed the design length criteria established for development of the regional airport system plan.

The recommended facilities at each airport were designed in accordance with those specific conditions that could be considered at the system planning level, taking into account topography, adjacent development, impact upon and availability of adjacent lands, local interests, prior studies conducted by the Wisconsin Department of Transportation, Division of Aeronautics, and information from airport master planning studies currently in progress. These recommendations can be used as a guide to subsequent, more detailed and refined planning work at each specific airport location.

SYSTEM DEVELOPMENT PROGRAM AND FINANCIAL ANALYSIS OF THE RECOMMENDED AIRPORT SYSTEM PLAN

Implementation of recommended improvements at airports comprising the regional system over the next 20 to 25 years must be accomplished in an orderly manner that is both responsive to the aviation needs of the Region and consistent with the financial capabilities

Table 242

SUMMARY OF RECOMMENDED FACILITY IMPROVEMENTS AND ESTIMATED COSTS UNDER THE REVISED AIR ACTIVITY FORECASTS: 1975-1995

County	Airport	Land Requirements		Operational Area Improvement Cost[a]	Terminal Area Improvements		Auto Parking and Onsite Road Improvements	
		Acres	Cost		Square Feet	Cost	Number of Stalls	Cost
Kenosha	Kenosha Municipal	500	$ 1,782,000	$ 4,486,100	8,500	$ 637,500	390	$ 60,900
Milwaukee	General Mitchell Field . .	70	2,060,000	22,800,000	--	43,090,000[c]	4,800	16,690,000[b]
	Timmerman Field	33	1,540,000	1,248,300	9,700	756,600	350	56,900
Ozaukee	Ozaukee County	320	434,000	1,675,000	8,300	649,700	440	71,800
Racine	Burlington Municipal . . .	233	607,500	2,486,000	6,600	500,000	360	57,000
	Racine Commercial	665	5,744,000	1,419,200	7,100	532,500	370	58,700
	Sylvania.	162	474,500	857,700	7,250	471,300	385	62,500
Walworth	East Troy Municipal. . . .	120	194,000	932,800	7,800	507,000	390	62,900
	Gruenwald	306	449,800	1,522,100	7,250	565,500	385	62,600
Washington	Hartford Municipal	95	333,500	923,000	8,000	624,000	385	64,200
	West Bend Municipal . . .	215	542,100	2,180,500	8,600	645,000	345	53,100
Waukesha	Waukesha County	140	1,535,000	2,123,300	8,100	607,500	265	41,400
Total	--	--	$15,696,400	$42,654,000	--	$49,586,600	--	$17,342,000

County	Airport	Hangar Improvements[b]		Offsite Surface Transportation Costs	Utility Service Cost	Total Estimated Capital Investment
		Square Yards	Cost			
Kenosha	Kenosha Municipal	24,300	$ 1,832,200	$ --	$ --	$ 8,798,700
Milwaukee	General Mitchell Field . . .	10,900	821,900	--	--	85,461,900
	Timmerman Field	25,000	1,885,000	--	--	5,486,800
Ozaukee	Ozaukee County	29,300	2,209,200	--	18,000	5,057,700
Racine	Burlington Municipal	25,500	1,922,700	115,000	--	5,688,200
	Racine Commercial	17,100	1,289,300	200,000	--	9,243,700
	Sylvania.	17,200	1,296,900	--	18,000	3,180,900
Walworth	East Troy Municipal.	20,200	1,523,000	--	--	3,219,700
	Gruenwald	20,000	1,508,000	--	18,000	4,126,000
Washington	Hartford Municipal	23,900	1,802,100	--	29,000	3,775,800
	West Bend Municipal	22,700	1,711,600	519,000	29,000	5,680,300
Waukesha	Waukesha County	26,800	2,020,700	187,000	--	6,514,900
Total	--	--	$19,822,600	$1,021,000	$112,000	$146,234,600

[a] *Includes cost to construct, extend, and improve runways and taxiways, aircraft parking apron, and lighting and navigation aids, but does not include cost to provide tower and landing and lighting approach systems, which are borne entirely by the Federal Aviation Administration.*

[b] *These improvements are considered to be self-amortizing.*

[c] *Includes $2,830,000 estimated cost to provide cargo terminal area, which is considered to be self-amortizing.*

Source: *R. Dixon Speas Associates, Inc. and SEWRPC.*

Table 243

SUMMARY OF PROPOSED AIRPORT CHARACTERISTICS AND DESIGN STANDARDS FOR AIRPORTS IN THE REGION INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN: 1995

Airport	Forecast Aviation Activity—1995		PANCAP	IFR Capability	Runway Characteristics					
					Primary			Secondary		
	Based Aircraft	Annual Operations			Length[a] (Feet)	Width (Feet)	Lighting	Length[a] (Feet)	Width (Feet)	Lighting
Scheduled Air Transport Standards.	--	--	--	Precision (Category II)	5,500 - 11,500	200[c]	HIRL[e]	4,400 - 9,200	200[c]	HIRL
General Mitchell Field. .	211	300,900	400,000	Precision (Category II)	11,500	200	HIRL	9,000	150	HIRL
Basic Transport Standards.	--	--	--	Nonprecision	4,600 Minimum	100[d]	HIRL[f]	3,680 Minimum	100	--
Burlington Municipal . .	231	188,500	253,300	Precision	5,400	100	HIRL	4,300	100	MIRL
Kenosha Municipal. . . .	286	232,800	337,600	Precision	7,000	150	HIRL	4,500	100	MIRL
Racine Commercial . . .	170	138,200	253,300	Precision	5,800	100	HIRL	4,600	100	MIRL
Waukesha County	397	322,000	337,600	Precision	5,800	100	HIRL	3,600	75	MIRL
West Bend Municipal[b]. .	295	239,800	253,300	Precision	5,500	100	HIRL	4,500	100	MIRL
General Utility Standards.	--	--	--	Nonprecision	3,200	75	MIRL[g]	2,560	75	
Gruenwald	180	147,400	306,300	Nonprecision	4,000	75	MIRL	3,200	75	MIRL
Hartford Municipal . . .	249	205,100	306,300	Nonprecision	3,800	75	MIRL	3,000	75	MIRL
Ozaukee[b]	272	221,500	306,300	Nonprecision	4,000	75	MIRL	3,200	75	MIRL
Timmerman Field	419	341,500	501,700	Nonprecision	4,017	100	MIRL	3,200	100	MIRL
Basic Utility Standards.	--	--	--	VFR	2,700	60 or 75	MIRL	2,160	60 or 75	--
East Troy Municipal. . .	253	203,800	319,000	VFR	3,200	60	MIRL	2,560	60	MIRL
Sylvania.	205	165,400	319,000	VFR	3,200	60	MIRL	2,560	60	MIRL

[a] *Runway length standards are representative of sea level elevations. To meet comparable standards, runway lengths at regional airports must be increased about 25 percent to account for the increase in elevation.*

[b] *When Ozaukee Airport was reclassified as a general utility airport, forecast of 5 "C" type aircraft and 3,500 associated operations were reassigned from Ozaukee Airport to West Bend Municipal Airport.*

[c] *Runway width of 200 feet is recommended for runways serving "AA" type aircraft and for new runway construction. Runway width of 150 feet is recommended for runways serving "A" and "B" type aircraft.*

[d] *Runway width of 150 feet is recommended for runways equipped with precision instrument landing system approach.*

[e] *High-intensity runway lighting.*

[f] *HIRL recommended on runways equipped with precision instrument landing system.*

[g] *Medium-intensity runway lighting.*

Source: SEWRPC.

of the implementing federal, state, and local agencies. A staged development program was prepared for each airport included in the recommended system, which if followed would result in construction of recommended airport facility improvements and provision of airport capability, in terms of runway system capacity and type of aircraft served, in a manner consistent with the forecast of aviation demand anticipated at each system airport. The program identifies the airport operating and maintenance costs expected to be incurred during the implementation period to 1995 as well as the capital costs associated with the needed facility improvements and land acquisition, and identifies the federal , state, and local revenues anticipated to be available to support improvement implementation and airport operation. Although federal and state funds are generally available for eligible airport improvements, local funds, including both airport-generated revenues and tax levies, must be used to match the federal and state monies for capital improvements eligible for federal and state aids; to undertake capital improvements not eligible for federal and state aids; and to operate and maintain the system airports. Of the total capital cost of the recommended airport system plan of about \$146 million, federal and state aids are considered available to assist in the acquisition of land, estimated to cost about \$15.7 million, including about \$3.9 million to purchase the existing privately owned Gruenwald, Ozaukee, Racine Commercial, and Sylvania Airports; to assist in the development of airport operational improvements such as runways, taxiways, aircraft parking aprons, lighting, and navigational aids, estimated to cost about $42.7 million; and to assist in the relocation of ground transportation facilities required to permit airport expansion, estimated to cost about $1.0 million.

Limited state aids up to $35,000 for eligible building projects are available to assist local airport sponsors in the development of terminal, administration, and auto parking facilities and attendant utility systems. The capital investment needed for these types of facilities is estimated to be about $67 million, including $57.6 million for expanded passenger and cargo terminal facilities at General Mitchell Field. Three major elements comprise the proposed terminal facilities at General Mitchell Field—the expanded passenger terminal building estimated to cost about $38.1 million, a 4,800-stall auto parking structure estimated to cost about $16.7 million, and the new cargo terminal area estimated to cost about $2.8 million. For purposes of the financial analysis, it was assumed that parking structure fees and cargo terminal area rentals would be established at a level which would permit the amortization of the cost of the new facilities without use of tax levies. It was further assumed that revenues associated with the passenger terminal facility would be available to reduce local sponsor capital investment cost obligations after meeting airport operating and maintenance costs. The estimated capital investment need of about $19.8 million for the provision of airplane storage and service hangars should also be self-amortizing under lease agreements between the private users of hangar space and the airport sponsor. Thus, of the total of about $146.2 million required for airport system plan development, about $106.9 million may be expected to require local sponsor revenue support and may be expected to be eligible for applicable federal and state aids.

In addition to providing the local share of funds to match state and federal aids available for airport facility improvement, the local units of government must also be prepared to assume the operating and maintenance costs of the recommended system of airports. Although some revenues are generated at airports through fuel sales, landing fees, land rental, and agreements with fixed-base operators, the revenues are generally not sufficient to offset airport operating and maintenance costs. As described in Chapter VI, the revenues generated at the seven publicly owned general aviation airports within the Region from 1966 to 1970 represented from 20 to 50 percent of the expenditures incurred to operate and maintain those airports. Together, the seven general aviation airports generated average annual revenues that equaled about 42 percent of average annual expenditures. In contrast, General Mitchell Field has been able to generate revenues that have exceeded the airport operating and maintenance costs by a factor of 1.7.

Analysis of other airport operating statements, particularly the financial statements of the Minneapolis-St. Paul Metropolitan Airports Commission (MAC) referenced in Chapter XI, indicates that revenues at general aviation airports generally may be expected to cover from 30 to 90 percent of annual expenditures, as shown in Table 244. Based upon the belief that the recommended system plan should provide an effective guide and discipline to the efficient and cost effective provision of airport facilities, and impose a limited burden upon the general, nonaviation oriented local taxpayer, it is recommended that an airport use revenue structure be developed at all airports in the system that is at least capable of meeting actual airport operation and maintenance costs. Recognizing, however, that some airport sponsors may choose to subsidize airport operations and to provide a conservative financial analysis, airport revenues meeting only 85 percent of annual expenditures, not including major capital investments, have been assumed in the subsequent analysis. Those airport operation and maintenance costs not offset by airport revenues become a local responsibility.

The estimated capital investment and airport operating and maintenance costs, in 1973 dollars for each system airport for four five-year periods to the year 1995, in accordance with the staged development plan for implementation, are summarized in Table 245. The total capital cost of $106.9 million represents only the cost of those improvement projects that require local, state, and federal aids, and does not include those improvements considered to be self-amoritizing—the $19.8 million for hangar facilities at all system airports and the $19.5 million for auto parking and cargo area improvements at General Mitchell Field. This summary table is further detailed in a set of tables included in Appendix H which list, for each airport, the 20-year facility improvement staging program and attendant capital costs; the forecast of annual aircraft operations and associated airport operation and maintenance costs; estimated annual airport revenues based upon recovery of 85 percent of operation and maintenance costs at general aviation airports through user fees and a factor of 1.5 times the

Table 244

RATIO OF AIRPORT REVENUES TO OPERATION AND MAINTENANCE COSTS AT FIVE MINNEAPOLIS-ST. PAUL METROPOLITAN AIRPORTS: 1970-1973

Airport	Airport Classification	Ratio of Revenues to Costs			
		1970	1971	1972	1973
Holman	BT	0.80	0.59	0.52	0.59
Flying Cloud . .	GU	0.89	0.67	0.65	0.62
Anoka County .	GU	0.44	0.28	0.44	0.34
Crystal	BU	0.70	0.52	0.64	0.43
Lake Elmo	BU	0.88	0.96	0.59	0.89

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 245

SUMMARY OF ESTIMATED CAPITAL AND OPERATION AND MAINTENANCE COSTS FOR AIRPORTS INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN: 1975-1995

County	Airport	1975-1980		1981-1985		1985-1990		1991-1995		Total 1975-1995	
		Capital Cost	Operation and Maintenance Cost	Capital Cost	Operation and Maintenance Cost	Capital Cost	Operation and Maintenance Cost	Capital Cost	Operation and Maintenance Cost	Capital Cost[a]	Operation and Maintenance Cost
Kenosha	Kenosha Municipal	$ 1,927,000	$ 201,825	$ 720,000	$ 249,075	$ 1,109,500	$ 319,635	$ 3,210,000	$ 551,680	$ 6,966,500	$ 1,322,215
Milwaukee	General Mitchell Field . .	17,800,000	6,232,319	14,970,000	7,041,342	17,180,000	7,631,340	15,170,000	7,914,000	65,120,000	28,819,001
	Timmerman Field.	828,150	210,586	1,164,750	309,574	702,150	408,314	906,750	477,764	3,601,800	1,406,238
Ozaukee	Ozaukee County	434,000	43,500	922,350	126,000	607,150	203,040	885,000	281,610	2,848,500	654,150
Racine	Burlington Municipal . . .	1,472,500	325,997	767,800	343,276	999,600	418,312	525,600	519,829	3,765,500	1,607,414
	Racine Commercial	749,750	212,000	5,781,500	272,000	910,650	335,200	512,500	401,600	7,954,400	1,220,800
	Sylvania	--	66,675	474,500	142,800	730,850	208,075	678,650	204,533	1,884,000	622,083
Walworth	East Troy Municipal . . .	194,000	241,700	504,800	276,400	569,900	198,880	428,050	177,520	1,696,750	894,500
	Gruenwald	--	48,600	1,021,800	132,975	839,300	212,400	756,900	286,020	2,618,000	679,995
Washington	Hartford Municipal	333,500	147,634	429,150	228,054	558,050	262,911	653,000	260,864	1,973,700	899,463
	West Bend Municipal . . .	1,061,100	276,066	1,013,750	380,021	1,195,750	491,242	698,100	627,510	3,968,700	1,774,839
Waukesha	Waukesha County.	1,535,000	662,630	892,000	727,630	1,418,300	802,620	648,900	936,780	4,494,200	3,129,660
Total	–	$26,335,000	$8,669,532	$28,662,400	$10,229,147	$26,821,200	$11,491,969	$25,073,450	$12,639,710	$106,892,050	$43,030,358

[a] *Does not include capital cost to construct hangar improvements which have been assumed to be self-amortizing and have been estimated to require a capital investment of $19,822,640 over the implementation period nor the capital costs to construct auto parking and cargo area improvements at General Mitchell Field, which have been estimated to require a capital investment of $16,690,000 and $2,830,000, respectively, over the implementation period.*

Source: SEWRPC.

operation and maintenance costs at General Mitchell Field; estimated federal and state funds available for capital improvements; and local funds required for capital improvements and net plan costs, including capital and operating costs to the local public airport sponsor. These elements are summarized by cost and revenue item and by five-year time period to 1995 in Table 246. The capital investments required for aircraft hangar facilities at all system airports have been excluded from the information summarized in Table 246 and detailed in the set of tables included in the appendix because those capital costs should be fully self-amortizing. The net plan cost to local sponsors by time period and average annual cost per five-year time period are also shown in Table 246.

These financial data are further summarized on an average annual basis by two airport system components, air carrier airport and general aviation airports, in Table 247. This table indicates that the total average annual cost of the proposed capital improvement program, about $5.3 million, may be expected to require about $2.6 million of local funds, about $2.3 million of federal grants-in-aid, and about $0.4 million of state grants-in-aid. The impact of the capital improvements at General Mitchell Field upon total system plan costs are clearly evident from the table, which further indicates that $3.3 million, or about 61 percent of the total capital investment requirement, may be expected to be incurred at the regional air carrier airport, and that $2.1 million, or 79 percent of the total local capital fund requirements, may be expected to be incurred at that airport, reflecting the significant costs associated with renovating the passenger terminal facilities. The excess of airport operating revenues over airport operation and maintenance costs, averaging about $720,000 per year, may be used to reduce the net plan cost of General Mitchell Field to an average of $1.4 million per year. The average net plan cost, including both capital and operation costs, to the local sponsors of the 11 publicly owned general aviation airports within the system plan may thus be expected to approximate $660,000 per year.

The history of airport facility expenditures and current revenues available from federal, state, and local airport development programs has been described in Chapter VI.

Based upon current programs and funding levels, federal, state, and local funding levels for airport capital improvements within Wisconsin may be expected to average about

Table 246

COMPARISON OF ESTIMATED AIRPORT SYSTEM COSTS, REVENUES, AND GRANT-IN-AID REQUIREMENTS FOR GENERAL AVIATION AIRPORTS IN THE REGION AND FOR GENERAL MITCHELL FIELD—MILWAUKEE COUNTY: 1975-1995

Time	Operation and Maintenance Costs	Airport Revenues	Net Cost (Surplus)	Capital Cost[a]	Capital Funding Source			Net Plan Cost to Local Sponsors (Surplus)	Average Annual Net Plan Cost to Local Sponsors (Surplus)
					Federal	State	Local		
1975-1980									
General Aviation Airports . .	$ 2,437,213	$ 2,071,631	$ 365,582	$ 8,535,000	$ 6,401,256	$1,066,872	$ 1,066,872	$ 1,432,454	$ 286,491
General Mitchell Field	6,232,319	9,348,478	(3,116,159)	17,800,000	13,350,000	2,225,000	2,225,000	(891,159)	(178,232)
Total	$ 8,669,532	$11,420,109	($ 2,750,577)	$ 26,335,000	$19,751,256	$3,291,872	$ 3,291,872	$ 541,295	$ 108,259
1981-1985									
General Aviation Airports . .	$ 3,187,805	$ 2,709,634	$ 478,171	$ 13,692,400	$ 9,511,024	$1,690,163	$ 2,491,213	$ 2,969,384	$ 593,877
General Mitchell Field	7,041,342	10,562,013	(3,520,671)	14,970,000	1,800,000	335,000	12,835,000	9,314,329	1,862,866
Total	$10,229,147	$13,271,647	($ 3,042,500)	$ 28,662,400	$11,311,024	$2,025,163	$15,326,213	$12,283,713	$2,456,743
1986-1990									
General Aviation Airports . .	$ 3,860,629	$ 3,281,535	$ 579,094	$ 9,641,200	$ 5,232,800	$1,047,125	$ 3,361,275	$ 3,940,369	$ 788,074
General Mitchell Field	7,631,340	11,447,010	(3,815,670)	17,180,000	1,290,000	250,000	15,640,000	11,824,330	2,364,866
Total	$11,491,969	$14,728,545	($ 3,236,576)	$ 26,821,200	$ 6,522,800	$1,297,125	$19,001,275	$15,764,699	$3,152,940
1991-1995									
General Aviation Airports . .	$ 4,725,710	$ 4,016,854	$ 708,856	$ 9,903,450	$ 4,738,544	$1,034,753	$ 4,130,153	$ 4,839,009	$ 967,802
General Mitchell Field	7,914,000	11,871,000	(3,957,000)	15,170,000	3,652,500	643,750	10,873,750	6,916,750	1,383,350
Total	$12,639,710	$15,887,854	($ 3,248,144)	$ 25,073,450	$ 8,391,044	$1,678,503	$15,003,903	$11,755,759	$2,351,152
20-Year Total									
General Aviation Airports . .	$14,211,357	$12,079,654	$ 2,131,703	$ 41,772,050	$25,883,624	$4,838,913	$11,049,513	$13,181,216	$ 659,061
General Mitchell Field	28,819,001	43,228,501	(14,409,500)	65,120,000	20,092,500	3,453,750	41,573,750	27,164,250	1,358,213
Total	$43,030,358	$55,308,155	($12,277,797)	$106,892,050	$45,976,124	$8,292,663	$52,623,263	$40,345,466	$2,017,274
Average Annual Costs Over 20-Year Period									
General Aviation Airports . .	$ 710,568	$ 603,983	$ 106,585	$ 2,088,602	$ 1,294,181	$ 241,946	$ 552,476	$ 659,061	$ --
General Mitchell Field	1,440,950	2,161,425	(720,475)	3,256,000	1,004,625	172,687	2,078,688	1,358,213	--
Total System	$ 2,151,518	$ 2,765,408	($ 613,890)	$ 5,344,602	$ 2,298,806	$ 414,633	$ 2,631,164	$ 2,017,274	$ --

[a] *Does not include self-amortizing improvements such as auto parking and cargo terminal areas at General Mitchell Field and hangars at all system airports.*

Source: SEWRPC.

Table 247

AVERAGE ANNUAL COSTS AND REVENUES FOR AIRPORTS INCLUDED IN THE REGIONAL AIRPORT SYSTEM PLAN: 1975-1995

Average Annual Costs and Revenues	Total System Airports (12)	Air Carrier Airport (1)	General Aviation Airports (11)
Operation and Maintenance Costs.	$2,151,500	$1,441,000	$ 710,500
Airport Operating Revenues	2,765,400	2,161,400	604,000
Net Airport Operating Costs (Surplus).	(614,000)	(720,500)	106,500
Total Capital Costs	5,344,600	3,256,000	2,088,600
Capital Funding Source			
Federal	2,298,800	1,004,600	1,294,200
State	414,600	172,700	241,900
Local.	2,631,200	2,078,700	552,500
Net Plan Cost to Local Airport Sponsors	2,017,200	1,358,200	659,000

Source: SEWRPC.

$5.0 million, $0.5 million,[6] and $2.0 million per year, respectively. These estimated federal and state resources must be apportioned among all the various regions of the state. Southeastern Wisconsin, although comprising only about 5 percent of the total area of the state, contains about 40 percent of the state's total population, about 40 percent of the state's total employment, about 40 percent of the state's tangible wealth as measured by equalized valuation, about 35 percent of the state's total based general aviation aircraft, and in 1970, enplaned about 65 percent of all passengers boarding aircraft at the ten Wisconsin airports serving certificated airlines.

On the basis of these relationships, it would appear reasonable that the Region should receive between 45 and 55 percent of the federal and state monies available for airport expenditures. Assuming that about 50 percent of the federal and state monies would be available for airport development within southeastern Wisconsin, approximately $2.7 million per year of federal ($2.5 million) and state ($0.25 million) funds would be available for matching with local resources for recommended airport facility development, which approximate the average annual level of federal and state aids of $2.7 million required for full implementation of the recommended plan. However, the recent ten-year (1963-1972) record of local funding for capital improvement projects at the eight publicly owned airports has averaged only about $255,000 per year, an average of $183,000 per year at General Mitchell Field, and $73,000 per year at the seven general aviation airports, well below the average annual local fund requirements of $2.6 million for full implementation of the recommended plan. In recent years, however, expenditures approximating $1.4 million have been made at General Mitchell Field, which is equivalent to the average annual cost to implement the recommended improvements.

Several alternative courses of action may be considered, separately or in combination, to meet the local public financial resource requirements for implementation of the regional airport system plan: substantially increase local funding through tax levies, provide a state subsidy for operation and maintenance costs, provide increased state grants for certain capital improvements, increase user fees to recover more of both capital and operation and maintenance costs, and extend the implementation period of the recommended airport system plan to reduce average annual funding requirements.

If increased state aids for capital improvements were made available by providing up to 50 percent of the cost of terminal and airport buildings at general aviation airports,[7] the average annual capital investment requirements of the local general aviation airport sponsors would be reduced from the $550,000 level identified in Table 247 to about $415,000, while average annual state aids would increase to about $377,000. Provision of a $10,000 per year state operation and maintenance subsidy for each system airport would eliminate the $106,500 operating subsidy from local sources identified in Table 247 based upon an assumed user fee structure which would recover 85 percent of the airport operation and maintenance costs. Increasing user fees to recover, at a minimum, all operation and maintenance costs as equity would demand would also eliminate the annual operating subsidy from local sources.

The airport facility plan elements recommended at each airport were reviewed to identify potential deferrals in plan implementation that would reduce system plan costs with a minimum adverse impact on airport system runway capacity or safety. Reductions in the size and amount of terminal and airport buildings and aircraft and auto parking facilities, and the postponement of some runway system construction until beyond 1995, could be made. This would reduce the total plan cost from $107 million to about $96 million, and would reduce the average annual capital improvement fund requirements to the local general aviation airport sponsor to about $363,000.

Thus, through a combination of actions, it would be possible to reduce the annual average net plan costs to local public airport sponsors through postponement of airport facility improvements and shifting the burden of financing the improvements to the users through increased taxes and fees at both state and local levels. While these actions may reduce airport system capacity, they may also reduce the marginal demand for aeronautical services, which will thus reduce the need for the airport facility improvements.

In light of the above-described staging program and financial analysis, the staff and the Technical Coordinating and Advisory Committee recommended the following:

- That the regional airport system plan as recommended herein to be staged over the 20-year time period 1975-1995, be modified through the actions listed below to reduce total system plan costs:

  1. Modify size and quality of terminal airport buildings at general aviation airports to effect a 50 percent cost reduction. This action represents a combined reduction in the standard of

[6] *State airport funds available for airport development have been reduced from earlier estimates of $1.8 million annually as a result of reduced revenues received from airline company property taxes. The airlines, through court action, have been successful in having their assessed valuation reduced for Wisconsin property tax purposes in both 1973 and 1974.*

[7] *Presently, the state is limited to providing up to $35,000 for eligible structures.*

24.5 square feet per peak hour pilot and passenger and the assumed quality of construction as represented in square foot cost estimates. The estimated total cost reduction associated with this action is $3.2 million.

2. Modify auto parking facility construction at general aviation airports to effect a 30 percent cost reduction. This action represents a reduction in the standard of 1.3 spaces per peak hour pilot and passenger to 1.0 spaces. The estimated total cost reduction associated with this action is $195,000.

3. Modify aircraft parking apron construction at general aviation airports to effect a 25 percent cost reduction. The estimated total cost reduction associated with this action is $1.3 million.

4. Develop the Kenosha Municipal Airport to basic transport airport standards during the plan implementation period through construction of a 5,600-foot Runway 6L/24R, associated taxiway and related navaids, and postponing provision of the longer 7,000-foot runway until after 1995. The purchase of this land for eventual runway extension is still recommended, however, during the plan implementation period. This action would provide a full basic transport airport in the Kenosha-Racine industrial area, and permit an estimated total cost reduction of $655,000.

5. Postpone paving of turf runways and widening of paved runways at Timmerman Field. This action would reduce runway system capacity at the airport and result in diverting operations to adjacent airports. Recommended restrictions to training operations would reduce airport demand so the need for runway improvements is lessened. With no change to the existing airport operating facilities and patterns other than the restriction of flight training activities, the need to acquire additional land interest in runway clear zones may also be postponed. The estimated total cost reduction associated with this action is $2.28 million, $1.54 million for clear zone land interest and $740,000 for runway improvements.

6. Continue to operate the Racine Commercial Airport as it is currently operated and postpone the purchase of clear zone land interest and relocation of Green Bay Road, both actions that would otherwise permit full runway use. The impact of reduced effective runway length, because of the need for displaced thresholds, is considered minimum, affecting only the operations of heavier loaded, critical aircraft types. Cost savings of $1.9 million can be effected.

7. Postpone construction of paved secondary runways at the Gruenwald and Ozaukee Airports until after 1995, utilizing turf runways in the interim period. The purchase of land for eventual runway construction is still recommended, however. Aircraft operations affected by the reduction of runway system capacity at these airports can be accommodated at adjacent airports. The estimated total cost reduction associated with this action is $1.0 million.

Together, these actions reduce system plan capital improvement costs a total of $10.7 million from the $106.9 million initially identified as requiring federal, state, and local capital improvement funds to a new total capital investment during the 20-year plan implementation period of $96.2 million. It must be emphasized that these deferrals are recommended for consideration based upon a financial analysis which indicated a revenue shortfall which, if not overcome, will not permit development of an airport system to the required standards to meet forecast demands. Airport facility improvement recommendations to meet aviation demands have been identified within this chapter; and if local funds can be made available to carry out the plan as initially recommended, the deferred items identified herein should be implemented prior to 1995. The cost of deferrals at each system airport and revised plan implementation costs are shown in Table 248.

- That the State of Wisconsin remove the present $35,000 limitation per eligible airport building and provide funds up to 50 percent of the cost of such building construction from an increased allocation of present aviation revenues or from new sources of aviation revenues.

- That local airport sponsors develop airport operating revenue structures that, at a minimum, offset the costs to operate and maintain system airports.

- That alternative jurisdictional airport system plans be evaluated to implement the regional airport system plan, as modified by the financial analysis discussed herein, to spread the increase in local airport funding requirements over as great a tax base as practical.

Based upon these considerations, the average annual cost to develop, operate, and maintain the regional airport system plan, by air carrier and general aviation airport component, is summarized in Table 249. When contrasted with the financial analysis summary of the initial system plan shown in Table 247, the significant net plan cost reductions, from an average annual cost of $659,000 to $280,000, to local general aviation airport sponsors through modifications to the initial plan recommendations can be seen. Nevertheless, the annual average cost of $280,000 for general aviation airports is nearly four

Table 248

SUMMARY OF DEFERRED CAPITAL INVESTMENT COSTS AND RESULTANT PLAN IMPLEMENTATION COSTS AT AIRPORTS INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN: 1975-1995

County	Airport	Total Estimated Capital Investment Required to Meet Forecast Demand 1975-1995	Total Estimated Deferred Capital Investment	Plan Implementation Costs 1975-1995
Kenosha	Kenosha Municipal	$ 8,798,700	$ 1,100,250	$ 7,698,450
Milwaukee	General Mitchell Field	85,461,900	--	85,461,900
	Timmerman Field	5,486,800	2,785,200	2,701,600
Ozaukee	Ozaukee County	5,057,700	985,100	4,072,600
Racine	Burlington Municipal	5,688,200	399,600	5,288,600
	Racine Commercial	9,243,700	2,274,600	6,969,100
	Sylvania.	3,180,900	317,800	2,863,100
Walworth	East Troy Municipal.	3,219,700	356,300	2,863,400
	Gruenwald	4,126,000	901,900	3,224,100
Washington	Hartford Municipal	3,775,800	487,300	3,288,500
	West Bend Municipal	5,680,300	504,400	5,175,900
Waukesha	Waukesha County	6,514,900	552,200	5,962,700
Total	--	$146,234,600	$10,664,650	$135,570,000

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 249

AVERAGE ANNUAL COSTS AND REVENUES AS MODIFIED BY FINANCIAL ANALYSIS FOR AIRPORTS INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN: 1975-1995

Average Annual Costs and Revenues	Total System Airports (12)	Air Carrier Airport (1)	General Aviation Airports (11)
Operation and Maintenance Costs.	$2,151,500	$1,441,000	$ 710,500
Airport Operating Revenues	2,871,900	2,161,400	710,500
Net Airport Operating Costs (Surplus).	720,500	720,500	--
Total Capital Costs	4,811,400	3,256,000	1,555,400
Capital Funding Source			
Federal	2,028,000	1,004,600	1,023,400
State	424,500	172,700	251,800
Local.	2,358,900	2,078,700	280,200
Net Plan Cost to Local Airport Sponsors	1,638,400	1,358,200	280,200

Source: SEWRPC.

times what the seven publicly owned general aviation airport sponsors have expended on capital improvements in the past ten years, but the $1.4 million total local funding requirement at Generl Mitchell Field approximates the amounts spent annually on capital improvements in recent years. In any comparison of past and recommended average annual capital costs, it must also be remembered that the proposed system plan includes 12 public airports, each to be improved over the next 25 years.

Although additional state aids for airport buildings are recommended as a result of the financial analysis, the recommended cutback in airport facility improvements reduced the requirement for other state aids such that the total annual average need for state funding increased only slightly from $415,000 per year to $425,000 which still exceeds the estimated $250,000-$300,000 considered to be available to the Region per year. Federal funding available to the Region, not considered a restriction under the initial financial analysis, is reduced from $2.3 million per year to an average of $2.0 million per year under the postponement of airport facility development recommended herein.

The actions required to implement the recommended airport system plan, described in this chapter to meet revised forecasts of aviation activity and modified consistent with anticipated local funding capabilities and with a minimum adverse effect upon aviation activity, are set forth in the next chapter.

SUMMARY

The previous chapters of this report have presented in summary form the basic inventory data; the forecasts of demand for aviation services; the results of the demand/capacity analyses to identify deficiencies in the existing airport system and to guide development of alternative system plans; and the results of the design, test, and evaluation of alternative airport system plans developed under the regional airport system planning program. Following the extensive evaluation of 21 alternative system plans, the Technical Coordinating and Advisory Committee on Regional Airport System Planning recommended that the alternative plan identified as the "no new sites alternative system plan" in Chapter XI of this report and fully described in this chapter be recommended as the regional airport system plan. The necessary onsite airport facilities and attendant capital costs associated with this alternative are presented in graphic, tabular, and narrative form; generalized proposals for off-airport land use development and height control zoning are mapped and described in an effort to encourage compatible land use development in the vicinity of the recommended airports; and restrictions to aircraft operations considered necessary or desirable to abate the adverse noise and nuisance effect of aircraft operations upon adjacent land uses are described; for each airport comprising the recommended airport system plan in this chapter.

The airport system plan recommended to serve the aviation needs of the Southeastern Wisconsin Region over the next two to three decades is comprised of a system of eight public and six privately owned airports and does not envision the development of any new airport sites within the Region. The plan, however, does recommend that all eight of the Region's publicly owned airports undergo considerable improvement during the plan design period and further recommends that steps be taken to ensure the continued availability for public use and to improve four currently privately owned airports as important elements of the regional airport system. Two other private airports, the Playboy and Lake Lawn Lodge Airports, included in the system plan are assumed to remain available for public use as private airports without any particular public action in order to accommodate the special aviation needs generated by and associated with recreational development in Walworth County.

Following the complete description of each airport within the recommended system plan in narrative and graphic format, a financial analysis was undertaken to test the feasibility of developing, operating, and maintaining the recommended system of airports through the year 1995. Based upon the financial analysis, which revealed local airport sponsor fund requirements to be substantially greater than expended by public agencies in the past, the staff and the Technical Coordinating and Advisory Committee identified areas where plan recommendations can be stretched beyond the 20-year implementation period; recommended that airport revenue structures be developed at each airport to, at a minimum, offset annual operation and maintenance costs; and recommended that additional state aids, from reallocated or new airport revenues, be made available for eligible airport terminal and administrative buildings; all efforts directed to reducing the airport improvement and operation burden on local taxpayers and shifting much of the cost of airports to airport users.

In addition to including General Mitchell Field as the only scheduled air transport airport within the Region, the plan includes five basic transport airports—the Burlington Municipal, Kenosha Municipal, Racine Commercial, Waukesha County, and West Bend Municipal Airports; four general utility airports—Gruenwald, Hartford Municipal, Ozaukee, and Timmerman Field Airports; two basic utility airports—East Troy Municipal and Sylvania Airports; and the two basic utility recreational airports at Playboy and Lake Lawn Lodge. The recommended system of 14 airports located within the seven counties available for public use contrasts to the 26 public use airports presently located within the Region which include one scheduled air transport airport, one basic transport airport, four general utility airports, and 20 basic utility airports having varying levels of service capability. While some of the existing privately owned airports may be expected to continue to operate through the planning period and may, in fact, be expanded to serve a growing portion of the total demand for aviation service, the recommended system plan does not depend upon the continued availability of these private airports nor does it preclude their continued operation. To the extent that these private airports remain in operation, the aviation demand at the public airports may be expected to be reduced and the need for improvements delayed. The plan does define, by service capability, the minimum number of airports considered necessary to accommodate the probable future aviation demand within the Region.

A description of the type and extent of airport facility development needed to improve each airport from its present operational capability to the airport classification recommended in the regional system plan to adequately accommodate the forecast of aviation demand is described in this chapter in terms of the six basic elements of an airport—that is, the land or site location, area, and configuration; the aircraft operational area, including runways, aircraft parking aprons, taxiways, lighting, and navigation aids; the terminal and hangar facilities; the supporting transportation access facilities; and the supporting utilities. In addition to identifying onsite airport improvements necessary to accommodate the aircraft demand, restrictions to aircraft operations, generalized land use plans, and height zoning restrictions in the vicinity of airports have been recommended, all in an effort to eliminate or reduce the incompatibilities between some land uses and activities and airport and aircraft operations. A brief discussion of the major airport improvement recommendations for each of the system airports follows.

1. Burlington Municipal Airport—The major improvements required to expand this basic utility airport to the proposed basic transport airport as recommended herein include construction of an 1,800-foot extension to Runway 11/29 to provide a primary runway having a length of 5,400 feet; construction of a paved 4,300-foot secondary crosswind Runway 1/19; construction of an associated taxiway system; installation of an air traffic control tower, a precision instrument landing and approach lighting system on approach to Runway 11, and other lighting and visual aids; and acquisition of an additional 233 acres of land interest to accommodate the airport site improvements and to provide clear zone protection. Improvements to Bieneman Road on its existing alignment and at its existing cross section should be anticipated during the plan design period to provide continued adequate ground access to the airport terminal from STH 11, which is recommended to become a county trunk highway under the Racine County jurisdictional highway system plan.

   The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities, is $5,288,600, which program may be staged over the next 20 years. The recommended staging plan proposes preparation of an airport master plan, acquisition of all land interest required for full airport site development and clear zone protection, construction of Runway 11/29 to serve business jet operations, and first stage improvements to apron, terminal, and hangar facilities during the 1975 to 1985 time period. During the 1986 to 1995 time period, additional improvements—including construction of the crosswind runway, installation of an air traffic control tower and a precision instrument landing and approach lighting system, completion of apron, terminal, and hangar expansion, and reconstruction of Bieneman Road—are recommended to achieve the full basic transport airport operational and facility requirements.

2. East Troy Municipal Airport—The major improvements required to expand this less than basic utility airport to the proposed basic utility airport as recommended herein include construction of a paved 3,200-foot primary Runway 9/27; construction of a paved 2,560-foot secondary crosswind Runway 18/36; installation of lighting and visual aids; and acquisition of an additional 120 acres of land interest to accommodate the airport site improvements and clear zone protection.

   The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities, is $2,863,000, which program may be staged over the next 20 years. The recommended staging plan proposes preparation of an airport master plan; acquisition of all land interests required for full airport site development and clear zone protection; primary runway construction; and first stage aircraft apron and hangar facilities, during the 1975 to 1985 time period. During the 1986 to 1995 time period, additional improvements—including construction of the secondary runway, and completion of apron, terminal, and hangar expansion—are recommended to achieve the full basic utility airport operational and facility requirements.

3. General Mitchell Field—The major improvements required at the only air carrier airport to serve the Region under the system plan as recommended herein include construction of an extension to Runway 1L/19R to 11,500 feet to accommodate international flights, construction of an extension to Runway 1R/19L to 7,000 feet, to provide a parallel north-south air carrier runway, construction of a 1,000-foot extension to Runway 7R/25L to the west to provide a total runway length of 9,000 feet realignment and construction of a general aviation aircraft Runway 7L/25L to 5,000 feet, renovation of the airline passenger terminal area, construction of a new cargo terminal area, and acquisition of an additional 90 acres of land interests to accommodate runway clear zone protection and to eliminate land use conflicts in the most severe noise impact areas.

The noise from air carrier operations has a severe impact upon surrounding land uses. In addition to recommending that all land within the 115 CNR isopleth be acquired by Milwaukee County to eliminate noise conflicts in areas where noise is clearly unacceptable, continued efforts to adjust aircraft operating procedures to modify the noise impact upon the airport environs are recommended. To limit the extent of adjacent lands subjected to adverse aircraft noise, it is recommended that jet aircraft not be permitted to use the proposed new general aviation Runway 7R/25L until the entire fleet of general aviation jet aircraft is equipped with the new quieter engines. In addition, continued restrictions to some turning movements until aircraft have reached a point on runway headings four or more miles beyond the airport boundaries and limitations upon jet traffic in late evening hours are recommended. A generalized off-site land use plan around General Mitchell Field has been prepared to guide achievement of compatible land uses, where still possible, in the vicinity of General Mitchell Field.

The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as runway resurfacing and construction of general aviation terminal and hangar facilities, is $85,461,900, which program may be staged over the next 20 years. The recommended staging plan proposes preparation of an airport master plan, acquisition of all land interests required for clear zone protection, resurfacing of air carrier runways, extension of Runway 1R/19L, and first stage improvements to passenger terminal and cargo area facilities during the 1975 to 1985 period. During the 1986 to 1995 period, additional improvements, including extension of the existing air carrier runways, realignment of the general aviation Runway 7L/25R, and completion of apron, terminal, cargo, and hangar expansion, are recommended to achieve the full airport operational and facility requirements.

4. Gruenwald Airport—The major improvements required to expand this less than basic utility, privately owned airport to the proposed general utility airport as recommended herein include construction of a 4,000-foot northeast-southwest primary runway and associated taxiway; installation of an air traffic control tower, a nonprecision instrument landing system on approach to the southwest end of the primary runway, and lighting and other visual aids; and acquisition of an additional 215 acres of land interests to accommodate the airport site improvements and clear zone protection. Should public takeover of this airport be necessary to maintain its availability for public use or to expand the airport to general utility standards, it will be necessary to acquire the existing 90-acre airport site and improvements. Construction of a 3,200-foot northwest-southeast secondary runway and associated taxiway system was recommended to be staged after 1995 on the basis of the financial analysis. The land acquisition for such runway system expansion, however, is recommended during the initial periods of plan implementation and development of the secondary runway as a turf runway is recommended.

   The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities but not including public takeover of the existing private airport, is $3,054,000, which program may be staged over the next 20 years. Acquisition of the existing privately owned airport, if required, is estimated to cost an additional $170,000. The recommended staging plan proposes preparation of an airport master plan, primary runway construction, and acquisition of all land interests required for full airport site development and clear zone protection during the 1975 to 1985 time period. During the 1986 to 1995 time period, additional improvements, including installation of an air traffic control tower and a nonprecision instrument landing system and construction of apron, terminal, and hangar facilities, are recommended to achieve the general utility airport operational and facility requirements.

5. Hartford Municipal Airport—The major improvements required to expand this basic utility airport to the proposed general utility airport as recommended herein include construction of an 800-foot extension to Runway 11/29 to provide a primary runway having a length of 3,800 feet; construction of a paved 3,000-foot secondary crosswind Runway 2/20; construction of an associated taxiway system; installation of a traffic control tower, a nonprecision instrument landing system approach to Runway 11, and additional lighting and visual aids; and acquisition of an additional 95 acres of land interests to accommodate the airport site improvements and clear zone protection.

   The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities, is $3,288,500, which program may be staged over the next 20 years. The recommended staging plan proposes preparation of an airport master plan, acquisition of all land interests required for full airport site development and clear zone protection, and extension of the existing runway during the 1975 to 1985 time period. During the 1986 to 1995 time period, the additional improvements—including secondary runway construction; installation of an air traffic control tower and a nonprecison instrument landing system; and apron, terminal, and hangar expansion—are recommended to achieve the full general utility airport operational and facility requirements.

6. Kenosha Municipal Airport—The major improvements required to expand this general utility airport to the proposed basic transport airport as recommended herein include construction of a 5,600-foot Runway 6L/24R; construction of a 300-foot extension to Runway 14/32 to provide a secondary runway having a length of 4,500 feet; construction of an associated taxiway system; installation of an air traffic control tower, a precision instrument landing and approach lighting system on approach to Runway 6L, and other lighting and visual aids; construction of approved terminal facilities, and acquisition of an additional 500 acres of land interests to accommodate the airport site improvements and clear zone protection.

   The Kenosha Municipal Airport site is recognized as the only existing airport site capable of extensive expansion, and was even evaluated for development as a general transport airport having a 7,000-foot primary runway. Demand for an airport having capabilities of a general transport classification was considered minimal within the Region and could be expected to be served adequately at General Mitchell Field. Therefore, it was recommended that the Kenosha Municipal Airport be developed as a basic transport airport with a 7,000-foot primary runway capable of serving 100 percent of the fleet at 90 percent load carrying capacity. Because of anticipated financial limitations, however, development of the site to basic transport airport standards with a 5,400-foot runway is recommended during the 20-year plan implementation with further development to the 7,000-foot length recommended after 1995. Land acquisition for such runway system development, however, is recommended during the initial periods of plan implementation.

   Because of the separation required between operations on the parallel runways, aircraft operations using the new runway, which will be comprised of the larger and jet-powered aircraft in the general aviation fleet, will be kept north of the urban area. In addition, establishment of a right-turn pattern for operations using Runway 14 to the southeast is recommended to reduce operations over the urban area east of the airport.

   The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities, is $7,698,000, which may be staged over the next 20 years. The recommended staging plan proposes preparation of an airport master plan; acquisition of all land interests required for full airport site development and clear zone protection; construction of the extension to Runway 14; and first stage improvements to apron, terminal, and hangar facilities from 1975 to 1985. During the 1986 to 1995 time period, additional improvements, including construction of the new 5,600-foot Runway 6L/24R; installation of an air traffic control tower and a precision instrument landing and approach lighting system; and completion of apron, terminal, and hangar expansion, are recommended to achieve the full basic transport airport operational and facility requirements.

7. Ozaukee Airport—The major improvements required to expand this less than basic utility, privately owned airport to the proposed general utility airport as recommended herein include construction of a 4,000-foot north-south primary runway and associated taxiways; installation of an air traffic control tower, a nonprecision instrument landing system, and other lighting and visual aids; and acquisition of an additional 230 acres of land interests for airport site development and clear zone protection. Should public takeover of this airport be necessary to maintain its availability for public use or to expand the airport to general utility standards, it will be necessary to acquire the existing 90-acre airport site and improvements. Eventual construction of the crosswind runway staged beyond 1995 because of anticipated local financial limitations necessitates termination of existing CTH B, which highway is recommended to be relocated as an extension of Lover's Lane Road between STH 84 and Mink Ranch Road under the jurisdictional highway system plan for Ozaukee County. The terminated highway will continue to provide access to the airport terminal area.

   The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities but not including capital costs to acquire the existing privately owned airport site, is $3,938,000, which program may be staged over the next 25 years. Acquisition of the existing privately owned airport, if required, is estimated to cost an additional $135,000. The recommended staging plan proposes preparation of an airport master plan; acquisition of all land interests required for full airport site development and clear zone protection; construction of the north-south primary runway; and first stage improvements to apron and hangar facilities during the 1975 to 1985 time period. During the 1986 to 1995 time period, additional improvements—including construction of a turf east-west secondary runway, installation of an air traffic control tower and a nonprecision instrument landing system and completion of apron, terminal, and hangar expansion—are recommended to achieve the general utility airport operational and facility requirements.

8. Racine Commercial Airport—The major improvements required to improve this privately owned, less than basic transport airport as recommended herein include construction of parallel taxiways and installation of an air traffic control tower, a precision instrument landing system, and lighting and other visual aids. While it is recognized as desirable to acquire land interest in an additional 175 acres of land to provide clear zone protection and street relocation to obtain full use of existing runways, the staff and Technical Coordinating and Advisory Committee recommended, based upon the financial analysis, that the Racine Commercial Airport continue operating as it is currently and be upgraded to full basic transport airport standards after 1995. Should public takeover of this airport be necessary to maintain its availability for public use or to expand the airport to basic transport standards, it will be necessary to acquire the existing 490-acre airport site and improvements.

   Because of the urban land uses surrounding the airport site, changes to aircraft flight patterns cannot be used effectively to reduce noise impact. However, flight training activities can be encouraged to divert to other nearby airports.

   The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities but not including the cost to purchase the existing privately owned airport, is \$3,719,000, which program may be staged over the next 20 years. Acquisition of the existing privately owned airport, if required, is estimated to cost an additional \$3,250,000. The recommended staging plan proposes preparation of an airport master plan, taxiway construction, and apron and hangar facilities construction during the 1975 to 1985 time period. During the 1986 to 1995 time period, additional improvements—including runway resurfacing, installation of an air traffic control tower and a precision instrument approach system and completion of apron, terminal, and hangar expansion—are recommended to achieve the basic transport airport operational and facility requirements.

9. Sylvania Airport—The major improvements required to expand this privately owned, less than basic utility airport to the proposed basic utility airport as recommended herein include widening and extension of the existing runway to provide a 3,200-foot primary runway; construction of a 2,560-foot north-south secondary cross-wind runway; and acquisition of an additional 110 acres of land interests to accommodate the airport site improvements and clear zone protection. To construct the north-south runway, it will be necessary to terminate the town road north of the present airport.

   The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities, but not including the cost to purchase the existing privately owned airport, is \$2,564,000, which program may be staged over the next 25 years. Acquisition of the existing privately owned airport, if required, is estimated to cost an additional \$299,000. The recommended staging plan proposes preparation of an airport master plan and acquisition of all land interests required for full airport site development and clear zone protection during the 1975 to 1985 time period. During the 1986 to 1995 time period, additional improvements—including construction of a new primary runway, termination of the town road, construction of the north-south crosswind runway, installation of lighting and other visual aids, and construction of terminal and hangar facilities—are recommended to achieve the full basic utility airport operational and facility requirements.

10. Timmerman Field—This airport is recommended to remain classified as a general utility airport. The major improvements recommended herein include installation of additional lighting and visual aids. Because of the anticipated limitations in local funding, paving of the turf runways and widening of the existing runways were recommended for consideration after 1995. Further, since no major facility improvements beyond currently existing conditions at Timmerman Field are recommended during the 20-year implementation period, acquisition of an additional 33 acres of land interest to provide runway clear zone protection was also postponed. It is recognized that the airport capacity will not be increased as necessary to meet forecast desires, but with the restrictions to flight training that are recommended and with available capacity located at adjacent airports, the lack of runway facility improvements is not considered critical. Since the airport is already surrounded by intense urban development, no changes to existing air traffic operating patterns are considered effective to alleviate noise. However, flight training activities should be required to use other adjacent airports.

    The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities, is \$2,702,000, which program may be staged over the next 20 years. The recommended staging plan proposes installation of navigation aids and initial stage development of apron, terminal, and hangar expansion during the 1975 to 1985 time period. During the 1986 to 1995 time period, completion of apron, terminal, and hangar expansion is recommended to achieve the full general utility airport operational and facility requirements.

11. Waukesha County Airport—The major improvements required to expand this general utility airport to the proposed basic transport airport as recommended herein include construction of a 1,400-foot extension to Runway 10L/28R to provide a runway length of 5,600 feet; realignment of CTH TJ to permit runway extension; construction of a 3,300-foot long basic utility Runway 10R/28L; provision of an improved air traffic control tower; installation of a precision instrument landing and approach lighting system to Runway 10L; and acquisition of an additional 140 acres of land interests to accommodate the airport site improvements and clear zone protection.

    To direct flight traffic away from the residential development located south and southwest of the airport, a right-hand traffic pattern should be established for operations using Runway 28. Since operations on Runway 10 already use the standard left-hand pattern, all traffic using Runway 10/28 would then remain north of the airport. In addition, flight training activities should be discouraged at this urban airport and directed to other nearby airports such as Hartford Municipal or West Troy Municipal in less densely developed areas.

    The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities, is $5,963,000, which program may be staged over the next 20 years. The recommended staging plan proposes preparation of an airport master plan; acquisition of all land interests required for full airport site development and clear zone protection; construction of an extension to Runway 10L/28R and associated taxiways; and realignment of CTH TJ during the 1975 to 1985 time period. During the 1986 to 1995 time period, additional improvements—including resurfacing of Runway 18/36; construction of Runway 10R/28L; installation of a new air traffic control tower and a precision instrument landing and approach lighting system; and completion of apron, terminal, and hangar expansion—are recommended to achieve the full basic transport airport operational and facility requirements.

12. West Bend Municipal Airport—The major improvements required to expand this general utility airport to the proposed basic transport airport as recommended herein include construction of a 1,600-foot extension to Runway 6/24 to provide a runway length of 5,500 feet; realignment of STH 33 to permit the runway extension; widening and strengthening of runways and taxiways; installation of an air traffic control tower, a precision instrument landing and approach lighting system, and other lighting and visual aids; and acquisition of an additional 235 acres of land interests to accommodate the airport site improvements and clear zone protection. As the areas west of the airport continue to urbanize, the aircraft traffic operating patterns can be revised to maintain flight paths southeast of Runway 6/24 and northeast of Runway 13/31 to further reduce the noise impact upon urban areas.

    The estimated capital investment required to accomplish the improvement program which includes these and other improvements, such as terminal and hangar facilities, is $5,176,010, which program may be staged over the next 20 years. The recommended staging plan proposes preparation of an airport master plan; acquisition of all land interests required for full airport site development and clear zone protection; realignment of STH 33; extension of Runway 6/24; and first stage improvements to hangar facilities during the 1975 to 1985 time period. During the 1986 to 1995 time period, facility improvements—including resurfacing Runway 13/31 installation of an air traffic control tower and a precision instrument landing and approach lighting system and completion of apron, terminal, and hangar expansion—are recommended to achieve the full basic transport airport operational and facility requirements.

The above list of airport improvements includes potential deferrals in initial plan recommendations that, based upon the financial analysis, would reduce system plan costs with a minimum adverse impact on airport system runway capacity and safety. In addition to the runway system improvement deferrals outlined in the above discussions at the Kenosha Municipal, Gruenwald, Ozaukee, and Racine Commercial Airports, facility improvements considered at all general aviation airports for deferral beyond 1995 included: 1) constructing terminal/airport administration buildings to the size and quality initially recommended; 2) constructing the number of auto parking spaces initially recommended; and 3) constructing the amount of aircraft parking apron initially recommended. It should be clearly understood, however, that all of the improvements considered for deferral beyond 1995 would be desirable and would contribute substantially toward meeting the forecast air transportation demand in the Region at the recommended standards. Accordingly, should local funds be available to carry out these additional improvements at any of the airports during the 20-year implementation period, the improvements should proceed as rapidly as possible.

As a check upon the recommended airport system plan validity and viability, a testing of the system plan under conditions of unplanned land development or continued urban sprawl as considered in the Commission's initial land use and transportation study was undertaken. Although the recommended airport system plan has been designed to accommodate regional aviation demand generated consistent with recommended planned land use patterns, the regional aviation demand distributed on the basis of population and land use characteristics under an unplanned land use development pattern was also assigned to the recommended airport system for evaluation. It was found that seven of the 14 airports within the regional airport system plan would be expected to serve a lesser number of based aircraft in 1990 under an unplanned land development pattern than under the land development pattern for which the regional airport system plan was based. The regional system of general aviation airports developed as proposed in this report would actually better serve the forecast of aviation demand as land patterns developed as described under the unplanned alternative than under the planned alternative, because the forecast of based aircraft and annual operations would be more uniformly distributed among the system airports. An increase of about 10 percent in ground travel time and costs to reach the regional air carrier airport at General Mitchell Field would be expected, however, under the uncontrolled land use pattern.

Development of improvement recommendations at the airports contained within the system plan within the next 20 years must be accomplished in an orderly manner that is both responsive to the aviation needs of the Region and is consistent with the financial capabilities of the implementing federal, state, and local agencies. The initial plan developed in accordance with the forecast of aviation activity and airport development standards was estimated to have a total capital investment requirement of nearly \$146.2 million. Of this amount, \$39.3 million was considered to represent the capital cost of such items as aircraft hangars and the auto parking structure and cargo terminal areas at General Mitchell Field, which are considered to be self-amortizing.

Following a financial analysis of the capital investment required and the federal, state, and local funds available for developing the remaining capital improvements in the system plan, the staff and Technical Coordinating and Advisory Committee identified potential reductions in the size and quality of terminal and airport building facilities, reductions in the amount of automobile parking and aircraft apron areas, and deferrals in runway systems at selected airports to achieve cost reductions of \$10.6 million, particularly in those facilities requiring significant local funding. The average annual cost over the next 20 years of the plan as recommended herein on the basis of aviation activity and modified by financial analysis is \$4,811,400, of which \$2,028,000 represents federal aid, \$424,500 represents state aid, and \$2,358,900 represents local fund requirements.

The federal funding requirements for plan implementation are within the \$2.5 million considered to be available annually for airport development in southeastern Wisconsin. The state funding requirements for plan implementation are beyond the \$250,000 to \$300,000 considered to be available annually for airport development in southeastern Wisconsin. Further, it is recommended herein that the limitation of \$35,000 of state aid participation in eligible airport building projects be changed to a rate of 50 percent state participation. The local funding requirement of \$2,358,900 annually consists of \$280,200 per year for improvements at the 11 general aviation airports and \$2,078,700 per year for improvements at General Mitchell Field, primarily for renovating the passenger terminal facility. General Mitchell Field does generate revenues which effectively reduce this annual cost to \$1,358,000. The \$280,000 per year required at the 11 general aviation airports is about four times that spent at the seven publicly owned airports in from 1963 to 1972; but the \$1.4 million local funding requirement for improving General Mitchell Field approximates the amounts spent by Milwaukee County or the airport in the recent past.

The actions required to implement the recommended system plan that is described in this chapter are set forth in Chapter XIII.

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Chapter XIII

PLAN IMPLEMENTATION

INTRODUCTION

The recommended airport system plan for the seven-county Southeastern Wisconsin Region, as described in Chapter XII of this report, consists of three main elements: 1) an airport facility construction and operation element, including recommendations for runway, taxiway, navigational aid, and associated terminal facility improvements at 12 of the 14 existing airports[1] in the seven-county Region which comprise the recommended airport system, together with recommendations concerning the operation of these airports, including the imposition of nonstandard air traffic patterns at four of the 14 airports and the restriction of certain flight activities at four of the 14 airports; 2) an airport airspace protection element relating to the airports, including a review, update, and extension of municipal height zoning ordinances; and 3) an airport area land use plan element for the immediate area surrounding each of the 12 airports. In a practical sense, the recommended regional airport system plan is not complete, however, until the steps required to implement that plan—that is, to convert the plan into action plans and policies—are specified.

This chapter is, therefore, presented as a guide for use in the implementation of the recommended regional airport system plan. Basically, it outlines the actions which must be taken by the various levels and agencies of government and private parties concerned if the recommended regional airport system plan is to be fully carried out over the next 20 to 25 years. Those units and agencies of government which have plan adoption and plan implementation powers applicable to the regional airport system plan are identified; necessary or desirable formal plan adoption actions specified; and specific implementation actions recommended to each of the units and agencies of government and private parties concerned with respect to airport facility construction, airport airspace protection, and airport area land use elements. Toward this end, specific recommendations are made concerning jurisdictional responsibilities for each of the 14 airports included in the recommended regional airport system plan. Finally, financial and technical assistance programs available to aid in the implementation of the airport system plan are discussed.

The plan implementation recommendations contained in this chapter are, to the maximum extent practicable, based upon and related to the existing governmental structure and governmental programs, and further are largely predicated upon existing enabling legislation. In few instances, changes in enabling legislation are being recommended. Because of the ever present possibility of unforeseen changes in economic conditions, state and federal legislation, case law decisions, governmental organization, and tax and fiscal policy, it is not possible to declare once and for all time exactly how a process as complex as airport system plan implementation should be administered and financed. In the continuing regional planning program for southeastern Wisconsin, therefore, it will be necessary to periodically update not only the regional airport system plan elements and the data and forecasts on which these plan elements are based, but also the elements recommended herein for plan implementation.

BASIC CONCEPTS AND PRINCIPLES

It is important to recognize that plan implementation measures should not only grow out of formally adopted plans, but should also be based upon a full understanding of the objectives underlying the recommendations contained in those plans. Thus, action policies and programs should not only be preceded by formal plan adoption, and following such adoption, be consistent with the adopted plans, but should also emphasize the implementation of the most important and essential elements of the plan and those areas of action which will have the greatest impact on guiding and shaping development in accordance with the objectives underlying the plan.

Substantial implementation of the regional airport system plan will be achieved if all of the 14 airports identified in the recommended plan are retained in airport use and improved according to the recommended staged development program; and if appropriate aircraft operating restrictions and compatible land use development adjacent to airports can be achieved to both minimize the adverse impacts of aircraft operations on the surrounding areas and to assure safe aircraft operation. In addition, since the regional airport system plan for southeastern Wisconsin has been prepared within the framework of a comprehensive planning program, it is also important to implementation of the regional airport system plan that certain other regional plan elements, in particular the regional land use and surface transportation plans, be substantially implemented. Failure to substantially implement the regional land use plan will likely create additional airport system development problems, particularly in and around those airports recommended to be improved in what are today largely rural areas. Failure to substantially implement the surface transportation plan will result in a lower level of accessibility to the airport facilities than contemplated.

[1] *Two airports, Lake Lawn Lodge and Playboy, are expected to remain in private ownership and to serve only a limited and specialized recreation oriented demand. Therefore, no airport facility improvements have been identified.*

The relationship of the regional airport system plan to other types and levels of planning is another important factor which must be understood for proper plan implementation. As discussed earlier in this report, federal legislation envisions basically two levels or types of planning at the state or local levels of government for assuring that airport system development is carried out in the most cost effective manner. At the most general level is the system plan, of which the recommended airport system plan set forth in the preceding chapter of this report is an example. The system plan is intended, for a logical planning area, to determine the number and type of airports required to meet forecast aviation demands, to define the particular function which each airport should perform in the overall system, to specify the general location of each of the airports included in the system plan, to identify the general runway and associated taxiway configurations, and to determine the major types of improvements needed at each identified airport site. Good planning practice would dictate that an airport system plan for a large metropolitan region, such as southeastern Wisconsin, will become an integral part of both the state and federal level airport system plans.

The second type of plan represents a more detailed level of airport planning and consists of the preparation of master plans for each airport facility identified in a system plan. Airport master plans are intended to refine and detail the recommendations contained in the regional airport system plan, and in so doing specify precise land area requirements for acquisition and protection; provide a detailed airport layout plan; conduct financial feasibility analyses and prepare a capital improvement budget; provide information on the impact of facility improvements on the environment; and provide for local level citizen participation in the planning effort. Whereas the preparation of the airport system plan is primarily the responsibility of the state agency responsible for aeronautics, the preparation of airport master plans is primarily the responsibility of the implementing local agencies of government.

It is extremely important to airport system plan implementation that all public officials and citizens concerned recognize that development of a coordinated regional airport system is important to meeting the fast, long distance transportation needs of the resident population and of local businesses and industries, and that development of such a system is, therefore, vital to the continued economic growth and social development of the Region. Such recognition is particularly important because plan implementation will require not only action by the units and agencies of government directly involved in airport ownership and development, but cooperative and related actions by many other units and agencies of government. Failure of one unit of government to implement a major element of the recommended system plan may adversely affect many other units and agencies of government and thereby detract from the ability of the entire Region to accommodate the forecast aviation demand in a safe, cost effective manner, or to achieve the compatible land use pattern deemed desirable around the airports in the Region. It is essential, too, that the state and federal implementing agencies recognize the needs of southeastern Wisconsin, particularly when the funds are apportioned for the needed airport improvements, for within the Region the largest and densest concentration of people resides and the most significant concentrations of economic activity exist.

PLAN IMPLEMENTATION ORGANIZATIONS

Although the Regional Planning Commission can promote and encourage plan implementation in various ways, the completely advisory role of the Commission makes actual implementation of the recommended regional airport system plan entirely dependent upon action by local, state, and federal units and agencies of government, and by certain private concerns. These agencies include general purpose local units of government, such as cities, villages, towns, and counties; state agencies, such as the Wisconsin Department of Transportation, Division of Aeronautics; and federal agencies, such as the U. S. Department of Transportation, Federal Aviation Administration. Because of the many and varied governmental agencies concerned with airport and related airport land use development, it becomes exceedingly important to identify those agencies having the legal authority and financial capability to most effectively implement the recommended plan.

Accordingly, those agencies whose actions will have a significant effect either directly or indirectly upon the successful implementation of the recommended regional airport system plan and whose full cooperation in plan implementation will be essential are listed and discussed below. The agencies are, for convenience, discussed by level of government; however, the interdependence between the various levels, as well as between agencies of government, and the need for close intergovernmental coordination cannot be overemphasized. In addition to identifying and discussing those agencies needed for implementation of the recommended regional airport system plan which are already in existence within the Region, the following discussion includes consideration of possible new agencies in order to provide a basis for comparison of the advantages and disadvantages of each in securing full implementation of the recommended plan. In a subsequent section of this chapter the alternative institutional arrangements for implementing the plan are discussed.

Technical Coordinating and Advisory Commitee

Since planning at its best is a continuing function, a public body should remain on the scene to coordinate and advise on the execution of the regional airport system plan and should undertake plan updating and renovation as necessitated by changing events. Although the Regional Planning Commission is charged by State Statute with, and will perform, this continuing areawide planning function as a part of the Commission continuing regional land use-transportation study, it cannot properly do so without the active participation and support of local, state, and federal officials concerned with urban development in the Region. It is, therefore, recommended that the Technical Coordinating and Advisory Committee on

Regional Airport System Planning be reconstituted as a continuing intergovernmental advisory committee to provide a focus for the coordination of the actions of all levels of government in the execution of the regional airport system plan. The Technical Coordinating and Advisory Commiteee on Regional Airport System Planning would thus continue to be a creature of the Southeastern Wisconsin Regional Planning Commission pursuant to Section 66.945(7) of the Wisconsin Statutes.

It is recommended that all public agencies presently represented on the Committee continue to be represented, but that the question of the Committee composition remain open so that membership from additional agencies could be added to the Committee from time to time as appropriate. It is anticipated that the primary focus of the Committee will be upon both the technical and institutional aspects of plan implementation, including the technical aspects related to the design criteria used in preparation of the plan as such criteria may be reflected in detailed airport master planning and engineering studies throughout the Region, and the institutional aspects relating to the recommended jurisdiction for implementation of the system plan.

Local Level Agencies

Local level agencies concerned with airport system development include counties, cities, villages, and towns. Under Section 114.11 of the Wisconsin Statutes, counties, cities, villages, and towns are authorized to acquire, establish, construct, own, control, lease, improve, maintain, and operate airports or landing fields within or without their jurisdictional limits. The local units of government are further empowered to provide for regulation of such airports and landing fields so long as such regulation does not conflict with rules and regulations promulgated by the federal government. Section 114.11 further authorizes the governing body of any county, city, village, or town to appropriate monies to any other county, city, village, or town for the acquisition, improvement, or operation of an airport by any county, city, village, or town or any combination of such municipalities.

Clearly, local units of government in Wisconsin have sufficient statutory authority to implement the airport facility construction and operation element of the recommended regional airport system plan. As discussed in Chapter VI of this report, eight airports in the Region are currently owned and operated by local units of government. Three of the eight are operated by counties—General Mitchell Field and Timmerman Field by Milwaukee County and Waukesha by Waukesha County; four are owned or operated by cities—Burlington, Hartford, Kenosha, and West Bend; and one by a village—East Troy. To a large degree, municipal ownership and operation of airports has resulted from a desire to attract and serve commerce and industry.

While cities and villages have historically been active in the development and operation of airports within the Region, a question can be raised as to the continued viability of such municipalities as sponsors of the airport facility development envisioned in the regional airport system plan. The capital expenditures required to carry out the recommended plan at the airports currently owned and operated by cities and villages are quite substantial and, even assuming full state and federal financial participation in eligible improvements, may well lie beyond the fiscal capacity of the local municipalities. Furthermore, each of the airports currently owned and operated by cities or villages, because of its location and importance in the regional system, may be expected to have a service area considerably larger than the incorporated area of the sponsoring municipality. This is particularly true with respect to those currently municipality owned airports designated in the plan to be upgraded to basic transport status—Kenosha, Burlington, and West Bend—where the role envisioned for such airports in the regional system plan is one extending well beyond the boundaries of the sponsoring municipality.

Areawide Level Agencies

Except as noted below, statutory provisions exist for the creation of certain areawide agencies which could implement the regional airport system plan. These agencies include union airports, cooperative contract commissions, airport authorities, multi-modal transportation authorities, and the Regional Planning Commission itself.

Union Airports: Section 114.151 of the Wisconsin Statutes provides that any county, city, village, or town may jointly act with any other county, city, village, or town in the establishment, acquisition, equiping, and operation of joint airports or landing fields. The statutory term name for an airport so established is a "union airport." While no such union airports have been established in the Southeastern Wisconsin Region, this statute has been used successfully elsewhere in Wisconsin to provide for joint intermunicipal cooperation in the establishment of airports having areawide importance.

Section 114.151 of the Wisconsin Statutes further provides that the governing body of any county, city, village, or town which participates in the ownership or operation of a joint airport may by resolution withdraw from such joint operation or control and thereby relinquish its interest in the airport. Given the substantial capital investment necessary to construct and operate a modern areawide airport facility, it is unlikely that, once such a union airport is established, a participating local unit of government would choose to abandon its investment by simple resolution.

The union airport approach to providing for intermunicipal cooperation in the development and operation of areawide airport facilities represents a viable technique, particularly in a large metropolitan Region such as southeastern Wisconsin. All of the airports included in the system plan, with the exception of the Playboy and Lake Lawn Airports which exclusively serve recreational resorts, serve populations residing in more than one municipality. Accordingly, the concept of the union airport, as set forth in Section 114.151 of the Wisconsin Statutes, could be applied to the public airports included in the recommended system plan for southeastern Wisconsin.

Cooperative Contract Commission: Section 66.30 of the Wisconsin Statutes permits the joint exercise by municipalities of any power or duty required of, or authorized to, such municipalities individually by statute. Hence, local units of government with equivalent powers may contract on a cooperative basis to provide jointly what each unit of government can provide individually. The exercise of this cooperative power may or may not include the formulation of a separate commission to conduct the particular municipal activity.

Since counties, cities, villages, and towns under Wisconsin law have equal powers to establish and maintain airports, the power conveyed by Section 66.30 of the Wisconsin Statutes has, like the union airport authority, significant potential for use in implementation of the regional airport system plan. While no such cooperative contract commissions have been formed to date in the Region for the purpose of providing airport facilities, such commissions have been created within the Region for the purpose of providing water and sewerage facilities on an areawide basis.

From a practical point of view, there appears to be little difference between the intergovernmental cooperative approach authorized under the union airport statute discussed above and the cooperative contract approach authorized under Section 66.30 of the Wisconsin Statutes. Perhaps the only meaningful difference between the two approaches is that under the Section 66.30 approach, local municipalities could contract and bind one another for indefinite periods of time, whereas under the union airport approach the statutes provide that any participating municipality may withdraw from such participation at any point in time by simple resolution.

Airport Authority: While not currently available under Wisconsin Legislation, it is conceivable that enabling legislation could be secured to permit the formation of regional or areawide airport authorities. Such airport authorities could be given responsibility for the ownership and operation of all or certain types of airports within a given geographical subarea of the state, and could either supplement or supplant existing airport agencies. The creation of such airport authorities normally requires the creation of a special-purpose governmental unit with its own power to raise and expend monies for the purpose for which the authority was created. Such an authority was created by the Minnesota legislature in 1943 for the Minneapolis-St. Paul metropolitan area. Presently the Minneapolis-St. Paul Airports Commission operates a six-airport system, including an air carrier airport similar to General Mitchell Field, and five general aviation airports located throughout a seven-county metropolitan area. This six-airport system has evolved over the years from an original system of two airports.

The creation of a single-purpose airport authority to carry out the regional airport system plan, such as the one contained herein for southeastern Wisconsin, has certain advantages and disadvantages. The advantages include the ability to relate the needed airport improvements to a much broader tax base than a single county or a single municipality. Since in a metropolitan region airports serve an areawide need, it can be argued that equity requires that support for that need be provided from throughout the entire geographical area served. In addition, the establishment of a single airport authority might effect some economies of scale in operation, particularly in terms of equipment and personnel. The establishment of a single airport authority would also greatly facilitate capital improvement programming with respect to airport facility development, and would thus provide a greater degree of assurance that the regional airport system plan would be carried out in a more orderly manner than if responsibility for such development were more diffused.

The disadvantages associated with the establishment of a single-purpose airport authority are those generally associated with the establishment of any special-purpose unit of government, and include an erosion of the responsibilities of the existing general-purpose local units of government, as well as a belief that creating single-purpose authorities leads to a fragmented and noncomprehensive approach to public policy making. In addition, it is argued that such authorities tend to operate in a manner which is not as responsive to citizen demands as general-purpose local units of government.

Multi-Modal Transportation Authority: Also not available under Wisconsin legislation is the power to create a multimodal transportation authority that could be assigned responsibility not only for areawide airport system development, but also for the development and operation of other areawide transportation systems within the metropolitan Region. Conceivably, such a multi-modal transportation authority could be limited to port operation, involving both airports and seaports, or could be extended to include additional transportation modes, such as urban mass transit, and additional terminal facilities such as automobile parking areas and structures. Conceptually, the multi-modal transportation authority approach has the same advantages and disadvantages of the single-purpose airport authority approach. Its main advantage over the single-purpose authority, however, would be that it would tend to make the attainment of the transportation system development objectives of a metropolitan region more readily attainable, since one body would be charged with the responsibility of allocating scarce public resources among competing modes. Like the single-purpose transportation authority approach, however, the multi-modal transportation authority approach is believed by some to erode the responsibility of the existing general-purpose local units of government, and further, depending upon its composition, may be less responsive to citizen demands than local units of government.

Regional Planning Commission: Although not a plan implementation agency itself, another areawide agency—the Regional Planning Commission—warrants comment. As noted earlier, the Commission has no statutory implementation powers. In its role as a coordinating agency for planning and development activities within the Southeastern Wisconsin Region, however, the Commission may through community assistance planning services and through the review of federal and state grants-in-aid promote airport system plan implementation. In addition, Commission efforts in plan implementation could include service on advisory committees asked to assist in the preparation of airport master plans. Finally, the Commission provides a basis for the creation and continued functioning of the Technical Coordinating and Advisory Committee on Regional Airport System Planning, which Committee, as noted above, is recommended to remain as an important continuing public planning organization in the Region.

State Level Agencies

At the state level the following agencies exist that either have general or specific planning authority and certain plan implementation powers important to the adoption and implementation of the regional airport system plan.

Wisconsin Department of Transportation: Responsibility for the planning and development of all modes of transportation in Wisconsin is centered in the Wisconsin Department of Transportation. Of particular importance to implementation of the regional airport system plan within the Department of Transportation are the Division of Aeronautics, headed by an administrator appointed by the Secretary of Transportation; the Division of Planning, headed by an administrator selected by the Secretary of Transportation; and the Division of Highways, headed by a three-member Highway Commission whose chairman serves as the division administrator.

The Division of Aeronautics represents the atate in the supervision, promotion, and development of a statewide system of publicly owned airports, and acts as the local government airport owner's agent in all projects involving state and federal aid. The Division promotes aviation education, assists airport operators in soundly managing their facilities, conducts safety and training programs for Wisconsin pilots, and coordinates the state's aviation interests with those of other states and the federal government. As such, the Division represents the key state agency in implementation of the regional airport system plan.

The Division of Planning is responsible for providing guidance and advice to all of the divisions in the Department of Transportation, and performs an important role in development of state transportation policy, including development of a multi-modal transportation improvement program.

The Division of Highways is in charge of all matters pertaining to the expenditures of state and federal funds for the improvement of highways. The Division lays out, constructs, and maintains the state trunk highway system and advises towns, villages, cities, and counties in regard to construction and maintenance of local roads and bridges. With respect to the regional airport system plan, the Division of Highways should perform an important function in assuring the development of adequate surface transportation access to each of the identified airport sites.

Although the State of Wisconsin has historically not been involved in the development and operation of a system of state owned airport facilities, unlike the position of the state with respect to highways, there exists in Section 114.33 of the Wisconsin Statutes authority for any state agency to initiate and sponsor an airport project in the same manner as a county, city, village, or town. This authority would appear to provide a basis for the establishment of a system of state operated airport facilities. The State of Wisconsin does own Volk Field in the Village of Camp Douglas in Juneau County, which airfield is the responsibility of the Department of Military Affairs. In addition, the Department of Natural Resources is part owner of an airstrip near Tomahawk in Lincoln County.

Wisconsin Department of Natural Resources: In performing its function relating to environmental protection, the Wisconsin Department of Natural Resources is responsible for securing compliance with federal air quality standards. Since airports are considered indirect sources of air pollution, it is considered important that the Department of Natural Resources be cognizant of and ultimately endorse the regional airport system plan.

Wisconsin Department of Administration: The Wisconsin Department of Administration provides for the integration of state level functional planning and serves as the state clearinghouse under U. S. Office of Management and Budget Circular A-95. Accordingly, the Department performs an important function with respect to review of all applications for federal airport development grants and, as such, becomes an important plan implementation agency with respect to the regional airport system plan.

Wisconsin Department of Local Affairs and Development: The Wisconsin Department of Local Affairs and Development has authority to review proposed municipal incorporations, consolidations, and annexations, and provides technical assistance to local units of government in planning and planning related matters. The Department is specifically directed by Section 114.31(6) of the Wisconsin Statutes to make available, in cooperation with the Division of Aeronautics, technical services to local units of government in the state in terms of promoting the development of aeronautics. Accordingly, this Department also performs an important function in implementation of the regional airport system plan.

Federal Level Agencies

At the federal level, the following agencies exist that administer federal programs that can have important effects upon implementation of the regional airport system plan.

U. S. Department of Transportation: Three administrations within the U. S. Department of Transportation—the Federal Aviation Administration, the Federal Highway Administration, and the Federal Urban Mass Transportation Administration—represent key implementation agencies with respect to the regional airport system plan. The Federal Aviation Administration in particular provides financial support for the development of airport master plans and the undertaking of land acquisition and capital improvement programs at airports included in approved system plans, sponsors research and development with respect to aviation, and provides technical assistance and advisory services on airport planning, design, construction, and maintenance.

The Federal Highway Administration provides financial support for the development of highways, including important support through the federal aid primary, federal aid secondary, and federal aid urban systems for the development of state, county, and local trunk highways. Such highways provide important surface transportation access to all of the airports included in the recommended regional airport system plan.

The Federal Urban Mass Transportation Administration provides capital grants and operating subsidies to approved local agencies providing urban mass transit. Since the regional airport system plan envisions the continuation of mass transit service to the Region's single scheduled air carrier airport—General Mitchell Field—it is important that this agency be cognizant of and endorse the system plan recommendations.

U. S. Environmental Protection Agency: This agency has broad powers under federal legislation to promulgate standards and guidelines and to review and monitor compliance with and achievement of air quality and noise level standards. Thus, this agency acts as the key federal agency involved in the control and management of air quality and noise levels, both of which are significant to airport development and operation. Accordingly, it is important that this agency review and endorse the recommended regional airport system plan.

U. S. Department of Housing and Urban Development: Under Section 701 of the Housing Act of 1954, as amended, this Department administers a comprehensive planning grant program for community development, including certification of the adequacy of comprehensive areawide planning in metropolitan areas. Maintenance of a certificate of planning adequacy for an urban area is essential for maintaining the eligibility of local units of government in the Region to receiving federal grants-in-aid for programs administered by the Department. In addition, the Department administers numerous federal housing programs, and in conjunction with such has developed noise and air pollution standards that have important implications for airport operation and management. Accordingly, it is important that this Department review and endorse the regional airport system plan.

Private Concerns

The development and implementation of the regional airport system plan in southeastern Wisconsin involves not only the aforementioned units and agencies of government but also a number of private individuals, partnerships, and corporations who historically have been involved in airport system development. Indeed, six of the 14 airports recommended for inclusion in the regional airport system plan are currently privately owned and operated. As a practical matter, it may be necessary in order to achieve full implementation of the plan to publicly acquire four of these six airports, excepting the Playboy and Lake Lawn Lodge Airports which exclusively serve private recreational resorts. In addition, it is anticipated that the owners of other private airports which exist today, or which may exist in the future, and which may or may not be for public use, understand the significance and impact of the recommended regional airport system plan. While it may be anticipated that the public will play a more important role in the development of the regional airport system in the future than it has in the past, it may be expected that private enterprise will continue to play a significant role in meeting aviation demand. Accordingly, it is important that these interests become cognizant of the recommended regional airport system plan.

PLAN ADOPTION AND INTEGRATION

Upon adoption of the regional airport system plan by formal resolution of the Southeastern Wisconsin Regional Planning Commission, in accordance with Section 66.945(10) of the Wisconsin Statutes, the Commission will transmit a certified copy of the resolution adopting the plan, together with a copy of the plan itself, to all local legislative bodies within the Southeastern Wisconsin Region and to all of the aforesaid existing local, areawide, state, and federal agencies and private concerns that have potential plan implementation functions.

Adoption, endorsement, or formal acknowledgement of the regional airport system plan by the local legislative bodies and the existing local, areawide, state, and federal level agencies and private parties concerned is highly desirable to assuring a common understanding between the public and private sector and between the several governmental levels, and to enable the programming of the necessary plan implementation work, and is, in some cases, required by the Wisconsin Statutes before certain planning actions can proceed, as in the case of city, village, and town plan commissions created pursuant to Section 62.23 of the Wisconsin Statutes. In addition, formal plan adoption may also be required for state and federal financial aid eligibility. It is extremely important to understand that adoption of the recommended regional airport system plan by any unit or agency of government pertains only to the statutory duties and functions of the adopting agencies, and such adoption does not, and cannot, in any way preempt or commit action by another unit or agency of government acting within its own area of functional and geographical jurisdiction.

Upon adoption or endorsement of the regional airport system plan by a unit or agency of government, it is recommended that the policy making body of the unit or agency direct its staff to review in detail the elements of the plan. Once such review is completed, the staff can propose to the policy making body for its consideration and approval the steps necessary to fully integrate the regional airport system plan elements into the plans and programs of the unit or agency of government.

Local Level Agencies

1. It is recommended that the Milwaukee County Board of Supervisors formally adopt the regional airport system plan by resolution, pursuant to

Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by the Transportation and Public Works Committee and the County Planning Commission.

2. It is recommended that the Waukesha County Board of Supervisors formally adopt the regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation of the Agricultural and Resource Committee and the County Park and Planning Commission.

3. It is recommended that the Walworth and Washington County Boards of Supervisors formally adopt the regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by their respective County Park and Planning Commissions.

4. It is recommended that the Kenosha, Ozaukee, and Racine County Boards of Supervisors formally adopt the regional airport sytem plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by their respective County Planning and Zoning Committees.

5. It is recommended that the City Council of the City of Kenosha formally adopt the regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by the Airport Commission and the City Plan Commission.

6. It is recommended that the City Council of the City of Burlington formally adopt the regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by the Airport Committee and the City Plan Commission.

7. It is recommended that the City Council of the City of Hartford formally adopt the regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by the Airport Committee and the City Plan Commission.

8. It is recommended that the City Council of the City of West Bend formally adopt the regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by the Airport Committee, the Airport Board, and the City Plan Commission.

9. It is recommended that the Village Board of the Village of East Troy formally adopt the regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by the Airport Committee and the Village Plan Commission.

10. It is recommended that the governing bodies of all other cities, villages, and towns within the Region formally adopt the regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, after review and recommendation by appropriate committees and local plan commissions.

11. It is recommended that the plan commissions of all cities, villages, and towns within the Region formally adopt the regional airport system plan, as it affects them, by resolution, pursuant to Sections 66.945(12) and 62.23(3)(b) of the Wisconsin Statutes, and certify such adoption to their respective governing body.

Areawide Level Agencies

1. It is recommended that any Union Airport Commission or Authority formed in the Region in the future pursuant to Section 114.151 of the Wisconsin Statutes formally adopt the recommended regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, and inform their respective creating governing bodies of such action.

2. It is recommended that any cooperative contract commission formed for airport development and operation purposes in the Region in the future, pursuant to Section 66.30 of the Wisconsin Statutes, formally adopt the recommended regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes, and inform their respective creating governing bodies of such action.

3. It is recommended that any airport authority or multipurpose transportation authority that may be formed for airport development and operation purposes in the Region in the future formally adopt the recommended regional airport system plan by resolution, pursuant to Section 66.945(12) of the Wisconsin Statutes.

State Level Agencies

1. It is recommended that the Wisconsin Department of Transportation endorse the recommended regional airport system plan, include the plan as an integral part of the State of Wisconsin airport system plan, and certify such plan to the U. S. Department of Transportation, Federal Aviation Administration. It is further recommended that the staff of the Wisconsin Department of Transportation, Divisions of Aeronautics, Highways, and Planning, integrate the recommended regional airport system plan elements into its broad range of transportation planning and development responsibilities, as well as assist in coordinating plan implementation activities over the next 15 to 20 years.

2. It is recommended that the Wisconsin Natural Resources Board endorse the recommended regional airport system plan and direct its staff in the Wisconsin Department of Natural Resources to recognize the plan recommendations, as appropriate, in the exercise of its air pollution control authority.

3. It is recommended that the Wisconsin Department of Administration endorse the recommended regional airport system plan and utilize the plan recommendations, as appropriate, in the exercise of its state planning and state A-95 Clearinghouse functions.

4. It is recommended that the Wisconsin Department of Local Affairs and Development endorse the recommended regional airport system plan and integrate the plan into its activities with respect to provision of technical assistance to local units of government, with respect to reviewing subdivision plats, and with respect to administering any federal and state grant-in-aid programs.

Federal Level Agencies

1. It is recommended that the U. S. Department of Transportation formally acknowledge the recommended regional airport system plan upon its inclusion in the State of Wisconsin airport system plan for inclusion in the National Airport System Plan, and through the Federal Aviation Administration, Federal Highway Administration, and Federal Urban Mass Transportation Administration, utilize the plan recommendations in its broad range of agency responsibility relating to airport, highway, and transit development. The National Airport System Plan should be amended by deleting the Franklin-Hales Corners, Menomonee Falls, Grafton, Oconomowoc, and Lake Geneva Airports from the plan and adding the Sylvania Airport to the plan.

2. It is recommended that the U. S. Environmental Protection Agency formally acknowledge the recommended regional airport system plan and recognize the plan recommendations in exercising its authority with respect to air quality and noise level control management.

3. It is recommended that the U. S. Department of Housing and Urban Development formally acknowledge the recommended regional airport system plan and utilize the plan recommendations, as appropriate, in the administration of its broad range of grant and loan programs and in its areawide plan certification process.

Private Concerns

It is recommended that those private individuals, partnerships, and corporations currently owning and operating airport facilities in the Region, and who would be directly affected by the plan recommendations, formally acknowledge the regional airport system plan, and cooperate with the units and agencies of government concerned in securing successful long-term implementation of the plan.

AIRPORT FACILITY CONSTRUCTION AND OPERATION

The recommended improvements at each of the airports identified in the regional airport system plan were fully described in Chapter XII of this report. A summary of these improvement recommendations is set forth in Table 250. Such improvements include, as appropriate at each airport site, land acquisition for site expansion, clear zone protection, and aircraft noise protection purposes; operational area improvements, including the construction of new runways and taxiways and the paving, widening, strengthening, and realigning of existing runways and taxiways, as well as the construction of additional parking aprons and traffic control towers and the installation of navigational aids, including lights and instrument landing systems; terminal area improvements, including expansion of existing or construction of new terminal and administration buildings and the expansion of auto parking, aircraft parking, and service roads; hangar area improvements, including the expansion of hangar storage/service areas; ground access improvements; and utility service improvements. In addition, the plan recommends the imposition of certain operational requirements at selected airports in the system, such as nonstandard air traffic patterns and the restriction of certain types of flight activity at selected airports.

If fully carried out, the regional airport system would consist of one scheduled air transport airport facility—General Mitchell Field; five basic transport airport facilities—Kenosha Municipal, Racine Commercial, Burlington Municipal, Waukesha County, and West Bend Municipal; four general utility airport facilities—Ozaukee, Hartford Municipal, Timmerman Field, and Gruenwald; and four basic utility airport facilities, including two general-purpose airports—East Troy Municipal and Sylvania—and two special-purpose airports—Lake Lawn Lodge and Playboy. A summary of the cost estimates of carrying out the recommended airport facility construction and operation plan element at each of the airports is set forth in Table 251.

The airport facility construction and operation recommendations summarized above and in Tables 250 and 251 represent a functional airport system plan. In order to assess the feasibility of implementing the recommended functional plan, and thus specify plan implementation responsibilities, it is necessary to consider the jurisdictional aspects of plan implementation, i.e., consider the feasibility of alternative institutional structures for plan implementation, including consideration of both public and private responsibilities and, with respect to public responsibilities, the consideration of alternative public institutional structures for plan implementation. Accordingly, the following discussion is intended to provide a basis for the establishment of a recommended institutional structure for implementation of the regional airport system plan.

Table 250

AIRPORT FACILITY CONSTRUCTION AND OPERATION PLAN ELEMENT FOR THE REGION

County	Airport	Classification: Existing	Classification: Proposed	Site Improvement Requirements: Land Acquisition: Existing Private Airport	Land Acquisition: Site Expansion	Land Acquisition: Clear Zone Protection	Land Acquisition: Aircraft Noise Protection	Runways: Pave	Runways: Extend	Runways: Widen	Runways: Strengthen	Runways: New	Taxiways: Extend	Taxiways: Widen	Taxiways: Strengthen	Taxiways: New	Parking Apron: Expand	Traffic Control Tower: New	Navigational Aids: Install Lighting	Navigational Aids: Mark and Light Obstructions	Navigational Aids: Install ILS
Kenosha	Kenosha Municipal . . .	General Utility	Basic Transport	--	X	X	--	--	X	X	X	X	X	--	X	X	X	X	X	--	X
Milwaukee	General Mitchell Field .	Scheduled Air Transport	Scheduled Air Transport	--	--	X	X	--	X	--	X	X	X	--	X	X	X	--	X	X	--
	Timmerman Field. . . .	General Utility	General Utility	--	--	--	--	--	--	--	--	--	--	--	--	--	X	--	X	--	--
Ozaukee	Ozaukee	Less than Basic Utility	General Utility	X	X	X	--	--	--	--	--	X	--	--	--	X	X	X	X	--	--
Racine	Burlington Municipal . .	Basic Utility	Basic Transport	--	X	X	--	X	X	X	X	--	--	--	--	X	X	X	X	--	X
	Racine Commercial . . .	Basic Transport (Limited)	Basic Transport	X	--	--	--	--	--	--	X	--	--	--	--	X	X	X	X	X	X
	Sylvania	Less than Basic Utility	Basic Utility	X	X	X	--	--	X	X	--	X	--	--	--	--	X	--	X	--	--
Walworth	East Troy Municipal . .	Less than Basic Utility	Basic Utility	--	X	X	--	X	X	--	--	X	--	--	--	--	X	--	X	--	--
	Gruenwald	Less than Basic Utility	General Utility	X	X	X	--	--	--	--	--	X	--	--	--	X	X	X	X	--	--
Washington	Hartford Municipal . . .	Basic Utility	General Utility	--	X	X	--	X	X	--	--	--	X	--	--	--	X	X	X	--	--
	West Bend Municipal . .	General Utility	Basic Transport	--	X	X	--	--	X	X	X	--	X	X	X	--	X	X	X	--	X
Waukesha	Waukesha County. . . .	General Utility	Basic Transport	--	X	X	--	--	X	X	X	X	X	--	X	--	X	X	X	--	X
Total	--	--	--	4	9	10	1	3	8	5	6	7	5	1	4	6	12	8	12	2	4

County	Airport	Classification: Existing	Classification: Proposed	Site Improvement Requirements: Terminal Area Improvements: Terminal/ Administration Building(s): Expand	Terminal/ Administration Building(s): New	Auto Parking and Service Roads: Expand	Auto Parking and Service Roads: New	Hangar Area Improvements: Expand Hangar Storage/Service Area	Hangar Area Improvements: New Hangar Storage/Service Area	Ground Access Improvements	Utility Service Improvements: Connect to Municipal Sewerage System	Utility Service Improvements: Expand Onsite Sewerage Facilities	Operational Requirements: Impose Nonstandard Air Traffic Patterns	Operational Requirements: Restrict Flight Activity
Kenosha	Kenosha Municipal	General Utility	Basic Transport	--	X	X	--	X	--	--	X	--	X	--
Milwaukee	General Mitchell Field . .	Scheduled Air Transport	Scheduled Air Transport	X	--	X	--	X	--	X	--	--	X	X
	Timmerman Field.	General Utility	General Utility	X	--	X	--	X	--	--	--	--	--	X
Ozaukee	Ozaukee	Less than Basic Utility	General Utility	--	X	--	X	--	X	--	X	--	--	--
Racine	Burlington Municipal . . .	Basic Utility	Basic Transport	X	--	X	--	X	--	X	X	--	--	--
	Racine Commercial	Basic Transport (Limited)	Basic Transport	--	X	X	--	X	--	--	--	--	--	X
	Sylvania	Less than Basic Utility	Basic Utility	--	X	--	X	X	--	--	--	X	--	--
Walworth	East Troy Municipal . . .	Less than Basic Utility	Basic Utility	--	X	X	--	X	--	--	X	--	--	--
	Gruenwald	Less than Basic Utility	General Utility	--	X	X	--	--	X	--	X	--	--	--
Washington	Hartford Municipal	Basic Utility	General Utility	--	--	X	--	X	--	--	X	--	--	--
	West Bend Municipal . . .	General Utility	Basic Transport	--	X	X	--	X	--	--	X	--	X	--
Waukesha	Waukesha County.	General Utility	Basic Transport	X	--	X	--	X	--	--	X	--	X	X
Total	--	--	--	4	7	10	2	10	2	2	8	1	4	4

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Table 251

COST ESTIMATE SUMMARY FOR THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN

County	Airport	Land Requirements		Operational Area Improvement Cost[a]	Terminal Area Improvements		Auto Parking and Onsite Road Improvements	
		Acres	Cost		Square Feet	Cost	Number of Stalls	Cost
Kenosha	Kenosha Municipal	500	$ 1,782,000	$ 4,486,100	8,500	$ 637,500	390	$ 60,900
Milwaukee	General Mitchell Field . . .	70	$ 2,060,000	$22,800,000	--	$43,090,000[c]	4,800	$16,690,000[b]
	Timmerman Field.	33	1,540,000	1,248,300	9,700	756,600	350	56,900
Ozaukee	Ozaukee County	320	$ 434,000	$ 1,675,000	8,300	$ 649,700	440	$ 71,800
Racine	Burlington Municipal	233	$ 607,500	$ 2,486,000	6,600	$ 500,000	360	$ 57,000
	Racine Commercial	665	5,744,000	1,419,200	7,100	532,500	370	58,700
	Sylvania	162	474,500	857,700	7,250	471,300	385	62,500
Walworth	East Troy Municipal	120	$ 194,000	$ 932,800	7,800	$ 507,000	390	$ 62,900
	Gruenwald	306	449,800	1,522,100	7,250	565,500	385	62,600
Washington	Hartford Municipal	95	$ 333,500	$ 923,000	8,000	$ 624,000	385	$ 64,200
	West Bend Municipal	215	542,100	2,180,500	8,600	645,000	345	53,100
Waukesha	Waukesha County.	140	$ 1,535,000	$ 2,123,300	8,100	$ 607,500	265	$ 41,400
Total	--	--	$15,696,400	$42,654,000	--	$49,586,600	--	$17,342,000

County	Airport	Hangar Improvements[b]		Offsite Surface Transportation Costs	Utility Service Cost	Total Estimated Capital Investment	Total Estimated Deferred Capital Investment	Plan Implementation Costs 1975-1995
		Square Yards	Cost					
Kenosha	Kenosha Municipal. . . .	24,300	$ 1,832,200	$ --	$ --	$ 8,798,700	$ 1,100,250	$ 7,698,450
Milwaukee	General Mitchell Field . .	10,900	$ 821,900	$ --	$ --	$ 85,461,900	$ --	$ 85,461,900
	Timmerman Field	25,000	1,885,000	--	--	5,486,800	2,785,200	2,701,600
Ozaukee	Ozaukee County	29,300	$ 2,209,200	$ --	$ 18,000	$ 5,057,700	$ 985,100	$ 4,072,600
Racine	Burlington Municipal . .	25,500	$ 1,922,700	$ 115,000	$ --	$ 5,688,200	$ 399,600	$ 5,288,600
	Racine Commercial . . .	17,100	1,289,300	200,000	--	9,243,700	2,274,600	6,969,100
	Sylvania	17,200	1,296,900	--	18,000	3,180,900	317,800	2,863,100
Walworth	East Troy Municipal . . .	20,200	$ 1,523,000	$ --	$ --	$ 3,219,700	$ 356,300	$ 2,863,400
	Gruenwald	20,000	1,508,000	--	18,000	4,126,000	901,900	3,224,100
Washington	Hartford Municipal. . . .	23,900	$ 1,802,100	$ --	$ 29,000	$ 3,775,800	$ 487,300	$ 3,288,500
	West Bend Municipal. . .	22,700	1,711,600	519,000	29,000	5,680,300	504,400	5,175,900
Waukesha	Waukesha County	26,800	$ 2,020,700	$ 187,000	$ --	$ 6,514,900	$ 552,200	$ 5,962,700
Total	--	--	$19,822,600	$1,021,000	$112,000	$146,234,600	$10,664,650	$135,570,000

[a] *Includes cost to construct, extend, and improve runways and taxiways, aircraft parking apron, and lighting and navigation aids, but does not include cost to provide tower and landing and lighting approach systems, which are borne entirely by the Federal Aviation Administration.*

[b] *These improvements are considered to be self-amortizing.*

[c] *Includes $2,830,000 estimated cost to provide cargo terminal area, which is considered to be self-amortizing.*

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Feasibility of Existing Institutional Structure to Implement Plan

At the present time, the 14 airports included in the regional airport system plan are owned and operated by a variety of public agencies and private concerns. Eight of the 14 airports are publicly owned and operated, with three owned and operated by counties—Milwaukee (Mitchell and Timmerman Fields) and Waukesha; four owned and operated by cities—Burlington, Kenosha, Hartford, and West Bend; and one owned and operated by a village—East Troy. The remaining six airports in the system plan are currently privately owned and operated—Ozaukee, Sylvania, Racine, Gruenwald, Lake Lawn Lodge, and Playboy. Two of these private airports—Lake Lawn and Playboy—exclusively serve major recreational resorts and do not, therefore, play an important role with respect to the permanent basing of aircraft. Accordingly, it may be assumed from this point on in the discussion that these two airports will continue to be privately owned and operated and continue to exclusively serve the recreational resorts, no matter what alternative institutional structure is being considered.

In consideration of the assignment of plan implementation responsibilities, a logical first step is to consider whether or not the existing institutional structure for airport operation and maintenance will likely be able to continue to ensure full implementation of the essential elements of the regional airport system plan. The estimated average annual local share of capital investment at the 12 general-purpose airports included in the regional airport system plan is set forth in Table 252. These estimates exclude any recommended facilities, such as hangars, that may be assumed to be self-amortizing through the use of user fees and other service charges, but include the estimate of excess revenues exceeding operating costs at General Mitchell Field which are applied to the capital costs at that airport. Table 252 indicates that a toal of about $30.8 million, including $27.2 million at General Mitchell Field, will be required locally to carry out airport improvements at the eight currently publicly owned airports over a 20-year plan implementation period, or an annual capital investment of about $1.5 million. This latter figure may be compared to the average $255,000 capital investment made annually at these eight airports over the period 1963 through 1972. From this, it may be concluded that, considering all eight currently publicly owned airports as a whole, a substantial increase in the local capital investment annually will be required if the recommended improvements are to be fully carried out, although the $1.0 million required represents a relatively small amount when compared to the $35 million expended locally in the Region on an annual average basis for all transportation facility improvements.

Looking individually at the eight airports, a more complex pattern emerges, with substantial increases in average annual local capital investment required at the Kenosha, Burlington, East Troy, Hartford, and because of the proposed passenger terminal building, General Mitchell Field Airports; and a lesser increase in local capital investment required at the Waukesha and West Bend Airports. The estimated average annual per capita cost of providing the necessary local capital investment at each of the eight publicly owned airports is set forth in Table 253. These per capita costs range from a low of $0.09 per capita in Waukesha County to a high of $5.03 per capita in the small Village of East Troy.

In addition to the $30.8 million of local capital investment required to implement the plan at the eight currently publicly owned airports, an additional $2.0 million in local capital investment will be required to implement the plan at the four currently privately owned airports, assuming public ownership of such airports and, consequently, the possibility of fully utilizing available state and federal airport development aids. Private airport owners are not eligible for federal and state airport development aids. The $2.0 million total corresponds to an additional average annual local capital investment of nearly $98,600. Thus, the total estimated local share of required capital investment at the 12 airports in the system plan, assuming public ownership and operation of all airports, is about $32.8 million, or about $1.64 million annually over a 20-year plan implementation period. This represents nearly a six-fold increase in the local commitment to capital investment in airport facilities over that experienced during the 1963 to 1972 period. Again, it should be emphasized that these figures reflect only essential airport facility improvements and do not include assumed self-amortizing facilities, such as hangars and the auto parking structure and cargo terminals at General Mitchell Field. These figures do, however, include the $38.1 million cost, or $1.5 million annually, of the proposed passenger terminal facility at General Mitchell Field. These figures further assume sufficient federal and state funds in accordance with current aid formulas.

If it is assumed that the four privately owned airports remain in private ownership, then it must be further assumed that federal and state airport development aids will not be available to assist in implementing the airport plan at those four sites. Table 254 presents the estimated private capital investment required at these airports under such assumptions. From this table, it may be seen that a total of about $7.1 million of private capital investment will be required, representing an average annual capital investment over a 20-year period of about $354,700. Again, these estimates do not include capital required for assumed self-amortizing facilities, such as hangars. The private capital investment required under these assumptions ranges from a high of about $2.4 million at the Racine Commercial Airport, or about $121,500 annually, to a low of about $1.3 million at the Sylvania Airport, or about $63,400 annually.

In addition to considering the capital investment required to carry out the recommended plan, the interest in, and attitude toward, aviation and airport development on the part of the public and private sponsors must also be taken into account. Based upon discussions with public airport owners or operators over the course of the study, considering the past performance of each sponsor, it may be fairly assumed that the likelihood of both Milwaukee and

Table 252

ESTIMATED AVERAGE ANNUAL LOCAL CAPITAL INVESTMENT AT AIRPORTS INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN

Airport	Estimated Capital Investment[a]				Average Annual Local Share of Required Capital Investment	
	Total	Local Share: Required to Match State and/or Federal Aid	Local Share: 100% Local	Local Share: Total	Actual 1963-1972 Using State and/or Federal Aid	Estimated (1975-1995)
Publicly Owned						
Kenosha Municipal. . . .	$ 5,866,250	$ 871,785	$ 18,300	$ 890,085	$ 7,260	$ 44,500
General Mitchell Field. .	65,120,000	27,164,250[b]	--	27,164,250[c]	183,000	1,358,200[b]
Timmerman Field	816,600	261,660	17,100	278,760	--	13,900
Burlington Municipal . .	3,365,900	532,298	17,100	549,398	7,160	27,500
East Troy Municipal. . .	1,340,450	282,217	18,900	301,117	--	15,100
Hartford Municipal. . . .	1,486,400	348,161	19,300	367,461	3,750	18,400
West Bend Municipal . .	3,464,300	595,998	15,900	611,898	23,140	30,600
Waukesha County	3,942,000	619,561	12,400	631,961	30,640	31,600
Subtotal	$85,401,900	$30,675,930	$119,000	$30,794,930	$254,770	$1,539,800
Privately Owned						
Ozaukee.	$ 1,863,400	$ 392,799	$ 21,500	$ 414,299	$ --	$ 20,700
Racine Commercial . . .	5,679,800	828,110	17,600	845,710	--	42,300
Sylvania.	1,566,200	319,400	18,800	338,200	--	16,900
Gruenwald	1,716,100	355,886	18,800	374,686	--	18,700
Subtotal	$10,825,500	$ 1,896,195	$ 76,700	$ 1,972,895	$ --	$ 98,600
Total	$96,227,400	$32,572,125	$195,700	$32,767,825	$254,770	$1,638,400

[a] *Does not include assumed self-amortizing facilities, such as hangars and the auto parking structures and cargo terminals at General Mitchell Field.*

[b] *Includes revenues exceeding operating costs applied against capital costs, estimated to equal $14.4 million over a 20-year period or an annual average of $720,400.*

Source: SEWRPC.

Waukesha Counties to carry out the recommended plan is quite high. Similarly, the Cities of Kenosha, West Bend, and Hartford have tended to evidence great interest in promoting aviation and airport development, primarily as part of a desire to promote commercial and industrial development. With respect to the two remaining public airports—East Troy and Burlington—it may be fairly assumed that these two public sponsors, which are quite small municipalities, will have a limited capability for undertaking extensive airport development and, hence, have indicated little interest in the preparation of airport master plans for their facilities and the subsequent undertaking of required airport improvements.

With respect to the private sector, it may be fairly concluded that only one of the four private sponsors or owners whose sites are included in the regional airport system plan has vigorously pursued airport facility development. This private owner is the corporation which owns and operates the Racine Commercial Airport. The remaining three private sponsors own and operate very small private airport facilities which would have to be substantially upgraded in order to fully carry out the plan recommendations.

The areawide nature of the importance of each of the 12 airports included in the regional airport system plan also must be considered when evaluating the likelihood that existing local airport owners and operators, both public and private, will be willing to commit the resources necessary to fully implement the plan recommendations. It is useful in this respect to examine the projected future service areas for each of the airports included in the system plan with respect to the type of aircraft to be accommodated. The three types of general aviation aircraft, identified earlier in this report as aircraft classifications C, D, and E, each have differing configurations with respect to the projected future service areas given the proposed role for each airport included in the system plan. These projected service areas are identified on

Table 253

ESTIMATED PER CAPITA COST FOR LOCAL CAPITAL INVESTMENT REQUIRED AT EXISTING PUBLICLY OWNED AIRPORTS IN THE REGION TO IMPLEMENT THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN

Airport Owner/Operator[a]	Estimated Average Annual Local Capital Investment Required[b]	Estimated 1990 Population[c]	Estimated Average Annual Per Capita Cost
Cities			
Burlington	$ 27,500	10,300	$2.67
Hartford.	18,400	10,500	1.75
Kenosha.	44,500	98,400	0.45
West Bend	30,600	30,400	1.01
Village			
East Troy	15,100	3,000	5.03
Counties			
Milwaukee	1,372,200	1,022,200	1.34
Waukesha.	31,600	356,600	0.09
Total	$1,539,900	1,531,400	$1.01

[a] *Assumes continued private ownership and operation of the Gruenwald, Ozaukee, Racine Commercial, and Sylvania Airports.*

[b] *Does not include assumed self-amortizing facilities, such as hangars and the auto parking structure and cargo terminals at General Mitchell Field.*

[c] *Represents estimated population approximately midway through the plan implementation period.*

Source: SEWRPC.

Table 254

ESTIMATED CAPITAL INVESTMENT REQUIRED AT EXISTING PRIVATELY OWNED AIRPORTS INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN

County	Airport	Estimated Capital Investment Required to Implement Recommended Regional Airport System Plan[a]	
		Total	Average Annual (20-Year Plan Implementation Period)
Ozaukee	Ozaukee	$1,849,900	$ 92,500
Racine	Racine Commercial	$2,429,800	$121,500
	Sylvania.	1,267,200	63,400
Walworth	Gruenwald.	$1,547,100	$ 77,300
Total	--	$7,094,000	$354,700

[a] *Does not include assumed self-amortizing facilities, such as hangars.*

Source: SEWRPC.

Maps 72, 73, and 74, respectively. While each general aviation airport may be considered to have a service area with a 30-minute ground travel time radius, the specific areas delineated herein are based upon minimum ground travel time to airports capable of serving each aircraft type and the demand/capacity ratios of each airport. Under this definition, airports in the more densely developed areas are apt to have small service areas, since their capacity will be utilized by the large number of aircraft whose owners live nearby, and owners living near the fringe of such an airport service area may find themselves in the service area of an airport that is some greater distance away but which has greater available capacity to serve them.

From an examination of Map 72, it may be seen that four of the six airports included in the system plan that are capable of accommodating C type aircraft, or the larger business jets, have anticipated service areas extending beyond the boundaries of a single county. Only the Racine and Waukesha Airports may be expected to have service areas confined to a portion of a single county. In particular, the Burlington and West Bend Airports are expected to serve a large geographic area. In the case of the Burlington Airport, it consists of nearly all of Walworth County and portions of Racine, Kenosha, and Waukesha Counties, and in the case of West Bend, all of Washington and Ozaukee Counties.

With respect to the type D aircraft, which can be accommodated at 10 of the proposed 12 general-purpose airports included in the recommended system plan, the service area configurations identified on Map 73 form a complex intergovernmental pattern, with the service areas of individual airports significantly overlapping county boundaries. Only the Racine, Waukesha, and Ozaukee Airports may be expected to serve geographic areas contained wholly within a single county. Similarly, with respect to type E aircraft, or the smallest aircraft, the service area pattern depicted on Map 74 is still generally of an intergovernmental and intercounty pattern, with only the Ozaukee, Kenosha, Mitchell, and Gruenwald Airports of the 12 airports in the system plan anticipated to have service areas lying primarily within the boundaries of a single county. Because of the complex, areawide, intergovernmental character of the airport service areas attendant to the various types of aircraft that must be accommodated in the Region, it is difficult to envision individual municipalities assuming a more important role with respect to the provision of public airport facilities. It is more likely, accordingly, that future public involvement in the provision of airport facilities will occur at the county, areawide, or state levels of government.

Several basic conclusions may be drawn from the foregoing discussion, the most important of which are the following:

1. A substantial increase in the average annual commitment to capital investment by the public will be required if the recommended regional airport system plan is to be fully implemented. Considering the eight currently publicly owned airport facilities alone, the average annual local capital investment will have to increase from about $255,000 a year to about $1.5 million a year. If the four currently privately owned airports become publicly owned, an additional $98,600 a year of local public capital investment will be required, representing a total of about $1.64 million annually, or nearly six times the current local annual capital investment.

2. It is likely that all of the existing public sponsors of airports, except the Village of East Troy and the City of Burlington, will actively seek to pursue implementation of the recommended plan and will commit the required necessary annual average capital investment. With respect to East Troy and Burlington, such a likelihood is less probable, primarily because of the size of the communities and the substantial increase required in average annual capital investment.

3. It is highly unlikely that any of the four owners of the privately owned airports included in the regional airport system plan will vigorously pursue implementation of the recommended plan, primarily because of the heavy capital investment required. The only possible exception is the corporation owning the Racine Commercial Airport. The estimated value of these four privately owned airports today is about $3.8 million, whereas the estimated capital investment required at these same four airports to fully implement the plan is about $7.1 million. While it is likely that the four existing operators would be willing to continue operation of their existing facilities, it is considered unlikely that any of the four operators would be willing or able to commit the necessary capital to fully implement the plan recommendations. Accordingly, it may be concluded that, with respect to these four airports, public ownership and operation is necessary if the recommended plan is to be fully carried out.

4. Failure to provide public sponsorship of the four existing privately owned airports in the existing plan will result in a situation where full advantage will not be taken of anticipated federal and state aids. As shown in Table 255, sufficient federal aids may be expected to become available for plan implementation, and with state aids only slightly less than required, local matching funds from public sponsors become the critical element in plan implementation. Not only must the level of average annual capital investment by current public sponsors in the Region be increased to cover improvements at existing publicly owned airports, but additional local public capital investment will be required to carry out improvements at the four existing privately owned airports in order to take full advantage of state and federal aids.

Table 255

COMPARISON OF ESTIMATED FEDERAL AND STATE CAPITAL INVESTMENT REQUIRED TO IMPLEMENT RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN AND ESTIMATED REVENUES TO BE MADE AVAILABLE FOR AIRPORT DEVELOPMENT PURPOSES BY THE FEDERAL AND STATE GOVERNMENTS

Governmental Level	Estimated Capital Investment Required to Implement Recommended Regional Airport System Plan[a] (In Millions)		Estimated Revenues to be Made Available for Airport Capital Investment[b] (In Millions)	
	Total	Average Annual	Total	Average Annual
Federal	$40.6	$2.03	$50.0	$2.50
State	8.4	0.42	5.0	0.25
Total	$49.0	$2.45	$55.0	$2.75

[a] Assumes continuation of current federal aid formulas and a revision of state aid formula to provide 50 percent of eligible terminal and administration building costs rather than only $35,000 toward such costs. Does not include assumed self-amortizing facilities, such as hangars and the auto parking structure and cargo terminal area at General Mitchell Field, nor the local share of capital investment required.

[b] Assumes a 20-year plan implementation period.

Source: SEWRPC.

5. The areawide character of the service areas of each of the 12 airports included in the regional airport system plan mitigates against the possibility that additional local public sponsors at the city and village level will be found to assume ownership and operation of the four currently privately owned airports included in the plan. It is highly unlikely, for example, that the Cities of Elkhorn or Port Washington would be willing to assume responsibility for ownership and operation of the two general utility airports recommended in their immediate environs given the fact that such airports serve a constituency well beyond the limits of the municipality. This same factor also mitigates against the continuing willingness of existing village and city sponsors to increase their capital investment, although in part this factor may be offset by a desire to promote industrial development. It is considered more likely that future public sponsorship of airport facilities will have to be found at the county, areawide, and state levels of government.

Alternative Public Airport Institutional Structures

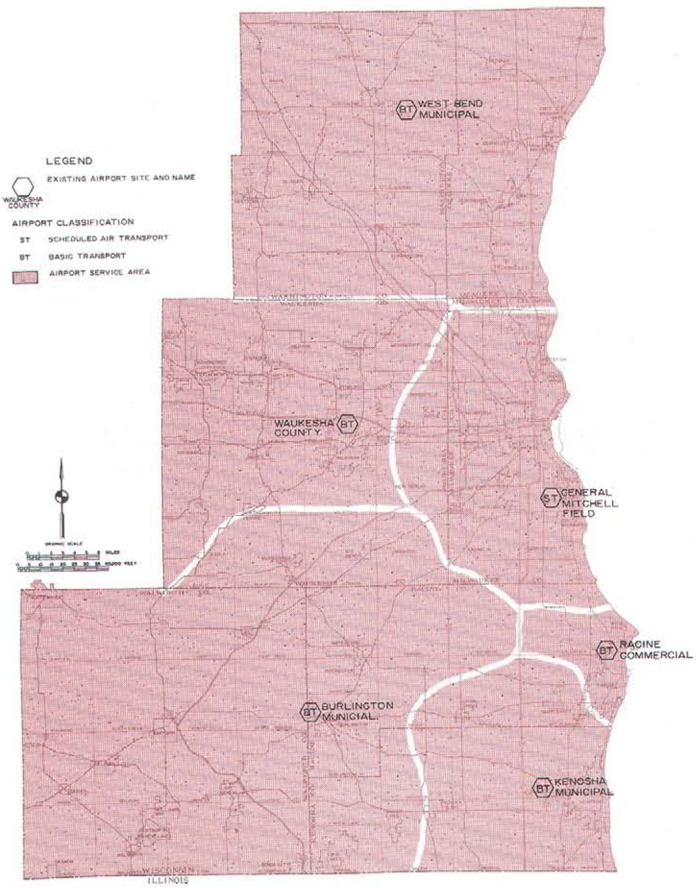
Based upon the foregoing considerations, it becomes necessary to consider alternative public institutional structures for implementation of the regional airport system plan airport improvement recommendations. From the many alternatives available, it was determined to consider the following five alternatives, which in the judgement of the Advisory Committee have a reasonable probability of being carried out: 1) continue existing major public sponsors and seek new local public sponsors; 2) seek county sponsorship of all public airport facilities; 3) seek county and multicounty sponsorship of all public airport facilities; 4) seek establishment of a regional airport authority; and 5) state ownership and operation of all public airport facilities. Each of these alternatives is discussed below.

Alternative No. 1—Continue Existing Major Public Sponsors and Seek New Local Public Sponsors: Under the first alternative public institutional structure considered for implementation of the regional airport system plan, the following existing public sponsors would continue to own and operate airport facilities as at present and carry out the necessary improvements at such facilities: the Cities of Kenosha, Hartford, and West Bend, and the Counties of Milwaukee and Waukesha. These existing public sponsors have historically pursued airport development in a vigorous manner, have in recent years evidenced a great deal of interest in continuing to sponsor airport development, and are likely to carry out the recommended improvements to airport facilities under their jurisdiction.

Under this alternative, new local public sponsors would be needed for the Ozaukee Airport in Ozaukee County, the Racine Commercial and Sylvania Airports in Racine County, and the Gruenwald Airport in Walworth County, all of which currently are privately owned. In addition, new public sponsors would be needed for the currently publicly owned facilities at East Troy and Burlington because of their increased importance in accommodating the general aviation aircraft fleet and their importance from an areawide point of view. Since it is unlikely that new local public sponsors in terms of cities, villages, or towns could be found to assume ownership and operation of the four existing private airports because of the

Map 72

ANTICIPATED FUTURE SERVICE AREAS OF AIRPORTS IN THE REGION CAPABLE OF ACCOMMODATING TYPE C AIRCRAFT

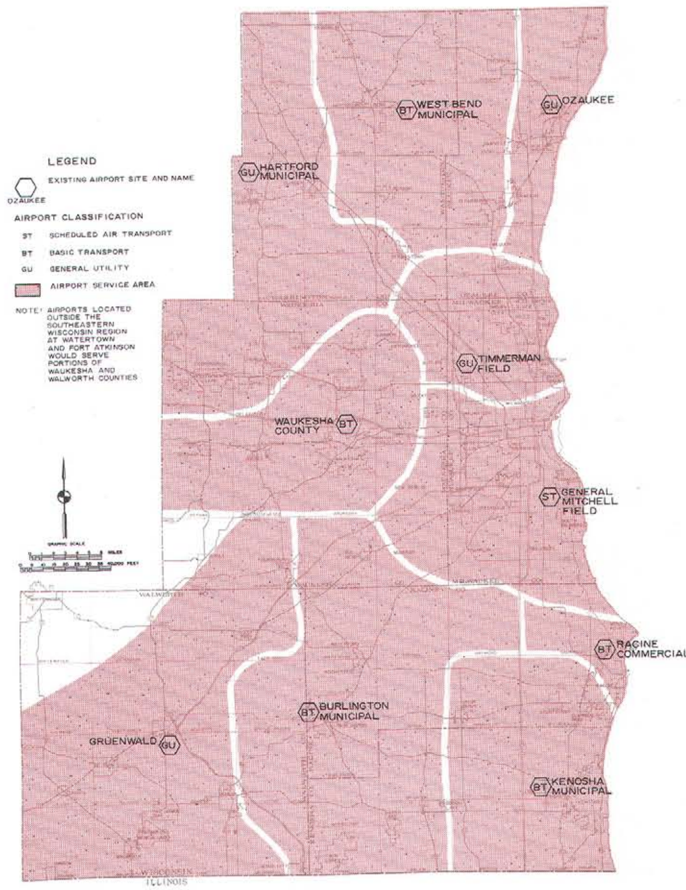


Allocation of type C aircraft-the heaviest, high performance type general aviation aircraft-to General Mitchell Field and to the five recommended basic transport airports on the basis of airport capacity and ground travel time standards produces anticipated airport service areas which would extend beyond county boundaries at four of the six regional airports capable of accommodating type C aircraft.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 73

ANTICIPATED FUTURE SERVICE AREAS OF AIRPORTS IN THE REGION CAPABLE OF ACCOMMODATING TYPE D AIRCRAFT



Allocation of type D aircraft—the intermediate weight, high performance type general aviation aircraft—to General Mitchell Field and to the five recommended basic transport and four general utility general aviation airports also produces anticipated airport service areas that overlap county boundaries. Only three of the 10 regional airports capable of accommodating type D aircraft have service areas contained within a single county.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

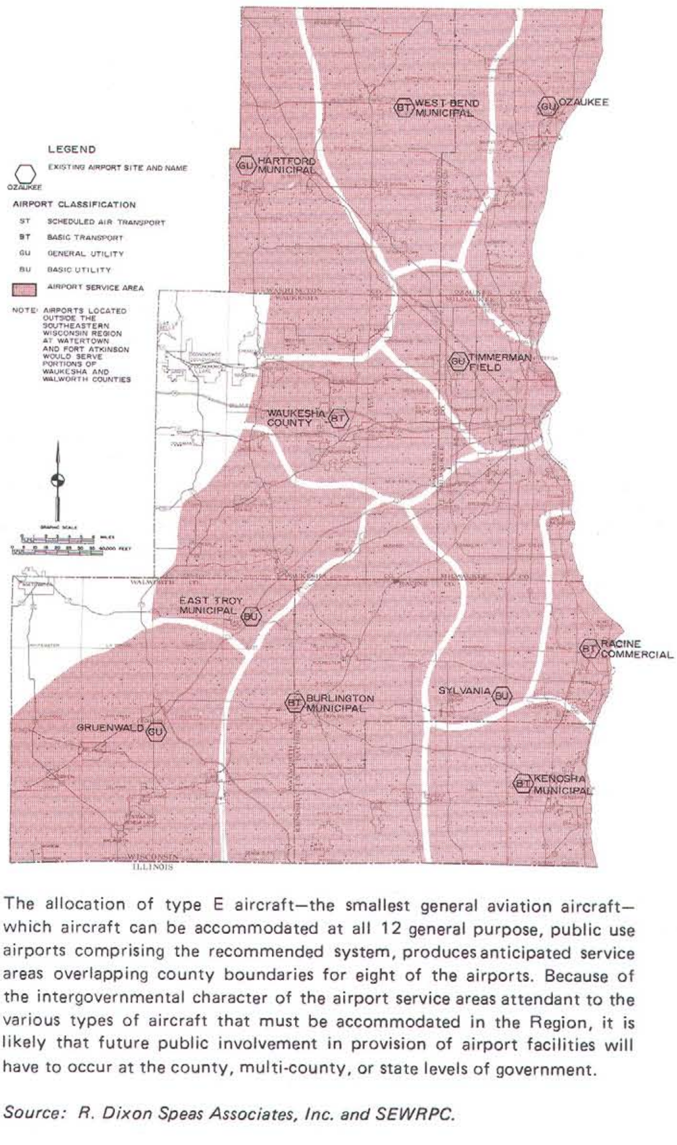
recognized areawide character of their service areas, this alternative would recommend that such sponsorship be assumed at the county level of government. Accordingly, this alternative would recommend that Ozaukee County purchase the existing privately owned Ozaukee Airport and establish a new Ozaukee County airport facility; that Racine County acquire the existing privately owned Racine Commercial and Sylvania Airports and the existing publicly owned Burlington Airport and create a three-airport county system; and that Walworth County purchase the existing privately owned Gruenwald Airport, as well as the existing publicly owned East Troy Airport, and create a two-airport county system. This alternative public airport institutional structure is shown on Map 75.

This alternative has several advantages, including its reliance on the existing public institutional structure for airport system development, thus taking advantage of historical responsibilities and known capabilities for airport facility development; providing for county level ownership and operation of airports in those counties where there are no existing public airports and where existing public sponsors are quite small and, therefore, have a limited capability to undertake future airport facility development; and the end result of having the public airport function being carried out at the county level in five of the seven counties in the Region, thus recognizing that airport service areas always include more than a single municipality and, in most cases, include more than a single county.

On the other hand, this alternative assumes that existing local government sponsors in Kenosha, Hartford, and West Bend will be willing to provide the capital invest-

Map 74

ANTICIPATED FUTURE SERVICE AREAS
OF AIRPORTS IN THE REGION CAPABLE
OF ACCOMMODATING TYPE E AIRCRAFT



The allocation of type E aircraft—the smallest general aviation aircraft—which aircraft can be accommodated at all 12 general purpose, public use airports comprising the recommended system, produces anticipated service areas overlapping county boundaries for eight of the airports. Because of the intergovernmental character of the airport service areas attendant to the various types of aircraft that must be accommodated in the Region, it is likely that future public involvement in provision of airport facilities will have to occur at the county, multi-county, or state levels of government.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

ment required to fully implement the plan. On a per capita cost basis, for example, it is estimated that the City of Hartford would be required to spend $1.75 per capita annually in order to carry out the recommended plan (see Table 256). The per capita cost of continuing to own and operate the airport in the City of West Bend would also be quite high, estimated at $1.01. Milwaukee County residents would pay $1.34 per capita. These three per capita cost estimates in particular are substantially higher than those estimated for the other public sponsors included in this alternative structure.

This alternative also has the disadvantage of requiring the county boards in three counties to assume responsibility for a completely new function. Historically, Ozaukee, Racine, and Walworth Counties have not undertaken airport development as part of their transportation responsibilities. Finally, while this alternative does seek to recognize, at least in part, the areawide nature of the airport facilities included in the plan, it does tend to ignore the intercounty role that several key airports in the system plan are expected to perform, particularly the Burlington and West Bend Airports. When considering all types of general aviation aircraft, and particularly when considering type C aircraft, the Burlington and West Bend Airports, because of their geographic location, tend to serve all or portions of several counties. Accordingly, this alternative does not fully take into account the areawide nature of the service areas of the airports included in the system plan.

Alternative No. 2—County Sponsorship of All Public Airport Facilities: Under the second alternative institutional structure considered, ownership and operation of all general-purpose airport facilities in the Region included in the system plan would be vested in the county level of government. Currently, two counties—Milwaukee and Waukesha—already own and operate airport facilities. Hence, under this alternative, the five remaining counties in the Region would have to assume an airport development and operation function. In Kenosha County, the county would assume ownership and operation of the airport currently owned and operated by the City of Kenosha; in Ozaukee County, the county would purchase the existing privately owned Ozaukee Airport and establish a new county airport facility on that site; in Racine County, the county would acquire the existing privately owned Racine Commercial and Sylvania Airports and the existing publicly owned Burlington Airport and create a three-airport county system; in Walworth County, the county would purchase the existing privately owned Gruenwald Airport and the existing publicly owned East Troy Airport and create a two-airport county system; and in Washington County, the county would acquire the existing publicly owned airports at Hartford and West Bend and establish a two-airport county system. This alternative public airport institutional structure is graphically shown on Map 76.

The estimated per capita cost for local capital investment required to implement the recommended plan under this alternative institutional structure is set forth by airport sponsor in Table 257. Such per capita costs range from a low of $0.09 in Waukesha County to a high of $1.34 in Milwaukee County. Thus, the relatively high per capita costs in the Cities of Hartford and West Bend observed under the first alternative institutional structure considered are greatly reduced when the ownership and operation of these facilities are transferred to the county level of government.

This second alternative is very similar to the first, differing only in that under the second alternative, the municipal airport ownerships at Kenosha, Hartford, and West Bend would be transferred to the respective counties, thus resulting in total county responsibility for the airport function within the Region. Therefore, this

Table 256

ESTIMATED PER CAPITA COST FOR LOCAL CAPITAL INVESTMENT REQUIRED TO IMPLEMENT THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN—ALTERNATIVE PUBLIC INSTITUTIONAL STRUCTURE NO. 1

Airport Owner/Operator	Estimated Average Annual Local Capital Investment Required[a]	Estimated 1990 Population[b]	Estimated Average Annual Per Capita Cost
Cities			
Kenosha.	$ 44,500	98,400	$0.45
Hartford.	18,400	10,500	1.75
West Bend	30,600	30,400	1.01
Counties			
Milwaukee	1,372,200	1,022,200	1.34
Ozaukee.	20,700	97,400	0.21
Racine.	86,700	203,600	0.43
Walworth	33,800	86,600	0.39
Waukesha.	31,600	356,600	0.09
Total	$1,638,500	1,905,700	$0.86

[a] *Does not include assumed self-amortizing facilities, such as hangars and the General Mitchell Field passenger and cargo terminals.*

[b] *Represents estimated population approximately midway through the plan implementation period.*

Source: SEWRPC.

Table 257

ESTIMATED PER CAPITA COST FOR LOCAL CAPITAL INVESTMENT REQUIRED TO IMPLEMENT THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN—ALTERNATIVE PUBLIC INSTITUTIONAL STRUCTURE NO. 2

Airport Owner/Operator	Estimated Average Annual Local Capital Investment Required[a]	Estimated 1990 Population[b]	Estimated Average Annual Per Capita Cost
Kenosha County	$ 44,500	159,900	$0.29
Milwaukee County.	1,372,200	1,022,200	1.34
Ozaukee County	20,700	97,400	0.21
Racine County	86,700	203,600	0.43
Walworth County	33,800	86,600	0.39
Washington County	49,000	117,600	0.42
Waukesha County	31,600	356,600	0.09
Total	$1,638,500	2,043,900	$0.80

[a] *Does not include assumed self-amortizing facilities, such as hangars and the General Mitchell Field passenger and cargo terminals.*

[b] *Represents estimated population approximately midway through the plan implementation period.*

Source: SEWRPC.

alternative has many of the same advantages and disadvantages discussed for the first alternative considered. Perhaps the greatest disadvantage of the second alternative is that it proposes the assumption in five counties of a completely new function by the county board. Perhaps offsetting this disadvantage is the advantage of a greater recognition of the areawide functions that the individual airports perform in the system plan. In addition, the range of per capita costs under the second alternative is reduced over that in the first alternative, thus resulting in a more equitable distribution of costs throughout the Region.

Alternative No. 3—County and Multicounty Sponsorship of All Public Airport Facilities: Under the third alternative public institutional structure considered, Milwaukee and Waukesha Counties would continue to own and operate airport facilities as at present and carry out the necessary improvements at such facilities, while two multi-county organizations would be formed to own and operate airport facilities in the remainder of the Region: one to serve Ozaukee and Washington Counties and one to serve Kenosha, Racine, and Walworth Counties. This alternative public airport institutional structure is shown on Map 77.

Under this alternative, the proposed Ozaukee-Washington County airport authority or commission would be responsible for acquiring the existing privately owned Ozaukee Airport, as well as the existing publicly owned Hartford and West Bend Airports, resulting in the creation of a three-airport multicounty system. Similarly, the proposed tri-county airport authority or commission for Kenosha, Racine, and Walworth Counties would be responsible for acquiring the existing privately owned Racine Commercial, Sylvania, and Gruenwald Airports, as well as the existing publicly owned Kenosha, Burlington, and East Troy Airports, resulting in the creation of a six-airport multicounty system.

The estimated per capita cost for local capital investment required to implement the plan under this alternative institutional structure for each airport sponsor in the Region is shown in Table 258. The average annual per capita costs range from a low of $0.09 in Waukesha County to a high of $1.34 in Milwaukee County. Thus, under this alternative, the local capital costs of implementing the regional airport system plan are more evenly distributed than under either of the first two alternatives considered, reflecting a more equitable distribution of costs for facilities that are areawide in nature.

This alternative also more fully recognizes than do the other two alternatives the truly areawide nature of several of the key airport facilities in the Region. For example, the West Bend Airport is the only airport facility in the regional plan in Ozaukee and Washington Counties capable of accommodating type C aircraft. Thus, it is logical that the local support for this airport be provided over the two-county area. Similarly, the Kenosha and Burlington Airports in the proposed tri-county Racine-Kenosha-Walworth county airport authority or commission each play an important intercounty role with respect to accommodating not only type C aircraft but also type D and E aircraft as well. The Burlington airport in particular literally straddles the Racine-Walworth County line, and because of its geographical location will always serve an area extending over at least three counties. On the other hand, this alternative, like the first two, fails to recognize the intercounty service provided by other airports extending across the county boundaries into Waukesha and Milwaukee Counties both from the north and south. In addition, this alternative, like the first two considered, fails to recognize the regional nature and importance of General Mitchell Field.

It is envisioned under this alternative that the multicounty organizations for airport development and operation proposed for Washington and Ozaukee Counties and for Kenosha, Racine, and Walworth Counties would be established either under the union airport authority, set forth in Section 114.151 of the Wisconsin Statutes, or under the cooperative contract authority set forth in Section 66.30 of the Wisconsin Statutes. In this respect, it is important to note that there are historical precedents that recognize the commonality of interest between the counties proposed for inclusion in multicounty authorities under this alternative. For example, Racine, Kenosha, and Walworth Counties together share a common areawide vocational technical school district, as well as a common planning organization for manpower planning development.

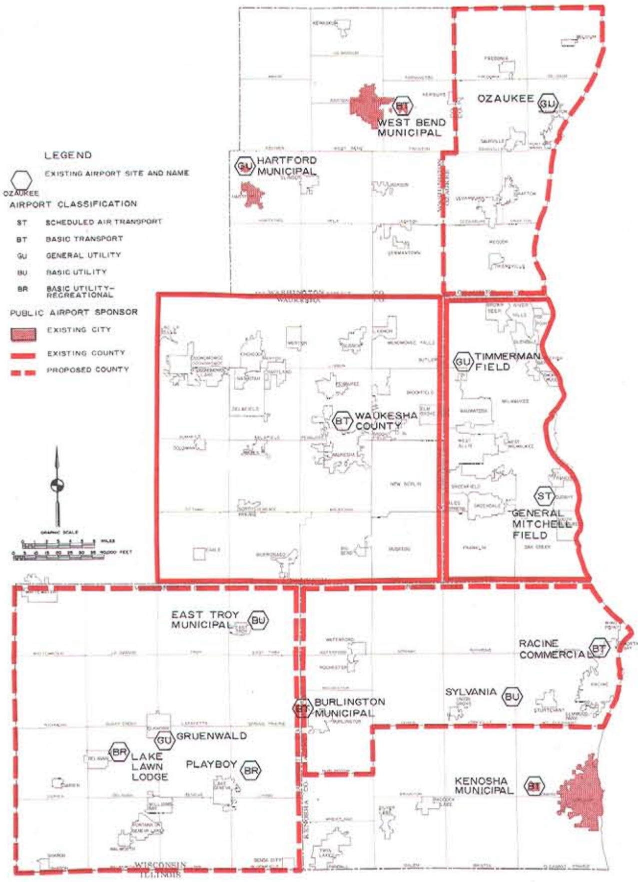
Alternative No. 4—Establish Regional Airport Authority: Under the fourth alternative public institutional structure considered, a regional public airport authority would be created to acquire and develop the currently privately owned airports included in the regional airport system plan and to ultimately assume ownership and operation and development responsibilities for all of the publicly owned airport facilities included in the recommended plan. This alternative is shown on Map 78, while the estimated per capita cost on a regionwide basis for carrying out the plan is set forth in Table 259.

This alternative has several advantages, including full recognition of the truly regional nature of General Mitchell Field in the airport system, as well as the areawide multicounty nature of all of the other 11 airports included in the recommended regional airport system plan. Furthermore, this alternative assures that the costs involved in providing for these regional and areawide airport facilities would be equitably distributed over the Region as a whole, resulting in an estimated average annual per capita cost of $0.80. On the other hand, this alternative has several disadvantages, including the need to seek new enabling legislation to create a regional airport authority, and the generally perceived disadvantage to create special authorities to conduct governmental functions resulting in the assumed erosion of responsibility on the part of general-purpose local units of government.

Alternative No. 5—State Ownership and Operation of All Public Airport Facilities: Under the fifth alternative public institutional structure considered, the State of Wisconsin would assume responsibility for the acquisition

Map 75

ALTERNATIVE PUBLIC AIRPORT INSTITUTIONAL STRUCTURE NO. 1—CONTINUE MAJOR EXISTING PUBLIC SPONSORS AND SEEK NEW LOCAL PUBLIC SPONSORS

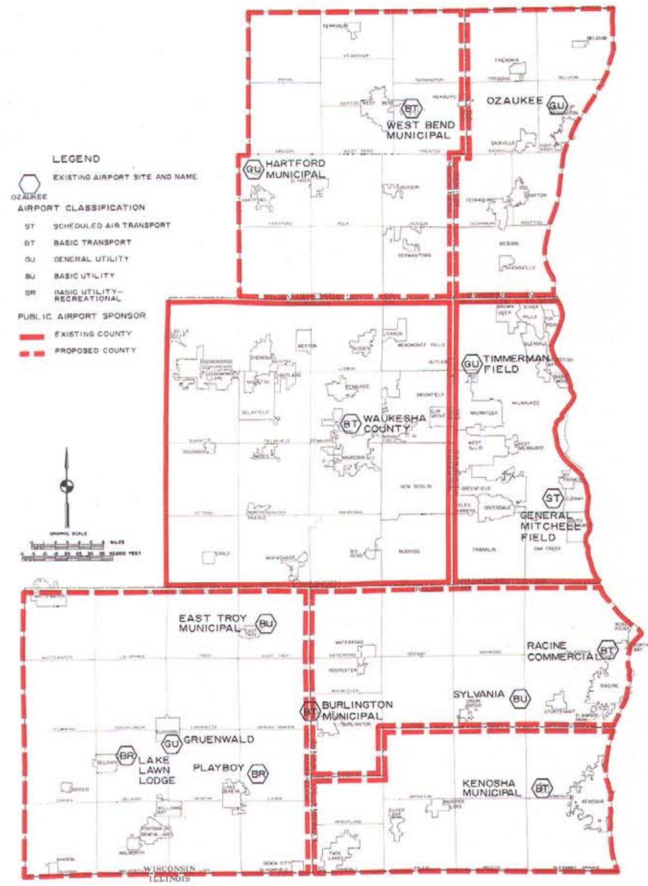


Under the first alternative institutional structure considered for airport system plan implementation, existing public sponsors would implement system plan recommendations at the Hartford, Kenosha, and West Bend Municipal airports and at the three county owned airports: Timmerman Field, General Mitchell Field, and Waukesha County. Since it was considered unlikely that municipal public sponsors could be found to assume ownership and operation of the four existing privately owned airports included in the system—Racine Commercial, Ozaukee, Gruenwald, and Sylvania—and since it was considered unreasonable to expect the City of Burlington and the Village of East Troy to fund the major improvements recommended for these two airports, county government would assume sponsorship for these six airports. The Playboy and Lake Lawn Airports would continue in private ownership and operation. Under this governmental structure, the local capital investment required to implement the plan would average $0.86 per capita per year from residents of the units of government involved and range from a low of $0.09 in Waukesha County to a high of $1.75 in the City of Hartford.

Source: SEWRPC.

Map 76

ALTERNATIVE PUBLIC AIRPORT INSTITUTIONAL STRUCTURE NO. 2—COUNTY SPONSORSHIP OF ALL PUBLIC AIRPORT FACILITIES



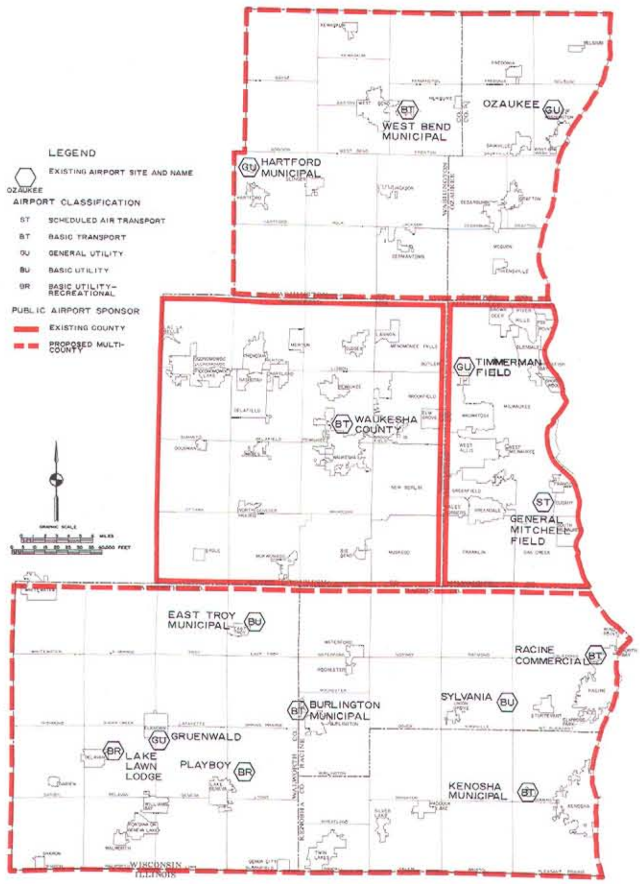
Under the second alternative institutional structure considered for airport system plan implementation, county government would assume sponsorship of 12 of the 14 airports comprising the recommended system. Under this governmental structure the local capital investment required to implement the plan would average $0.80 per capita per year, and range from a low of $0.09 in Waukesha County to a high of $1.34 in Milwaukee County. The Playboy and Lake Lawn Lodge Airports would remain as private airports.

Source: SEWRPC.

and development of all existing privately owned airports included in the regional airport system plan, as well as the acquisition and development of all currently publicly owned airport facilities. As noted earlier in this chapter, the State of Wisconsin does have statutory authority to implement this alternative; however, as also noted, the state historically has not sought to exercise that authority and establish a system of state airport facilities, unlike its posture with respect to highway development. This alternative would also have ramifications beyond the boundaries of the Region in that if the state were to reverse its historic position and assume airport development and operation responsibilities, it would probably have to do so on a statewide level. Accordingly, the probability of implementation of this alternative is judged to be quite low, although it fully takes into account the areawide nature of the airport facilities included in the regional airport system plan, fully recognizes the interregional importance of General Mitchell Field, and would result in an equitable distribution of airport improvement costs throughout the Region.

Map 77

ALTERNATIVE PUBLIC AIRPORT INSTITUTIONAL STRUCTURE NO. 3—COUNTY AND MULTI-COUNTY SPONSORSHIP OF ALL PUBLIC AIRPORT FACILITIES

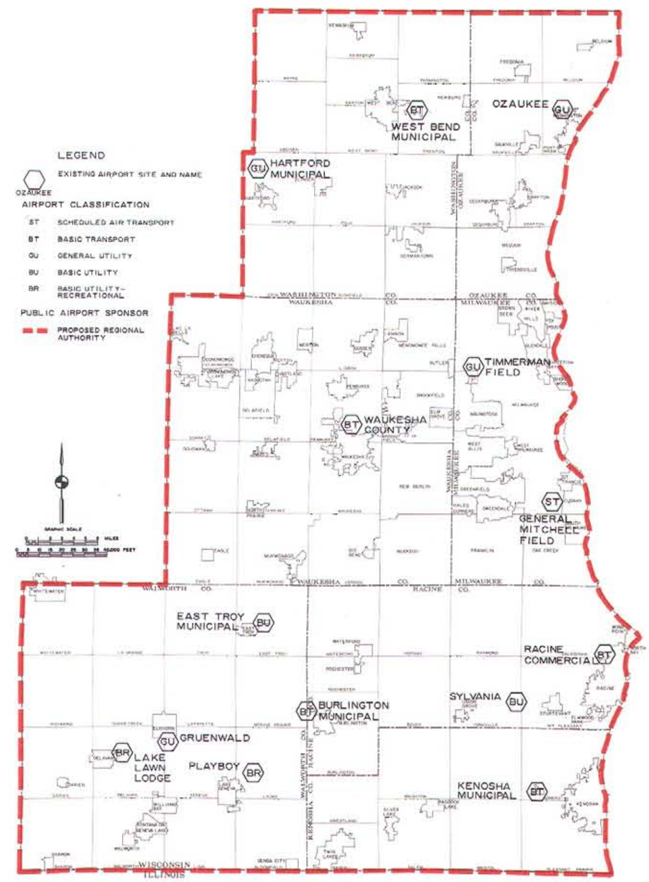


Under the third alternative institutional structures considered for airport system plan implementation, two new multi-county organizations, in addition to two counties—Milwaukee and Waukesha—would assume sponsorship of 12 airports within the system plan. Under this governmental structure the local capital investment to implement the plan would still average $0.80 per capita per year and range from a low of $0.09 in Waukesha County to a high of $1.34 in Milwaukee County. The per capita cost in Ozaukee and Washington Counties—one of the multi-county airport districts—would be $0.32, while in Kenosha, Racine, and Walworth Counties—the other multi-county airport district—the per capita cost would be $0.37. The Playboy and Lake Lawn Lodge Airports would remain as private airports.

Source: SEWRPC.

Map 78

ALTERNATIVE PUBLIC AIRPORT INSTITUTIONAL STRUCTURE NO. 4—ESTABLISHMENT OF REGIONAL AIRPORT AUTHORITY



Under the fourth alternative institutional structure considered for airport system plan implementation, the regional character of the service area of General Mitchell Field, the only air carrier airport within the system, as well as the multi-county character of the service areas of the other 11 public airports included in the recommended system plan would be recognized and a new regional agency would assume airport sponsor responsibilities. Under this governmental structure the local capital investment required to implement the plan would be $0.80 per capita per year. Whereas the other institutional structures considered for plan implementation can be developed under existing statutes, a regional airport authority would require new enabling legislation.

Source: SEWRPC.

Recommended Airport Institutional Structure

Based upon the foregoing discussion and considering such intangibles as the probability of securing the intergovernmental structure necessary to implement the regional airport system plan, it is recommended that Alternative 2—county sponsorship of all public airport facilities—be selected as the institutional structure for implementation of the airport facility construction and operation element of the regional airport system plan. This recommendation is based upon the following major factors:

1. Three of the largest and most important airports included in the system plan are already owned and operated by counties—General Mitchell and Timmerman Fields by Milwaukee County and Waukesha County Airport by Waukesha County. The recommended institutional structure would fully utilize the airport development and operation capabilities that now exist in these two counties.

Table 258

ESTIMATED PER CAPITA COST FOR LOCAL CAPITAL INVESTMENT REQUIRED TO IMPLEMENT THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN—ALTERNATIVE PUBLIC INSTITUTIONAL STRUCTURE NO. 3

Airport Owner/Operator	Estimated Average Annual Local Capital Investment Required[a]	Estimated 1990 Population[b]	Estimated Average Annual Per Capita Cost
Milwaukee County	$1,372,200	1,022,200	$1.34
Waukesha County	31,600	356,600	0.09
Kenosha-Racine-Walworth Counties	165,000	450,100	0.37
Ozaukee-Washington Counties	69,700	215,000	0.32
Total	$1,638,500	2,043,900	$0.80

[a] *Does not include assumed self-amortizing facilities, such as hangars and the General Mitchell Field passenger and cargo terminals.*

[b] *Represents estimated population approximately midway through the plan implementation period.*

Source: SEWRPC.

Table 259

ESTIMATED PER CAPITA COST FOR LOCAL CAPITAL INVESTMENT REQUIRED TO IMPLEMENT THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN—ALTERNATIVE PUBLIC INSTITUTIONAL STRUCTURE NO. 4

Airport Owner/Operator	Estimated Average Annual Local Capital Investment Required[a]	Estimated 1990 Population[b]	Estimated Average Annual Per Capita Cost
Regional Airport Authority	$1,638,500	2,043,900	$0.80

[a] *Does not include assumed self-amortizing facilities, such as hangars and the General Mitchell Field passenger and cargo terminals.*

[b] *Represents estimated population approximately midway through the plan implementation period.*

Source: SEWRPC.

2. The remaining nine airports included in the recommended system plan are either privately owned or owned by cities or villages. Given the areawide nature of all of the facilities included in the recommended plan, and further given the required capital investment necessary to implement the plan, it is inappropriate the consider either continued private ownership or city, village, or town ownership and operation of these nine airport facilities. As already noted, per capita costs at the local level would tend to be quite high, resulting in an inequitable distribution of costs among the Region's residents. Hence, the county level of government is more appropriate than the city, village, or town level of government for ownership and operation of these nine facilities.

3. The likelihood of establishing airport functional responsibility at the county level in the five individual counties is judged to be higher than the likelihood of establishing multicounty authorities or commissions for those same five counties.

4. The provision of the airport function at the county level of government results in a relatively equitable distribution of costs on a per capita basis throughout the Region, although it is recognized that such distribution is not as equitable as it would be if the recommendation were to be made to create a regional airport authority.

In making the above recommendations, it is recognized that some privately owned airports recommended for inclusion within the regional airport system plan, particularly the Racine Commercial Airport, may be expanded and operated by private interests to carry out their role within the system during all or part of the planning period to 1995. If the private owners of these airports are able to provide the capacity and safety required for the recommended classification of the airport, public ownership and operation would be considered unnecessary and the associated capital improvement and operating and maintenance costs assigned to the county public agency sponsor would be reduced.

Also in making the above recommendation, it is recognized that a strong case can be made for the establishment of a regional airport authority, since that alternative would not only result in a more equitable distribution of costs but would also more fully take into account the areawide, intercounty, and intercommunity nature of all of the 12 airport facilities included in the recommended system plan. It is judged, however, that the probability of securing such a single purpose authority is low, and that it may well not be sound to create a regional authority solely for the purpose of providing a single transportation function. Accordingly, it is further recommended that should future transportation planning studies for southeastern Wisconsin relating to either highway, mass transit, or seaport development conclude that consideration of a regional transportation authority is warranted for any of these functions, the question of the establishment of a regional airport authority be reopened and, more importantly, that the possibility of a multi-function regional transportation authority be reopened and fully considered.

Master Plan Preparation

It is recommended that a master plan be prepared as soon as possible for each of the 12 major airports included in the regional airport system plan. As noted earlier in this chapter, airport master planning is required to refine and detail the recommendations contained in the regional airport system plan, and in so doing establish eligibility for federal financial aid under the Airport and Airway Development Act of 1970. It is recommended that such airport master plans, in addition to refining and detailing the facility improvement requirements set forth in more general terms in the regional airport system plan, also include preparation of more detailed land use plans and height limitation zoning maps for the airport impact area surrounding the airport facility.

At the present time, airport master planning efforts have been mounted, concurrent with the system planning effort, for the following four airport facilities: General Mitchell Field, Waukesha County, Kenosha Municipal, and West Bend Municipal. Accordingly, it is recommended that the following specific master planning efforts be undertaken:

1. That the four master plans currently under preparation be completed in a manner consistent with the regional system plan recommendations, and with respect to the Kenosha and West Bend Airports, that the county level of government be involved in the master plan preparation in light of the above recommendation to ultimately provide for county ownership and operation of those two airport facilities.

2. It is recommended that, upon acquiring the Ozaukee Airport, the Ozaukee County Board mount an airport master planning effort for the Ozaukee Airport.

3. It is recommended that the Milwaukee County Board mount a master planning effort for Timmerman Field.

4. It is recommended that, upon acquisition of the Racine Commercial, Sylvania, and Burlington Municipal Airports, the Racine County Board mount airport master planning efforts for those facilities.

5. It is recommended that, upon acquisition of the Gruenwald and East Troy Municipal Airports, the Walworth County Board mount master planning efforts for those facilities.

6. It is recommended that, upon acquisition of the Hartford Municipal Airport, the Washington County Board mount a master planning effort for that facility.

Under rules established by the U. S. Department of Transportation, Federal Aviation Administration, funding required for the preparation of airport master plans must be included within the annual unified work program of the Southeastern Wisconsin Regional Planning Commission. Accordingly, upon request from the airport sponsors identified above, the Commission will include airport master planning work in its annual unified work program and assist in seeking the funding necessary for the preparation of the required plans.

Establishment of State Revolving Fund for Aircraft Hangar Construction

Recognizing the climatic conditions existing in the Region, the regional airport system plan recommends substantial investment in the development of hangar facilities at the 12 airports included in the plan. Under current regulations, federal and state aid is not available to assist airport sponsors in the construction of such facilities. While it may be assumed that hangar storage fees could be set at a level sufficient to finance the cost of constructing and maintaining such hangars, there remains the problem of securing funds for the initial development of such facilities. In order to assist local public sponsors in hangar construction, it is accordingly recommended that the Wisconsin Department of Transportation seek enabling legislation and an appropriation to establish a state financial assistance fund for the sole purpose of aiding local public airport sponsors in financing initial hangar construction. It is envisioned that this fund would be maintained and replenished over a period of time from hangar rent receipts.

AIRPORT AIRSPACE PROTECTION PLAN ELEMENT IMPLEMENTATION

The recommended regional airport system plan includes an element relating to the protection of airspace around airports in order to ensure safe aircraft operations. More specifically, the plan recommends that the U. S. Department of Transportation, Federal Aviation Administration obstruction criteria be used to define the general height restrictions attendant to all airports included in the regional system. The height of buildings and other structures around airports can be regulated by local public airport sponsors through the enactment of height restriction ordinances under the authorization provided in Section 114.136 of the Wisconsin Statutes. This authorization permits public sponsors to regulate the height of structures within three miles of a publicly owned airport in order to prevent new construction of tall objects that would endanger safe aircraft operation. Section 114.135 of the Wisconsin Statutes further allows a public airport owner to negotiate the purchase of, or acquire by eminent domain, the air rights to any property which might contain structures or objects which endanger safe airport operations.

At the present time, height control zoning ordinances are in effect with respect to the following publicly owned airports: Kenosha Municipal, Mitchell Field, Timmerman Field, Hartford Municipal, West Bend Municipal, and Waukesha County. No such height control zoning restrictions are in effect at the Burlington or East Troy Municipal Airports. It is envisioned that one of the specific outputs of the airport master planning effort recommended above is the identification of needed changes to existing height control zoning ordinances and the enactment of new ordinances where necessary. Accordingly, upon completion of the master planning effort at each of the 12 airports included in the regional system plan, it is recommended that the county public sponsors take appropriate action to review existing, or enact new, airport height control ordinances in order to properly protect the airspace at the individual airports concerned.

Under Section 114.135 of the Wisconsin Statutes, special permits from the Wisconsin Secretary of Transportation are required to erect buildings, structures or towers which exceed more than 500 feet above ground level within one mile of an airport, or which exceed 150 feet above ground level if the structure would be above the slope of 1 foot vertical for each 40 feet horizontal from the nearest airport boundary. It is recommended that in carrying out responsibilities pertaining to this regulatory statute, the Wisconsin Secretary of Transportation utilize the regional airport system plan for southeastern Wisconsin, as well as any master plans prepared and adopted for facilities included in the regional airport system plan, as appropriate, in discharging his responsibilities under this statute.

AIRPORT AREA LAND USE PLAN ELEMENT IMPLEMENTATION

The recommended regional airport system plan includes, for each of the 12 general-purpose airports included in the recommended regional airport system, a general plan for development of land uses in the general impact area around each of the airport sites. These general land use plans seek to prevent incompatible land use development within the airport environs and thus minimize nuisances that develop between aircraft operations and neighboring land uses. It is essential that these general airport land use plans be refined and detailed in two ways. First, the plan should be further refined and detailed as an essential element of the airport master planning effort for each of the identified sites. Advisory committees established to assist in the airport master planning effort should include responsible public officials from all local communities in the airport environs having land use control authority. The airport master planning effort is thus envisioned as a step toward achieving a local consensus on land use development in the airport area.

Upon completion of the airport master plans, it is recommended that each individual municipality, in those cases where airports are located in urban or urbanizing areas, further refine and detail the airport area land use plan to the neighborhood level of planning detail, as recommended by the Regional Planning Commission under the regional land use plan.[2] The preparation of such detailed neighborhood unit land use development plans represents an essential step toward assuring that future urban development will be carried out in a manner fully compatible with not only the land use development objectives expressed in regional and local land use plans, but the airport development objectives expressed in the regional airport system plan and in any airport facility master plans.

Upon completion of the master planning effort at each airport included in the regional system plan, it is recommended that those local cities, villages, and towns involved review their local land use zoning ordinances to determine what adjustments, if any, are needed to ensure that the land use development allowed by the zoning ordinance is fully compatible with the land use development objectives expressed in the airport area land use plan. With respect to those airport facilities located in urban or urbanizing areas, it is recommended that such zoning ordinance and zoning district map adjustments take place both at the time of completion of the airport area land use plan and again at the completion of any detailed neighborhood land use plans for neighborhoods in areas influenced by airports.

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[2] *See Appendix D, SEWRPC Planning Report No. 7, The Regional Land Use-Transportation Study, Volume Three, Recommended Regional Land Use-Transportation Plans—1990.*

Another important plan implementation tool, the official map, is currently not available for use in Wisconsin with respect to the reservation of land for future public airport development. As discussed in SEWRPC Planning Guide No. 2, An Official Mapping Guide, proper application of the official map allows a community to precisely designate right-of-way lines and site boundaries for streets, highways, parkways, and playgrounds. It would appear that the official map could similarly be advantageously used to protect land needed for future airport site development. Accordingly, it is recommended that the Wisconsin Department of Transportation seek appropriate legislation to enable local public airport sponsors, including counties, to place lands needed for future airport site development on duly adopted official maps. It is envisioned, in this respect, that such legislation would require the preparation and adoption of an airport master plan before any lands for future airport development could be placed upon an official map.

FINANCIAL AND TECHNICAL ASSISTANCE

Upon adoption of the regional airport system plan, it becomes necessary for the governmental units and agencies concerned to effectively utilize all sources of financial and technical assistance available for the timely execution of the recommended plan. In addition to current property tax revenues and user fees, the agencies and units of government concerned with airport development can make use of state and federal grants-in-aid. In addition, the local public airport sponsors can also take advantage of technical assistance available through the Wisconsin Department of Transportation, Division of Aeronautics.

Federal Airport Development Aid Program

As discussed in Chapter VI of this report, the U. S. Department of Transportation, Federal Aviation Administration, administers a federal airport development aid program authorized by the Airport and Airway Development Act of 1970. This program provides for 75 percent federal aids for eligible capital improvement and land acquisition programs, as well as for the preparation of airport master plans. Eligible federal aid items include land acquisition; site preparation; runway, taxiway, and parking apron improvements; airfield lighting; street and roadway work related to airport development; obstruction removal; fences; and navigational and landing aids. Noneligible airport development items include hangars, terminals, runway maintenance, construction and lighting of public parking areas, and improvement of off-site roadways.

State Airport Development Aid Program

This program, authorized by Sections 114.34 and 114.35 of the Wisconsin Statutes, provides for state funds to aid local public sponsors in undertaking airport development projects. For those project items eligible for federal aid, the statutes provide that the state may fund up to one-half of the remaining 25 percent. For all other projects, the state program may provide 50 percent of the project cost, the only exceptions being that the state may not participate in the cost of hangar construction, and that the state cost sharing on a building project may not exceed $35,000.

Technical Assistance

Technical services to local public airport sponsors, including planning and engineering services, are provided by the Wisconsin Department of Transportation, Division of Aeronautics, pursuant to Section 114.31(6) of the Wisconsin Statutes. In addition, the Division of Aeronautics acts as agent for local public airport sponsors with respect to any airport development projects involving state and federal aid. The Division of Aeronautics has prepared an information brochure entitled "How to Initiate an Airport Improvement Project" which is included as Appendix I to guide plan implementation activities. The U. S. Department of Transportation, Federal Aviation Administration, also provides technical assistance and advisory services on airport master planning and on the development of airport design, construction, and maintenance standards. Such federal assistance is available through the Wisconsin Department of Transportation, Division of Aeronautics.

SUBSEQUENT ADJUSTMENT OF THE PLAN AND CONTINUING PLANNING PROCESS

No plan can be permanent in all of its aspects or precise in all of its elements. The very definition and characteristics of areawide planning suggest that an areawide plan such as the regional airport system plan, to be viable and of use to local, areawide, state, and federal units and agencies of government and to private interests, must continually be adjusted through formal amendments, extensions, additions, and refinements to reflect changing conditions. The Wisconsin legislature clearly foresaw this when it gave the regional planning commissions the power to "...amend, extend, or add to the master plan or carry any part or subject matter into greater detail..." in Section 66.945(9) of the Wisconsin Statutes.

Amendments, extensions, and additions to the regional airport system plan will be forthcoming not only from the work of the Commission under the continuing regional planning programs, but also from local and areawide agencies as they prepare more detailed master plans for airport facilities; from state agencies as they adjust and refine statewide plans; and from federal agencies as new policies are established or modified, as new programs are created, or as existing programs are expanded or curtailed.

All of these adjustments or refinements will require the utmost cooperation by the local, areawide, state, or federal units and agencies of government and private interests, as well as coordination by the Southeastern Wisconsin Regional Planning Commission, which has been empowered under Section 66.945(8) of the Wisconsin Statutes to act as a coordinating agency for programs and activities of the local units of government. To achieve this coordination between the local, state, and federal programs most effectively and efficiently, and therefore to assure the timely adjustment of the regional airport system plan, it is recommended that all of the aforesaid local, areawide, state, and federal agencies having various plan and plan implementation powers advise and transmit all subsequent planning studies, plan proposals and amendments, and plan implementation devices to the Southeastern Wisconsin Regional Planning Commission for consideration as to integration into, and adjustment of, the recommended regional airport system plan. Of particular importance in this respect will be the continuing role of the Technical Coordinating and Advisory Committee on Regional Airport System Planning in intergovernmental coordination, and the role of the Regional Planning Commission itself under the grant review authority set forth in the U. S. Office of Management and Budget Circular A-95.

In order to provide a basis for ensuring that the regional airport system plan is implemented and, from time to time, adjusted and updated as appropriate, it is recommended that the Southeastern Wisconsin Regional Planning Commission include airport system planning as part of the continuing regional land use-transportation study for southeastern Wisconsin. The location of airport system planning within the comprehensive regional land use-transportation planning effort will contribute toward the goal of proper intermodal transportation planning for the Region. It is further recommended in this respect that the U. S. Department of Transportation, Federal Aviation Administration, and the Wisconsin Department of Transportation, Division of Aeronautics, provide continuing financial assistance for that portion of the continuing regional land use-transportation study for southeastern Wisconsin dealing with continuing planning for regional airport system development.

SUMMARY

This chapter has described the various means available and has recommended specific procedures for implementation of the recommended regional airport system plan. The most important recommended plan implementation actions are summarized in the following paragraphs by level and responsible agency or unit of government.

Local Level

City Councils, Village Boards, and Town Boards: It is recommended that upon referral to, and upon recommendation of, the local plan commission, each city council, village board, and town board within the Region, as appropriate:

1. Adopt the recommended regional airport system plan as a guide to future development in the community, as that plan affects each community.

2. Cooperate with their respective county boards of supervisors in assuring the orderly transfer of existing publicly owned airport facilities to the county level of government (Cities of Burlington, Hartford, Kenosha, and West Bend and the Village of East Troy).[3]

3. Complete master plans for airport facilities and include the county level of government in the preparation of such master plans (Cities of Kenosha and West Bend).

4. Cooperate with their respective county boards of supervisors in conducting airport master planning programs, in preparing airport area land use plans, and in implementing such plans through appropriate adjustments to local zoning ordinances and zoning district maps (all cities, villages, or towns located in airport influence areas).

5. Upon completion of airport facility master plans, place future airport site areas on local official maps when the authority becomes available (all cities, villages, or towns located in airport influence areas).

Plan Commission of Cities, Villages, and Towns: It is recommended that the plan commissions of all cities, villages, or towns within the Region:

1. Adopt the regional airport system plan as a guide to development in the community, and certify such adoption to the local governing body.

2. As appropriate, cooperate in the preparation of airport facility master plans and integrate such plan recommendations into comprehensive local master plans.

3. As appropriate, review and recommend changes to local land use controls to properly reflect plan recommendations contained in the regional airport system plan and any local airport master plans.

County Boards of Supervisors: It is recommended that the county boards of supervisors of the seven counties in the Region upon recommendation of the appropriate agencies and committees:

1. Adopt the regional airport system plan, as it applies to each county, as a guide to future airport system development in the county.

2. Continue development and operation of existing county owned airports (Milwaukee and Waukesha Counties).

3. Acquire those existing publicly and privately owned airports in the county included in the regional airport system plan, and assume responsibility for the development and operation of such airport facilities (Kenosha, Ozaukee, Racine, Walworth, and Washington Counties).

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[3] *Parentheses indicate that the recommended action is applicable only to the named unit or units of government.*

4. Complete master plans for all airport facilities included in the regional airport system plan.

5. Upon completion of airport master plans, amend existing or enact new airport area height control ordinances to protect airport airspace.

6. Cooperate in the preparation of detailed land use plans for airport influence areas and in the adjustment of existing zoning and other land use control ordinances to properly reflect such plans.

Areawide Level

Regional Planning Commission: It is recommended that the Southeastern Wisconsin Regional Planning Commission:

1. Mount a continuing regional airport system planning effort as an integral part of the previously established continuing regional land use-transportation study for southeastern Wisconsin.

2. Reconstitute the Technical Coordinating and Advisory Committee on Regional Airport System Planning as a continuing advisory committee under Section 66.945(7) of the Wisconsin Statutes.

3. Upon request of an appropriate airport sponsor, include in its unified annual work program the preparation of master plans for airports included in the recommended regional airport system.

4. Assist the county airport sponsors in the preparation of airport facility master plans, including airport area land use elements of such plans.

State Level

Wisconsin Department of Transportation: It is recommended that the Wisconsin Department of Transportation:

1. Endorse the recommended regional airport system plan, include the plan as an integral part of the State of Wisconsin airport system plan, and certify the plan to the U. S. Department of Transportation, Federal Aviation Administration.

2. Utilize the plan, as appropriate, in its broad range of agency responsibilities relating to airport, highway, and transit development.

3. Promote the establishment of an airport development and operation function at the county level of government in the Region, and encourage the undertaking of master planning efforts by county airport sponsors at all general-purpose airports included in the regional airport system plan.

4. Seek enabling legislation and an appropriation to establish a state financial assistance fund for aiding local public airport sponsors in financing initial hangar construction.

5. Utilize the regional airport system plan, as appropriate, in carrying out the tall structure permit responsibility pursuant to Section 114.135 of the Wisconsin Statutes.

6. Seek enabling legislation to permit local public airport sponsors, including counties, to place lands needed for future airport site development on duly adopted official maps.

7. Provide technical services to local public airport sponsors.

8. Direct all available state development aids toward projects found to be in accordance with the regional airport system plan and any airport facility master plans prepared for airports included in the regional airport system.

9. Provide appropriate financing for the continuing regional airport system planning effort.

Wisconsin Department of Natural Resources: It is recommended that the State Natural Resources Board:

1. Endorse the recommended regional airport system plan.

2. Direct its staff in the Wisconsin Department of Natural Resources to recognize the plan recommendations, as appropriate, in the exercise of the Department's air pollution control authority.

Wisconsin Department of Administration: It is recommended that the Wisconsin Department of Administration:

1. Endorse the recommended regional airport system plan.

2. Utilize the plan recommendations, as appropriate, in the exercise of its state planning and state A-95 clearinghouse functions.

Wisconsin Department of Local Affairs and Development: It is recommended that the Wisconsin Department of Local Affairs and Development:

1. Endorse the recommended regional airport system plan.

2. Utilize the plan recommendations, as appropriate, in the provision of technical assistance to local units of government, in reviewing subdivision plats, and in administering any federal and state grant-in-aid programs.

Federal Level

U. S. Department of Transportation, Federal Aviation Administration: It is recommended that the U. S. Department of Transportation, Federal Aviation Administration:

1. Formally acknowledge the recommended regional airport system plan upon its inclusion in the State of Wisconsin airport system plan.

2. Include the recommended regional airport system plan in the national airport system plan, amending the latter plan as appropriate to reflect the regional plan recommendations.

3. Utilize the plan recommendations, as appropriate, in the discharge of its broad range of agency responsibilities relating to airport development, including the provision of control towers and navigation aids and the provision of federal airport development funds.

4. Provide appropriate financing for the continuing regional airport system planning effort.

U. S. Department of Transportation, Federal Highway Administration: It is recommended that the U. S. Department of Transportation, Federal Highway Administration:

1. Formally acknowledge the regional airport system plan.

2. Utilize the plan recommendations, as appropriate, in its broad range of agency responsibilities relating to highway development, including the provision of federal highway aids in support of surface transportation improvements to airports included in the regional airport system plan.

U. S. Department of Transportation, Urban Mass Transportation Administration: It is recommended that the U. S. Department of Transportation, Urban Mass Transportation Administration:

1. Formally acknowledge the regional airport system plan.

2. Utilize the plan recommendations, as appropriate, in its broad range of agency responsibilities relating to transit development, including the provision of federal funds ensuring the continuation of urban mass transit services to the Region's single scheduled air carrier airport.

U. S. Environmental Protection Agency: It is recommended that the U. S. Environmental Protection Agency:

1. Formally acknowledge the regional airport system plan.

2. Recognize, as appropriate, the plan recommendations in exercising its authority with respect to air quality and noise level control management.

U. S. Department of Housing and Urban Development: It is recommended that the U. S. Department of Housing and Urban Development:

1. Formally acknowledge the regional airport system plan.

2. Utilize the plan recommendations, as appropriate, in the administration of its broad range of grant and loan programs and in its areawide plan certification process.

Private Concerns

With respect to the owners and operators of private airport facilities in the Region, it is recommended that:

1. The owners and operators of private airports not included in the regional airport system formally acknowledge the regional airport system plan recommendations and, as appropriate, coordinate development of their facilities with the proposed public airport facilities.

2. Those owners and operators of private airports included in the regional airport system formally acknowledge the regional airport system plan recommendations and cooperate with local public airport sponsors in assuring an orderly transition from private to public ownership and in securing long-range implementation of the plan recommendations. It is recognized that such transition from private to public ownership would become necessary only upon the inability of the private owner and operator to provide the airport capacity and safety identified and recommended within the regional airport system plan.

Chapter XIV

SUMMARY AND CONCLUSIONS

INTRODUCTION

On May 10, 1968, Milwaukee County Executive John L. Doyne formally requested the Commission to undertake a comprehensive regional airport system planning program that would work toward the ultimate resolution of the growing air transportation problems of the Region. On June 4, 1968, a similar request was made by the then Secretary of the Wisconsin Department of Transportation, Mr. G. H. Bakke. These requests recognized that only within the context of a long-range, comprehensive areawide planning effort could an adequate airport system plan be prepared to guide the development of airport facilities within the Region. In addition, these requests recognized that an airport system plan must be fully integrated with land use and surface transportation plans for the Region. Acting in response to these requests, the Commission on June 9, 1968, created a 13-member Technical Coordinating and Advisory Committee on Regional Airport Planning to assist the Commission in the study of the air transportation needs of the Region and in the preparation of the needed regional airport system plan. The Committee was so structured as to actively involve the agencies most concerned with airport development within the Region, and included those local officials directly concerned with provision of airport facilities.

In 1969 the Committee prepared a prospectus for a comprehensive, areawide airport system planning program for the Region. This prospectus identified five major factors that contribute to the need to prepare an airport system plan. These are: extensive, areawide urbanization and the consequent need to coordinate airport facility development with land use development; changes in surface transportation use and development and the consequent need to coordinate airport facility development with surface transportation facility development; rapid growth and change in air traffic demand; rapid change in aircraft size, type, and performance and related changes in airport facility requirements; and state and federal grant eligibility requirements. The prospectus outlined the scope and content of the required regional airport system planning program.

The work program outlined in the prospectus was subsequently approved by the Regional Planning Commission on December 4, 1969. Cooperative funding arrangements for the study involving the U. S. Department of Transportation, Federal Aviation Administration; the U. S. Department of Housing and Urban Development; the Wisconsin Department of Transportation, Division of Aeronautics; and the seven counties in the Region were completed in December 1970. The program itself was conducted over a four and one-half year period by the Commission staff, assisted by the consulting firm of R. Dixon Speas Associates, Inc., Manhassett, New York. Guidance to the staff and consultant was provided throughout the program by the Technical Coordinating and Advisory Committee. The Commission staff assumed responsibility for all work elements of a general regional planning nature, and R. Dixon Speas Associates, Inc., assumed responsibility for all work of a highly specialized air transportation planning and engineering nature, including the development of the necessary demand forecasting and distribution models, the conduct of airport capacity analyses, and the preparation of alternative regional airport system plans.

Five basic principles were formulated which formed the basis for the planning process applied in the regional airport system planning program. These five principles are:

1. Airport system planning must be regional in scope, since airport service areas develop over an entire urban region without regard to corporate limit lines.

2. Airport system planning must be conducted concurrently with, and cannot be separated from, land use planning.

3. Airport and surface transportation systems must be planned together.

4. Airport facilities must be planned as an integrated system, with the function and capacity of each airport in the system carefully fitted to air travel demands.

5. Both land use and airport facility planning must recognize the existence of a limited natural resource base to which urban and rural land use as well as airport development must be properly adjusted to ensure a pleasant and habitable environment.

The major findings and recommendations of the regional airport system planning program are discussed and presented in this report. This report is intended to allow careful, critical review of the alternative plans by public officials, agency staff personnel, and citizen leaders within the Region, and to provide the basis for plan adoption and implementation by the local, areawide, state, and federal agencies of government concerned. The report can only summarize in brief fashion the information assembled in the extensive data collection, analysis, forecasting, and plan design phases of the program. Although the reproduction of all information assembled in the study in report form is impractical due to its magnitude and complexity, all of the basic data are on file in the Commission offices and are available to member units and agencies of government and to the public in general upon specific request.

INVENTORY AND ANALYSIS FINDINGS

Socioeconomic Base

The seven-county Southeastern Wisconsin Region is an interrelated complex of natural and manmade features which together form a rapidly changing environment for human life. Important manmade features of the Region include its land use pattern, its public utility networks, and its transportation system. Together with the population residing in the Region and the economic activities taking place within the Region, these features may be thought of as the socioeconomic base of the Region. Since one of the basic purposes of airport system planning is to provide for the sound development of public air transportation facilities to meet the air transportation needs of the existing and probable future resident population and of the economic activities taking place within the Region, an understanding of the socioeconomic base is essential to sound regional airport system planning.

The Region consists of a seven-county area encompassing 2,689 square miles of land and inland water area, representing about 5 percent of the total area of the State of Wisconsin. About 40 percent of the state's population, however, resides within the seven counties, which employ about 38 percent of the total work force of the state and which contain about half of all the tangible wealth of the state as measured by equalized assessed property valuation. The Region contains 154 local units of government, exclusive of school or other special purpose districts, and encompasses all or parts of 11 major watersheds.

The population of the Region has been increasing at an average rate of about 18,000 persons per year from 1960 to 1970, and totaled about 1.75 million persons in 1970 and 1.8 million persons in 1974. This rate of population growth, although higher than state and national growth rates, is considerably lower than the approximately 33,000 persons per year experienced within the Region from 1950 to 1960. The population growth within the Region has been occurring primarily in the newer outlying suburban, rural-urban fringe areas of the Region, while the populations of the older central cities and suburbs have remained relatively stable or have actually declined. The composition of the population is becoming increasingly urban, with only about 12 percent of the total regional population currently classified as rural. Moreover, of the total population only about 10 percent is classified as rural nonfarm and 2 percent as rural farm.

Personal income has generally increased at a higher rate than population, so that per capita and per household incomes have increased markedly over the last two decades. The areas of highest average household income are located in the most rapidly growing new suburban and rural urban areas of the Region, presently located in northeastern and western Milwaukee County and eastern Waukesha County. Since personal income has been found to have a major effect on the demand for air transportation services, the distribution of the higher income households is an important factor in airport system planning.

Employment opportunities in the Region have increased at a rate of approximately 9,400 jobs per year over the last decade to a 1970 level of approximately 742,000 jobs. The economic factors which promote job growth and urbanization of the Region are largely centered in and around the major urban centers of Milwaukee, Racine, and Kenosha, although a diffusion of economic activities into the outlying areas of the Region is occurring, with Waukesha County showing the largest increases in the proportion of total jobs.

Land within the Region has been undergoing a particularly rapid conversion from rural to urban use. Recent urban development within the Region has been discontinuous and highly diffused, consisting in large part of scattered, low density enclaves of residential development located away from established urban centers. The overall population density of the developed urban area of the Region, which peaked in 1920 at about 11,000 persons per square mile, steadily declined to about 4,300 persons per square mile in 1970. The highly diffused nature of recent urban development and the sharp decline in urban population density have intensified environmental problems within the Region and have created new developmental problems, including problems relating to airport system development. Current and probable future land use development patterns must be carefully considered in the development of airport system plans to effectively serve aviation demands while minimizing the adverse impact that airport facilities have upon residential land use.

Natural Resource Base

The natural resource base is a primary determinant of the development potential of a region and of its ability to provide a pleasant and habitable environment for all forms of life. Accordingly, an understanding of the natural resource base of the Region is essential to sound airport system planning. Of particular importance in this respect are those elements of the natural resource base relating to climate and to certain important land related elements of the natural resource base.

Wind direction and velocity are important considerations in airport facility siting and orientation. Winds in southeastern Wisconsin may be expected to blow from the southwest and northwest each about 20 percent of the time, and from the southeast and northeast each about 15 percent of the time. Runways oriented in these four directions accordingly may be expected to provide the most favorable wind coverage for operating aircraft. Wind velocities throughout the Region may be expected to be less than 4 knots (4.6 mph) about 12 percent of the time, between 4 and 14 knots (4.6 and 16.1 mph) about 62 percent of the time, and over 14 knots (16.1 mph) the remaining 26 percent of the time.

On an annual basis, weather conditions that permit aircraft operations under visual flight rules occur approximately 90 percent of the time, making the operation under instrument flight rules necessary only about 10 percent of the time. The most favorable visual flight rule weather occurs under summer daylight hours. Also, the higher wind velocities occur predominantly during the visual flight rule weather.

The kind and amount of precipitation that may be expected to occur within the Region are also important considerations in airport planning, design, construction, operation, and maintenance. Airport operational problems created by various forms of precipitation include restricted visibility, atmospheric turbulence, slippery conditions on hard surface runways, nonuse of turf runways, decreased rate of climb for some aircraft, and congested terminal and air space created in and around airports because of various operational delays. With excessive quantities of freezing precipitation, operations at even air carrier airports such as General Mitchell Field can become so urbalanced as to cause flight cancellations and delays, ferrying of aircraft, terminal confusion, and inconvenience to the traveling public. The average annual total precipitation in the Region is about 30.3 inches expressed as water equivalent, with an average annual snowfall of 43.2 inches. Average total monthly precipitation ranges from 1.32 inches in February to 3.86 inches in June. About 85 percent of the snowfall occurs in the months of December, January, February, and March, with the maximum average monthly snowfall of 11.9 inches occurring in January. Maximum daily precipitation recorded in the Region was 7.58 inches of rainfall and 30.0 inches of snowfall.

Lake fog is a weather condition affecting the operation of airports located in close proximity to large water surfaces. Lake fog, primarily caused by warm moist air moving toward the colder waters of Lake Michigan, is common in the warmer months along the lake shoreline of the Region. This type of fog is extremely limited in its areal extent, normally being confined to an area over the water itself and extending only a mile or two inland from the shoreline. Thus, within the Region lake fog becomes a problem in airport siting and operation only in a one or two mile band along the shoreline of the lake itself.

Delineation of those areas of the Region in which concentrations of particularly valuable elements of the natural resource base occur produces an essentially linear pattern of narrow, elongated areas which have been termed "environmental corridors." These corridors, while encompassing only about 18 percent of the total area of the Region, contain almost all of the best remaining woodlands and wetlands, the best remaining wildlife habitat areas, almost all of the streams and lakes and associated undeveloped floodlands and shorelands, as well as many of the significant topographical, geological, and historical features remaining in the Region. Airport system planning, involving as it does not only airport and airport facility development but also urban development generated by the presence of the airport, must carefully consider the environmental corridors so as to assure their preservation. Proper airport siting can actually contribute to environmental corridor preservation by encompassing the environmental corridors within the open spaces associated with good airport development, and by using the environmental corridors as buffer areas between airports and other types of urban development.

Existing Regional Air Transportation System

The existing air transportation system within the Region consists of a combination of airport and airway facilities required to accommodate the movement of people and goods into, within, and out of the Region. The ability of the system to perform its primary function depends to a considerable extent upon the quality of the surface transportation facilities linking each airport to its respective service area. Consequently, the regional air transportation system includes the airways and associated air navigation aids, the aircraft landing areas and associated air navigation and air traffic control aids, the airport terminal facilities and appurtenant aircraft and automobile parking areas, and the ground access transportation facilities.

In order to provide definitive data on the existing regional air transportation system, an inventory was conducted of all airports, airways, air navigation facilities, and related surface transportation facilities serving the Region, as well as of the number and types of aircraft using these facilities. The primary data sources for this inventory include Federal Aviation Administration and Wisconsin Division of Aeronautics files, and a specially prepared and conducted regional airport survey wherein personal interviews were conducted with airport owners and/or managers to obtain all of the necessary facility data. These data were then compiled, analyzed, and used to assess the adequacy of existing airport facilities and the need for further airport development.

In 1971 there were 46 publicly and privately owned airports located within the Region. Each of these airports may be classified by service category as air carrier, general aviation, military, or special use airports; by availability for use as public or private; and by ownership also as public or private. Of these 46 airports, General Mitchell Field in Milwaukee County was the only air carrier airport providing commercial airline service to the general public on a regularly scheduled basis. As the Region's single air carrier airport, General Mitchell Field constitutes a major interregional transportation terminal handling relatively large volumes of passengers, mail, and cargo in large, high performance aircraft.

Of the remaining 45 airports in the Region, 43 were classified as general aviation airports which are intended to serve training, business, charter, agricultural, recreational, pleasure and air taxi aircraft. The remaining two airports in the Region were special use facilities, including one heliport and one seaplane base. There were no exclusive military use airports within the Region. However, both General Mitchell Field in Milwaukee County and the West Bend Municipal Airport in Washington County are joint use facilities providing for both civil and military aircraft operations.

Of the 43 general aviation airports in the Region, 25 were public use airports, both publicly and privately owned, with the remaining 18 constituting privately owned airports for private use only. The 25 general aviation public use airports accommodate the majority of the business and pleasure aviation activity in the Region, accommodating about 79 percent of the based aircraft and about 72 percent of the aircraft operations in the Region in 1971. Consequently, these 25 existing airports are, together with General Mitchell Field, of primary interest in regional airport system planning.

Each of the Region's existing airports may be further classified by function and operational role. The airport functional classification system chosen for use in this study relates to that developed nationally for aviation planning and development purposes. The 10 airport classifications include three relating to scheduled air transportation facilities—primary, secondary, and feeder; general transport; basic transport; general utility; basic utility; STOLport; heliport; and seaplane base.[1] Of the 46 airports in the Region, one—General Mitchell Field—is presently (1975) classified as a scheduled air transportation—secondary facility; one—Racine Commercial Airport—is classified as a basic transport facility; one—the Johnson Wax Heliport in Racine—is classified as a heliport facility; one—the Edgewood Air Seaplane Base in Walworth County—is classified as a seaplane base facility; four—Kenosha Municipal, Timmerman Field, West Bend Municipal, and Waukesha County—are classified as general utility facilities; and the remaining 38 airports are classified as basic utility or lower facilities.

For purposes of airport system planning in southeastern Wisconsin, the basic utility classification was further subdivided in order to identify those airports not capable of meeting minimum standards specified for such airports. These three subcategories were termed basic utility stage II, basic utility stage I, and less than basic utility stage I. Three of the 38 basic utility airports were subclassified into the basic utility stage II class, and three of the 38 basic utility airports were subclassified into the basic utility stage I class. The remaining 32 basic utility airports were subclassified into the less than basic utility utility stage I category.

As already noted, the 46 airports in the Region may be classified by ownership. Nineteen of the 46 airports are privately owned and restricted to private use. Of the 27 airports open to public use, including one air carrier airport, one seaplane base, and 25 general aviation airports, only eight are publicly owned and operated. These eight airports include Kenosha Municipal in Kenosha County, owned and operated by the City of Kenosha; General Mitchell Field and Timmerman Field in Milwaukee County, owned and operated by Milwaukee County; Burlington Municipal in Racine County, owned by the City of Burlington; East Troy Municipal in Walworth County, owned by the Village of East Troy; Hartford Municipal in Washington County, owned by the City of Hartford; West Bend Municipal in Washington County, owned by the City of West Bend; and the Waukesha County Airport in Waukesha County, owned by Waukesha County. The eight publicly owned and operated airports include one scheduled air carrier, four general utility, and three basic utility airports. All of the publicly owned airports except East Troy Municipal provide year-round use reliability with paved and lighted runways. All but the East Troy and Hartford Municipal Airports provide some form of instrument landing capability.

Data on the relationship of each airport to the regional arterial street and highway system indicate that 22 of the 46 airports are directly served by arterial streets or highways and that an additional 15 airports are located within one mile of an arterial street or highway. Furthermore, it was found that only three arterial facilities serving as airport service roads are presently carrying traffic volumes which exceed the design capacity of the road. General Mitchell Field is the only airport in the Region presently provided with direct intraurban transit service. General Mitchell Field is also served by interurban bus service, including bus service to Chicago's O'Hare Field. Local bus routes also exist in the vicinity of Timmerman Field and the Racine Commercial Airport, but these routes do not provide direct service to the airport facilities.

Basic information regarding the regional airspace and air traffic control system and aircraft activity within this system was also collected and analyzed in the study. This study of air traffic activity in the controlled airspace of southeastern Wisconsin focused upon the en route and airport related controlled airspace and air traffic control systems to determine if air traffic loadings or aircraft operational restrictions existed which could have an adverse effect upon the operation of the regional airports. The en route airspace environment of southeastern Wisconsin is only a portion of a larger regional airspace structure, including service of the Chicago metropolitan area. From analysis of this airspace structure, it was

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[1] *Primary scheduled air transport facilities are those airports served by commercial air carriers which together serve at least one million enplaning passengers annually; secondary scheduled air transport facilities are those airports served by commercial air carriers which together serve from 50,000 to one million enplaning passengers annually; and feeder scheduled air transport facilities are those airports served by commercial air carriers which together serve less than 50,000 enplaning passengers annually. General transport facilities are those airports capable of accommodating the heaviest multi-engine, including turbojet, aircraft in the general aviation fleet, including such aircraft as the DC-9. Basic transport facilities are those airports capable of accommodating the medium-weight multi-engine, including turbojet, aircraft in the general aviation fleet, including such aircraft as the Learjet. General utility facilities are those airports capable of accommodating the lighter weight multi-engine and single engine aircraft in the general aviation fleet, which excludes all jets. Basic utility facilities are those airports capable of accommodating the lightest aircraft in the general aviation fleet, generally including only single engine aircraft. STOLports are those aviation facilities specially designed to accommodate "short take-off and landing" aircraft. Heliports are those aviation facilities specially designed to accommodate vertical takeoff and landing aircraft. Seaplane bases are those aviation facilities specially designed to provide service to aircraft and capabilities to land and take off from water.*

concluded that en route air traffic density in southeastern Wisconsin is moderately heavy and will require continuing evaluation to assure that saturation is not reached during periods of heavy operation. If necessary, traffic pressure could be relieved by restructuring the en route system to provide bypass routes around the congested area.

Airport related controlled airspace, or that controlled airspace normally associated with arrival and departure patterns of aircraft operations under either visual flight rules (VFR) or instrument flight rules (IFR) within southeastern Wisconsin, was quantitatively analyzed to identify any airspace restrictions upon airport capacity which could be attributed to airspace interaction between airports in and immediately adjacent to the Region. Air traffic flow diagrams were prepared to depict close-in arrival and departure procedures of the seven IFR general aviation and one air carrier airport within the Region, plus the general aviation airports in two contiguous counties in Illinois and Wisconsin. Airport related airspace restrictions were found to exist, and act to effect some reduction in capacity for Timmerman Field, General Mitchell Field, Racine Commercial, Burlington Municipal, Kenosha Municipal, and Playboy Airports. Airspace restrictions which may affect airport capacity of these six airports can be attributed to conflicts between arrival and departure paths. It was determined, however, that these conflicts can be alleviated through changes in the approach and departure courses and/or glide slopes used in takeoff and landing.

Inventories conducted under the study revealed that there were about 1,100 aircraft permanently based at the 46 airports within the Region in 1971. Nearly 800 of these aircraft, or about 75 percent of the total, were based at the eight publicly owned and operated airports in the Region. The study also included examination of the composition of the present aircraft fleet and an assessment of the probable impact of current aircraft research and development programs on that composition. This assessment generally concluded that the aircraft likely to come into use within the Region in the foreseeable future can be expected to be somewhat faster, quieter, and have lower operating costs than at present. It is unlikely, however, that the anticipated changes in the aircraft fleet will substantially affect terminal needs.

Existing Air and Air-Related Travel Habits and Patterns

One of the central concepts underlying all transportation planning efforts is that travel is an orderly, regular, and measurable occurrence evidenced by recognizable patterns. Accordingly, an inventory was conducted under the regional airport system planning program for southeastern Wisconsin of all air and related ground transportation movements within the Region to discover those patterns and disclose those aspects which demonstrate a high degree of repetitiveness. Knowledge of existing air travel habits and patterns is essential in order to provide an understanding of the probable future demand for air transportation and related facilities. In addition to collecting and collating all pertinent existing data from secondary sources, three types of personal interview air travel surveys were conducted: a commercial enplaning passenger survey, a general aviation airport pilot survey, and a general aviation airport user survey.

The commercial enplaning passenger survey was conducted at General Mitchell Field in Milwaukee County, the Region's only air carrier airport. This inventory indicated that five certificated air carriers served the Southeastern Wisconsin Region through General Mitchell Field in 1971. These included Eastern Air Lines, Inc.; North Central Airlines, Inc.; Northwest Airlines, Inc.; Ozark Air Lines, Inc.; and United Airlines, Inc. Of these, North Central, Northwest, and United were the most important carriers in terms of routes authorized and passenger traffic carried to and from General Mitchell Field. A comparison of air carrier service and passenger demand between cities served from General Mitchell Field indicated that the quality of service provided appeared to be low in comparison to demand between Milwaukee and Kansas City, Los Angeles, Pittsburgh, and San Francisco.

A survey of total aircraft operations indicated that four airports within the Region—General Mitchell Field, Timmerman Field, Waukesha County Airport, and Kenosha Municipal Airport—together accounted for over half of the total landings and takeoffs on an average weekday, nearly 80 percent of all "touch and go" flight training operations, and about 60 percent of all total local flights, that is, flights originating and ending at a single airport. In terms of total aircraft operations, General Mitchell Field was found to be the most heavily used airport, with Timmerman Field having the highest number of "touch and go" flight training operations.

The ground travel time of enplaning passengers at General Mitchell Field was found to average 23 minutes, with 78 percent of the originating passengers traveling 30 minutes or less and over 90 percent traveling 40 minutes or less to reach the airport. The average time that pilots spent in traveling on the ground to and from the general aviation airports was found to be only 16 minutes, with 85 percent traveling 30 minutes or less to reach an airport. General aviation passengers were found to be within 13 minutes average ground travel time of the general aviation airports, and nearly 90 percent traveled 30 minutes or less. Over 90 percent of the general aviation airport users surveyed within the Region traveled 20 miles or less to reach the airport.

The surveys revealed that about 35 percent of all enplaning air carrier passengers in the Region were traveling on work and work-related business, with an additional 32 percent of the enplaning air carrier passengers traveling for social or recreational purposes. The surveys further revealed that with respect to general aviation passengers, about 30 percent were traveling for work and work-related business, with about 50 percent of general aviation passenger trips conducted solely for social or recreational purposes.

The socioeconomic characteristics of commercial air passengers and the general aviation pilots and passengers were found to be remarkably similar. Over 70 percent of the total enplaning passengers at General Mitchell Field were male, 75 percent of the passengers using general aviation transport were male, and 98 percent of the general aviation pilots were male. The median age of airline passengers, general aviation passengers, and pilots was found to be about 41 years. The median annual household income of the air transportation system users was found to range from about $15,700 for pilots to $16,650 for enplaning commercial airline passengers and to $18,650 for general aviation passengers.

The special inventories also provided important guidelines in the establishment of objectives and standards for the development of an effective and efficient air transportation system for the Region. In general, the surveys indicated that the existing air transportation system primarily serves the needs of residents of the Region, and that in order to effectively meet these needs, the regional airport system should be designed so that ground travel times and distances from user residences to airports are kept to within 30 minutes and 20 miles. This would maintain a level of service that is presently provided to approximately 85 percent of all air transportation service users within the Region.

Legal, Institutional, and Financial Resource Base

Legal, institutional, and financial resource constraints must also be considered in airport system planning, since these factors will influence the nature and timing of recommended plan implementation measures, as well as the practicability of the system plan itself. Accordingly, an inventory was conducted under the study of the existing legislative, administrative, and financial resource factors affecting airport system development. In general, these inventories found that public airport development in the Region involves a complex web of federal, state, and local activity. The local unit of government owning or desiring to sponsor airport facility development must, under the provisions of the Wisconsin Statutes, look to the Wisconsin Department of Transportation, Division of Aeronautics, as well as the U. S. Department of Transportation, Federal Aviation Administration, for both financial and technical assistance.

The Wisconsin Statutes give full authority to all counties, cities, towns, and villages to acquire, own, and operate airports; to issue bonds to finance airport development; to make reasonable rules and regulations for the use of airports; and to charge fees to pay for the operating costs thereof. Of the eight publicly owned airports currently in the Region, six are under the direct control of committees comprised entirely of elected public officials. These six airports are General Mitchell Field and Timmerman Field in Milwaukee County, Burlington Municipal Airport in Racine County, East Troy Municipal Airport in Walworth County, Hartford Municipal Airport in Washington County, and the Waukesha County Airport. The West Bend Municipal Airport in Washington County is governed by a committee comprised of elected officials and appointed citizens, and the City of Kenosha has delegated the responsibility for airport development and operation to an Airport Commission appointed by the Mayor and approved by the Council. Three of the airports—Kenosha Municipal, General Mitchell Field, and Timmerman Field—are managed and maintained directly by the governmental agencies, whereas the remaining five publicly owned airports are managed by fixed base operators under terms of lease agreements with the units of government.

Legislation governing airport development, specifically with respect to land use development near airports, clear zone protection, noise abatement, and air pollution abatement, is limited. Special airport zoning ordinances restricting the height of aeronautical hazards in the vicinity of the airport have been enacted by all of the local units of government responsible for airport operation in the Region. As yet, there are no requirements that airport operations conform to any noise or air pollution standards. The U. S. Environmental Protection Agency is, however, presently formulating standards of this type.

The Federal Airport and Airway Development Act of 1970 establishes a separate airport and airway trust fund for aviation improvement and further establishes user charges to generate revenues for the fund. Since 1972, such aids have been made available at a rate of 75 percent of eligible project cost. Under this program the amount of federal aid available for airport development in Wisconsin has more than tripled over the amount of such aid available prior to passage of the act. Wisconsin Statutes, through revenues derived from airline property taxes and aircraft registration fees, provide for a state airport development aid program limiting state aid to no more than 50 percent of the nonfederal share of costs. However, state funds available for projects have averaged only 12 percent of the total project cost during the ten-year period ending in 1971.

The eight publicly owned airports in the Southeastern Wisconsin Region together expended an average of about $1.27 million annually for operation, maintenance, and the local share of capital expenditures during the five-year period 1966-1970, and received an average of about $1.93 million annually as revenue from their airport operations during this same period. The amounts expended do not include an allowance for depreciation of capital investment. Only at General Mitchell Field and Timmerman Field did revenues exceed expenditures as reported in the statement for this five-year period.

AIRPORT RELATED DEVELOPMENT OBJECTIVES

The task of formulating objectives and standards to be used in plan design and evaluation is a difficult but necessary part of the planning process. Regional plan elements must advance development proposals which are physically feasible, economically sound, aesthetically pleasing, and conducive to the promotion of public health and safety. Agreement on development objectives beyond such generalities, however, becomes more difficult to achieve because the definition of specific development objectives and supporting standards inevitably involves value judgments. Nevertheless it is essential to state such objectives for the development of the regional airport system and to quantify them insofar as possible through standards in order to provide a basis for the design, test, and evaluation of alternative regional airport system plans. Moreover, in order to assure that regional airport system development will be compatible with regional land use development and with the development of other functional systems such as surface transportation and utility systems, the regional airport system development objectives must be prepared within the context of other regional development objectives. Therefore, the regional airport system development objectives and supporting principles and standards set forth in this report were based upon previously adopted regional development objectives as established under the regional land use and transportation planning programs, supplemented as required to meet the specific needs of the regional airport system planning program.

Nine new development objectives, together with supporting principles and standards, were formulated under the regional airport system planning program. These nine new development objectives are:

1. An integrated regional airport system which will effectively serve the existing and probable future inter- and intra-regional air travel demand with appropriate types and adequate levels of service; alleviate air traffic congestion; and reduce travel times between the Region and its component parts and other regions.

2. A regional airport system which will minimize accident exposure and provide increased travel safety.

3. A regional airport system which will be compatible with the existing land use patterns and adopted land use plans.

4. A regional airport system which will be properly related to the underlying and sustaining natural resource base and which will minimize the existing and potential adverse effects upon that natural resource base.

5. A regional airport system which will promote flexibility, allowing air transportation service to be readily adapted to changes in the demands for air transportation and changes in aviation technology.

6. A regional airport system which will be properly related to and integrated with the supporting ground transportation system.

7. A regional airport system which will be properly related to the regional public utility systems, permitting efficient and economic provision of necessary public utility services to airport and airport-related land use development.

8. A regional airport system which will be located and designed to maintain a high aesthetic quality, with proper visual relation of the facilities to the landscape and cityscape.

9. A regional airport system which will be economical and efficient, meeting all other objectives at the lowest possible cost.

Together with the land use and transportation facility development objectives previously established under related Commission work programs, these new development objectives and their supporting principles and standards provided the basic framework within which alternative regional airport system plans were formulated and evaluated, and a recommended regional airport system plan selected.

AIR TRANSPORTATION DEMAND FORECASTS AND ANALYSES

Forecasts of aviation demand provide a basis for determining the extent of air transportation facility needs and for the scheduling of airport facility improvements. In the regional airport system planning program for southeastern Wisconsin, forecasts were prepared of the following major components of aviation demand: commercial passenger enplanements; commercial cargo tonnage; air mail tonnage; air carrier movements; diversion to or from other modes of travel and/or geographic regions; general aviation activity; and military aviation activity. An initial set of such forecasts was prepared midway through the study which was based, in part, upon population and economic activity level forecasts prepared in 1963, which envisioned a year 1990 regional population of about 2.7 million persons, and in part upon independently prepared national forecasts of aviation activity. This set of forecasts was used in the preparation of alternative regional airport system plans and in the preparation of an initial recommended regional airport system plan. As the study was being completed, however, certain significant changes in national and regional demographic and economic conditions were becoming evident. Such changes included dramatic decreases in birthrates, rapid price inflation, sharp declines in economic activity and employment, and rapidly rising energy costs, including costs of aviation fuel, with attendant rapidly rising costs of aircraft operation. Analyses indicated that these changes would affect the original regional population and employment forecasts and the initial aviation demand forecasts.

Accordingly, and in full coordination with the regional land use-surface transportation plan reevaluation effort which was being concurrently conducted by the Commission, new forecasts of the components of aviation demand for the base year 1995 were prepared based upon new regional population and economic activity forecasts and new national forecasts of aviation activity. The new forecasts envisioned a year 2000 regional population of 2.2 million persons.[2]

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[2] *The new regional population forecast of about 2.2 million persons relates directly to the plan design year 2000 selected for the new regional land use and regional surface transportation plans. The revised forecast of the components of aviation demand prepared under the regional airport system planning program were for the base year 1995 in order to provide a 20-year plan implementation period from the anticipated completion year of the regional airport system plan as required Federal Aviation Administration standards. Thus, the 1995 regional population forecast to which all of the aviation demand figures relate is about 2.1 million persons.*

The revised forecast of the components of aviation demand utilized in the preparation of the recommended regional airport system plan may be summarized as follows:

1. Annual air carrier passenger enplanements may be expected to increase from a 1971 level of about 980,000 to a 1995 level of about 2.8 million passengers. These totals include both originating and transferring passengers. Originating passengers are forecast to increase from a 1971 level of about 730,000 to about 2.3 million in 1995.

2. Air freight and air express cargo are forecast to increase from about 14,000 tons in 1971 to about 275,500 tons in 1995, the forecast level constituting about 1 percent of the forecast national total of air cargo movements. Air mail is forecast to continue to remain at slightly less than 1 percent of the national total, increasing from nearly 6,000 tons in 1971 to about 25,000 tons in 1995.

3. Air carrier operations are forecast to increase from about 72,000 annually in 1971 to slightly over 100,000 in 1995. These forecast operations are expected to comprise about 93,000 operations by aircraft in scheduled and nonscheduled certificated air carrier service, about 2,300 operations by aircraft in supplemental nonscheduled air carrier service, and about 4,700 other air carrier aircraft operations not in revenue service.

4. No significant change in the diversion to or from other modes of travel or other airports was assumed in the preparation of the forecasts. Continued diversion to Chicago's O'Hare Field of from 20 to 25 percent of the total air carrier passenger demand generated within the Region was thus assumed.

5. A potential demand of from 300,000 to 400,000 enplaning passengers annually is forecast for vertical and/or short takeoff and landing air carrier service. Based upon this forecast level of demand, it was concluded that the provision of a special vertical and/or short takeoff and landing airport facility in the Region would not be warranted.

6. General aviation aircraft based within the Region are forecast to increase from about 1,100 in 1971 to about 3,500 in 1995. Annual general aviation aircraft operations are forecast to increase from about 770,000 in 1971 to about 2.86 million in 1995. Accordingly, a total of about 7,800 general aviation aircraft operations can be expected to take place within the Region on an average weekday in 1995, as compared to a total of about 2,100 such operations in 1971. General aviation in the Region is expected to serve about 3.2 million passengers annually in 1995, compared with about 800,000 annually in 1971.

7. Military activity in the Region, which currently is confined to General Mitchell Field and the West Bend Municipal Airport and which comprised about 1 percent of the total aircraft activity in the Region in 1970, is expected to remain at about 15,000 annual operations through 1995.

Under the regional airport system planning program, demand distribution models were developed in order to distribute the regional air transportation demand forecasts to about 600 traffic analyses zones within the Region. Two such demand distribution models were developed, one to distribute airline passenger demand and the other to distribute general aviation demand. The data used to calibrate the air carrier passenger demand distribution model were derived primarily from the Commission's surveys of enplaning passengers at General Mitchell Field. Resident address information on regional general aviation aircraft owners was used to calibrate the general demand distribution model.

Two distributions were made in each case, one based upon assumptions that the Region would develop substantially in accord with the adopted regional land use plan, and another—for comparison purposes—based upon the assumption that the Region would develop at variance with the adopted land use plan as indicated by the unplanned land use alternative prepared under previous Commission work programs. The demand distribution under the adopted regional land use plan conditions was used to develop, test, and evaluate alternative system plans. The recommended airport system plan ultimately developed was then tested against the air transportation service demand that would be expected to occur under the unplanned alternative in order to ascertain the viability of the recommended plan under quite different land use development conditions within the Region. This test indicated that the recommended airport system plan would serve the Region equally well should a land use pattern significantly different from that planned occur.

The forecast air passenger and general aviation demands as distributed through the application of the models were then scaled against the capacity of the existing air transportation facilities in the Region in order to identify system deficiencies. The capacity of each existing airport facility was computed from the landing area configuration using accepted engineering techniques. The result of this demand-capacity comparison indicated that:

1. General Mitchell Field and the 20 public use general aviation airports in the Region have sufficient landing area capacity to accommodate operations at current demand levels without excessive delays.[3]

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[3] *Initially, all of the 26 existing public use airports within the Region as inventoried in 1971, not including the one public use seaplane base, were considered for potential inclusion in the alternative system plans. Subsequently, five airports were eliminated from the list—Rainbow, Hales Corners, Aero Park, Mt. Fugi, and O'Leary—because these airports either offered poor expansion potential, had already been or were expected to be purchased and converted to other uses, or were no longer available for public use.*

2. The capacity of the existing runway systems at General Mitchell Field and at five of the 20 public use general aviation airports within the Region—Waukesha County, Kenosha Municipal, Racine Commercial, Timmerman Field, and East Troy Municipal—may be expected to be exceeded by the anticipated future demand within the next 20 to 25 years.

3. The single existing air carrier airport in the Region—General Mitchell Field; the single existing basic transport airport in the Region—Racine Commercial; and the four existing general utility airports—Kenosha Municipal, Timmerman Field, West Bend Municipal, and Waukesha County—which must together accommodate the larger type of general aviation aircraft will not be spatially located within the Region to provide the airport facilities needed within the desired 30 minutes ground travel time of the residences of the owners of the larger type aircraft.

4. All of the 20 existing public use general aviation airports may be expected to be deficient with respect to paved tie-down area, hangar area, and terminal building area within the next 20 to 25 years.

5. The runway systems at 15 of the 20 public use general aviation airports within the Region have weather and seasonal-imposed operational limitations because these runway systems are not paved.

The results of the demand-capacity analyses also indicated that the probable future air carrier needs in the Region can be readily accommodated at a single air carrier airport. In addition, these analyses indicated that from six to eight basic transport airports designed to serve the business jet aircraft will be needed during the next 20 to 25 years, along with from five to seven general utility and basic utility airports designed primarily to meet the needs of the smaller propeller-driven, general aviation aircraft.

ALTERNATIVE REGIONAL AIRPORT SYSTEM PLANS

Under the regional airport system planning program for southeastern Wisconsin, a number of alternative regional airport system plans were designed, tested, and evaluated. Each of the alternative system plans was designed insofar as possible to meet the airport development objectives and supporting standards developed under the study as well as the forecast probable future demand for air transportation within the Region. Based upon the identified deficiencies in the existing airport system and an understanding of the characteristics of the unsatisfied demand, alternative regional airport system plans were identified through an evolutionary process involving successive iterations. Three complete sets and a total of 21 alternative airport system plans consisting of various combinations of airports were analyzed, including systems consisting of only existing publicly owned airports, of existing publicly and privately owned airports, of airports located only within the Region, of airports located both in and beyond the Region, and of various combinations of proposed new airports in conjunction with all or some of the existing airports. Through this iterative process, alternative airport system plans were evolved which met the forecast demand at increasingly higher levels of service.

Based upon an initial review of 15 initial alternative regional airport system plans, the advisory committee selected a set of six alternative system plans for more comprehensive evaluation. These six alternatives included a "no build" system plan, prepared to evaluate the effects of not expanding the existing publicly owned airports nor developing any new publicly owned airports within the Region; and "ideal" system plan, prepared to identify a theoretically ideal configuration of airports to serve the needs of the air transportation users of the Region without regard to other considerations; an "ideal plan modified" system plan, prepared to evaluate a practical system plan closely approximating the theoretically ideal configuration; a "nonurban" system plan, prepared to evaluate the effects of locating airports in less intensely developed areas of the Region away from urban and urbanizing areas; a "no new sites" system plan, prepared to evaluate the effects of expanding only selected existing publicly and privately owned airports to accommodate the forecast demands; and a "relocated air carrier" system plan, prepared to evaluate the effects of relocating commercial air carrier service from General Mitchell Field.

The six alternative airport system plans were evaluated on the basis of their ability to satisfy the forecast demand for aviation service; on the potential impact upon the land use patterns and natural resource base of the Region; on the relationship to other regional development plan elements; and against the airport system development objectives and supporting standards. The evaluation process included extensive analyses and comparisons undertaken with respect to landing area demand/capacity relationships; direct capital, operating, and maintenance costs; user costs; environmental considerations; compatibility with other regional plan elements; and compatibility with regional airport system development objectives and supporting standards.

Because of certain policy issues raised by elected officials from within the Region during the course of the study, a separate evaluation of alternative air carrier airport locations was undertaken. Four alternative locations within and adjacent to the Region were considered for the single air carrier airport required to serve the forecast demand: General Mitchell Field, the existing regional air carrier airport; a new site located in northern Racine County west of IH 94; the site of the abandoned Richard I. Bong Air Force Base in northwestern Kenosha County; and a new site located in Jefferson County west of the Region along IH 94, the latter considered as a potential joint use facility for the Madison urban area and the Southeastern Wisconsin Region.

Initial analysis of these four alternative air carrier sites was based upon satisfaction of the originating passenger demand—the primary reason for provision of an air carrier airport. The centroid of air carrier passenger demand expected to exist within the Region in 1990 was identified as a point in western Milwaukee County in the vicinity of the intersection of S. 114th Street and W. Layton Avenue in the City of Greenfield. An air carrier airport located on that site would minimize ground travel time and attendant costs for all originating passengers within the seven-county Region. General Mitchell Field is located less than eight miles from that regional centroid of air travel demand, while an air carrier airport located in northern Racine County would be about 15 miles from the centroid of public demand, and airports located at the abandoned Bong Air Force Base and in Jefferson County would be located 25 and 35 miles, respectively, from the centroid of demand.

Analyses of these four alternative sites further indicated that substantially increased diversion of in-Region generated air transportation demand to Chicago's O'Hare Field could be expected if the air carrier site was moved from General Mitchell Field to any of the other three sites. In addition, it was found that the total time spent in ground travel by the fewer passengers allocated to any of the three new alternative air carrier airport sites would exceed the amount of total ground travel time by passengers using General Mitchell Field. Thus, the three alternative sites to General Mitchell Field could be expected to serve a smaller portion of the Region generated air passenger demand and result in further increases in total ground travel time and associated costs than would continued use of General Mitchell Field.

The alternative airport site in Racine County was found to be the better of the three alternative sites in this respect in that it is located closest to the centroid of the demand and thus could be expected to experience lesser diversion to Chicago and would result in lesser ground travel time and cost than the other two alternatives. A major disadvantage of the abandoned Bong site is that it is not conveniently located with respect to the developing regional freeway system. A major disadvantage of the Jefferson County site is that it would be located between the two major urban areas of Madison and Milwaukee, and would thus place large concentrations of air passenger demand at the limits of desirable ground travel time to an air carrier airport. Improved high speed ground transportation to serve such isolated sites as the Jefferson County and the Bong airport sites was ruled impractical, since the provision of such transportation would require commitments of extensive financial resources to narrow transportation corridors to serve a very limited special purpose. Based upon this initial analysis, it was judged that only the Racine County site warranted further evaluation as a possible location for the regional air carrier airport.

The two remaining sites—General Mitchell Field and Racine County—were then compared in terms of landing area, demand/capacity, cost, and environmental considerations. With limited landing area improvements, General Mitchell Field, located nearer the center of regionally generated originating passenger demand, was found to have adequate capacity to meet the forecast air carrier demands under nearly all of the alternative system plans considered. The cost to develop an alternative air carrier airport at the Racine site was estimated at about $200 million, almost twice that found necessary to expand General Mitchell Field to accommodate the forecast passenger demands. While the analyses indicated that slightly more passengers would use General Mitchell Field than an airport located in northern Racine County because of the lesser ground travel time, the cost of ground travel to passengers using air carrier service is estimated to be about 80 percent less at General Mitchell Field than at the new air carrier site. The impact of noise from aircraft operations, however, may be expected to be more severe at General Mitchell Field than at the rural Racine County site.

RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN

Based upon analyses of the many alternative regional system plans considered, a recommended regional airport system plan was developed to serve the aviation needs of southeastern Wisconsin over the next two to three decades. The recommended plan is comprised of a system of 14 airports and does not envision the development of any new airport sites within the Region. Eight of the 14 airports are currently publicly owned, with the remaining six currently privately owned and operated. The plan recommends that all eight of the Region's publicly owned airports undergo improvement during the plan design period, and further recommends that steps be taken to ensure the continued availability for public use and to improve four currently privately owned airports as important elements of the regional airport system. Two other private airports included in the system plan—the Playboy and Lake Lawn Lodge airports—were assumed to remain available for public use as private airports without any particular public action in order to accommodate the special aviation needs generated by and associated with recreational development in Walworth County.

In addition to including General Mitchell Field as the only scheduled air transport airport within the Region, the plan includes five basic transport airports—the Burlington Municipal, Kenosha Municipal, Racine Commercial, Waukesha County, and West Bend Municipal Airports; four general utility airports—Gruenwald, Hartford Municipal, Ozaukee, and Timmerman Field Airports; two basic utility airports—East Troy Municipal and Sylvania Airports; and the two basic utility-recreational airports at Playboy and Lake Lawn Lodge noted above. The recommended system of 14 airports located within the seven counties available for public use contrasts to the 26 public use airports presently located within the Region which include one scheduled air transport airport, one basic transport airport, four general utility airports, and 20 basic utility or lower airports having varying levels of service capability.

While some of the existing privately owned airports may be expected to continue to operate through the planning period and may, in fact, be expanded to serve a growing portion of the total demand for aviation service, the recommended system plan does not depend upon the continued availability of these private airports nor does it preclude their continued operation. To the extent that these private airports remain in operation, the aviation demand at the 14 airports included in the plan may be expected to be reduced and the need for improvements delayed. The plan does define, by service capability, the minimum number of airports considered necessary to accommodate the probable future aviation demand within the Region.

Included in the plan is a description of the type and extent of airport facility development needed to improve each airport from its present operational capability to the airport classification recommended in the regional system plan in order to adequately accommodate the forecast aviation demand. Improvements are recommended, as appropriate, with respect to the land or site location, area, and configuration; the aircraft operational area, including runways, aircraft parking aprons, taxiways, lighting, and navigation aids; the terminal and hangar facilities; the supporting transportation access facilities; and the supporting utilities. In addition to identifying onsite airport improvements necessary to accommodate the aircraft demand, restrictions to aircraft operations, generalized land use plans, and height zoning restrictions in the vicinity of the airports have been recommended, all in an effort to eliminate or reduce the incompatibilities between some land uses and activities and airport and aircraft operations.

The following is a brief summary of the major airport improvement recommendations for each of the airports included in the system plan, as that plan was presented at a series of public meetings and hearings:

1. Burlington Municipal Airport—The major improvements required to expand the Burlington Airport from a basic utility to a basic transport airport include the construction of an 1,800-foot runway extension in order to provide a primary runway having a length of 5,400 feet; the construction of a paved 4,300-foot secondary crosswind runway; the construction of an associated taxiway system; the installation of an air traffic control tower, a precision instrument landing and approach lighting system and other lighting and navigation aids; and the acquisition of additional land to accommodate the airport site improvements and clear zone protection.

2. East Troy Municipal Airport—The major improvements required to expand the East Troy Municipal Airport from a less than basic utility airport classification to a proposed basic utility airport classification include the construction of a paved 3,200-foot primary runway; the construction of a paved 2,560-foot secondary crosswind runway; the installation of lighting and other navigation aids; and the acquisition of additional land to accommodate the airport site improvements and clear zone protection.

3. General Mitchell Field—The major improvements required at the only air carrier airport to serve the Region in the system plan include the construction of runway extensions; the realignment of the northeast-southwest general aviation runway; renovation and expansion of the airline passenger terminal area, including a proposed customs facility to accommodate international flights; construction of a new cargo terminal area; and the acquisition of land to accommodate runway clear zone protection and to eliminate land use conflicts in the most severe noise impact areas. In addition, the plan recommends, as a noise abatement measure, that jet aircraft not be permitted to use the proposed realigned general aviation runway until the entire fleet of general aviation jet aircraft is equipped with the new quieter types of engines. In addition, continued restrictions to turning movements until aircraft have reached a point on runway headings four or more miles beyond the airport boundaries, as well as limitations upon jet traffic in late evening and early morning hours, are recommended.

4. Gruenwald Airport—The major improvements required to expand this less than basic utility, currently privately owned airport to a proposed general utility airport classification include the construction of a 4,000-foot primary runway, construction of a 3,200-foot secondary crosswind runway and associated taxiways; the installation of an air traffic control tower, a nonprecision instrument landing system, and lighting and other navigation aids; and the acquisition of additional land to accommodate airport site improvements and clear zone protection.

5. Hartford Municipal Airport—The major improvements required to expand this existing basic utility airport to a proposed general utility airport classification include the construction of an 800-foot runway extension to provide a primary runway having a length of 3,800 feet; construction of a paved 3,000-foot secondary crosswind runway; construction of an associated taxiway system; installation of a traffic control tower, a nonprecision instrument landing approach and other lighting and navigation aids; and acquisition of additional land to accommodate the airport site improvements and clear zone protection.

6. Kenosha Municipal Airport—The major improvements required to expand this existing general utility airport to the proposed basic transport airport classification include the construction of a 7,000-foot runway; construction of a secondary runway extension; construction of an associated taxiway system; installation of an air traffic control tower, a precision instrument landing and approach lighting system, and other lighting and navigation aids; and acquisition of additional land to accommodate airport site improvements and clear zone pro-

tection. Nonstandard air traffic operational patterns are recommended to minimize the adverse impact of aircraft activity on nearby residential development.

7. Ozaukee Airport—The major improvements required to expand this less than basic utility, currently privately owned airport to a proposed general utility airport classification include the construction of a new north-south primary runway, construction of a new east-west secondary crosswind runway and associated taxiways; the installation of an air traffic control tower, a nonprecision instrument landing system, and other lighting and navigation aids; and acquisition of additional land for airport site development and clear zone protection.

8. Racine Commercial Airport—The major improvements required to improve this currently privately owned, less than basic transport airport include the construction of parallel taxiways; the installation of an air traffic control tower, a precision instrument landing system, and lighting and other navigation aids; and the land acquisition for clear zone protection and street relocation to obtain full use of existing runways. The plan further recognizes that because of urban land uses surrounding this airport site, changes to aircraft flight patterns cannot be used effectively to reduce noise impact. However, the plan does recommend that all "touch and go" flight training activities be discouraged at this urban airport and be diverted to such nonurban airports as East Troy, Sylvania, and Gruenwald.

9. Sylvania Airport—The major improvements required to expand this currently privately owned, less than basic utility airport to a proposed basic utility airport include widening and extensions of the existing runway; construction of a paved secondary crosswind runway; and acquisition of additional land to accommodate the airport site improvements and clear zone protection. To construct a north-south runway it will be necessary to terminate the existing town road northwest of the airport.

10. Timmerman Field—This airport is recommended to remain classified as a general utility airport and, therefore, not normally used by jet aircraft. A Milwaukee County ordinance currently prohibits jet aircraft traffic at this airport. The major improvements recommended consist of widening existing paved runways and paving existing turf runways, the installation of additional lighting and navigation aids, and the acquisition of land interest for clear zone protection. Since the airport is already surrounded by intense urban development, no changes to existing air traffic operating patterns are considered to be effective to alleviate noise. However, the plan does recommend that all "touch and go" flight training activities be discouraged at this urban airport and be diverted to such nonurban airports as the Hartford and West Bend Municipal Airports.

11. Waukesha County Airport—The major improvements required to expand this general utility airport to a proposed basic transport airport classification include the construction of a 1,400-foot runway extension to provide a primary runway length of 5,600 feet; realignment of CTH TJ to permit runway extension; construction of a 3,300-foot parallel runway; provision of an improved air traffic control tower; installation of a precision instrument landing and approach lighting system and other lighting and navigation aids; and acquisition of additional land to accommodate the airport site improvements and clear zone protection. Nonstandard air traffic operational patterns are recommended to minimize the adverse impact of aircraft activity on adjacent residential development. In addition, the plan recommends that all "touch and go" flight training activities at this urban airport be discouraged and be diverted to such nonurban airports as the Hartford Municipal and East Troy Municipal.

12. West Bend Municipal Airport—The major improvements required to expand this general utility airport to a proposed basic transport airport include the construction of a 1,600-foot extension to the primary runway to provide a runway length of 5,500 feet; widening and strengthening of other runways and taxiways; installation of an air traffic control tower, a precision instrument landing and approach lighting system, and other lighting and navigation aids; and the acquisition of additional land to accommodate the airport site improvements and clear zone protection.

The full capital cost of implementing the regional airport system plan as described herein is estimated at about $146 million. Because the initial financial analysis indicated that it was unlikely that the local revenue requirements for full implementation of the plan could be met, the airport facility plan elements recommended at each airport were reviewed to identify potential deferrals in plan implementation that would reduce system plan costs with a minimum adverse impact upon airport system runway capacity or safety. Examples of the facility improvements considered for deferral beyond the plan implementation period to 1995 include the following:

1. Increasing the size of the terminal/airport administration buildings at the 11 general aviation airports. By initially constructing smaller terminal buildings, the total estimated capital cost of the recommended plan could be reduced by about $3.2 million.

2. Increasing the size of the automobile parking facilities provided at the 11 general aviation airports. By initially providing fewer parking spaces, the total estimated capital cost of the recommended plan could be reduced by about $195,000.

3. Increasing the aircraft parking apron areas at the 11 general aviation airports. By initially providing smaller apron areas, the total estimated cost of the recommended plan could be reduced by about $1.3 million.

4. Constructing the new runway at the Kenosha Municipal Airport to 7,000 feet. Initial runway construction to 5,600 feet would provide basic transport standards, and while land for the eventual construction of this runway extension should be acquired as soon as practicable, deferral of the runway extension to 7,000 feet could reduce the total cost of the recommended plan by $655,000.

5. Paving turf runways, widening the existing paved runways, and obtaining additional clear zone land interest at Timmerman Field. Deferral of these improvements reduced the total estimated cost of the plan by about $2.3 million.

6. Purchasing clear zone land and the relocation of Green Bay Road in order to permit full runway use at Racine Commercial Airport. By deferring these land acquisitions, cost savings of about $1.9 million can be effected.

7. Constructing paved secondary runways at the Gruenwald and Ozaukee Airports. While land for this runway construction should be acquired as soon as practicable, deferral of the runway improvements can effect cost savings of about $1.0 million.

Thus, the suggested deferrals could reduce the total capital cost of the recommended plan by nearly $10.7 million, and would bring the capital cost of the plan implementation more nearly into accord with the anticipated availability of local financing. It should be clearly understood, however, that all of the improvements listed above would be desirable and would contribute in substantial manner toward meeting the forecast air transportation demand in the Region at the recommended standards. Accordingly, should local funds become available to carry out these additional improvements as indicated, such improvements should proceed as rapidly as possible.

Assuming that the above-listed recommended facility improvements are deferred to beyond the plan implementation period to 1995, the capital cost of implementing the regional airport system plan during the next 20 years is estimated to be about $135.6 million, including $39.3 million for improvements considered to be self-amortizing.[4] Thus, the average annual capital cost over the 20-year plan implementation period 1975-1995 requiring public funding is about $4.8 million. Of this average annual capital cost, about $2.0 million would be eligible for federal airport development aids, and about $400,000 for state airport development aids under the recommendations contained in the plan. The remaining $2.4 million would represent local capital requirements. The federal funding requirements for plan implementation are within the amounts which can be expected to be made available annually for airport development in southeastern Wisconsin. However, the state funding requirements for plan implementation are beyond the anticipated amounts which can be expected to be made available annually by the State of Wisconsin for airport development in the seven-county Region. The plan recommends that the current statutory limitation of $35,000 of state aid participation in eligible airport building projects be changed to a permissible rate of 50 percent state participation in such building projects.

The local capital funding requirement for plan implementation of about $2.4 million annually consists of about $280,000 per year for improvements at the 11 general aviation airports, and about $2.1 million annually for improvements at General Mitchell Field, primarily for the expanded passenger terminal facility. It should be pointed out that General Mitchell Field does generate revenues which could serve to effectively reduce this annual cost by about $720,500. However, the $280,000 per year required at the 11 general aviation airports is nearly four times that spent annually for capital investment by local units of government at the seven publicly owned general aviation airports over the past decade; and the $1.4 million total local funding requirement at General Mitchell Field approximates the amounts spent annually on capital improvements in recent years.

PUBLIC REACTION TO RECOMMENDED PLAN

As outlined in Chapter II of this report, the general approach utilized by the Commission in the selection of a recommended plan from among alternatives is to proceed through the use of advisory committees, interagency meetings, public informational meetings, and public hearings to a final decision and plan adoption by the Commission in accordance with the provisions of the state enabling legislation. Because plan selection and adoption necessarily involve both technical and nontechnical policy determinations, such selection and adoption must involve the various governmental bodies, technical agencies, and private interest groups concerned. Such involvement is particularly important in light of the advisory role of the Commission in shaping regional development. The use of advisory committees, public informational meetings, and public hearings appears to be the most practical and effective procedure available for attaining the necessary involvement of elected and appointed public officials and interested citizens in the planning process and of eventually arriving at agreement on development plans which can be jointly adopted and cooperatively implemented.

As an integral part of the regional airport system planning program, a series of informational meetings and a formal public hearing were held within the Region. The purpose

[4] *The self-amortizing improvements include hangars at 11 general aviation airports--$19.8 million; automobile parking structure at General Mitchell Field—$16.7 million; and cargo terminal area at General Mitchell Field—$2.8 million.*

of these meetings and hearing was to more fully inform public officials, private airport owners and operators, and interested citizens about the findings and preliminary recommendations of the regional airport system planning program, and to obtain public reaction to the regional airport system plan recommended by the staff and by the Technical Coordinating and Advisory Committee. The meetings and hearing were widely announced with letters of invitation being sent to all concerned local, state, and federal public officials; to private airport owners and operators; to interested citizen groups; and to about 2,000 individuals and organizations included on the Commission Newsletter mailing list. In addition, news releases were issued to all daily and weekly newspapers and radio and television stations serving the Region. A summary of the inventory, analysis, and forecast findings; of the airport system development objectives and standards; of the alternative airport system plans considered; and of the recommended preliminary regional airport system plan was presented in SEWRPC Newsletter Volume 15, No. 3, which was widely disseminated throughout the Region prior to and at the meetings and hearing. A verbal briefing on the findings and preliminary recommendations of the regional airport system planning program was given at each of the informational meetings and again at the public hearing, together with data on the costs and means for implementation of the recommended preliminary plan.

The informational meetings, including one special informational meeting for public officials and private airport owners and operators and four informational meetings for the general public, and the public hearing were held in accordance with the schedule listed below; and minutes of both the informational meetings and the public hearing, together with documentation of the notification procedures utilized by the Commission, totaling 479 pages in length, were published in November 1975 and transmitted to the Technical Coordinating and Advisory Committee and the Commission for review and consideration prior to final adoption of the recommended plan.

Informational Meeting for Public Officials and Private Airport Owners and Operators

Presiding Agency	Place of Meeting	Date and Time of Meeting
Southeastern Wisconsin Regional Planning Commission	Milwaukee County Courthouse Milwaukee, Wisconsin	August 5, 1975 2:00 p.m. - 3:30 p.m.

Informational Meetings for General Public

Presiding Agency	Place of Meeting	Date and Time of Meeting
Southeastern Wisconsin Regional Planning Commission	Washington County Courthouse West Bend, Wisconsin	August 19, 1975 7:30 p.m. - 9:15 p.m.
Technical Coordinating and Advisory Committee on Regional Airport Planning	Racine County Highway and Office Building Sturtevant, Wisconsin	August 20, 1975 7:30 p.m. - 10:10 p.m.
Technical Coordinating and Advisory Committee on Regional Airport Planning	Waukesha County Courthouse Waukesha, Wisconsin	August 26, 1975 7:30 p.m. - 11:10 p.m.
Southeastern Wisconsin Regional Planning Commission	Walworth County Courthouse Elkhorn, Wisconsin	August 27, 1975 7:30 p.m. - 10:30 p.m.

Public Hearing

Southeastern Wisconsin Regional Planning Commission	Milwaukee County Courthouse Milwaukee, Wisconsin	September 3, 1975 7:30 p.m. - 10:30 p.m.

One additional informational meeting for the general public was held at the request of local governmental officials in order to provide a more detailed briefing on the preliminary recommended plan and to give further opportunity for citizen and public official involvement. In addition, three special intergovernmental meetings were held in response to concerns expressed at the public hearing. These additional meetings were held as follows:

Special Informational Meeting for General Public

Governmental Units Requesting Meeting	Place of Meeting	Date and Time of Meeting
Cities of St. Francis and Oak Creek	City Hall St. Francis, Wisconsin	September 25, 1975 7:00 p.m. - 9:30 p.m.

Special Intergovernmental Meetings

Governmental Units and Officials Represented at Meeting	Place of Meeting	Date and Time of Meeting
City of Burlington Burlington Airport Commission Town of Burlington Town of Spring Prairie The Honorable Cloyd A. Porter, Representative, 43rd District Southeastern Wisconsin Regional Planning Commission	Burlington Municipal Airport Burlington, Wisconsin	September 30, 1975 7:30 p.m. - 9:30 p.m.
Village of East Troy Southeastern Wisconsin Regional Planning Commission	Village Hall East Troy, Wisconsin	October 27, 1975 7:30 p.m. - 11:00 p.m.
City of Waukesha Plan Commission Southeastern Wisconsin Regional Planning Commission	City Hall Waukesha, Wisconsin	October 14, 1975 4:00 p.m. - 5:30 p.m.

A total of over 650 persons attended the special and general public informational meetings and the public hearing. The record of the proceedings indicates that local government and public reaction to the plan recommendations was mixed, with significant controversy developing with respect to some of the recommendations contained in the plan and with no controversy at all with respect to other recommendations contained in the plan. The preliminary plan recommendations for the Kenosha Municipal, Racine Commercial, Sylvania, Gruenwald, Timmerman Field, Lake Lawn Lodge, and Playboy Airports all met with a favorable response. Significant controversy existed with respect to the plan recommendations for Ozaukee, West Bend Municipal, Hartford Municipal, Waukesha County, General Mitchell Field, East Troy Municipal, and Burlington Municipal Airports. The following discussion summarizes the salient issues raised concerning these airports at the informational meetings and the public hearing and the Commission response with respect thereto.

Ozaukee Airport

The preliminary plan recommended that the existing privately-owned Ozaukee Airport be improved from its existing status as a less-than-basic utility airport to a proposed general utility airport. At the public informational meeting held in West Bend, the owner and operator of Grob Field, a private airport in Ozaukee County, recommended that consideration be given instead to the construction of a new airport located on the newly-constructed IH 43 midway between the Cities of Port Washington and Sheboygan. This operator indicated that, in his opinion, the Ozaukee Airport is located too close to existing urban development and to electric power transmission lines emanating from the Port Washington power plant operated by the Wisconsin Electric Power Company. Subsequent to the West Bend informational meeting, a formal resolution was filed by the Common Council of the City of Port Washington formally endorsing the recommended preliminary plan, indicating full support for the proposed improvements at the existing Ozaukee Airport.

After careful consideration of this matter, the Technical Coordinating and Advisory Committee and the Commission determined that the plan should continue to recommend the improvement of the existing Ozaukee Airport. In its determination in this matter, the Committee and Commission noted that the existing Ozaukee Airport was well located with respect to demand, was well served by ground transportation facilities, could be readily expanded, and that the Common Council of the City of Port Washington had formally indicated its support for the proposed improvements. Moreover, the state airport system plan recommends the retention and improvement of the Sheboygan County Airport located about 16 miles north of the regional boundary, which airport is centrally located to serve all of Sheboygan County.

West Bend Municipal Airport

At the public informational meeting held in West Bend, substantial support by private aircraft operators was indicated for the plan recommendation to upgrade the West Bend Municipal Airport to basic transport status. Some opposition to the recommendation came from citizens of the Town of Trenton living in the immediate vicinity of the airport site. The aircraft operators indicated, however, that the proposed 5,500-foot principal runway was minimal for the safe operation of business jet type aircraft, and recommended that consideration be given to changing the plan recommendation to provide for a minimum runway length of 6,000 feet. Questions were also raised at this meeting by concerned citizens and public officials over the practicality of the relocation of STH 33 in order to accommodate the proposed northeast-southwest runway extension.

After careful consideration of these comments, the Technical Coordinating and Advisory Committee and the Commission determined to leave the plan recommendations stand as presented. In so doing, the Commission noted that the City of West Bend, as the existing local public airport sponsor, had recently initiated an airport master planning effort, and that since no significant controversy had developed over the basic function of the West Bend Airport in the regional airport system plan—that is, an upgrading to a basic transport status—specific questions concerning optimum runway length and orientation should be determined as part of that master planning effort. Similarly, the question of whether or not the proposed major runway extension should be effected through a relocation of STH 33, a relocation of the adjacent Milwaukee River, or a bridging of the Milwaukee River represent issues more properly decided at the master planning level. Accordingly, no change was made in the West Bend Municipal Airport improvement recommendations.

Hartford Municipal Airport

At the public informational meeting at West Bend, the Chairman of the Hartford Airport Committee requested that consideration be given to changing the recommended plan to provide for a basic transport airport at Hartford as opposed to the general utility airport recommended in the plan. Currently, the Hartford Municipal Airport is classified as a basic utility stage I airport. The chairman indicated that the Airport Committee had been conducting its own study with respect to the need, from an industrial development point of view, for a basic transport airport in Hartford, and that a relatively large number of companies responded to a survey questionnaire indicating that they would be interested in being able to utilize the Hartford Airport for business-related purposes.

In considering this matter, the Commission directed the staff to determine the additional cost that would be incurred in expanding the Hartford Municipal Airport to a basic transport classification as opposed to the recommended general utility classification. As proposed in the preliminary plan, the Hartford Municipal Airport would be upgraded to a general utility classification at a total capital cost of $3.8 million. For analysis of the capital cost attendant to upgrading the airport to a basic transport classification, two alternative runway alignment configurations were prepared. The first, shown on Map 79, would involve extension of the two existing runways beyond the lengths required to meet the general utility classification standards. An alternative configuration, shown conceptually on Map 80, was proposed by the Hartford Airport Committee. In the opinion of the local committee, the alternative configuration provided a better use of land, taking into account topography, soil conditions, and land ownership patterns, and provided a primary runway better aligned with the prevailing wind direction. Development of the airport to basic transport standards under either alternative would have similar capital costs for many elements, including land acquisition and terminal and hangar facility construction. To construct a new runway, however, rather than to widen, strengthen, and lengthen the existing runway, would raise the capital cost of the second alternative configuration slightly above that for the first alternative, $6.3 million against $6.0 million, respectively. A comparison of the cost of developing the airport as a basic transport, as opposed to a general utility, airport—based upon the first alternative runway configuration—is set forth in Table 260. The estimated total cost of expanding the Hartford Municipal Airport to a basic transport classification is $6.0 million, an increase in capital layout of $2.3 million, or 61 percent, over that required to achieve general utility status. The local share of the capital cost would rise from about $840,000 under the recommended plan to about $1.10 million under the proposed basic transport alternative, an increase of about $260,000, or 31 percent. The land requirements would be significantly greater, rising from 30 acres of additional land required under the recommended plan to about 120 acres of additional land required under the basic transport alternative, including the acquisition of two additional existing residential units. The land required for clear zone protection would increase from about 65 acres under the recommended plan to about 165 acres under the basic transport alternative.

After careful consideration of the comments made at the public informational meeting and the additional cost estimate developed in response to the suggestion by Hartford officials, the Technical Coordinating and Advisory Committee and the Commission determined not to make a change in the airport classification of the Hartford Municipal Airport in the recommended plan, thereby continuing to recommend that the Hartford Municipal Airport be upgraded from its existing basic utility status to the proposed general utility status. In making this determination, the Commission noted that there was no compelling need to provide another basic transport airport to serve the Ozaukee-Washington County portion of the Region, that the West Bend Municipal Airport was well located with respect to demand and could well provide basic transport service in this portion of the Region, and that the relatively small number of critical aircraft anticipated to be based at a basic transport in this portion of the Region—13—did not warrant development of a second basic transport airport. Further-

Table 260

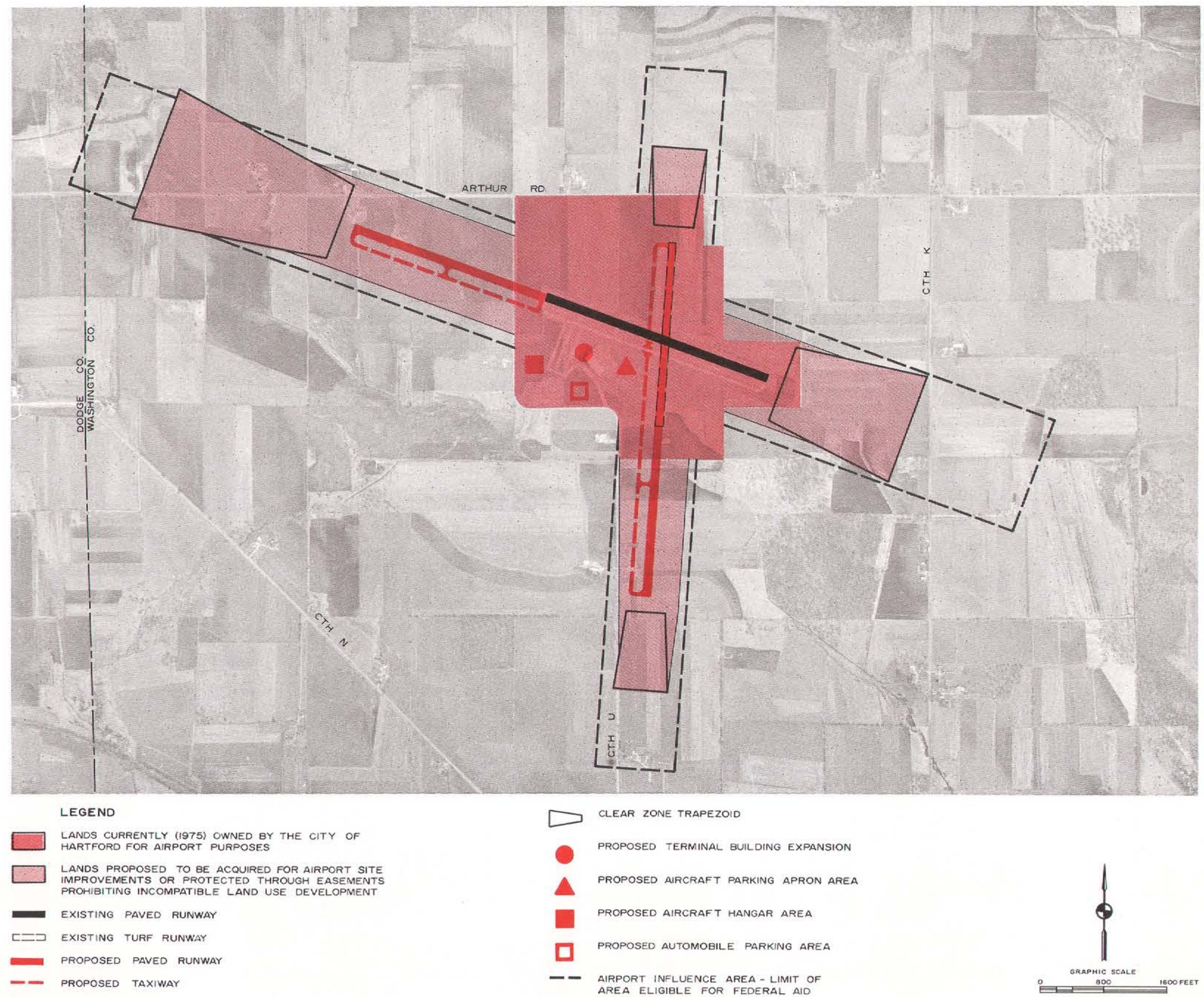
COMPARISON OF FACILITY REQUIREMENTS AND ESTIMATED COSTS TO EXPAND THE HARTFORD MUNICIPAL AIRPORT TO GENERAL UTILITY AND BASIC TRANSPORT AIRPORT STANDARDS

Facility Requirements	Alternative Airport Classification	
	General Utility	Basic Transport
Land Requirements		
Site Expansion	30 Acres	120 Acres
Clear Zone Protection	65 Acres	165 Acres
Residential Units	2	4
Total Estimated Cost	$ 333,500	$ 755,000
Operational Area Improvements		
Extend Runway 11/29 to 3,800 feet		
Runway: 75 feet x 800 feet	$ 71,000	
Taxiway: 30 feet x 1,000 feet	$ 52,000	
Develop Runway 11/29 to 5,600 feet		
Extend Runway 11/29: 100 feet x 2,600 feet		$ 374,000
Widen and strengthen existing Runway 11/29: 25 feet x 3,000 feet		$ 250,000
Extend Taxiway: 40 feet x 2,800 feet		$ 175,000
Widen and strengthen Taxiway: 10 feet x 3,200 feet		$ 80,000
Construct Runway 2/20		
Runway: 75 feet x 3,000 feet	$ 255,000	
Runway: 100 feet x 4,500 feet		$ 647,000
Taxiway: 40 feet x 5,000 feet		$ 350,000
Install navigation aids		
HIRL Runway 11/29		$ 98,000
MIRL Runway 11/29	$ 49,000	
Runway 2/20	$ 39,000	$ 56,000
Taxiway Exit Lights	$ 28,000	$ 35,000
VASI-2	$ 28,000	
VASI-4		$ 38,000
Runway End Identification Lights	$ 16,000	$ 16,000
Construct additional paved aircraft parking area	$ 384,000	$ 531,000
Total Estimated Cost	$ 923,000	$2,650,000
Terminal Area Improvements		
Expand terminal/administration building	$ 624,000	$ 612,000
Expand auto parking and service roads	$ 64,200	$ 61,400
Utility improvements	$ 29,000	$ 29,000
Total Estimated Cost	$ 717,000	$ 702,400
Hangar Area Improvements		
Expand aircraft hangar storage and service area		
Total Estimated Cost	$1,802,100	$1,896,300
Total Estimated Capital Investment	$3,775,800	$6,003,700

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 79

SITE IMPROVEMENT PLAN FOR THE HARTFORD MUNICIPAL AIRPORT
SEWRPC BASIC TRANSPORT AIRPORT ALTERNATIVE



Source: SEWRPC.

Map 80

SITE IMPROVEMENT PLAN FOR THE HARTFORD MUNICIPAL AIRPORT
LOCAL AIRPORT COMMITTEE BASIC TRANSPORT AIRPORT ALTERNATIVE

LEGEND

- LANDS CURRENTLY (1975) OWNED BY THE CITY OF HARTFORD FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING EXPANSION
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- AIRPORT INFLUENCE AREA - LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

GRAPHIC SCALE
0 800 1600 FEET

Source: City of Hartford Airport Committee and SEWRPC.

more, nearly all of Ozaukee and Washington Counties lie within 30 minutes travel time to the West Bend Airport and, thus, within the standards recommended in the plan for ground travel time to a basic transport airport. The Commission did recognize, however, that alternative runway configurations and runway extensions beyond that proposed in the regional plan but still within the general utility classification to accommodate certain critical type D aircraft that the local airport sponsor may desire to accommodate could properly be considered in the preparation of a master plan for airport expansion. Therefore, no change to the recommended plan was made with respect to the recommended function of the Hartford Municipal Airport in the regional airport system. It was recommended, however, that alternative runway configurations, with the length of the primary runway extending to 4,200 feet, be considered in the master planning stage.

Waukesha County Airport

The record of the informational meetings and public hearing indicates that great controversy exists among the various segments of the public over the particular function proposed for the Waukesha County Airport in the preliminary regional airport system plan. The viewpoints expressed on this matter may be summarized as follows:

1. Property owners living in proximity to the airport expressed concern about potential land-takings for airport expansion and about the adverse impact of the danger, noise, air pollution, and general nuisance from aircraft operations as observed to exist currently and as perceived to exist under future conditions if the airport were expanded and operated in accordance with the preliminary plan recommendations. These property owners, therefore, strongly opposed the proposed classification of the Waukesha County Airport as a basic transport airport and the attendant proposed facility expansion and improvements.

2. Owners and operators of smaller aircraft who fly primarily for pleasure and who group themselves under the term "sport pilots" expressed concern over the potential impact of the increased operational controls which would accompany installation of a permanent air traffic control tower and landing system instrumentation; of the increased costs of improved aircraft instrumentation; and of the potential increase in user fees which might be required to pay the capital cost of improved facilities and the increased operation and maintenance costs associated with an expanded airport that this segment of the aviation community neither wants nor needs. These pilots and aircraft owners, therefore, also strongly opposed the proposed classification and attendant improvements and expansion of the airport, recommending instead the development of from one to three new basic utility or general utility airports to serve the Milwaukee urbanized area, together with improvements in such appurtenant facilities as tie-down areas and hangars at the Waukesha County Airport.

3. Executives of, and pilots for, business enterprises that use high performance, general aviation aircraft as a business resource expressed the need for improved airport control and navigation facilities to provide a safer, all-weather operational capability and, therefore, strongly supported the proposed airport classification and improvements and expansion—particularly the proposed longer and stronger runways—in order to accommodate high performance and greater load carrying capacity aircraft for business use; provision of a permanent control tower and installation of a precision instrument landing system; while emphasizing the importance of the recommended airport improvements to the economic base of the "greater Waukesha area."

4. The Waukesha community at large expressed concern over the potential adverse impact of the public airport expansion upon the property tax base; the need to allocate increasingly limited local tax monies to other public purposes having a higher priority than airport improvement; the apparent high risk associated with the proposed large public investment in facility expansion on the basis of a forecast of a comparatively limited number of critical aircraft and attendant operations; and the desirability of converting the airport site to alternative urban land uses.

Questions were raised at the public meetings and hearing that related indirectly to the standards incorporated in the plan, particularly those relating to ground travel time and the number of operations by critical or "design" aircraft to determine airport classification, location, and operational control.

Before considering the specific response to this public reaction, it is useful to briefly review the basis on which the Waukesha County Airport was designated as a basic transport airport in the preliminary plan. The Waukesha County Airport, together with four other airports within the Region—West Bend Municipal, Racine Commercial, Kenosha Municipal, and Burlington Municipal—were recommended to be classified as basic transport airports in order to accommodate the operations of local and itinerant type C aircraft—the higher performance turbojet aircraft and the larger carrying capacity piston-powered and turbo-powered propeller-driven general aviation aircraft—that may be expected to operate within the Region to the plan design year. At present, there are 23 such aircraft registered in the Region—11 multiple-engine piston-powered aircraft and 12 turbojet-powered aircraft. Two airports can presently accommodate operations by the type C aircraft—General Mitchell Field and Racine Commercial Airport. Turbojet operations do occur at the West Bend Municipal Airport and at the Waukesha County Airport, both of which are currently classified as general utility airports. Turbojet operations at these airports, however, take place only under desirable weather conditions and with the aircraft not fully loaded.

The forecasts prepared under the regional airport system planning program indicate about 32 type C aircraft may be expected to be based within the Region by 1985 and about 62 by 1995. Type C aircraft include both turboprop and turbojet aircraft. Examples of type C turboprop aircraft in the general aviation fleet are the Convair 580 and the Fairchild Hiller F27; and examples of type C turbojet aircraft in the general aviation fleet are the Learjet, the Saber Liner, and the Falcon Fan Jet.

Among the basic issues to be addressed by the regional airport system planning program are such questions as: is it reasonable to expect that all operations by these type C aircraft—both based and itinerant—be accommodated at General Mitchell Field and Racine Commercial Airport; should additional landing system capability be provided elsewhere in the Region to accommodate these operations; and, if so, where should such additional capability be located? Generally, the type C high performance heavy general aviation aircraft are owned and operated by businesses that perceive the use of such aircraft as an important function in the conduct of their normal daily business activity.

One of the regional airport system development objectives formulated under the regional airport system planning program calls for development of an integrated regional airport system which will effectively serve the existing and probable future inter- and intra-regional air travel demand with appropriate types and adequate levels of service; alleviate air traffic congestion; and reduce travel times between the Region, its component parts, and other regions. Standards prepared to guide system development and to permit an evaluation of the ability of alternative systems to achieve this objective include ground travel time between an airport and its service area, a threshold number of itinerant aircraft operations of the critical aircraft type for which the airport is being designed, and the desire to locate reliever general utility or basic transport airports within 30 minutes ground travel time from an air carrier airport.

Another objective formulated under the regional airport system planning program calls for a regional airport system which will be compatible with existing land use patterns and adopted land use plans. Supporting standards prepared for this objective quantify the impact of aircraft operations upon surrounding land use activities as an aid in the development of land use plans for the vicinity of airports, and recommend the advance acquisition of land for airport expansion and the enactment of a coordinated set of local land use controls to prevent the encroachment of incompatible land uses.

In response to forecast demands and system development objectives, alternative system plans were prepared and a preliminary recommended plan selected for public presentation and reaction. This preliminary plan includes the upgrading of existing sites to provide basic transport capability at general aviation airports in each of the three recognized urbanized areas of the Region—at the Kenosha Municipal Airport, the Racine Commercial Airport, and and the Waukesha County Airport—the latter supplementing General Mitchell Field in the Milwaukee urbanized area, thus providing full service general aviation capability in areas of probable concentrated demand. In addition, the plan recommended similar service capabilities to accommodate demand expected in the remaining rural-urban fringe areas of the Region through provision of a basic transport airport at West Bend in the northern portion of the Region and at Burlington in the southwestern portion of the Region. The total number of type C aircraft forecast in the design year were assigned to the basic transport airports as follows: 19 to General Mitchell Field, 13 to Waukesha County, 9 to Burlington Municipal, 6 to Kenosha Municipal, 13 to West Bend Municipal, and 2 to Racine Commercial. As described later in this section, upon reappraisal following the public informational meetings and public hearing, the recommended classification of the Burlington Municipal Airport was changed from a basic transport airport to a basic utility airport. The nine type C aircraft expected to be located within the Burlington service area would be reallocated to adjacent basic transport airports.

The preliminary recommended system plan would have placed all type C aircraft owners within 30 minutes ground travel time of the airport. The travel time service area map presented with the recommended plan in Chapter XII of this report identifies those portions of the Region located beyond 30 minutes ground travel time from General Mitchell Field and Racine Commercial Airports, the only two existing airports presently capable of accommodating the needs of type C aircraft (see Map 47). These two airports accommodate the needs, in this respect, of the urbanized areas of the Region, but do not accommodate the needs of owners who might reside or whose place of business might be located beyond these urbanized areas.

As noted, upon reappraisal, it is now recommended that the Burlington Municipal Airport be classified to remain a basic utility airport and not be upgraded to a basic transport airport. From the travel time service area map in Chapter XII (see Map 47), it can be seen that the Kenosha Municipal Airport could accommodate much of the demand within the Burlington Municipal Airport service area within 30 minutes ground travel time. Some portions of Walworth County would, however, be located beyond a 30-minute ground travel time of a basic transport airport. A basic transport airport in the West Bend area will nearly accommodate all of the needs generated by the owners of type C aircraft living or operating within Washington or Ozaukee County within the established ground travel time standard. While much of the urbanized area of Waukesha County is located within 30 minutes ground travel time of General Mitchell Field, there are large portions of Waukesha County, including the City of Waukesha, located beyond this ground travel time standard. Reanalysis indicates that 16 owners of the forecast 62 type C aircraft may be expected to be located more than 30 minutes ground travel time away from an airport capable of accommodating their aircraft if neither the Waukesha County nor the Burlington Municipal Airports are classified as basic transport airports.

The preliminary system plan was carefully designed to provide airport classification, location, and capacity to accommodate the forecast needs. If certain airports are not improved to the standards recommended to accommodate some aircraft types, those aircraft may be assumed to be diverted to adjacent airports having adequate capabilities and, therefore, the impact of such diversion upon airport capacity must be evaluated. Such evaluations indicate that General Mitchell Field could accommodate the operations of all type C aircraft that would be diverted to that airport from Waukesha County Airport. It was also determined that the operations of both type C and D aircraft could be diverted from the Burlington Municipal Airport without causing adjacent airports at Gruenwald capable of accommodating type D aircraft, or Kenosha capable of accommodating both type C and type D aircraft, to exceed the proposed landing system capabilities. Thus, if a basic transport capability is not provided at Burlington or Waukesha, the needs of the affected type C owners and operators can be met at adjacent airports but at the expense of some increased ground travel times for such aircraft operators and users.

Four alternative courses of action appear possible with respect to resolving the issues raised at the public hearings with respect to the Waukesha County Airport: 1) leave the airport classified as a general utility airport, providing such improvements as are necessary to meet forecast demand for all but the type C aircraft; 2) raise the airport classification to basic transport as recommended in the preliminary system plan; 3) abandon the present airport site and relocate the airport as a basic transport airport at an alternative site; and 4) modify the preliminary plan recommendation to continue to recommend basic transport status for the Waukesha Airport, but not construct a parallel east-west runway to accommodate all forecast demands with respect to type E aircraft. Each of these alternatives has an attendant set of advantages and disadvantages; and in a situation involving conflicting interests, it may be expected that none of these solutions will be fully acceptable to all parties concerned.

If the airport is continued to be classified as a general utility airport, it could continue to serve turboprop and piston-powered aircraft under 12,500 pounds gross weight. This would include all of the types of corporate aircraft presently based at the airport, but would exclude the larger type C aircraft. Under this alternative, annual operations could be expected to increase from a 1971 level of about 117,000 to a 1995 level of about 313,000, while based aircraft—types D and E—could be expected to increase from a 1971 level of 167 to a 1995 forecast level of 384.

The improvements at the Waukesha County Airport necessary to accommodate the anticipated demand under this alternative are identified in Table 261 and Map 81. These include the construction of a new 3,300-foot east-west runway, navigation aids, and aircraft parking apron areas, estimated to cost about $1.1 million. Terminal area improvements, including onsite roads, automobile parking areas, and terminal buildings under this alternative would be expected to cost $547,000, while hangar area improvements would be expected to cost a total of nearly $1.8 million. A total of 17 acres of additional land would be required, including 10 acres for airport site expansion and seven acres for clear zone protection. The cost of acquiring this land is estimated at about $71,000. In total, then, as shown in Table 261, the cost of improving the Waukesha County Airport as a general utility airport is estimated at nearly $3.5 million.

The major advantages of this alternative relate to the accommodation of all anticipated demand generated by type D and type E aircraft, including sport and recreational flying and some business related flying. This alternative would require less land for site expansion and clear zone protection than a basic transport airport on the site. Under this alternative, however, Waukesha County would be left without a basic transport airport and would not be capable of accommodating any future demands for basing type C business aircraft in the county. This could affect future economic development in Waukesha County. The construction of the parallel east-west runway and the general expansion of aircraft operations under this alternative would, like the basic transport alternative, contribute to increasing conflicts between airport users and residents of neighborhoods in the vicinity of the airport. The construction of parallel runways in this case forces the establishment of air traffic patterns that will contribute to increased air activity over those Waukesha neighborhoods lying to the south and west of the airport. Under this alternative, the airport could continue to serve the sport and recreation element of general aviation that would choose to operate under tower control. Even without accommodating type C aircraft, the greater amount of general aviation activity from type D and type E aircraft may be expected to require continuation of tower control in order to provide a safer aircraft operating environment.

In summary, then, the apparent advantages of keeping Waukesha County Airport as a general utility airport, as opposed to a basic transport airport, are the more limited requirements for additional land and capital cost for expansion, absence of impact from noise of jet traffic, and no requirement for high risk investment based on forecast needs of a limited segment of the total aircraft fleet. The disadvantages of continuing to classify the Waukesha County Airport as a general utility airport relate mainly to the impact such a decision might have on the industrial and economic base of this subarea of the Region; the continued and increased nuisance from general aviation operations in an urban area; the continued expenditure of public funds primarily to meet training, sport, and recreation flying demands; and, unless curtailed, the continued use of the airport by jet traffic in a comparatively unsafe operating pattern. In addition, the regional airport system would not have the added flexibility provided by the location of a basic transport reliever airport in the Milwaukee urbanized area.

The second alternative—namely, that of continuing to plan for the establishment of a basic transport airport at Waukesha—is identical to that presented at the public informational meetings and hearing. This alternative is resummarized in Table 262. Under this alternative, the airport would be able to serve all type C, D, and E aircraft. Annual operations could be expected to increase

Table 261

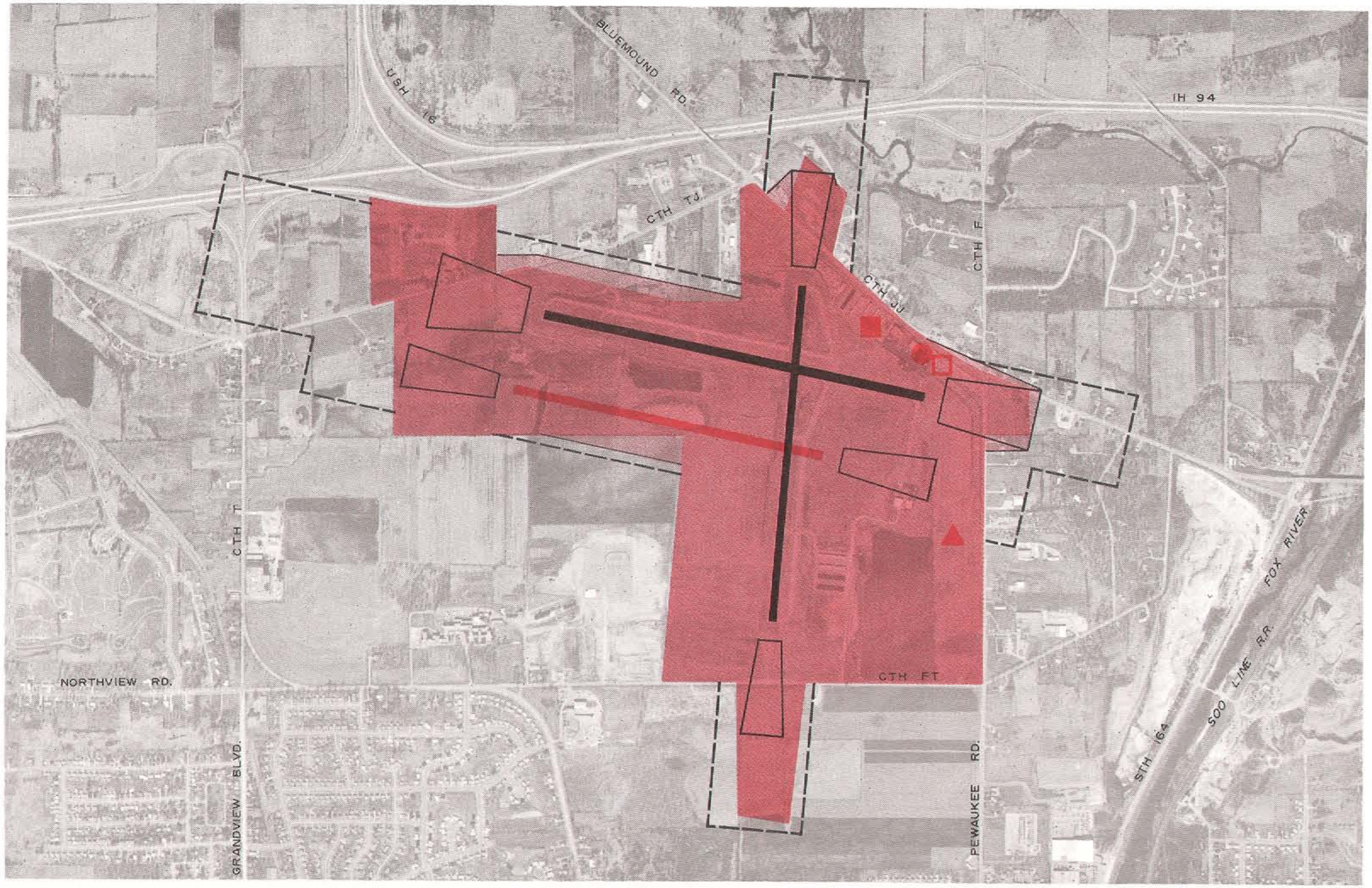
SITE REQUIREMENTS FOR THE WAUKESHA COUNTY AIRPORT
GENERAL UTILITY AIRPORT ALTERNATIVE

General Conditions	
Airport Classification	Existing—General Utility Proposed—General Utility
Aviation Demand	
Annual Operations	1971 Inventory—117,400 1995 Forecast—313,000
Based Aircraft	1971 Inventory—167 1995 Forecast—384
Runway System Capacity (PANCAP)	Existing—284,000 Proposed—337,600
IFR Capability	Nonprecision Instrument Approach
FAA Designation	Reliever Airport to General Mitchell Field
Land Requirements	
Site Expansion (Acres)	10
Clear Zone Protection (Acres)	7
Total Estimated Cost	$ 71,000
Operational Area Improvements	
Construct Runway 10R/28L: 75 feet x 3,300 feet	
Construct additional paved aircraft parking apron: 73,000 square yards	
Install navigation aids	
MIRL Runway 10L/28R	
MIRL Runway 18/36	
Taxiway Exit Lights—Both Runways	
VASI-2 Runway 10L/28R, 10L End	
REILS—All Runways, Both Ends	
Install nonprecision instrument landing system approach to Runway 10	
Total Estimated Cost	$1,086,300
Terminal Area Improvements	
Expand terminal/administration building: 7,800 square feet	
Expand auto parking and service roads: 8,800 square yards	
Total Estimated Cost	$ 547,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 23,800 square yards	
Total Estimated Cost	$1,794,500
Total Estimated Capital Investment	$3,498,800

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 81

SITE IMPROVEMENT PLAN FOR THE WAUKESHA COUNTY AIRPORT
GENERAL UTILITY AIRPORT ALTERNATIVE



LEGEND

- LANDS CURRENTLY (1975) OWNED BY WAUKESHA COUNTY FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- PROPOSED PAVED RUNWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- AIRPORT INFLUENCE AREA—LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

GRAPHIC SCALE
0 800 1600 FEET

Source: SEWRPC.

Table 262

SITE REQUIREMENTS FOR THE WAUKESHA COUNTY AIRPORT: BASIC TRANSPORT AIRPORT ALTERNATIVE

General Conditions	
Airport Classification	Existing–General Utility Proposed–Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory–117,400 1995 Forecast–322,000
Based Aircraft	1971 Inventory–167 1995 Forecast–397
Runway System Capacity (PANCAP)	Existing–284,000 Proposed–337,600
IFR Capability	Precision Instrument Approach
FAA Designation	Reliever Airport to General Mitchell Field
Land Requirements	
Site Expansion (Acres)	20
Clear Zone Protection (Acres)	120
Residential Units	12
Commercial Units	8
Total Estimated Cost	$1,535,000
Operational Area Improvements	
Extend Runway 10L/28R to 5,600 feet	
Runway: 100 feet x 1,600 feet	
Taxiway: 40 feet x 1,800 feet	
Construct Runway 10R/28L: 75 feet x 3,300 feet	
Strengthen runways and taxiways to accommodate 60,000 pounds gross weight aircraft	
Runway 10L/28R–3 1/2 inch overlay: 100 feet x 4,000 feet	
Runway 18L/36R–2 1/2 inch overlay: 75 feet x 3,400 feet	
Taxiway 10L/28R–3 1/2 inch overlay: 40 feet x 4,000 feet	
Taxiway 18L/36R–2 inch overlay: 40 feet x 3,900 feet	
Construct additional paved aircraft parking aprons: 77,400 square yards	
Install lighting and visual aids	
MIRL Runway 18L/36R: 3,400 feet	
HIRL Runway 10L/28R: 5,600 feet	
Taxiway Exit Lights–Both Runways	
VASI-4 Runway 10L/28R, 10L End	
REILS Runway 10L/28R, 28R End	
Runway 18L/36R, 36R End	
Runway 10L/28R, Relocate 10L, End	
Replace air traffic control tower	
Install precision instrument landing and approach lighting system on approach to Runway 10	
Total Estimated Cost	$2,123,300
Terminal Area Improvements	
Expand terminal building: 8,100 square feet	
Expand auto parking and service roads: 9,100 square yards	
Total Estimated Cost	$ 648,900
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 26,800 square yards	
Total Estimated Cost	$2,020,700
Ground Access Facilities	
Relocate CTH TJ to permit runway extension	
Total Estimated Cost	$ 187,000
Utility Services	
Airport within proposed service area–cost of connections considered nominal	
Total Estimated Capital Investment	$6,514,900

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

from a 1971 level of about 117,000 to a 1995 level of 322,000, while based aircraft—types C, D, and E—would increase from a 1971 level of 167 to a 1995 forecast level of 397.

As shown in Table 262, the improvements at the Waukesha County Airport necessary to accommodate the anticipated demand under this alternative include extension of the existing east-west runway and taxiway to 5,600 feet and strengthening and widening of the existing east-west runway and taxiway to accommodate 60,000-pound gross aircraft weight, the construction of a new 3,300-foot east-west runway, navigation aids, and airport parking apron areas, all estimated to cost about $2.1 million. Terminal airport improvements, including onsite roads, automobile parking areas, and terminal buildings would be expected to cost $649,000, while hangar area improvements would be expected to cost a total of about $2.0 million. A total of 140 acres of additional land would be required, including 20 acres for airport site expansion and 120 acres for clear zone protection. The cost of acquiring this land is estimated at about $1.5 million. Surface transportation improvements—namely, the realignment of CTH TJ to permit the existing east-west runway extension—would cost about $187,000. In total, then, as shown in Table 262, the cost of improving the Waukesha County Airport as a basic transport airport is estimated at about $6.5 million.

The major advantages of this alternative relate to the accommodation of all anticipated demand generated by types C, D, and E aircraft, including training, sport, and recreational flying and all business-related flying. This alternative would, however, be more costly and require more land for site expansion and clear zone protection than the continued development of a general utility airport on the site. This alternative would fully meet the probable future demand for based type C business aircraft in the county, and would ensure that the lack of a basic transport airport in the county would not adversely affect the economic development of the county. The construction of the parallel east-west runway and the consequent general expansion of general aviation activity under this alternative would, like the general utility alternative, contribute to increasing conflicts between airport users and residents of neighborhoods in the vicinity of the airport. As in the case of the general utility airport alternative, the construction of parallel runways forces the establishment of air traffic patterns that will contribute to increased air activity over those Waukesha neighborhoods lying to the south and west of the airport. The accommodation of all anticipated aviation activity from types C, D, and E aircraft must include the continuation of tower control in order to provide a safe operating environment.

In summary, then, the major advantage of expanding the Waukesha County Airport to basic transport status relates to the capability of accommodating future demand for the basing and operation of business jets at an airport in Waukesha County, and the effect that such a decision would have on the industrial and economic base of this subarea of the Region. The establishment of a basic transport airport as proposed would, however, be more costly and require more land than the continued improvement of the airport as a general utility airport. Like the general utility alternative, the basic transport alternative shares the disadvantages of providing for a continued and increased nuisance from general aviation operations in the urban area because of the need for parallel runways.

The third alternative would consist of abandoning the existing Waukesha County Airport and establishing a new airport at an alternate site near the Waukesha urban area. One possible such site is located in Sections 6 and 7, T6N, R19E, in the Town of Waukesha and Sections 1 and 12, T6N, R18E in the Town of Genesee, an area lying nearly midway between the City of Waukesha and the Village of Wales. Under this alternative, the new airport would be a basic transport airport capable of serving all type C, D, and E aircraft. Annual operations in 1995 could be expected to reach a level of 322,000, while based aircraft—types C, D, and E—could be expected to reach 397 by 1995.

The improvements necessary to accommodate the anticipated demand under this alternative are identified in Table 263 and Map 82. Such improvements include the construction of a 5,600-foot primary east-west runway and taxiway, a 3,300-foot parallel east-west runway, a 4,500-foot secondary north-south runway and taxiway, navigation aids, and aircraft parking apron areas, all estimated to cost about $5.8 million. About $1.5 million of this estimated cost is required to overcome the severe limitations of the soil conditions for airport construction and to overcome difficult drainage problems at this site. Terminal area improvements, including the construction of onsite roads, automobile parking areas, and a new administration/terminal building, would be expected to cost about $882,000; while hangar area improvements would be expected to cost a total of about $3.2 million. A total of about 800 acres of land would be required at the site for the airport site and for associated clear zone protection. The cost of acquiring this land is estimated at about $1.5 million. In total, then, as shown in Table 263, the cost of establishing a new basic transport airport southwest of the City of Waukesha is estimated at about $11.4 million. This total cost could be partially offset by the proceeds that could be obtained from selling the approximately 440 acre existing airport site for urban development, estimated at about $2.0 million. Thus, the net cost of establishing a new Waukesha County Airport would be about $9.4 million. The Federal Aviation Administration (FAA) has indicated that net proceeds from the sale of an existing airport must be reinvested in a new airport before additional federal funds can be applied toward development of an airport at the new site. Moreoever, if the FAA and Wisconsin Department of Transportation determine that the existing site is expandable to meet forecast demands and the airport sponsor still desires to relocate the airport, in kind replacement of the existing facility entirely at local cost is required before additional federal and state funds can be applied toward expansion of the airport in a new location. In the case of a relocated Waukesha County Airport, this would require development of a relocated airport to

Table 263

SITE REQUIREMENTS FOR THE WAUKESHA COUNTY AIRPORT
BASIC TRANSPORT AIRPORT ON NEW SITE
IN THE TOWNS OF GENESEE AND WAUKESHA

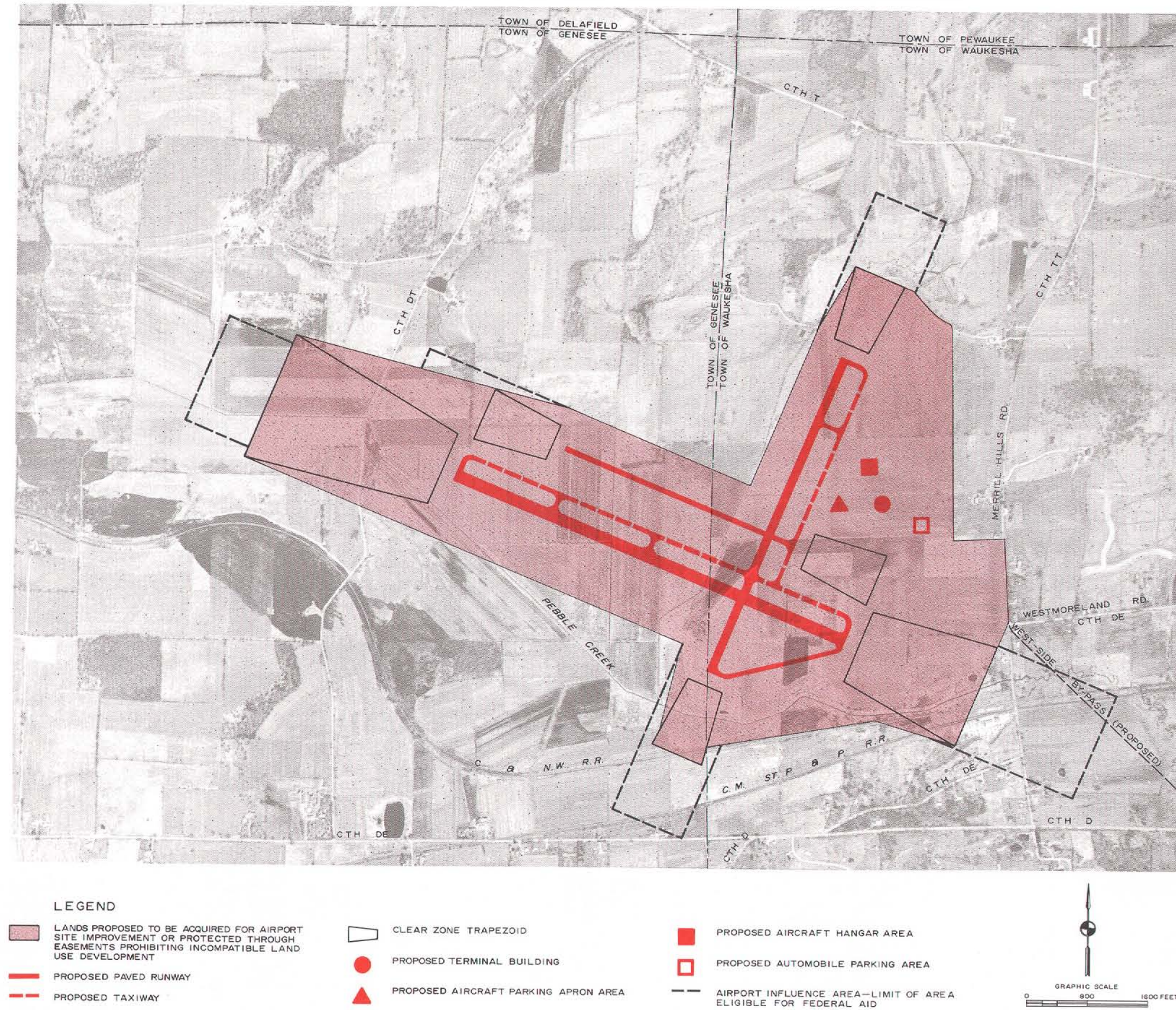
General Conditions	
Airport Classification	Existing–No Airport Proposed–Basic Transport
Aviation Demand[a]	
Annual Operations	1995 Forecast–322,000
Based Aircraft	1995 Forecast–397
Runway System Capacity (PANCAP)	Proposed–337,600
IFR Capability	Precision Instrument Approach
Land Requirements	
Site, including	
Clear Zone Protection (Acres)	800
Residential Units	1
Total Estimated Cost	$ 1,500,000
Operational Area Improvements	
Construct East/West Primary Runway: 150 feet x 5,600 feet	
Construct East/West Primary Taxiway: 50 feet x 6,200 feet	
Construct North/South Secondary Runway: 100 feet x 4,500 feet	
Construct North/South SecondaryTaxiway: 40 feet x 5,000 feet	
Construct East/West Basic Utility Runway: 75 feet x 3,300 feet	
Construct aircraft parking apron: 77,000 square yards	
Peat removal and drainage improvements to construct runways	
Install navigation aids	
HIRL East/West Primary Runway	
MIRL North/West Runway	
Taxiway Exit Lights	
VASI-4 East/West Runway, West End	
REILS Primary and Secondary Runways	
Total Estimated Cost	$ 6,261,000
Terminal Area Improvements	
Construct administration/terminal building: 10,600 square feet	
Construct auto parking and service roads: 28,000 square yards	
Total Estimated Cost	$ 882,000
Hangar Area Improvements	
Construct aircraft hangar storage and service area: 42,800 square yards	
Total Estimated Cost	$ 3,225,000
Total Estimated Capital Investment	$11,368,000

[a] *Assumed equal to demand forecast for existing Waukesha County Airport.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 82

SITE IMPROVEMENT PLAN FOR THE WAUKESHA COUNTY AIRPORT
BASIC TRANSPORT AIRPORT ON NEW SITE IN THE TOWNS OF GENESEE AND WAUKESHA



Source: SEWRPC.

general utility standards, the existing airport classification, at local expense before federal and state funds would become available for expanding the airport to basic transport standards. This development is estimated to cost $6 million.

The major disadvantages of this alternative include its high cost, especially the local share, relative to the other alternatives considered, including the abandonment of the capital investment in the existing airport; the realization that the establishment of a new pattern of air traffic in the Waukesha area, while solving the airport-neighboring land use conflicts that exist at the present site, would only serve to create new airport-land use conflicts at a new site; and the failure of the new site to resolve the basic conflicts between the sport flyers and the users and operators of corporate aircraft that exist at the present site. The only important advantages of establishing a new airport at an alternate site would be the resolution of existing airport-neighboring land use conflicts at the present site and the freeing of the land for urban development. With respect to the latter, the site is particularly well located for industrial development, having good freeway access, utility service, and good topographic and soil conditions for such development.

In considering this alternative, the Technical Coordinating and Advisory Committee and the Commission agreed that any decision to abandon the capital investment at the existing Waukesha County Airport would only be justified if such a decision would resolve other airport-related problems. Since the establishment of a new Waukesha County Airport at an alternate site would not resolve the basic problems inherent at the existing site, this alternative was considered to be unacceptable.

In considering the foregoing three alternatives, a fourth alternative became apparent. This alternative would involve improving and reclassifying the Waukesha County Airport as a basic transport airport, but not providing all of the improvements necessary to meet the anticipated 1995 demand. Under this alternative, which is summarized in Table 264 and shown on Map 83, the existing east-west runway would be lengthened and strengthened as proposed under the basic transport alternative discussed above, but the proposed parallel east-west runway would not be constructed. This would mean that the airport would not be capable of accommodating all of the anticipated general aviation demand, particularly with respect to that portion of the demand generated by type E aircraft.

As shown in Table 264, the improvements necessary under this alternative include extension of the existing east-west runway and taxiway to 5,600 feet and strengthening and widening the existing east-west runway and taxiway, navigation aids, and airport parking apron areas, estimated to cost about $1.6 million. Terminal area improvements, including onsite roads, automobile parking areas, and terminal buildings would be expected to cost $378,000, while hangar area improvements would be expected to cost about $1.3 million. A total of 137 acres of additional land would be required, including 17 acres for airport site expansion and 120 acres for clear zone protection. The cost of acquiring this land is estimated at about $1.5 million. The realignment of CTH TJ to permit extension of the existing east-west runway would cost about $187,000. In total, then, the cost of improving the Waukesha County Airport as a modified basic transport airport is estimated at nearly $5.0 million.

The major advantage of this alternative over the previous basic transport alternative relates to the anticipated reduction in conflicts between airport users and airport area neighborhoods due to not constructing the parallel east-west runway and forcing air traffic patterns over residential neighborhoods to the south, east, and west of the airport site. With proper operational controls, the modified basic transport airport as proposed in this alternative could accommodate most of the anticipated general aviation activity, including all type C and type D aircraft activity, and do so utilizing air traffic patterns that extend predominantly over open and industrial lands to the north and east of the airport site. Thus, a major plan objective—that of minimizing conflicts between airport users and airport area land uses—could be achieved, while at the same time accommodating the anticipated demand for business jet activity in Waukesha County and thereby not comprising the industrial development objectives of Waukesha County communities. In addition, this alternative would provide flexibility by permitting future expansion of capacity beyond that herein recommended without additional land takings, should local officials in the future so desire.

The major disadvantage of this alternative relates to the need to reallocate about 96 type D and E aircraft to other airports in the regional system. Evaluation of such a reallocation indicates that these 96 based aircraft would generate about 77,500 annual operations and that such operations could be readily accommodated at the East Troy, Hartford, Sylvania, Timmerman, and Burlington airports. Further analysis indicates that those aircraft owners at the fringe of the Waukesha County Airport service area lie well within the 30-minute ground travel time standard of other airports in the system. It should be noted in this respect, however, that the modified basic transport facility would still accommodate a relatively large increase in based type E aircraft above those based at the airport today.

After carefully considering the foregoing alternatives and the public hearing record with respect to the preliminary plan recommendations for the Waukesha County Airport, the Commission, upon recommendations of the Technical Coordinating and Advisory Committee, determined to change the recommended regional airport system plan to provide for a modified basic tranport airport at the Waukesha County site (see Map 83). A revised area land use plan corresponding to the modified site improvement plan for the Waukesha County Airport is shown on Map 84, while revised airport airspace protection recommendations are identified on Figure 86. In so doing, the Commission recognized that all of the competing and conflicting interests with respect to the Waukesha County Airport situation would not be satisfied with the com-

Table 264

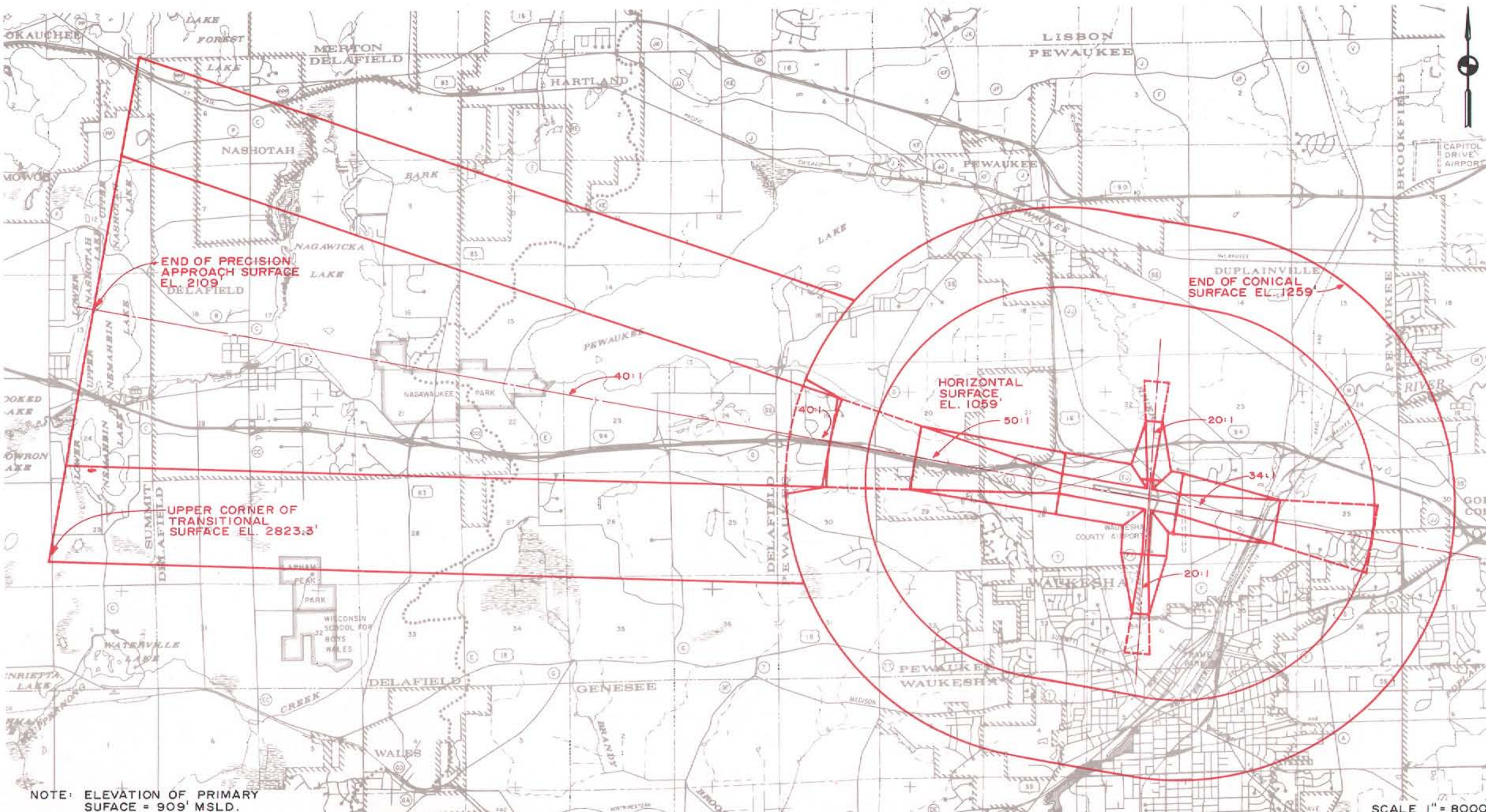
SITE REQUIREMENTS FOR THE WAUKESHA COUNTY AIRPORT MODIFIED BASIC TRANSPORT AIRPORT ALTERNATIVE

General Conditions	
Airport Classification	Existing—General Utility Proposed—Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory—117,400 1995 Forecast—244,500
Based Aircraft	1971 Inventory—167 1995 Forecast—301
Runway System Capacity (PANCAP)	Existing—284,000 Proposed—253,300
IFR Capability	Precision Instrument Approach
FAA Designation	Reliever Airport to General Mitchell Field
Land Requirements	
Clear Zone Protection (Acres)	120
Site Expansion (Acres)	17
Residential Units	12
Commercial Units	8
Total Estimated Cost	$1,531,000
Operational Area Improvements	
Extend Runway 10/28 to 5,600 feet	
Runway: 100 feet x 1,600 feet	
Taxiway: 40 feet x 1,800 feet	
Strengthen runways and taxiways to accommodate 60,000 pounds gross weight aircraft	
Runway 10/28—3 1/2 inch Overlay: 100 feet x 4,000 feet	
Runway 18L/36R—2 1/2 inch Overlay: 75 feet x 3,400 feet	
Taxiway 10/28—3 1/2 inch Overlay: 40 feet x 4,000 feet	
Taxiway 18L/36 R—2 inch Overlay: 40 feet x 3,900 feet	
Construct additional paved aircraft parking aprons: 51,200 square yards	
Install navigation aids	
MIRL Runway 18/36: 3,400 feet	
HIRL Runway 10/28: 5,600 feet	
Taxiway Exit Lights—Both Runways	
VASI-4 Runway 10/28, 10 End	
REILS Runway 10/28, 28 End	
Runway 18/36, 36 End	
Runway 10/28, Relocate 10 End	
Install precision instrument landing system approach to Runway 10	
Total Estimated Cost	$1,544,000
Terminal Area Improvements	
Expand terminal building: 5,500 square feet	
Expand auto parking and service roads: 4,300 square yards	
Total Estimated Cost	$ 432,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 16,350 square yards	
Total Estimated Cost	$1,232,800
Ground Access Facilities	
Realign CTH TJ to permit runway extension	
Total Estimated Cost	$ 187,000
Utility Services	
Airport within proposed service area—cost of connections considered nominal	
Total Estimated Capital Investment	$4,926,800

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Figure 86

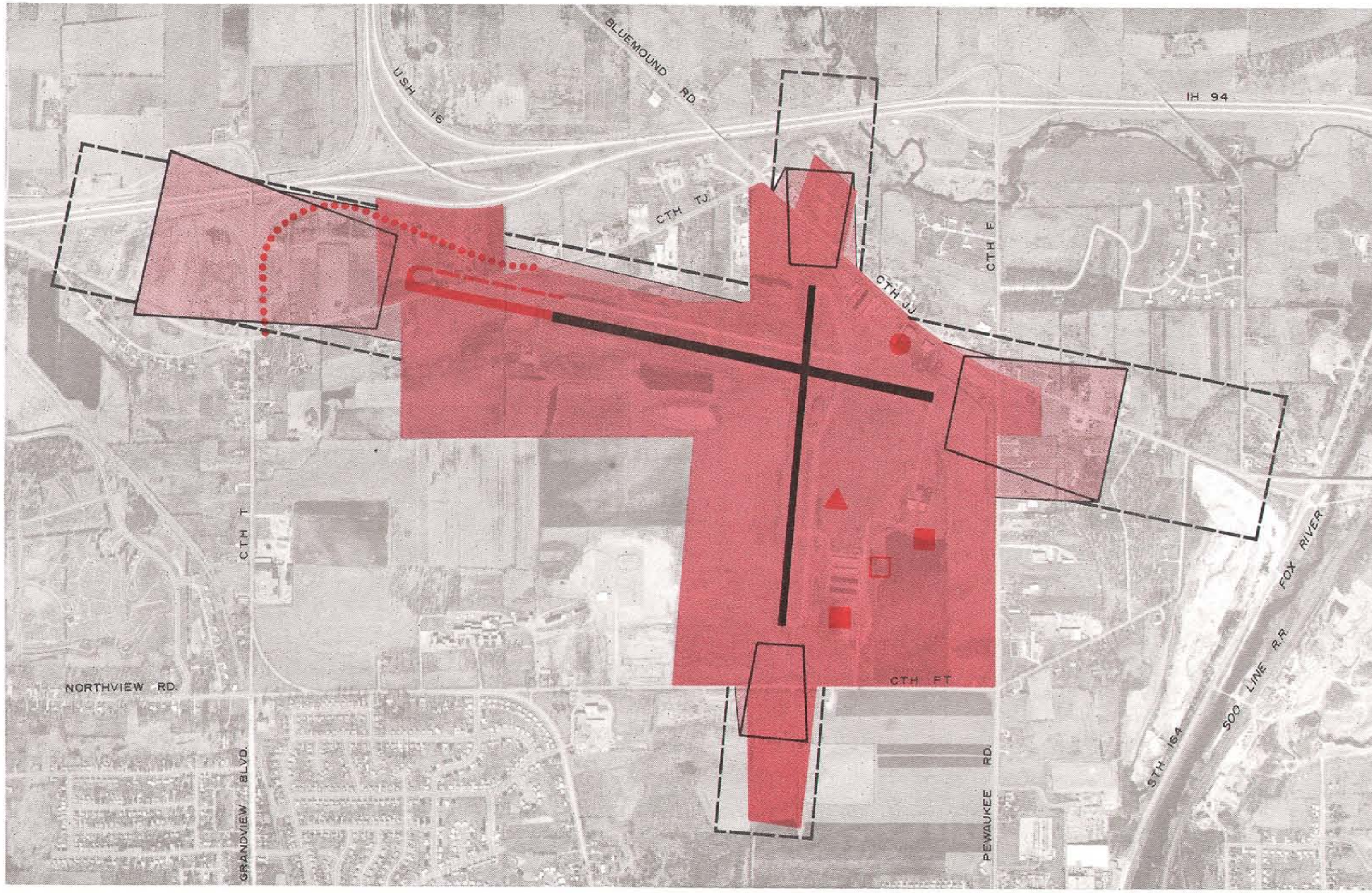
WAUKESHA COUNTY AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING: MODIFIED BASIC TRANSPORT AIRPORT ALTERNATIVE



Source: SEWRPC.

Map 83

SITE IMPROVEMENT PLAN FOR THE WAUKESHA COUNTY AIRPORT
MODIFIED BASIC TRANSPORT AIRPORT ALTERNATIVE



LEGEND

LANDS CURRENTLY (1975) OWNED BY WAUKESHA COUNTY FOR AIRPORT PURPOSES

LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT

EXISTING PAVED RUNWAY

PROPOSED PAVED RUNWAY

PROPOSED TAXIWAY

CLEAR ZONE TRAPEZOID

PROPOSED TERMINAL BUILDING EXPANSION

PROPOSED AIRCRAFT PARKING APRON AREA

PROPOSED AIRCRAFT HANGAR AREA

PROPOSED AUTOMOBILE PARKING AREA

PROPOSED ROAD REALIGNMENT

AIRPORT INFLUENCE AREA—LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

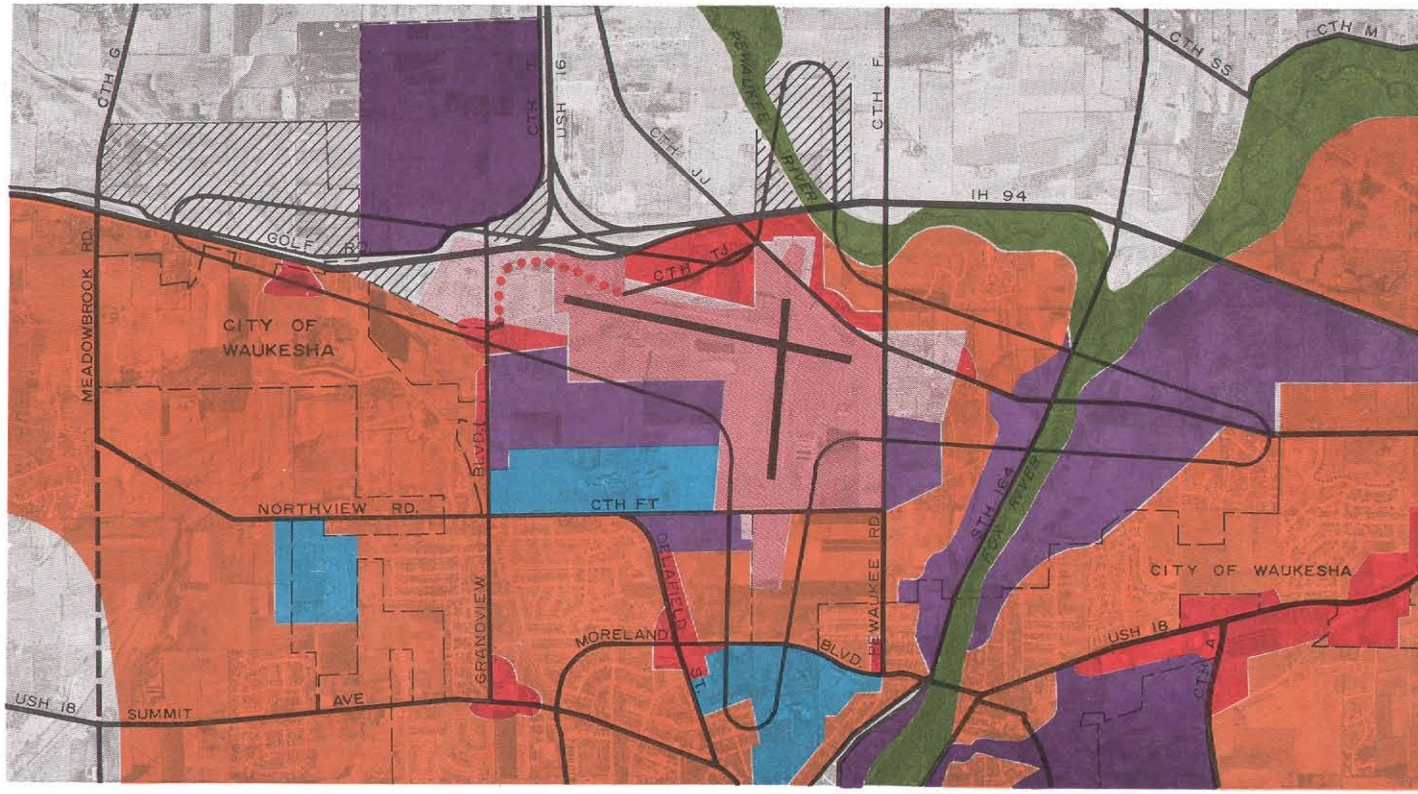
GRAPHIC SCALE

0 800 1600 FEET

Source: SEWRPC.

Map 84

AREA LAND USE PLAN FOR THE WAUKESHA COUNTY AIRPORT
MODIFIED BASIC TRANSPORT AIRPORT ALTERNATIVE



LEGEND

- LANDS CURRENTLY OWNED BY WAUKESHA COUNTY FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENT OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- LANDS ADJACENT TO AIRPORT PROPOSED TO REMAIN IN AGRICULTURE OR OTHER OPEN SPACE LAND USES, OR TO BE UTILIZED FOR NON-RESIDENTIAL URBAN LAND USES COMPATIBLE WITH AIRPORT ACTIVITY
- MEDIUM DENSITY RESIDENTIAL AND RELATED (7.3–22.8 PERSONS PER NET RESIDENTIAL ACRE)
- COMMERCIAL
- INDUSTRIAL
- GOVERNMENT AND INSTITUTIONAL
- PRIMARY ENVIRONMENTAL CORRIDOR
- AGRICULTURAL

- PROPOSED ROAD REALIGNMENT
- MUNICIPAL LIMITS–1975
- 100 CNR NOISE RATING ISOPLETH

ARTERIAL STREET OR HIGHWAY

- EXISTING
- PROPOSED

GRAPHIC SCALE
0 2000 4000 FEET

Source: SEWRPC.

promise solution. Particularly, the Commission was aware that those included within the sport pilot category would not agree with the decision, particularly because of the recommended reallocation of about 86 type E aircraft from Waukesha County to other airports in the system. The Commission deemed, however, that the perceived need to accommodate the demand for business related corporate jet activity and to not in any way compromise industrial development potential in the county outweigh the admittedly adverse impact upon the sport flying community members.

With respect to the concerns raised by those individuals whose lands would be directly affected by the expansion requirements of the Waukesha Airport, the Commission recommends that Waukesha County, in developing the required airport master plan, carefully analyze each individual situation with a view toward staging any needed airport improvements in such a manner so as to ensure that all individuals that now reside on lands to be acquired may continue to reside throughout their individual lives. The Commission urged in this respect that any taking that becomes necessary to accommodate airport expansion include due consideration of such techniques as the granting, at the owners' option, of life tenancies to those now residing on affected properties, purchasing of development rights, and acquiring easements. The Commission further recommends that Waukesha County as part of its master planning effort take steps to ensure the imposition of operational controls so as to minimize the adverse affect of aircraft operations on adjacent land uses. Operational controls relating to establishment of a right hand rather than the normal left hand pattern departing runway 28 can be initiated at present to provide immediate noise nuisance relief to residential development south of the airport. Finally, the Commission recommends that the City and County work together in the master planning effort to identify those areas in the immediate vicinity of the airport which could be safely and properly developed for industrial and commercial land uses compatible with aircraft operations.

General Mitchell Field

The record of the public hearing and the subsequent informational meeting held in the City of St. Francis indicates that the major concerns on the part of the public officials and residents of the area surrounding General Mitchell Field relate to the impact of aircraft operations on nearby residential land uses. Significantly, no support was voiced for the relocation of Mitchell Field, although alternatives to Mitchell Field as the Region's single air carrier airport were considered in the regional airport system planning program and presented at the hearings. Of particular concern to area residents was the timetable for the acquisition of about 90 homes located in the City of St. Francis immediately north of General Mitchell Field. These 90 homes lie within the clear zone associated with the proposed north-south air carrier runway immediately east of the present air carrier runway. Extension of this runway has been proposed for several years, and Milwaukee County has indicated its willingness to purchase the impacted properties. Land acquisition has been delayed, however, until all planning, including airport master plans and environmental impact assessments, is completed and approved so that the runway extension project can be initiated.

In considering the matter of the impact of aircraft operations at General Mitchell Field upon surrounding land uses and activities, both under current and forecast conditions--whether the airport is expanded or not—the Commission noted that Milwaukee County is undertaking the preparation of a master plan designed to refine and detail system plan recommendations and that it was essential that the concerns expressed at the public meetings be specifically addressed as part of that master planning effort. The Commission has been retained by the Wisconsin Division of Aeronautics and Milwaukee County to prepare the offsite land use element of the General Mitchell Field master planning study and, in so doing, has worked with the surrounding communities in an effort to develop an offsite land use plan that would help to resolve the serious conflicts in land use and airport development which surround this major air carrier airport.

East Troy Municipal Airport

Following the public informational meeting held at Elkhorn, the Village Board of the Village of East Troy filed a resolution with the Commission objecting to the preliminary airport system plan with respect to the proposed improvements recommended for the East Troy Municipal Airport. In particular, the Village Board indicated its concern over the ability of the Village to finance the proposed improvements and over the proposed taking of additional land to accommodate the improvements.

In response to this communication, the Commission scheduled an intergovernmental meeting on October 27, 1975, with the Village Board to discuss this matter. Representatives of the Walworth County Board, the Town of East Troy, the East Troy Development Association, and the East Troy Plan Commission were invited to, and also did, attend the meeting. The record of that meeting reflects a consensus that the East Troy Municipal Airport should continue to function as a basic utility airport. That consensus, however, did not extend to all of the proposed site improvements included in the preliminary recommended regional airport system plan. Since many of the users of the airport may be expected to reside outside of the Village, the Board expressed support for the recommendation contained in the plan that Walworth County become the local public airport sponsor of the East Troy Airport, particularly if, at some future date, the demand reached a level where all of the airport site improvements recommended in the preliminary plan were required.

Following that intergovernmental meeting, the Village Board of the Village of East Troy filed a second resolution reaffirming its opposition to inclusion of the East Troy Municipal Airport in the recommended regional system plan as a basic utility airport. The Board indicated that it favored continued operation of the airport as it exists today and continued to express objection to the specific site improvements recommended in the plan for the East Troy Municipal Airport.

In considering the foregoing, the Commission, after careful deliberation, determined to continue to include the East Troy Municipal Airport in the recommended regional airport system plan as a basic utility airport. In so doing, the Commission noted that the system plan recommends that the local public airport sponsor retain full control over the timing and scope of future airport site improvements, if any, and that the local sponsor initiate the preparation of airport master plans as a first step toward the more precise identification of any improvements that may be needed. The Commission further noted that the site improvements identified for the East Troy Municipal Airport in the airport system plan were based upon forecast demand, and that the decisions concerning the need for and staging of these improvements would be made only as the actual demand developed either in accordance with or at variance to the forecasts, the decisions resting with the local sponsor. Accordingly, although the Village Board continued to express opposition to the airport system plan, the Commission believed that it would be important to maintain the option of undertaking site improvements at the East Troy Airport with federal and state aid. Removing the airport from the system plan would preclude future state and federal aid projects at the airport. On the other hand, inclusion of the airport in the system plan would ensure that improvements would be eligible for federal and state funding should, at some future date, the local sponsor determine on its own volition to proceed with site improvements or, in the alternative, relinquish control of the airport to another public sponsor who would then be responsible for needed site improvements.

Burlington Municipal Airport

The record of the public informational meetings at Sturtevant and Elkhorn reflects widely-based opposition to the proposed future function of the Burlington Municipal Airport in the regional airport system. The plan, as presented at the public meetings, included a recommendation that the Burlington Airport be upgraded from its present status as a basic utility stage II airport to a proposed status as a basic transport airport. The Burlington Airport was, thus, envisioned as being the single basic transport airport serving all of Walworth County and western Racine and Kenosha Counties. The forecast upon which the recommended preliminary plan was based envisioned a need to base about nine business jet and heavier twin-engine type aircraft at the Burlington Airport.

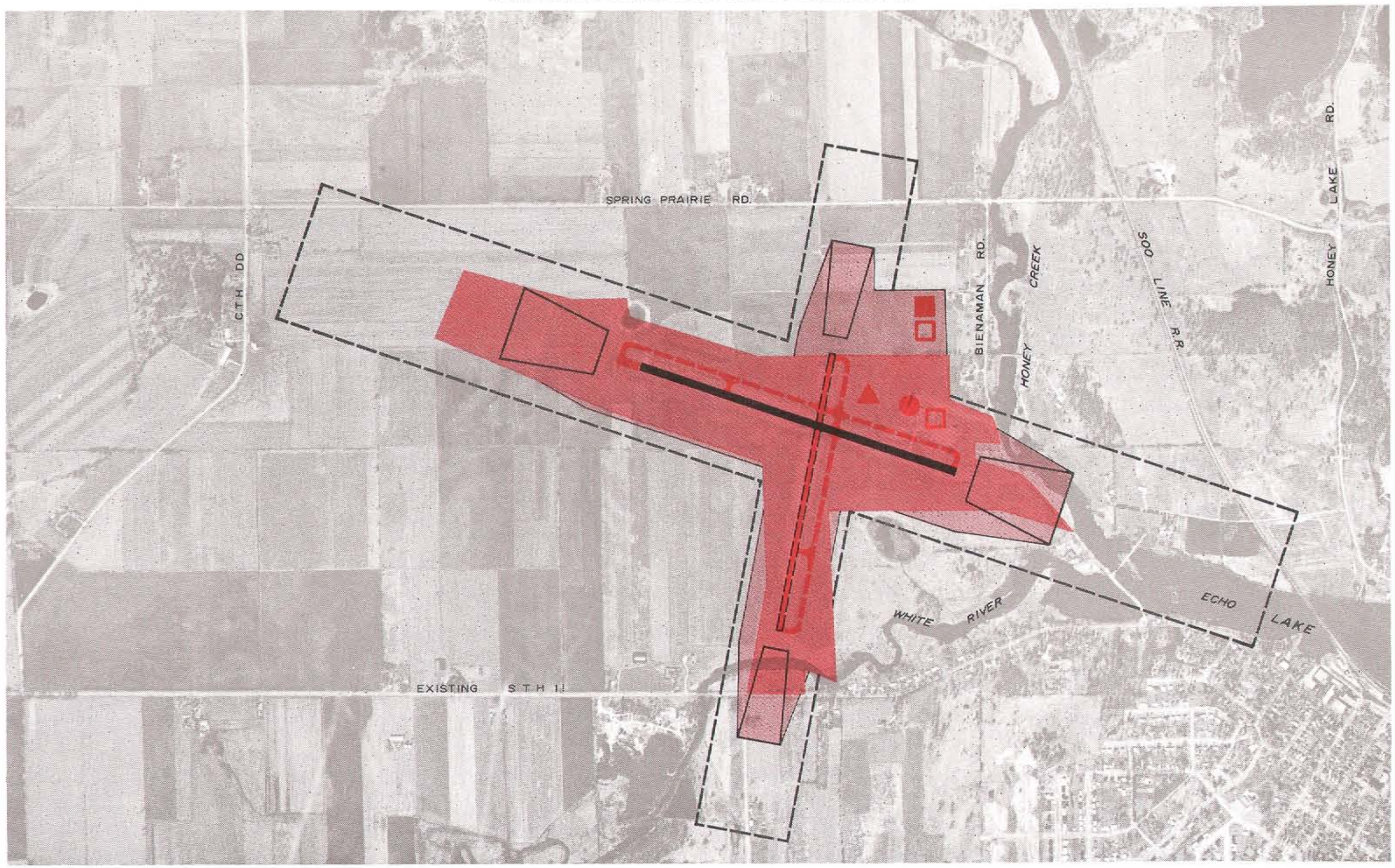
The preliminary plan recommendations were opposed by nearly all parties concerned, including the sport flying community, the Towns of Burlington and Spring Prairie, and the City of Burlington itself as the local public airport sponsor. The recreation aviation community was particularly concerned over the plan recommendation to provide greater landing system capacity and to provide a control tower to regulate aviation activity. The Towns of Burlington and Spring Prairie and their residents were particularly concerned about the increased amount of land needed to accommodate the proposed airport improvements. The City of Burlington indicated that it did not believe the provision of a basic transport airport was important to its industrial development program. Not a single industrial or business representative evidenced support for the development of a basic transport airport at Burlington at any of the public informational meetings or the public hearing.

In response to this overwhelming reaction, the Commission held a special intergovernmental meeting on September 30, 1975, with all concerned local parties in order to arrive at a consensus as to what adjustments should be made in the system plan in light of the near unanimity of opinion opposing the preliminary plan recommendations. At that intergovernmental meeting, the Commission staff presented two additional alternatives with respect to the Burlington Municipal Airport, one which would provide improvements that would upgrade the airport from a basic utility to a general utility airport, and the other which would continue to classify the Burlington Municipal Airport as a basic utility airport. The site improvements required to upgrade the airport to a general utility airport are shown on Map 85 and are listed in Table 265. The site improvements required as a basic utility airport are shown on Map 86 and are listed in Table 266. The record of that special intergovernmental meeting indicates unanimous support by all parties concerned for retention of the Burlington Municipal Airport as a basic utility airport. The record further reveals that a consensus was achieved with respect to including in the recommended plan the following specific site improvements at the Burlington Municipal Airport: resurfacing existing Runway 11/29 and construction of a taxiway parallel to Runway 11/29.

Based upon the foregoing, the Commission determined to adjust the recommended regional airport system plan to provide for a basic utility airport at Burlington (see Map 86) as opposed to the initial recommendation to upgrade the Burlington Airport to a basic transport status. A revised area land use plan corresponding to the revised site improvement plan for the Burlington Municipal Airport is shown on Map 87, while revised airport airspace protection recommendations are identified on Figure 87. In so doing, the Commission noted that the system plan, as thus revised, does not provide a basic transport airport in western Racine and Kenosha Counties or in Walworth County and that, accordingly, any demand for basing corporate jet aircraft on the part of businesses and industrial concerns in this portion of the Region will have to be satisfied by basing such aircraft either at the Kenosha Municipal Airport, Racine Commercial Airport, or General Mitchell Field in Milwaukee County. Because of the small number of type C and D aircraft involved, the relocation of such aircraft and attendant operations are not expected to significantly affect airport capacity at any of these alternative sites. Since the ground travel time from Elkhorn to each of these three airports is about 40, 55, and 50 minutes, respectively, this change in the system plan means that the ground travel time standard of 30 minutes for the higher-performance business jet aircraft, whose owners might reside in this part of the Region, will not be met.

Map 85

SITE IMPROVEMENT PLAN FOR THE BURLINGTON MUNICIPAL AIRPORT GENERAL UTILITY AIRPORT ALTERNATIVE



LEGEND

- LANDS CURRENTLY (1975) OWNED BY THE CITY OF BURLINGTON FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- EXISTING TURF RUNWAY
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING EXPANSION
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- AIRPORT INFLUENCE AREA—LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

GRAPHIC SCALE
0 800 1600 FEET

Source: SEWRPC.

Table 265

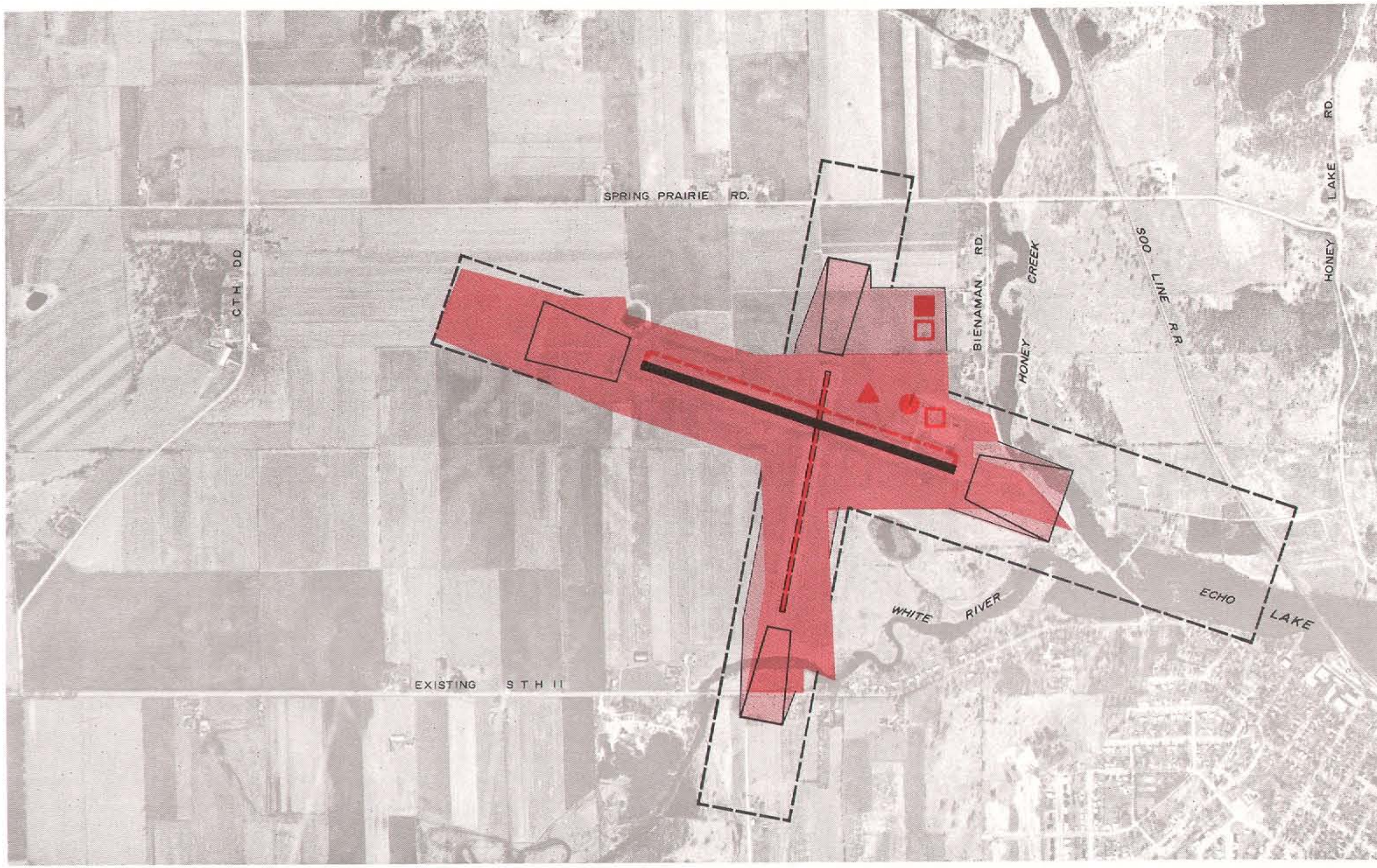
SITE REQUIREMENTS FOR THE BURLINGTON MUNICIPAL AIRPORT
GENERAL UTILITY AIRPORT ALTERNATIVE

General Conditions	
Airport Classification	Existing–Basic Utility II Proposed–General Utility
Aviation Demand	
Annual Operations	1971 Inventory–8,000 1995 Forecast–182,000
Based Aircraft	1971 Inventory–38 1995 Forecast–222
Runway System Capacity	Existing–133,000 Proposed–306,000
IFR Capability	Nonprecision Instrument Approach
Land Requirements	
Site Expansion (Acres)	40
Clear Zone Protection (Acres)	37
Residential Units	2
Total Estimated Cost	$ 225,000
Operational Area Improvements	
Extend Runway 11/29 to 3,800 feet	
Pave Runway 1/19: 75 feet x 3,000 feet	
Construct parallel taxiways	
Resurface Runway 11/29	
Construct additional paved aircraft parking apron area: 30,000 square yards	
Install navigation aids	
MIRL, Both Runways: 6,800 feet	
Taxiway Exit Lights, Both Runways	
VASI-2, Runway 11	
REILS, Both Runways, Both Ends	
Provide air traffic control tower and install nonprecision instrument landing system on approach to Runway 11 when number and type of aircraft operations justify	
Total Estimated Cost	$1,299,000
Terminal Area Improvements	
Expand administration/terminal building: 6,300 square feet	
Expand auto parking and onsite service roads: 12,600 square yards	
Total Estimated Cost	$ 465,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 21,000 square yards	
Total Estimated Cost	$1,583,000
Ground Access Facilities	
Improve Bieneman Road between terminal area and STH 11	
Total Estimated Cost	$ 75,000
Total Estimated Capital Investment	$3,647,000

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Map 86

SITE IMPROVEMENT PLAN FOR THE BURLINGTON MUNICIPAL AIRPORT
BASIC UTILITY AIRPORT ALTERNATIVE



LEGEND

- LANDS CURRENTLY (1975) OWNED BY THE CITY OF BURLINGTON FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENTS OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- EXISTING PAVED RUNWAY
- EXISTING TURF RUNWAY
- PROPOSED PAVED RUNWAY
- PROPOSED TAXIWAY
- CLEAR ZONE TRAPEZOID
- PROPOSED TERMINAL BUILDING EXPANSION
- PROPOSED AIRCRAFT PARKING APRON AREA
- PROPOSED AIRCRAFT HANGAR AREA
- PROPOSED AUTOMOBILE PARKING AREA
- AIRPORT INFLUENCE AREA–LIMIT OF AREA ELIGIBLE FOR FEDERAL AID

GRAPHIC SCALE
0 800 1600 FEET

Source: SEWRPC.

Map 87

AREA LAND USE PLAN FOR THE BURLINGTON MUNICIPAL AIRPORT
BASIC UTILITY AIRPORT ALTERNATIVE

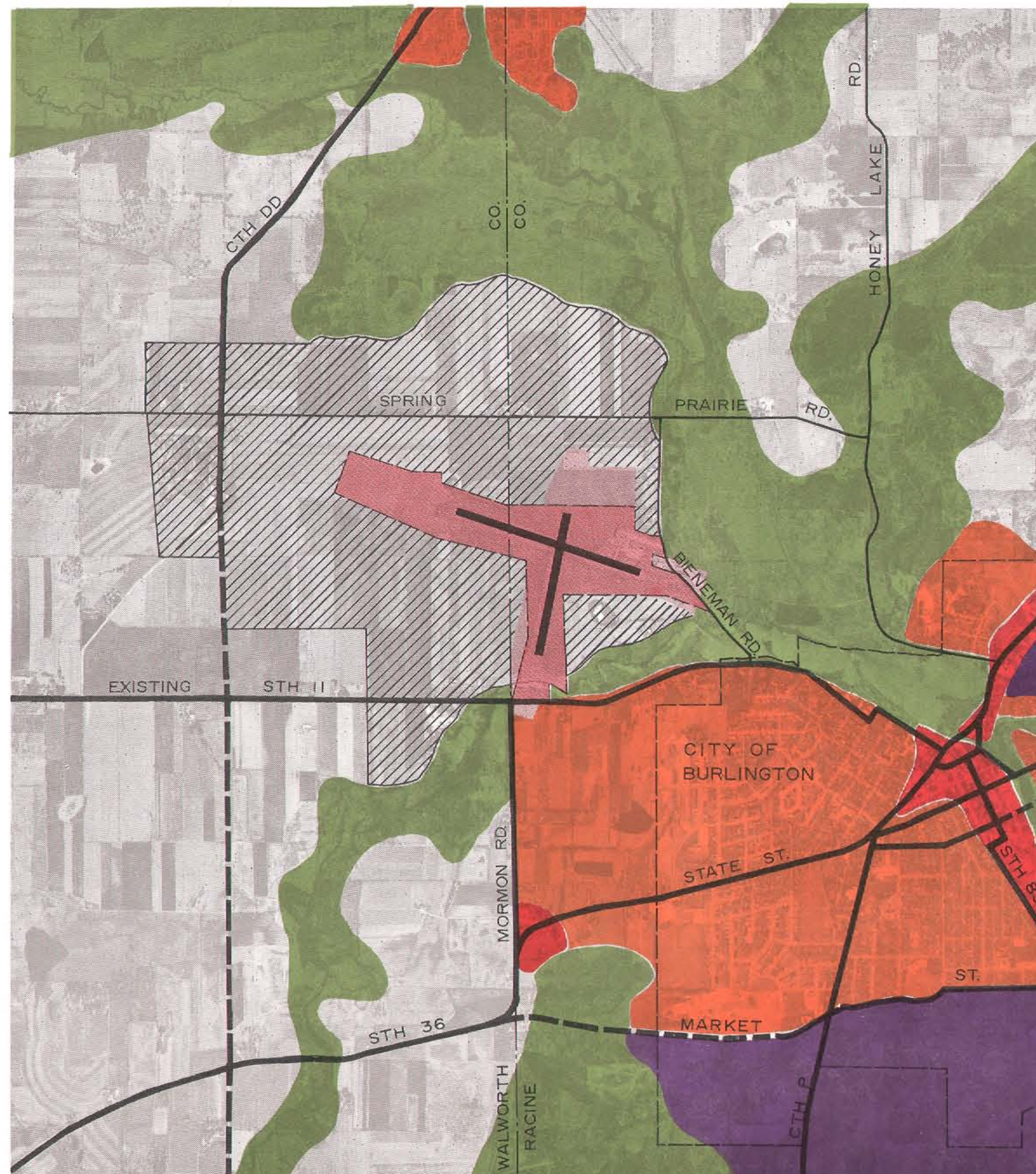
LEGEND

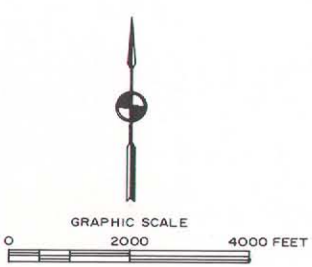
- LANDS CURRENTLY (1975) OWNED BY THE CITY OF BURLINGTON FOR AIRPORT PURPOSES
- LANDS PROPOSED TO BE ACQUIRED FOR AIRPORT SITE IMPROVEMENT OR PROTECTED THROUGH EASEMENTS PROHIBITING INCOMPATIBLE LAND USE DEVELOPMENT
- LANDS ADJACENT TO AIRPORT PROPOSED TO REMAIN IN AGRICULTURAL OR OTHER OPEN SPACE LAND USES, OR BE UTILIZED FOR NON-RESIDENTIAL URBAN LAND USES COMPATIBLE WITH AIRPORT ACTIVITY
- MEDIUM DENSITY RESIDENTIAL AND RELATED (7.3-22.8 PERSONS PER NET RESIDENTIAL ACRE)
- COMMERCIAL
- INDUSTRIAL
- PRIMARY ENVIRONMENTAL CORRIDOR
- AGRICULTURAL
- MUNICIPAL LIMITS-1975

ARTERIAL STREET OR HIGHWAY

- EXISTING
- PROPOSED

NOTE: THE FORECAST LEVEL OF AVIATION ACTIVITY AT THIS AIRPORT DOES NOT GENERATE A 100 CNR NOISE RATING ISOPLETH





Source: SEWRPC.

Table 266

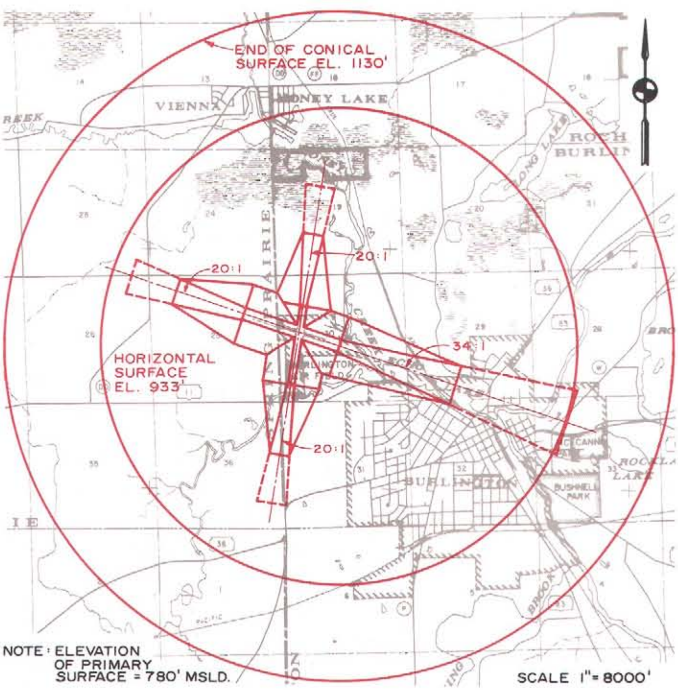
SITE REQUIREMENTS FOR THE BURLINGTON MUNICIPAL AIRPORT
BASIC UTILITY AIRPORT ALTERNATIVE

General Conditions	
Airport Classification	Existing—Basic Utility II Proposed—Basic Utility II
Aviation Demand	
Annual Operations	1971 Inventory—8,000 1995 Forecast—160,900
Based Aircraft	1971 Inventory—38 1995 Forecast—200
Runway System Capacity (PANCAP)	Existing—133,000 Proposed—319,000
IFR Capability	Existing Nonprecision Instrument Approach
Land Requirements	
Site Expansion (Acres)	21
Clear Zone Protection (Acres)	33
Residential Units	2
Total Estimated Cost	$ 200,000
Operational Area Improvements	
Resurface Runway 11/29	
Pave Runway 1/19: 60 feet x 2,600 feet	
Construct Taxiway 11/29: 30 feet x 4,000 feet	
Construct additional paved aircraft parking apron: 24,900 square yards	
Install navigation aids	
MIRL Runway 1/19: 2,600 feet	
MIRL Runway 11/29: 3,800 feet	
Taxiway Exit Lights	
VASI-2 Runway 11/29, 11 End	
REILS Both Runways, Both Ends	
Total Estimated Cost	$ 752,000
Terminal Area Improvements	
Expand administration/terminal building: 6,000 square feet	
Expand auto parking and service roads: 11,400 square yards	
Total Estimated Cost	$ 444,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 17,000 square yards	
Total Estimated Cost	$1,277,000
Ground Access Facilities	
Improve Bieneman Road between terminal area and STH 11	
Total Estimated Cost	$ 75,000
Utility Services	
Airport terminal within proposed service area—cost of connections considered nominal	
Total Estimated Capital Investment	$2,748,000

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Figure 87

BURLINGTON MUNICIPAL AIRPORT AIRSPACE RECOMMENDED TO BE MAINTAINED OBSTRUCTION FREE THROUGH HEIGHT RESTRICTION ZONING BASIC UTILITY AIRPORT ALTERNATIVE



Source: SEWRPC.

Other Concerns Expressed at Meetings and Hearing

The record of the public meetings reflects one additional series of comments not covered in the above discussion. This relates to the recommendations made by representatives of the recreational aviation community to provide one or more new basic utility airports in the Milwaukee urbanized area. In considering this recommendation, the Commission noted that the Technical Coordinating and Advisory Committee had evaluated the feasibility of establishing new airports on the fringe of the Milwaukee urbanized area, and had rejected these alternatives in favor of a plan that would make maximum use of the existing public capital investment in airport facilities and the existing established patterns of general aviation activity. The Commission considered that recommendation to be well founded, particularly in light of the evidenced capability of accommodating all forecast aviation activity at the 14 airports included in the system plan and, furthermore, the avoidance thereby of the creation of new aviation-land use development conflicts, particularly in the rapidly developing suburban fringe of the Milwaukee urbanized area. In addition, the Commission recognized the continued potential of a large number of small privately-owned airfields that are available to meet the needs of the sport or recreation aviation community. Accordingly, the Commission determined not to change the recommended system plan to include any new general aviation airport sites in the Milwaukee urbanized area.

Concluding Remarks—Public Reaction

In summary, it may be concluded that public reaction to the preliminary regional airport system plan recommendations was mixed, with significant controversy developing with respect to several of the airports included in the system plan and with no controversy at all with respect to other airports included in the system plan. In addition, little public response was obtained regarding alternative system plans or alternative jurisdictional plans and the recommendation that system plan airports become the responsibility of the counties. In reviewing all of the comments, opinions, and data presented at all of the meetings and the hearing held concerning the plan recommendations, the Commission, after consultation with the Technical Coordinating and Advisory Committee, determined to change the preliminary plan recommendations in only two significant respects. The Commission acted to modify the preliminary plan by changing the scope of proposed improvements at the Waukesha County Airport, thereby reducing its capacity and causing the reallocation of about 96 based aircraft to other airports in the system. The Commission further acted to change the recommended function of the Burlington Municipal Airport from a basic transport status to a basic utility status, thereby leaving all of Walworth County and western Racine and Kenosha Counties unserved with respect to corporate jet activity. Since the expected demand from the corporate jet portion of the total aviation community in Walworth County and in western Racine and Kenosha Counties can be accommodated at other airports included in the regional airport system plan, without seriously compromising the ground travel time standard, and since the reallocated aircraft at the Waukesha airport can be accommodated at other airports without causing capacity problems, such changes to the preliminary plan may be termed minor, with respect to the integrity of the regional airport system.

POST-PUBLIC HEARING RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN

The recommended regional airport system plan as initially prepared was refined as a result of a new forecast of aviation activity undertaken during the regional airport system planning process and was presented for public review and comment. As documented in the previous section of this chapter, the Technical Coordinating and Advisory Committee and the Commission carefully considered the information and comments presented at the public informational meetings and public hearing on the plan, and in accordance with the information and comments made modifications to the preliminary system plan as that plan concerned the Waukesha County and Burlington Municipal Airports. Although these changes were considered minor with respect to the potential effect on, and integrity of, the regional airport system plan, the changes will influence the allocation of aircraft based within the Region and thereby affect aircraft operations and airport facility requirements. Accordingly, the Commission reallocated aircraft to the modified system in order to determine any changes in airport facility needs at each system airport which may have resulted from the plan changes made in response to the public reaction to the preliminary plan. Table 267 sets forth a comparison of airport classification and capacity, distribution of based aircraft by type, and number of annual operations developed for the preliminary recommended system plan and for the final recommended system plan. The final recommended system plan is graphically summarized on Map 88, while the approximate future service areas of the system airports with respect to types C, D, and E aircraft are identified on Maps 89, 90, and 91, respectively.

Based upon the reallocation of based aircraft and the changes in airport facilities—particularly in the runway-taxiway systems—made in response to public comment, a new series of tables setting forth site requirements at each system airport was prepared to refine and detail the final plan recommendations. For the most part, the adjustments to airport facilities affected only aircraft parking apron, terminal, hangar, and automobile parking facilities, reflecting the changes in the number of based aircraft. It was only necessary to modify recommended land acquisition requirements and runway facilities and associated costs at the Hartford Municipal Airport, the Waukesha County Airport, and the Burlington Municipal Airport. The site requirements at each airport as recommended in the final plan, along with attendant capital costs, are shown in Tables 268 through 279. A summary of total system development costs by airport is provided in Table 280. Total final system plan costs vary only slightly from those estimated for the preliminary system plan. The changes at Hartford, Waukesha, and Burlington resulted in a $3.7 million decrease in total estimated system plan costs, or about two percent less than the estimated cost of the preliminary recommended system plan.

PLAN IMPLEMENTATION

The legal and governmental framework existing in the Southeastern Wisconsin Region is such that the existing local, county, and state units and agencies of government can readily implement all of the major recommendations contained in the regional airport system plan. In Chapter XIII of this report, a comprehensive, cooperative, intergovernmental plan implementation program is set forth which indicates the specific actions which will be required at each level, agency, and unit of government if the recommended regional airport system plan is to be fully implemented.

Consideration was given in formulating plan implementation responsibilities to simply continuing to use the existing institutional structure for plan implementation, a structure that consists of a mix of public and private ownership. Given the magnitude of capital improvements required, it was considered unlikely that the private owners, except perhaps the private operator of the Racine Commercial Airport, would be able to fully implement the system plan recommendations. Accordingly, it was considered necessary to investigate alternative public airport institutional structures in order to select a recommended public strategy for plan implementation. Five basic public airport institutional structures were considered: continuing existing major public sponsors and seeking new local public sponsors, primarily cities and villages; seeking county sponsorship of all public airport facilities; seeking county and multi-county sponsorship of all public airport facilities; seeking establishment of a regional airport authority; and seeking state ownership and operation of all public airport facilities.

Table 267

COMPARISON OF AVIATION ACTIVITY ALLOCATED TO SYSTEM AIRPORTS IN THE SOUTHEASTERN WISCONSIN REGION UNDER THE PRELIMINARY AND FINAL RECOMMENDED SYSTEM PLANS: 1995

Airport	Preliminary System Plan								Final System Plan							
	Classification	Capacity	1995 Operations	Demand as a Percent of Capacity	Based Aircraft				Classification	Capacity	1995 Operations	Demand as a Percent of Capacity	Based Aircraft			
					C	D	E	Total					C	D	E	Total
Kenosha Municipal	BT	337,600	232,800	69	6	47	233	286	BT	337,600	238,000	70	14	43	237	294
General Mitchell Field . .	SAT	400,000	300,900[b]	75	19	192	--	211	SAT	400,000	318,000[c]	80	22	210	--	232
Timmerman Field.	GU	501,700	341,500	68	--	62	357	419	GU	501,700	363,800	73	--	62	390	452
Ozaukee County	GU	306,300	200,000	65	--	42	230	272	GU	306,300	219,700	72	--	47	222	269
Burlington Municipal . . .	BT	253,300	188,500	74	9	50	172	231	BU	319,000	160,900	50	--	--	200	200
Racine Commercial. . . .	BT	253,300	138,200	55	2	18	150	170	BT	253,300	133,700	53	2	20	143	165
Sylvania	BU	319,000	165,400	52	--	--	206	206	BU	319,000	166,000	52	--	--	206	206
East Troy Municipal . . .	BU	319,000	203,800	64	--	--	253	253	BU	319,000	211,600	66	--	--	268	268
Gruenwald.	GU	306,300	147,400	48	--	46	134	180	GU	306,300	163,800	53	--	79	118	197
Hartford Municipal	GU	306,300	205,100	67	--	72	177	249	GU	306,300	227,400	74	--	75	206	281
West Bend Municipal . . .	BT	253,300	236,300	93	13	50	233	296	BT	253,300	234,400	93	10	47	232	289
Waukesha County.	BT	337,600	322,000	95	13	60	324	397	BT-Modified	253,300	244,500	97	14	50	237	301
Airports Beyond Region .	--	--	--	--	--	32	262	294	--	--	--	--	--	38	269	307
Playboy[a]	BUR	--	15,800	--	--	--	20	20	BUR	--	18,400	--	--	--	23	23
Lake Lawn Lodge[a]	BUR	--	13,100	--	--	--	16	16	BUR	--	13,100	--	--	--	16	16
Total	--	--	--	--	62	671	2,767	3,500	--	--	--	--	62	671	2,767	3,500

[a] *Private airports assumed to service a limited amount of general aviation demand.*

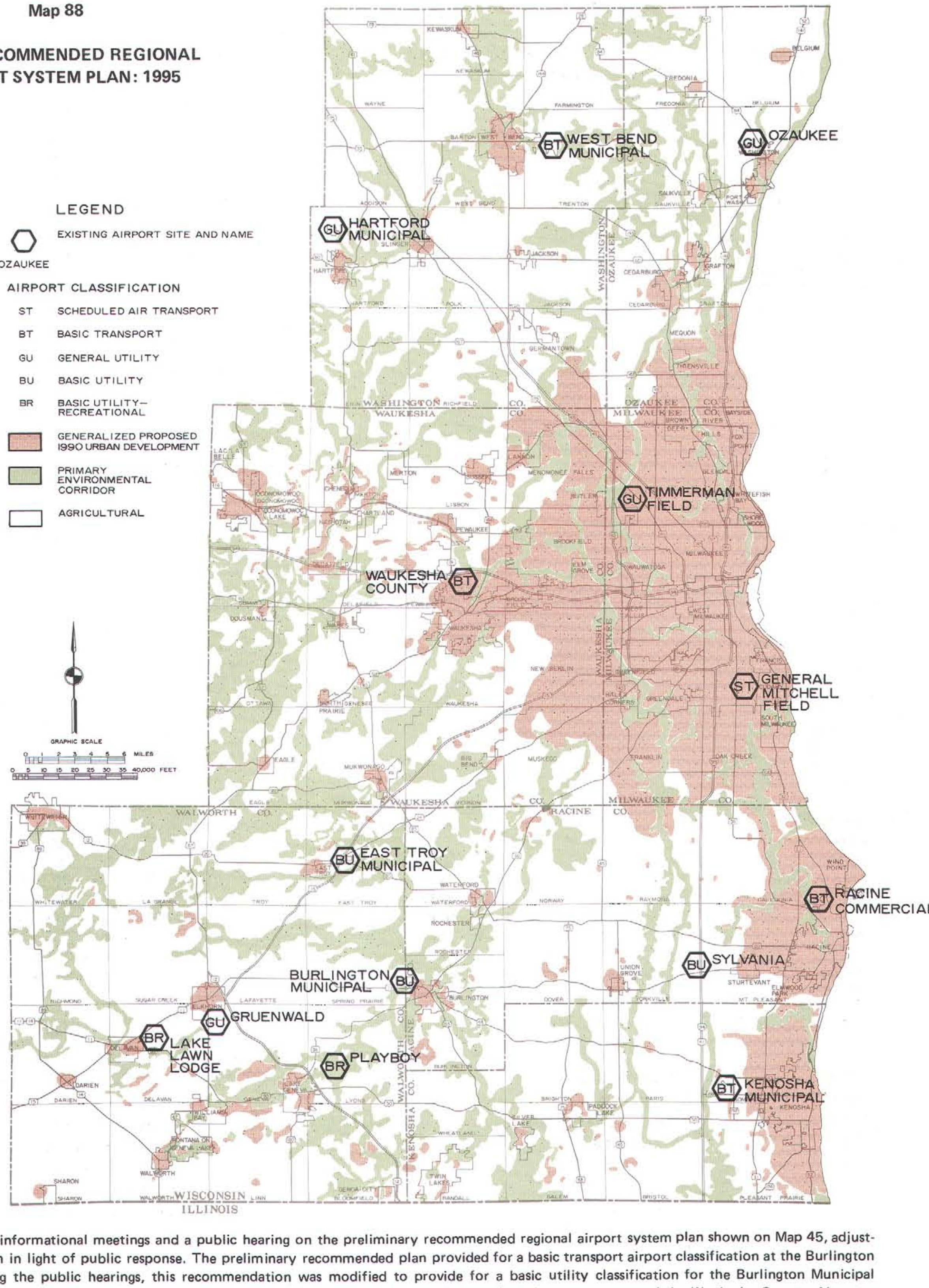
[b] *Includes forecast of 181,200 general aviation, 104,600 air carrier, and 15,100 military operations.*

[c] *Includes forecast of 198,300 general aviation, 104,600 air carrier, and 15,100 military operations.*

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

Map 88

FINAL RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN: 1995

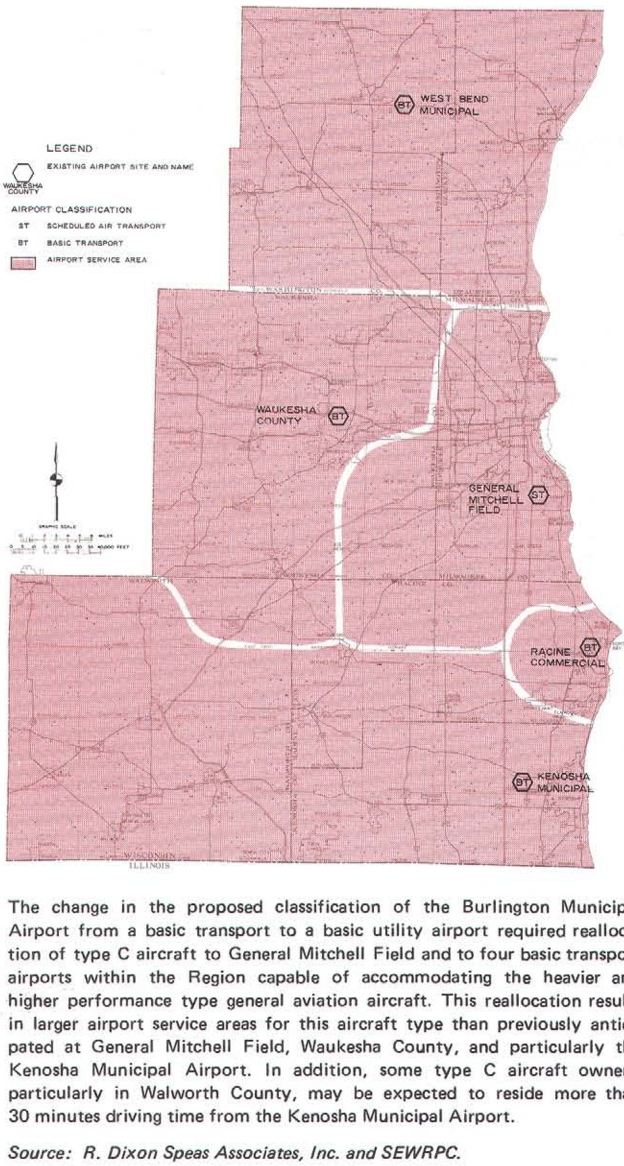


Following a series of public informational meetings and a public hearing on the preliminary recommended regional airport system plan shown on Map 45, adjustments were made in the plan in light of public response. The preliminary recommended plan provided for a basic transport airport classification at the Burlington Municipal Airport. Following the public hearings, this recommendation was modified to provide for a basic utility classification for the Burlington Municipal Airport. Runway system adjustments were also made at the Hartford Municipal Airport—lengthening the primary runway—and the Waukesha County Airport—eliminating the parallel basic utility runway—to achieve system plan objectives. Thus, the final recommended regional airport system plan contains 14 public use airports, including one air carrier airport, three basic transport airports, one modified basic transport airport, four general utility airports, three basic utility airports, and two basic utility-recreation airports.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 89

AIRPORT SERVICE AREAS IN THE REGION
FOR TYPE "C" AIRCRAFT: 1995

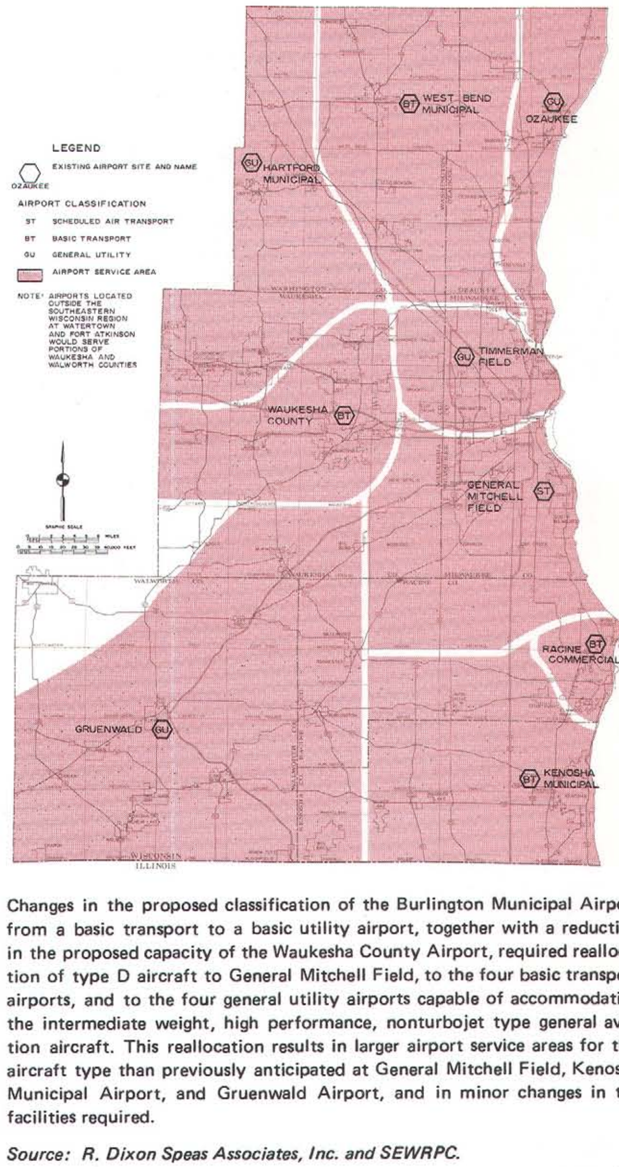


The change in the proposed classification of the Burlington Municipal Airport from a basic transport to a basic utility airport required reallocation of type C aircraft to General Mitchell Field and to four basic transport airports within the Region capable of accommodating the heavier and higher performance type general aviation aircraft. This reallocation results in larger airport service areas for this aircraft type than previously anticipated at General Mitchell Field, Waukesha County, and particularly the Kenosha Municipal Airport. In addition, some type C aircraft owners, particularly in Walworth County, may be expected to reside more than 30 minutes driving time from the Kenosha Municipal Airport.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

Map 90

AIRPORT SERVICE AREAS IN THE REGION
FOR TYPE "D" AIRCRAFT: 1995



Changes in the proposed classification of the Burlington Municipal Airport from a basic transport to a basic utility airport, together with a reduction in the proposed capacity of the Waukesha County Airport, required reallocation of type D aircraft to General Mitchell Field, to the four basic transport airports, and to the four general utility airports capable of accommodating the intermediate weight, high performance, nonturbojet type general aviation aircraft. This reallocation results in larger airport service areas for this aircraft type than previously anticipated at General Mitchell Field, Kenosha Municipal Airport, and Gruenwald Airport, and in minor changes in the facilities required.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

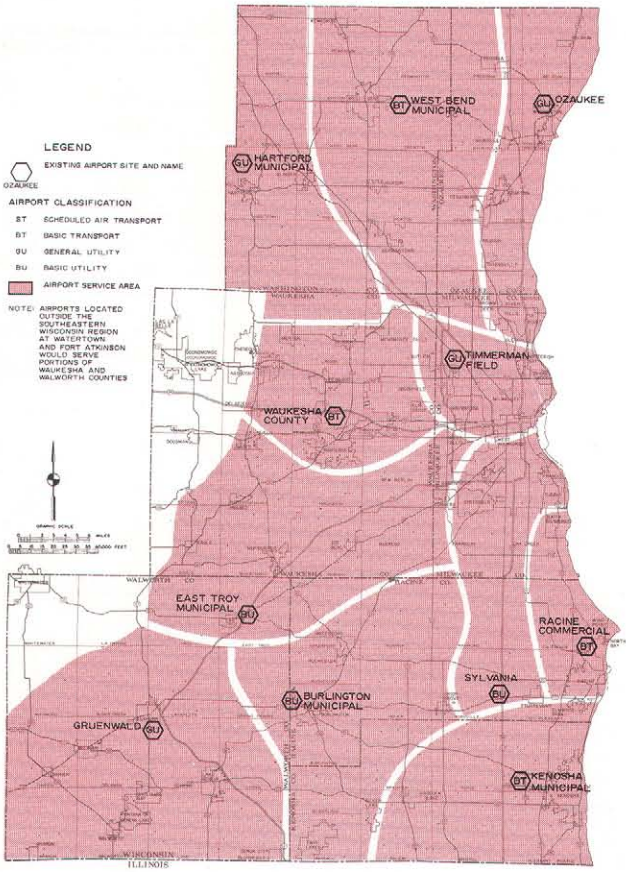
Consideration of these alternatives led to a recommendation that county sponsorship be sought for all public airport facilities included in the recommended system plan. This recommendation was based upon the following major factors:

1. Three of the largest and most important airports included in the system plan are already owned and operated by counties—General Mitchell and Timmerman Fields by Milwaukee County and the Waukesha County Airport by Waukesha County.

2. The remaining nine airports included in the recommended system plan are either privately owned or owned by cities or villages. Given the areawide nature of all of the facilities included in the recommended plan, and further given the required capital investment necessary to implement the plan, it is inappropriate to consider either continued private ownership or city, village, or town ownership and operation of these nine airport facilities, the single exception being perhaps continued private ownership of the Racine Commercial Airport facility. Per capita costs at the local level would tend to be quite high, resulting in an inequitable distribution of costs among the Region's residents. Hence, the county level of government is more appropriate than the city, village, or town level of government for ownership and operation of these airport facilities.

Map 91

AIRPORT SERVICE AREAS IN THE REGION FOR TYPE "E" AIRCRAFT: 1995



A reallocation of type E aircraft to all 11 general-purpose public-use general aviation airports comprising the recommended regional airport system was required following the public hearings on the initial plan recommendations. These reallocations were necessitated by the reclassification of the Burlington Municipal Airport from a basic transport to a basic utility airport and by a reduction in proposed capacity at the urban Waukesha County Airport, and resulted in changes in the airport service areas for the type E aircraft from those previously anticipated. The most significant change in this respect is the increased size of the anticipated service area for the East Troy Municipal Airport.

Source: R. Dixon Speas Associates, Inc. and SEWRPC.

3. The likelihood of establishing airport functional responsibility at the county level in the five individual counties is judged to be higher than the likelihood of establishing multi-county authorities or commissions for those same five counties.

4. The provision of the airport function at the county level of government results in a relatively equitable distribution of costs on a per capita basis throughout the Region, although it is recognized that such distribution is not as equitable as it would be if the recommendation were to be made to create a regional airport authority.

In addition to recommending a county level public institutional structure for plan implementation, the plan also recommends that airport master planning efforts be undertaken for each of the 12 major airports included in the recommended system plan; that a state revolving fund for aircraft hangar construction be established; that the local public authorities involved take appropriate action to amend local zoning and/or height control ordinances to provide for proper airport airspace protection; and that the local public authorities involved undertake more precise and detailed land use planning to assist in assuring a proper relationship between airport site development and airport area land development.

CONCLUSION

The regional airport system plan provides another important element of the evolving comprehensive plan for the physical development of the seven-county Southeastern Wisconsin Region. Together with the regional transportation plan for highways and transit, the regional airport system plan provides the Region, its public officials, and its citizens with a sound, coordinated guide to transportation facility development. The plan is based upon extensive inventories and analyses of the existing regional air transportation system, and has been carefully selected from among many alternatives considered. The plan has been endorsed by an advisory committee comprised of knowledgeable and experienced public works engineers, airport operators, and other individuals representing aviation interests throughout the Region. The recommended plan and the alternatives thereto were, moreover, subject to extensive public review at informational meetings and a formal public hearing, the results of which are documented in a published transcript.

The regional airport system plan includes definitive recommendations for airport facility construction and operation, including recommendations for runway, taxiway, navigational aid, and associated terminal facility improvements as well as the imposition of nonstandard air traffic patterns and aircraft activity restrictions; airport airspace protection; and airport area land use for the immediate area surrounding each of the airports included in the airport system plan. Within the context of the overall regional planning program, the recommended regional airport plan should meet all applicable federal and state planning requirements for system level planning. As such it should provide a sound basis for the preparation of airport facility master plans and for the approval of state and federal grants-in-aid.

The plan, as refined on the basis of local financial resource analyses and information obtained through a series of public informational meetings and a public hearing, should provide a sound basis for future public capital investment in airport and airport-related facilities. The plan makes maximum use of existing, available airport facilities to the point where no new airport sites have been recommended. Importantly, the plan was initially prepared for a regional population now thought to be in substantial excess of that anticipated to occur over the next two to three decades. Accordingly, the plan should serve the Region well, being capable of meeting aviation demands in the Region at least until the turn of the century.

Table 268

SITE REQUIREMENT RECOMMENDATIONS FOR THE BURLINGTON MUNICIPAL AIRPORT
UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing–Basic Utility II Proposed–Basic Utility II
Aviation Demand	
Annual Operations	1971 Inventory–8,000 1995 Forecast–160,900
Based Aircraft	1971 Inventory–38 1995 Forecast–200
Runway System Capacity (PANCAP)	Existing–133,000 Proposed–319,000
IFR Capability	Existing Nonprecision Instrument Approach
Land Requirements	
Site Expansion (Acres)	21
Clear Zone Protection (Acres)	33
Residential Units	2
Total Estimated Cost	$ 200,000
Operational Area Improvements	
Resurface Runway 11/29	
Pave Runway 1/19: 60 feet x 2,600 feet	
Construct Taxiway 11/29: 30 feet x 4,000 feet	
Construct additional paved aircraft parking apron: 24,900 square yards	
Install navigation aids	
MIRL Runway 1/19: 2,600 feet	
MIRL Runway 11/29: 3,800 feet	
Taxiway Exit Lights	
VASI-2 Runway 11/29, 11 End	
REILS Both Runways, Both Ends	
Total Estimated Cost	$ 752,000
Terminal Area Improvements	
Expand administration/terminal building: 6,000 square feet	
Expand auto parking and service roads: 11,400 square yards	
Total Estimated Cost	$ 444,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 17,000 square yards	
Total Estimated Cost	$1,277,000
Ground Access Facilities	
Improve Bieneman Road between terminal area and STH 11	
Total Estimated Cost	$ 75,000
Utility Services	
Airport terminal within proposed service area–cost of connections considered nominal	
Total Estimated Capital Investment	$2,748,000

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 269

SITE REQUIREMENT RECOMMENDATIONS FOR THE EAST TROY MUNICIPAL AIRPORT UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing—Less Than Basic Utility I Proposed—Basic Utility II
Aviation Demand	
Annual Operations	1971 Inventory—5,700 1995 Forecast—211,600
Based Aircraft	1971 Inventory—18 1995 Forecast—268
Runway System Capacity (PANCAP)	Existing—8,600 Proposed—319,000
IFR Capability	None (VFR)
Land Requirements	
Site Expansion (Acres)	70
Clear Zone Protection (Acres)	50
Residential and Commercial Units	1
Total Estimated Cost	$ 194,000
Operational Area Improvements	
Pave Runway 9/27: 60 feet x 3,200 feet	
Pave Runway 18/36: 60 feet x 2,560 feet	
Construct additional paved aircraft parking apron: 37,170 square yards	
Install navigation aids	
MIRL Runway 9/27	
MIRL Runway 18/36	
VASI-2 Runway 9/27, 27 End	
REILS Both Runways, Both Ends	
Total Estimated Cost	$ 925,700
Terminal Area Improvements	
Construct new administration/terminal building: 7,700 square feet	
Expand auto parking and service roads: 13,100 square yards	
Total Estimated Cost	$ 562,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 19,700 square yards	
Total Estimated Cost	$1,486,000
Ground Access Facilities	
No additional facilities required	
Utility Services	
Airport terminal is within proposed service area—cost of connections considered nominal	
Total Estimated Capital Investment	$3,167,700

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 270

SITE REQUIREMENT RECOMMENDATIONS FOR GENERAL MITCHELL FIELD UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing–Scheduled Air Transport Proposed–Scheduled Air Transport
Aviation Demand	
Annual Operations	
Total	1971 Inventory–230,810 1995 Forecast–318,000
Air Carrier	1971 Inventory–78,550 1995 Forecast–104,600
Military	1971 Inventory–14,000 1995 Forecast–15,100
General Aviation	1971 Inventory–138,260 1995 Forecast–198,300
Based Aircraft	1971 Inventory–183 1995 Forecast–232
Runway System Capacity (PANCAP)	Existing–341,000 Proposed–400,000
IFR Capability	Precision Instrument Approach
Land Requirements	
Site Expansion (Acres)	0
Clear Zone Protection (Acres)	35
Noise Impact Elimination (Acres)	35
Residential and Commercial Units	30
Total Estimated Cost	$ 2,060,000
Operational Area Improvements	
Resurface Runways 1L/19R and 7R/25L	
Resurface Taxiways 1L/19R and 7R/25L	
Extend Runway 1L/19R to 11,500 feet	
Runway: 200 feet x 1,584 feet	
Taxiway: 75 feet x 2,000 feet	
Extend Runway 1R/19L to 7,000 feet	
Runway: 150 feet x 2,800 feet	
Taxiway: 75 feet x 2,875 feet	
Extend Runway 7R/25L to 9,000 feet	
Runway: 150 feet x 1,000 feet	
Taxiway: 75 feet x 1,288 feet	
Realign and Extend Runway 7L/25R to 5,000 feet	
Runway: 100 feet x 5,000 feet	
Mark and light or remove obstructions	
Total Estimated Cost	$22,800,000
Terminal Area Improvements	
Expand airline passenger terminal and auto parking facilities	
Construct cargo terminal area	
Construct maintenance yard and shop and firehouse	
Expand general aviation terminal facilities	
Total Estimated Cost	$59,780,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 14,800 square yards	
Total Estimated Cost	$ 1,215,600
Ground Access Facilities	
Airport Spur Freeway recommended as state trunk highway under jurisdictional highway system plan for Milwaukee County	
Utility Services	
Airport is within existing utility service area	
Total Estimated Capital Investment	$85,855,600

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 271

SITE REQUIREMENT RECOMMENDATIONS FOR THE GRUENWALD AIRPORT UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing—Basic Utility I Proposed—General Utility
Aviation Demand	
Annual Operations	1971 Inventory—1,600 1995 Forecast—163,800
Based Aircraft	1971 Inventory—4 1995 Forecast—197
Runway System Capacity (PANCAP)	Existing—95,000 Proposed—306,300
IFR Capability	Nonprecision Instrument Approach
Land Requirements	
Acquire existing privately-owned airport (90 acres) and improvements	
Total Estimated Cost	$ 169,000
Site Expansion (Acres)	150
Clear Zone Protection (Acres)	65
Residential Unit	1
Total Estimated Cost	$ 280,800
Operational Area Improvements	
Construct new northeast/southwest primary runway: 75 feet x 4,000 feet	
Construct new northwest/southeast secondary runway: 75 feet x 3,200 feet	
Construct taxiway parallel to northeast/southwest runway: 40 feet x 4,400 feet	
Construct taxiway parallel to northwest/southeast runway: 40 feet x 3,600 feet	
Construct connecting and crossover taxiways	
Install navigation aids	
MIRL Northwest/Southeast Runway	
MIRL Northeast/Southwest Runway	
Taxiway Exit Lights	
VASI-2 Northeast/Southwest Runway, Southwest End	
REILS Both Runways, Both Ends	
Construct additional aircraft parking apron: 42,300 square yards	
Construct air traffic control tower	
Install nonprecision instrument landing system approach to southwest end of primary runway	
Total Estimated Cost	$1,591,900
Terminal Area Improvements	
Construct new administration/terminal building: 7,500 square feet	
Construct auto parking and service road: 13,700 square yards	
Total Estimated Cost	$ 552,200
Hangar Area Improvements	
Construct new aircraft hangar storage area: 24,400 square yards	
Total Estimated Cost	$1,839,800
Ground Access Facilities	
No additional facilities necessary	
Utility Services	
Extend utility service from City of Elkhorn service area	
Total Estimated Cost	$ 18,000
Total Estimated Capital Investment	$4,451,700

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 272

SITE REQUIREMENT RECOMMENDATIONS FOR THE HARTFORD MUNICIPAL AIRPORT UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing—Basic Utility I Proposed—General Utility
Aviation Demand	
Annual Operations	1971 Inventory—57,600 1995 Forecast—227,400
Based Aircraft	1971 Inventory—53 1995 Forecast—281
Runway System Capacity (PANCAP)	Existing—211,000 Proposed—306,300
IFR Capability	Nonprecision Instrument Approach
Land Requirements	
Site Expansion (Acres)	65
Clear Zone Protection (Acres)	30
Residential Units	2
Total Estimated Cost	$ 333,500
Operational Area Improvements Extend Runway 11/29 to 4,200 feet Runway: 75 feet x 1,200 feet Taxiway: 30 feet x 1,400 feet Construct Runway 2/20 Runway: 75 feet x 3,000 Construct additional paved aircraft parking apron: 50,000 square yards Install lighting and visual aids MIRL Both Runways: 7,200 feet Taxiway Exit Lights—Runway 11/29 VASI-2 Runway 11/29, 29 End REILS Both Runways, Both Ends Construct air traffic control tower Install nonprecision instrument landing system approach to Runway 11	
Total Estimated Cost	$1,006,300
Terminal Area Improvements Construct new administration/terminal building: 8,800 square feet Expand auto parking and service roads: 15,200 square yards	
Total Estimated Cost	$ 643,500
Hangar Area Improvements Expand aircraft hangar storage and service area: 27,700 square yards	
Total Estimated Cost	$2,088,600
Ground Access Facilities Terminal access road recommended as county trunk highway under jurisdictional highway system plan for Washington County	
Utility Services Extend utility services from proposed City of Hartford sewer service area	
Total Estimated Cost	$ 29,000
Total Estimated Capital Investment	$4,100,900

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 273

SITE REQUIREMENT RECOMMENDATIONS FOR THE KENOSHA MUNICIPAL AIRPORT UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing–General Utility Proposed–Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory–64,500 1995 Forecast–238,000
Based Aircraft	1971 Inventory–82 1995 Forecast–294
Runway System Capacity (PANCAP)	Existing–181,000 Proposed–337,600
IFR Capability	Precision Instrument Approach
Land Requirements	
Site Expansion (Acres)	315
Clear Zone Protection (Acres)	185
Residential Unit	24
Total Estimated Cost	$1,782,000
Operational Area Improvements Construct new parallel Runway 6L/24R Runway: 150 feet x 7,000 feet Taxiway: 50 feet x 8,100 feet Extend Runway 14/32 to 4,500 feet Runway: 100 feet x 300 feet Taxiway: 40 feet x 500 feet Widen runways Runway 14/32: 25 feet x 4,200 feet Strengthen runways and taxiways to accommodate 60,000 pounds gross weight aircraft Runway 6R/24L–3 1/2 inch Overlay: 75 feet x 3,300 feet Runway 14/32–1 1/2 inch Overlay: 75 feet x 4,200 feet Taxiway 6R/24L–3 1/2 inch Overlay: 40 feet x 3,400 feet Taxiway 14/32–3 1/2 inch Overlay: 40 feet x 1,900 feet 3 1/4 inch Overlay: 40 feet x 1,500 feet 1 1/2 inch Overlay: 40 feet x 1,350 feet Construct additional paved aircraft parking apron: 35,800 square yards Install lighting and visual aids MIRL Runway 14/32 Extension: 300 feet Relocation: 4,200 feet HIRL Runway 6L/24R: 7,000 feet Taxiway Exit Lights Runway 6L/24R Runway 6R/24L Runway 14/32 VASI-4 Runway 14/32, 14 End REILS 3 Runways, Both Ends VASI-4 Runway 6L/24R, Both Ends Construct air traffic control tower. Install precision instrument landing and approach lighting system on approach to Runway 6	
Total Estimated Cost	$4,589,700
Terminal Area Improvements Construct new terminal building: 8,500 square feet Expand auto parking and service roads: 13,400 square yards	
Total Estimated Cost	$ 698,400
Hangar Area Improvements Expand aircraft hangar storage and service area: 24,300 square yards	
Total Estimated Cost	$1,832,200
Ground Access Facilities No additional facilities required	
Utility Services Airport within proposed service area–cost of connections considered nominal	
Total Estimated Capital Investment	$8,902,300

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 274

SITE REQUIREMENT RECOMMENDATIONS FOR THE OZAUKEE AIRPORT
UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing—Less Than Basic Utility I Proposed—General Utility
Aviation Demand	
Annual Operations	1971 Inventory—3,500 1995 Forecast—219,700
Based Aircraft	1971 Inventory—3 1995 Forecast—269
Runway System Capacity (PANCAP)	Existing—91,000 Proposed—306,300
IFR Capability	Nonprecision Instrument Approach
Land Requirements	
Acquire existing privately-owned airport (90 acres) and improvements	
Total Estimated Cost	$ 135,000
Site Expansion (Acres)	150
Clear Zone Protection (Acres)	80
Total Estimated Cost	$ 299,000
Operational Area Improvements	
Construct new north/south primary runway: 75 feet x 4,000 feet	
Construct new east/west secondary runway: 75 feet x 3,200 feet	
Construct taxiway parallel to north/south runway: 40 feet x 4,400 feet	
Construct taxiway parallel to east/west runway: 40 feet x 3,600 feet	
Construct connecting taxiways and crossover taxiways	
Install lighting and visual aids	
MIRL East/West Runway	
MIRL North/South Runway	
Taxiway Exit Lights	
VASI-2 North/South Runway, North End	
REILS Both Runways, Both Ends	
Construct aircraft parking apron: 46,860 square yards	
Construct air traffic control tower	
Install precision instrument landing system approach to north end of primary runway	
Total Estimated Cost	$1,632,200
Terminal Area Improvements	
Construct new administration/terminal building: 8,500 square feet	
Construct auto parking and service roads: 15,500 square yards	
Total Estimated Cost	$ 625,600
Hangar Area Improvements	
Construct new aircraft hangar storage and service area: 27,600 square yards	
Total Estimated Cost	$2,081,000
Ground Access Facilities	
No additional facilities necessary	
Utility Services	
Extend utility service from proposed Port Washington sewer service area	
Total Estimated Cost	$ 29,000
Total Estimated Capital Investment	$4,801,800

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 275

SITE REQUIREMENT RECOMMENDATIONS FOR THE RACINE COMMERCIAL AIRPORT UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing—Basic Transport (Limited) Proposed—Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory—35,000 1995 Forecast—133,700
Based Aircraft	1971 Inventory—34 1995 Forecast—165
Runway System Capacity (PANCAP)	Existing—145,000 Proposed—253,300
IFR Capability	Precision Instrument Approach
Land Requirements	
Acquire existing privately-owned airport (490 acres) and improvements (runways, taxiways, and apron)	
Total Estimated Cost	$3,250,000
Site Expansion (Acres)	45
Clear Zone Protection (Acres)	130
Residential and Commercial Units	51
Total Estimated Cost	$2,494,000
Operational Area Improvements	
Strengthen runways to accommodate 60,000 pound gross weight aircraft	
Runway 4/22—4 inch Overlay: 100 feet x 5,800 feet	
Runway 14/32—4 inch Overlay: 100 feet x 4,600 feet	
Construct parallel taxiways	
Taxiway 4/22: 40 feet x 5,500 feet	
Taxiway 14/32: 40 feet x 3,100 feet	
Construct additional paved aircraft parking apron: 19,300 square yards	
Install lighting and visual aids	
MIRL Runway 14/32	
HIRL Runway 4/22	
Taxiway Exit Lights	
VASI-4 Runway 4/22, 22 End	
REILS	
Mark and light obstructions	
Relocate hangars	
Construct air traffic control tower	
Install precision instrument landing system on approach to Runway 22 22	
Total Estimated Cost	$1,415,500
Terminal Area Improvements	
Construct administration/terminal building: 7,100 square feet	
Construct auto parking facilities: 12,900 square yards	
Total Estimated Cost	$ 590,900
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 12,700 square yards	
Total Estimated Cost	$ 957,600
Ground Access Facilities	
Realign Green Bay Road	$ 200,000
Utility Services	
Airport is within existing utility service area	
Total Estimated Capital Investment	$8,908,000

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 276

SITE REQUIREMENT RECOMMENDATIONS FOR THE SYLVANIA AIRPORT UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification . . .	Existing—Less Than Basic Utility I Proposed—Basic Utility II
Aviation Demand	
Annual Operations . . .	1971 Inventory—12,000 1995 Forecast—166,000
Based Aircraft . . .	1971 Inventory—38 1995 Forecast—206
Runway System Capacity (PANCAP). . .	Existing—172,000 Proposed—319,000
IFR Capability . . .	None (VFR)
Land Requirements	
Acquire existing privately-owned airport (34 acres) and improvements	
Total Estimated Cost	$ 299,000
Site Expansion (Acres) . . .	78
Clear Zone Protection (Acres) . . .	30
Total Estimated Cost	$ 175,500
Operational Area Improvements	
Construct new north/south secondary runway: 60 feet x 2,560 feet	
Extend and widen existing runway: 60 feet x 3,200 feet	
Construct additional paved aircraft parking apron: 28,800 square yards	
Install navigation aids	
VASI-2 East/West Runway, West End	
MIRL on Both Runways: 5,760 feet	
REILS Both Runways, Both Ends	
Total Estimated Cost	$ 858,600
Terminal Area Improvements	
Construct new administration/terminal building: 7,250 square feet	
Construct new auto parking and service road: 13,260 square yards	
Total Estimated Cost	$ 533,800
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 17,300 square yards	
Total Estimated Cost	$1,304,700
Ground Access Facilities	
No additional facilities required	
Utility Services	
Airport is beyond proposed service areas. Continued use of onsite facilities	
Total Estimated Cost	$ 18,000
Total Estimated Capital Investment	$3,189,600

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 277

SITE REQUIREMENT RECOMMENDATIONS FOR TIMMERMAN FIELD UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing—General Utility Proposed—General Utility
Aviation Demand	
Annual Operations	1971 Inventory—173,900 1995 Forecast—363,800
Based Aircraft	1971 Inventory—180 1995 Forecast—452
Runway System Capacity (PANCAP)	Existing—302,000 Proposed—501,700
IFR Capability	Nonprecision Instrument Approach
FAA Designation	Reliever Airport to General Mitchell Field
Land Requirements	
Site Expansion (Acres)	0
Clear Zone Protection (Acres)	33
Residential and Commercial Units	50
Total Estimated Cost	$1,540,000
Operational Area Improvements	
Pave existing turf Runway 15R/33L: 75 feet x 3,150 feet	
Pave existing turf Runway 4R/22L: 75 feet x 3,000 feet	
Widen existing Runway 15L/33R: 25 feet x 4,100 feet	
Widen existing Runway 4L/22R: 25 feet x 3,200 feet	
Install lighting and visual aids	
VASI-2 Runway 15L/33R, Both Ends	
Runway 4L/22R, Both Ends	
REILS Runway 15L/33R, 33R End	
Runway 4L/22R, Both Ends	
Construct additional paved aircraft parking apron: 55,190 square yards	
Total Estimated Cost	$1,297,700
Terminal Area Improvements	
Expand administration/terminal building: 10,700 square feet	
Expand auto parking and service roads: 13,800 square yards	
Total Estimated Cost	$ 760,500
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 28,500 square yards	
Total Estimated Cost	$2,148,900
Ground Access Facilities	
No additional facilities required	
Utility Services	
Airport is within present utility service area	
Total Estimated Capital Investment	$5,747,100

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 278

SITE REQUIREMENT RECOMMENDATIONS FOR THE WAUKESHA COUNTY AIRPORT UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing–General Utility Proposed–Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory–117,400 1995 Forecast–244,500
Based Aircraft	1971 Inventory–167 1995 Forecast–301
Runway System Capacity (PANCAP)	Existing–284,000 Proposed–253,300
IFR Capability	Precision Instrument Approach
FAA Designation	Reliever Airport to General Mitchell Field
Land Requirements	
Site Expansion (Acres)	17
Clear Zone Protection (Acres)	120
Residential Units	12
Commercial Units	8
Total Estimated Cost	$1,531,000
Operational Area Improvements	
Extend Runway 10/28 to 5,600 feet	
Runway: 100 feet x 1,600 feet	
Taxiway: 40 feet x 1,800 feet	
Strengthen runways and taxiways to accommodate 60,000 pounds gross weight aircraft	
Runway 10/28–3 1/2 inch Overlay: 100 feet x 4,000 feet	
Runway 18L/36R–2 1/2 inch Overlay: 75 feet x 3,400 feet	
Taxiway 10/28–3 1/2 inch Overlay: 40 feet x 4,000 feet	
Taxiway 18L/36R–2 inch Overlay: 40 feet x 3,900 feet	
Construct additional paved aircraft parking aprons: 51,200 square yards	
Install navigation aids	
MIRL Runway 18/36: 3,400 feet	
HIRL Runway 10/28: 5,600 feet	
Taxiway Exit Lights–Both Runways	
VASI-4 Runway 10/28, 10 End	
REILS Runway 10/28, 28 End	
Runway 18/36, 36 End	
Runway 10/28, Relocate 10 End	
Install precision instrument landing system approach to Runway 10	
Total Estimated Cost	$1,544,000
Terminal Area Improvements	
Expand terminal building: 5,500 square feet	
Expand auto parking and service roads: 4,300 square yards	
Total Estimated Cost	$ 432,000
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 16,350 square yards	
Total Estimated Cost	$1,232,800
Ground Access Facilities	
Realign CTH TJ to permit runway extension	
Total Estimated Cost	$ 187,000
Utility Services	
Airport within proposed service area–cost of connections considered nominal	
Total Estimated Capital Investment	$4,926,800

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 279

SITE REQUIREMENT RECOMMENDATIONS FOR THE WEST BEND MUNICIPAL AIRPORT UNDER THE FINAL REGIONAL AIRPORT SYSTEM PLAN

General Conditions	
Airport Classification	Existing–General Utility Proposed–Basic Transport
Aviation Demand	
Annual Operations	1971 Inventory–71,200 1995 Forecast–234,400
Based Aircraft	1971 Inventory–92 1995 Forecast–289
Runway System Capacity (PANCAP)	Existing–175,000 Proposed–253,300
IFR Capability	Precision Instrument Approach
Land Requirements	
Site Expansion (Acres)	67
Clear Zone Protection (Acres)	148
Residential Units	5
Total Estimated Cost	$ 542,100
Operational Area Improvements	
Extend Runway 6/24 to 5,500 feet	
Runway: 100 feet x 1,600 feet	
Taxiway: 40 feet x 1,800 feet	
Relocate or encase oil pipe line	
Remove obstruction, 24 End	
Extend Taxiway 13/31	
13 End: 40 feet x 600 feet	
31 End: 40 feet x 900 feet	
Widen runways and taxiways	
Runway 6/24: 25 feet x 3,900 feet	
Runway 13/31: 25 feet x 4,500 feet	
Taxiway 6/24: 10 feet x 2,900 feet	
Taxiway 13/31: 10 feet x 3,850 feet	
Strengthen runways and taxiways to accommodate 60,000 pounds gross weight aircraft	
Runway 6/24–3 3/4 inch Overlay: 75 feet x 3,900 feet	
Runway 13/31–2 inch Overlay: 75 feet x 4,500 feet	
Runway 6/24–3 3/4 Inch Overlay: 30 feet x 2,900 feet	
Runway 13/31–2 inch Overlay: 30 feet x 3,850 feet	
Construct additional paved aircraft parking apron: 55,900 square yards	
Install navigation aids	
MIRL Runway 13/31: 4,500 feet	
HIRL Runway 6/24: 5,500 feet	
Taxiway Exit Lights–Both Runways	
VASI-4 Runway 6/24, 24 End	
REILS Runway 6/24, Both Ends	
Relocate REILS Runway 13/31, Both Ends	
Construct air traffic control tower	
Install precision instrument landing system approach to Runway 24	
Total Estimated Cost	$2,197,600
Terminal Area Improvements	
Construct new administration/terminal building: 8,400 square feet	
Expand auto parking and service roads: 11,400 square yards	
Total Estimated Cost	$ 681,900
Hangar Area Improvements	
Expand aircraft hangar storage and service area: 23,190 square yards	
Total Estimated Cost	$1,748,500
Ground Access Facilities	
Realign STH 33 to permit runway extension	
Total Estimated Cost	$ 519,000
Utility Services	
Extend utility services from proposed City of West Bend sewer service area	
Total Estimated Cost	$ 29,000
Total Estimated Capital Investment	$5,718,100

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table 280

COST ESTIMATE SUMMARY FOR THE FINAL RECOMMENDED AIRPORT SYSTEM PLAN FOR THE SOUTHEASTERN WISCONSIN REGION

Airport	Land Requirements		Operational Area Improvement Costs	Terminal Area Improvements		Auto Parking and Onsite Road Improvements		Hangar Improvements		Off-Site Surface Transportation Costs	Utility Service Costs	Total Estimated Capital Investment
	Acres	Cost		Square Feet	Cost	Number of Stalls	Cost	Square Yards	Cost			
Kenosha Municipal . . .	500	$ 1,782,000	$ 4,589,700	8,500	$ 637,500	390	$ 60,900	24,300	$ 1,832,200	--	--	$ 8,902,300
General Mitchell Field .	70	20,060,000	22,800,000	--	43,090,000	4,800	16,690,000	14,800	1,215,600	--	--	85,855,600
Timmerman Field. . . .	33	1,540,000	1,297,700	10,700	695,500	400	65,000	28,500	2,148,900	--	--	5,747,100
Ozaukee County	320	434,000	1,632,200	8,500	552,500	450	73,100	27,600	2,081,000	--	29,000	4,801,800
Burlington Municipal . .	64	200,000	752,000	6,000	390,000	330	54,000	17,000	1,277,000	75,000	--	2,748,000
Racine Commercial . . .	665	5,744,000	1,415,500	7,100	532,500	375	58,400	12,700	957,600	200,000	--	8,908,000
Sylvania	142	474,500	858,600	7,250	471,300	385	62,500	17,300	1,304,700	--	18,000	3,189,600
East Troy Municipal . .	120	194,000	925,700	7,700	500,000	380	62,000	19,700	1,486,000	--	--	3,167,700
Gruenwald.	306	449,800	1,591,900	7,500	487,500	400	64,700	24,400	1,839,800	--	18,000	4,451,700
Hartford Municipal . . .	95	333,500	1,006,300	8,800	572,000	440	71,500	27,700	2,088,600	--	29,000	4,100,900
West Bend Municipal . .	215	542,100	2,197,600	8,400	630,000	330	51,900	23,190	1,748,500	519,000	29,000	5,718,100
Waukesha County. . . .	137	1,531,000	1,544,000	5,500	412,500	125	19,500	16,350	1,232,800	187,000	--	4,926,800
Total	--	$15,284,900	$40,611,200	--	$48,971,300	--	$17,333,500	--	$19,212,700	$981,000	$123,000	$142,517,600

Source: R. Dixon Speas Associates, Inc., and SEWRPC.

Appendix A

TECHNICAL COORDINATING AND ADVISORY COMMITTEE ON REGIONAL AIRPORT SYSTEM PLANNING

William D. Rogan . . . . County Agri-Business Agent, Waukesha County
Chairman

Kurt W. Bauer . . . . Executive Director, SEWRPC
Secretary

John H. Batten . . . . President, Twin Disc, Inc., Racine; Member, National Business Aircraft Association

Robert R. Brackett . . . . Manager, Kenosha Municipal Airport, Member, Wisconsin Aviation Trades Association

Donald M. Cammack . . . . Chief Planning Engineer, Division of Aeronautics, Wisconsin Department of Transportation

Arne L. Gausmann . . . . Director, Bureau of Systems Planning, Division of Planning, Wisconsin Department of Transportation

Bill R. Hippenmeyer . . . . Director of Planning, City of Oak Creek

Paul C. Leonard . . . . Manager, Central Operations Regional Office, American Air Transport Association, Rosemont, Illinois

James F. Popp . . . . Chief of Planning, U. S. Department of Transportation, Federal Aviation Administration, Great Lakes Region, Chicago

Joseph F. Sanek . . . . Airport Director, Milwaukee County

Earl Stier . . . . Manager, West Bend Airport

Henry B. Wildschut . . . . County Highway Commissioner and Director of Public Works, Milwaukee County

Lt. Col. Fred R. Wylie . . . . Civil Engineer, 128th Air Refueling Group, Wisconsin Air National Guard, Milwaukee

The following individuals also participated actively in the work of the Technical Coordinating and Advisory Committee: John R. Brown, Corporation Counsel, Racine Commercial Airport Corporation, Racine-Horlick Airport and James E. Foley, Airport Engineer, Airport Planning and Construction Division, Milwaukee County Department of Public Works.

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APPENDICES

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Appendix B

COMPOSITION OF AD HOC REVIEW PANEL ON REGIONAL AIRPORT SYSTEM PLAN

George C. Berteau Panel Chairman	Chairman, Southeastern Wisconsin Regional Planning Commission
Robert W. Branan	Transportation Director, Milwaukee County Expressway and Transportation Commission
Leonard S. Burns	Chairman, Hartford Airport Committee
Emil Cirillo, Jr.	Supervisor, Town of Pewaukee
Vito Colano	Supervisor, Town of Spring Prairie
Daniel Cupertino, Jr.	Supervisor, Milwaukee County
Willard R. Evans	Waukesha County Board Supervisor
James E. Foley	Airport Engineer, Milwaukee County Department of Public Works
Alfred Hemauer	Clerk, City of West Bend
Donald Hoeppner	Civil Engineer, City of Milwaukee
Gerhardt Immega	Mayor, City of Elkhorn
Gerald G. Keeling	Assistant Airport Director, General Mitchell Field
Lawrence P. Kelly	Mayor, City of Cudahy
Robert F. Kolstad	Director of Community Development, City of Kenosha
Albert Koser	Sylvania Airport, Inc., Sturtevant
Rick W. Kuckkahn	City Planner, City of Waukesha
Thomas P. Leisle	Mayor, City of Mequon
Roland L. Merz	Waukesha County Board Supervisor
Andrew R. Miller	Supervisor, Airport Planning and Special Study Units, Division of Planning, Wisconsin Department of Transportation
Herbert M. Nettesheim	Chairman, Town of Pewaukee
Glen Orcutt	Federal Aviation Administration
Nick T. Paulos	Director of Public Works, Village of Greendale
Hazel K. Roesselet	Commissioner, Town of Pewaukee Planning and Zoning Commission
Carl G. Rosenmerkel	Waukesha County Board Supervisor
Raymond A. Russell	President, Russell Aviation, Inc.; Manager, Gruenwald Field, Elkhorn
R. N. Salcedo	Environmental Scientist, Department of City Development, Milwaukee
Karl R. Schaarschmidt	Aero Park Airport, Menomonee Falls
Ralph Schoenhaar	Mayor, City of West Bend
Henry A. Scholz	City Administrator, City of St. Francis
H. F. Schweikart	Planner, Department of City Development, Milwaukee
Donald R. Stockdale	Federal Aviation Administration
F. E. Wolf	Administrator, Division of Aeronautics, Wisconsin Department of Transportation
Bernard C. Ziegler	Chairman, West Bend Airport Board

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Appendix C

DETAILED CHARACTERISTICS OF GENERAL AVIATION AIRPORTS IN THE REGION: 1971

Table C-1

DETAILED CHARACTERISTICS OF GENERAL AVIATION AIRPORTS IN KENOSHA COUNTY

Detailed Characteristics	Public Use Airport: Kenosha Municipal (City of Kenosha)		Public Use Airport: Vincent (Town of Randall)
Airport			
Classification	GU		BU-C
Owner	City of Kenosha		John Vincent
Attendance			
Month	All Months		Unattended
Day	All Days		Unattended
Hours	8 a.m. - 8 p.m.		Unattended
Airport Acreage	252		N/A[e]
Navaids[a]			
Wind Cone	x		x
Segmented Circle	--		--
Airport Beacon Light	x		--
Omnidirectional Range Beacon (VOR)	x		--
Remote VOR	--		--
Nondirectional Radio Beacon	x		--
Runway End Identification Lights	--		--
Control Tower	--		--
Facilities			
Pilot and Passenger Terminal	Fixed Base Operator		N/A[e]
Auto Parking (Spaces)	60		N/A[e]
Hangared Spaces	41		6
Paved Tie-downs	31		0
Turf Tie-downs	29		N/A[e]
Paved Apron (Square Yards)	19,000		0
Runway	1st Runway	2nd Runway	
Alignment	06/24[b]	14/32[b]	09/27[b]
Length (Feet)	3,300	3,600	2,550
Width (Feet)	75	75	150
Surface	Asphalt	Asphalt	Turf
Lighting	Medium Intensity	Medium Intensity	Unlighted
Approach Surface	25/20[c]	33/50[c]	--
Strength (Pounds)			
Single Wheel Load	31,000	31,000	--
Dual Wheel Load	50,000	50,000	--
Dual Tandem Wheel Load	65,000	65,000	--
Capacity (Aircraft Operations)			
Peak Hour	95		86
Practical Annual Capacity	181,000		91,000
Fixed Base Operations	1st Runway	2nd Runway	
Operator	Kenosha Aviation Service	Kenosha Airways, Inc.	Yes
Services			
Aircraft Storage	--	--	--
General Services	x	--	--
Rental	--	x	--
Flight Instruction	--	x	x
Charter	--	x	x
Air Taxi	--	--	x
Agricultural Activity	--	--	--
Maintenance	x	--	--
Fuel	x	--	--
Aeronautical Activity			
Based Aircraft			
Single Engine	71		8
Multiengine	11		2
Other	0		0
Total	82[d]		10[f]
Annual Operations			
Local	40,000		N/A[e]
Itinerant	23,000		1,600
Military	1,500		2,400
Total	64,500		4,000
Comments	Frequent use by local and national corporations for passengers and freight		

Table C-1 (continued)

Detailed Characteristics	Private Use Airport			
	Camp Lake (Town of Salem)	Olson (Town of Brighton)	Westosha (Town of Randall)	
Airport				
Classification	BU-C	BU-C	BU-B	
Owner	Leon Sommers	Rudolph Olson	Richard Davis	
Attendance				
Month	Summer	Unattended	All Months	
Day	Saturday-Sunday	Unattended	All Days	
Hours	9 a.m. - 7 p.m.	Unattended	Daytime	
Airport Acreage	N/A[e]	N/A[e]	80	
Navaids[a]				
Wind Cone	x	--	--	
Segmented Circle	--	--	--	
Airport Beacon Light	--	--	--	
Omnidirectional Range Beacon (VOR)	--	--	--	
Remote VOR	--	--	--	
Nondirectional Radio Beacon	--	--	--	
Runway End Identification Lights	--	--	--	
Control Tower	--	--	--	
Facilities				
Pilot and Passenger Terminal	--	--	--	
Auto Parking (Spaces)	--	--	--	
Hangared Spaces	--	--	--	
Paved Tie-downs	--	--	--	
Turf Tie-downs	--	--	--	
Paved Apron (Square Yards)	--	--	--	
Runway			1st Runway	2nd Runway
Alignment	North/South	09/27[b]	East/West	North/South
Length (Feet)	2,200	1,500	2,600	2,000
Width (Feet)	100	100	80	80
Surface	Turf	Turf	Turf	Turf
Lighting	Unlighted	Unlighted	Unlighted	Unlighted
Approach Surface	--	--	--	--
Strength (Pounds)				
Single Wheel Load	--	--	--	--
Dual Wheel Load	--	--	--	--
Dual Tandem Wheel Load	--	--	--	--
Capacity (Aircraft Operations)				
Peak Hour	N/A[e]	N/A[e]	N/A[e]	
Practical Annual Capacity	N/A[e]	N/A[e]	N/A[e]	
Fixed Base Operations				
Operator	None	None	Richard Davis	
Services				
Aircraft Storage	--	--	x	
General Services	--	--	--	
Rental	--	--	--	
Flight Instruction	--	--	--	
Charter	--	--	--	
Air Taxi	--	--	--	
Agricultural Activity	--	--	--	
Maintenance	--	--	--	
Fuel	--	--	x	
Aeronautical Activity				
Based Aircraft				
Single Engine	3	0	21	
Multiengine	0	0	0	
Other	0	0	3	
Total	3[f]	0[f]	24[d]	
Annual Operations				
Local	840	0	400	
Itinerant	360	100	100	
Military	0	0	0	
Total	1,200	100	500	

[a] *Navaids are air navigational aids available on or near an airport which can be used for landing aids.*

[b] *The runway alignment is shown as the magnetic heading to the nearest 10 degrees.*

[c] *The approach surface is the obstruction free runway approach slope clearance plane. Noting the runway alignment and runway approach surface figures for the Kenosha Municipal Airport, for example, runway 06 presently has an obstacle free approach equivalent to 25:1. Similarly, runway 24 has an obstacle free approach equivalent to 20:1.*

[d] *The number of based aircraft is based on the R. Dixon Speas Associates, Inc. Airport Inventory Survey.*

[e] *Data are not available.*

[f] *The number of based aircraft is based on Federal Aviation Administration Airport Master Record Form 5010-1.*

Source: U. S. Department of Transportation, Federal Aviation Administration; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table C-2

DETAILED CHARACTERISTICS OF GENERAL AVIATION AIRPORTS IN MILWAUKEE COUNTY

Detailed Characteristics	Public Use Airport		
	Hales Corners (Village of Hales Corners, City of Franklin)	Rainbow (City of Franklin)	
Airport			
Classification	BU-B	BU-A	
Owner	L. Falk	Edward Rediske	
Attendance			
Month	All Months	All Months	
Day	All Days	All Days	
Hours	8 a.m. - dark	8 a.m. - dark	
Airport Acreage	39	71	
Navaids[a]			
Wind Cone	x	x	
Segmented Circle	--	--	
Airport Beacon Light	--	--	
Omnidirectional Range Beacon (VOR)	--	--	
Remote VOR	--	--	
Nondirectional Radio Beacon	--	--	
Runway End Identification Lights	--	--	
Control Tower	--	--	
Facilities			
Pilot and Passenger Terminal	Fixed Base Operator	Fixed Base Operator	
Auto Parking (Spaces)	N/A[b]	N/A[b]	
Hangared Spaces	17	9	
Paved Tie-downs	0	1	
Turf Tie-downs	40	21	
Paved Apron (Square Yards)	0	170	
Runway		1st Runway	2nd Runway
Alignment	09/27[c]	08/26[c]	18/36[c]
Length (Feet)	2,100	2,350	2,150
Width (Feet)	100	40	50
Surface	Turf	Asphalt	Gravel
Lighting	Low Intensity	Low Intensity	Low Intensity
Approach Surface	--	--	--
Strength (Pounds)			
Single Wheel Load	--	--	--
Dual Wheel Load	--	--	--
Dual Tandem Wheel Load	--	--	--
Capacity (Aircraft Operations)	--	--	--
Peak Hour	85	90	
Practical Annual Capacity	87,000	153,000	
Fixed Base Operations			
Operator	Aero Enterprises	Rainbow Airport	
Services			
Aircraft Storage	--	--	
General Services	--	--	
Rental	--	--	
Flight Instruction	x	x	
Charter	x	--	
Air Taxi	--	--	
Agricultural Activity	--	--	
Maintenance	x	x	
Fuel	--	x	
Aeronautical Activity			
Based Aircraft			
Single Engine	39	23	
Multiengine	1	0	
Other	0	0	
Total	40[d]	23[d]	
Annual Operations			
Local	17,600	13,000	
Itinerant	7,600	7,000	
Military	0	0	
Total	25,200	20,000	
Comments	Airport used by local industry	Popular parachute jumping location. Industrial park nearby. This airport has been purchased by Milwaukee County as part of the county park system in accordance with recommendations contained in the Root River Watershed planning report.	

Table C-2 (continued)

Detailed Characteristics	Public Use Airport: Timmerman Field (City of Milwaukee)
Airport	
Classification	GU
Owner	Milwaukee County
Attendance	
Month	All Months
Day	All Days
Hours	Day
Airport Acreage	497
Navaids[a]	
Wind Cone	x
Segmented Circle	--
Airport Beacon Light	x
Omnidirectional Range Beacon (VOR)	x
Remote VOR	x
Nondirectional Radio Beacon	--
Runway End Identification Lights	x
Control Tower	x
Facilities	
Pilot and Passenger Terminal	2,160 square yards
Auto Parking (Spaces)	250
Hangared Spaces	86
Paved Tie-downs	65
Turf Tie-downs	125
Paved Apron (Square Yards)	23,300

Runway	1st Runway	2nd Runway	3rd Runway	4th Runway	5th Runway
Alignment	04L/22R[c]	04R/22L[c]	09/27[c]	15L/33R[c]	15R/33L[c]
Length (Feet)	3,200	2,980	1,940	4,017	3,230
Width (Feet)	75	275	75	75	240
Surface	Asphalt	Turf	Turf	Asphalt	Turf
Lighting	Medium Intensity	Unlighted	Unlighted	Medium Intensity	Unlighted
Approach Surface	19/28[e]	10/22[e]	18/20[e]	42/25[e]	43/14[e]
Strength (Pounds)					
Single Wheel Load	16,000	--	--	16,000	--
Dual Wheel Load	22,000	--	--	22,000	--
Dual Tandem Wheel Load	--	--	--	--	--
Capacity (Aircraft Operations)					
Peak Hour	151				
Practical Annual Capacity	302,000				

Fixed Base Operations		
Operator	Gran-Aire, Inc.	Univair, Inc.
Services		
Aircraft Storage	x	--
General Services	x	--
Rental	x	--
Flight Instruction	x	--
Charter	x	x
Air Taxi	x	--
Agricultural Activity	--	--
Maintenance	x	--
Fuel	x	--

Aeronautical Activity	
Based Aircraft	
Single Engine	135
Multiengine	25
Other	0
Total	160[d]
Annual Operations	
Local	81,500
Itinerant	62,100
Military	300
Total	143,900
Comments	Jet traffic ordinance in effect due to proximity of residential development

[a] Navaids are air navigational aids available on or near an airport which can be used for landing aids.

[b] Data are not available.

[c] The runway alignment is shown as the magnetic heading to the nearest 10 degrees.

[d] The number of based aircraft is based on the R. Dixon Speas Associates, Inc. Airport Inventory Survey.

[e] The approach surface is the obstruction free runway approach slope clearance plane. Noting the runway alignment and runway approach surface figures for Timmerman Field, for example, runway 04L presently has an obstacle free approach equivalent to 19:1. Similarly, runway 22R has an obstacle free approach equivalent to 28:1.

Source: U. S. Department of Transportation, Federal Aviation Administration; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table C-3

DETAILED CHARACTERISTICS OF GENERAL AVIATION AIRPORTS IN OZAUKEE COUNTY

Detailed Characteristics	Public Use Airport: Ozaukee (Town of Port Washington)		Private Use Airport: Cedarbird Field (Town of Cedarburg)	Private Use Airport: Grob (Town of Cedarburg)		
Airport						
Classification	BU-C		BU-C	BU-C		
Owner	Ray Karrels		Gernald Ohser	Grob, Inc.		
Attendance						
Month	Unattended		Unattended	Unattended		
Day	Unattended		Unattended	Unattended		
Hours	Unattended		Unattended	Unattended		
Airport Acreage	70		N/A[b]	115		
Navaids[a]						
Wind Cone	x		x	--		
Segmented Circle	--		--	--		
Airport Beacon Light	--		--	--		
Omnidirectional Range Beacon (VOR)	--		--	--		
Remote VOR	--		--	--		
Nondirectional Radio Beacon	--		--	--		
Runway End Identification Lights	--		--	--		
Control Tower	--		--	--		
Facilities						
Pilot and Passenger Terminal	N/A[b]		--	--		
Auto Parking (Spaces)	N/A[b]		--	--		
Hangared Spaces	0		--	--		
Paved Tie-downs	0		--	--		
Turf Tie-downs	4		--	--		
Paved Apron (Square Yards)	0		--	--		
Runway	1st Runway	2nd Runway		1st Runway	2nd Runway	3rd Runway
Alignment	18/36[c]	09/27[c]	Northeast/Southwest	05/23[c]	13/31[c]	18/36[c]
Length (Feet)	3,000	1,800	1,900	2,600	1,500	2,500
Width (Feet)	200	200	75	200	200	200
Surface	Turf	Turf	Turf	Turf	Turf	Turf
Lighting	Unlighted	Unlighted	Unlighted	Unlighted	Unlighted	Unlighted
Approach Surface	--	--	--	17/1[f]	10/33[f]	0/0[f]
Strength (Pounds)						
Single Wheel Load	--	--	--	--	--	--
Dual Wheel Load	--	--	--	--	--	--
Dual Tandem Wheel Load	--	--	--	--	--	--
Capacity (Aircraft Operations)						
Peak Hour	86		N/A[b]	N/A[b]		
Practical Annual Capacity	91,000		N/A[b]	N/A[b]		
Fixed Base Operations						
Operator	None		None	None		
Services						
Aircraft Storage	--		--	--		
General Services	--		--	--		
Rental	--		--	--		
Flight Instruction	--		--	--		
Charter	--		--	--		
Air Taxi	--		--	--		
Agricultural Activity	--		--	--		
Maintenance	--		--	--		
Fuel	--		--	--		
Aeronautical Activity						
Based Aircraft						
Single Engine	3		2	10		
Multiengine	0		0	0		
Other	0		0	0		
Total	3[d]		2[e]	10[e]		
Annual Operations						
Local	2,400		560	2,300		
Itinerant	1,100		240	900		
Military	0		--	--		
Total	3,500		800	3,200		

[a] *Navaids are air navigational aids available on or near an airport which can be used for landing aids.*

[b] *Data are not available.*

[c] *The runway alignment is shown as the magnetic heading to the nearest 10 degrees.*

[d] *The number of based aircraft is based on the R. Dixon Speas Associates, Inc. Airport Inventory Survey.*

[e] *The number of based aircraft is based on Federal Aviation Administration Airport Master Record Form 5010-1.*

[f] *The approach surface is the obstruction free runway approach slope clearance plane. Noting the runway alignment and runway approach surface figures for the Grob Airport, for example, runway 05 presently has an obstacle free approach equivalent to 17:1. Similarly, runway 23 has an obstacle free approach equivalent to 1:1.*

Source: U. S. Department of Transportation, Federal Aviation Administration; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table C-4

DETAILED CHARACTERISTICS OF GENERAL AVIATION AIRPORTS IN RACINE COUNTY

Detailed Characteristics	Public Use Airport			
	Burlington Municipal (City of Burlington)		Fox River (Town of Rochester)	Hunt Field (Town of Norway)
Airport				
Classification	BU-A		BU-B	BU-C
Owner	City of Burlington		Jerry Mehlhaff	Stanley Hunt and Son
Attendance				
Month	All Months		All Months	Part-time
Day	All Days		All Days	Part-time
Hours	Daytime		Dawn to Dark	
Airport Acreage	223		212	N/A[e]
Navaids[a]				
Wind Cone	x		x	x
Segmented Circle	--		--	--
Airport Beacon Light	--		--	--
Omnidirectional Range Beacon (VOR)	x		--	--
Remote VOR	--		x	--
Nondirectional Radio Beacon	--		--	--
Runway End Identification Lights	--		--	--
Control Tower	--		--	--
Facilities				
Pilot and Passenger Terminal	125 Square Yards		Fixed Base Operator	N/A[e]
Auto Parking (Spaces)	50		N/A[e]	N/A[e]
Hangared Spaces	7		2	0
Paved Tie-downs	5		0	N/A[e]
Turf Tie-downs	30		12	N/A[e]
Paved Apron (Square Yards)	4,250		0	0
Runway	1st Runway	2nd Runway		
Alignment	01/19[b]	11/29[b]	01/19[b]	North/South
Length (Feet)	2,600	3,600	2,600	1,800
Width (Feet)	250	75	150	75
Surface	Turf	Asphalt	Turf	Turf
Lighting	Unlighted	Low Intensity	Unlighted	Unlighted
Approach Surface	20/40[c]	15/20[c]	--	--
Strength (Pounds)				
Single Wheel Load	--	--	--	--
Dual Wheel Load	--	--	--	--
Dual Tandem Wheel Load	--	--	--	--
Capacity (Aircraft Operations)				
Peak Hour	95		87	86
Practical Annual Capacity	133,000		87,000	84,000
Fixed Base Operations				
Operator	Burlington Airways		Jerry Mehlhaff	None
Services				
Aircraft Storage	x		--	--
General Services	x		x	--
Rental	--		x	--
Flight Instruction	x		x	--
Charter	x		x	--
Air Taxi	--		--	--
Agricultural Activity	--		--	--
Maintenance	--		x	x
Fuel	x		--	--
Aeronautical Activity				
Based Aircraft				
Single Engine	30		8	0
Multiengine	4		0	0
Other	4		0	0
Total	38[d]		8[d]	0[d]
Annual Operations				
Local	4,000		1,300	560
Itinerant	4,000		1,900	240
Military	0		0	0
Total	8,000		3,200	800
Comments	Some corporate use apparent		Owner plans considerable expansion	--

Table C-4 (continued)

Detailed Characteristics	Public Use Airport: Racine Commercial (Town of Caledonia)		
Airport			
Classification	BT		
Owner	Racine Commercial Airport Corporation		
Attendance			
Month	All Months		
Day	All Days		
Hours	Daytime		
Airport Acreage	350		
Navaids[a]			
Wind Cone	x		
Segmented Circle	--		
Airport Beacon Light	x		
Omnidirectional Range Beacon (VOR)	x		
Remote VOR	--		
Nondirectional Radio Beacon	x		
Runway End Identification Lights	--		
Control Tower	--		
Facilities			
Pilot and Passenger Terminal	Fixed Base Operator		
Auto Parking (Spaces)	N/A[e]		
Hangared Spaces	34		
Paved Tie-downs	2		
Turf Tie-downs	15		
Paved Apron (Square Yards)	10,000		
Runway	1st Runway	2nd Runway	3rd Runway
Alignment	09/27[b]	04/22[b]	14/32[b]
Length (Feet)	2,446	5,825	4,890
Width (Feet)	50	100	100
Surface	Asphalt	Asphalt	Asphalt
Lighting	Medium Intensity	Medium Intensity	Medium Intensity
Approach Surface	25/50[c]	20/25[c]	13/45[c]
Strength (Pounds)			
Single Wheel Load	48,000	48,000	48,000
Dual Wheel Load	69,000	69,000	69,000
Dual Tandem Wheel Load	--	--	--
Capacity (Aircraft Operations)			
Peak Hour	89		
Practical Annual Capacity	145,000		
Fixed Base Operations			
Operator	Racine Commercial Airport Corporation		
Services			
Aircraft Storage	--		
General Services	--		
Rental	--		
Flight Instruction	--		
Charter	--		
Air Taxi	--		
Agricultural Activity	--		
Maintenance	x		
Fuel	x		
Aeronautical Activity			
Based Aircraft			
Single Engine	20		
Multiengine	14		
Other	0		
Total	34[d]		
Annual Operations			
Local	24,500		
Itinerant	10,500		
Military	0		
Total	35,000		
Comments	--		

Table C-4 (continued)

Detailed Characteristics	Public Use Airport		
	Sylvania (Town of Yorkville)	Valhalla (Town of Raymond)	
Airport			
Classification	BU-A	BU-B	
Owner	Albert Koser	Francis Moran	
Attendance			
Month	All Months	All Months	
Day	All Days	All Days	
Hours	Daytime	6 a.m. to 10 p.m.	
Airport Acreage	36	80	
Navaids[a]			
Wind Cone	x	x	
Segmented Circle	--	x	
Airport Beacon Light	--	--	
Omnidirectional Range Beacon (VOR)	--	--	
Remote VOR	--	--	
Nondirectional Radio Beacon	--	--	
Runway End Identification Lights	--	--	
Control Tower	--	--	
Facilities			
Pilot and Passenger Terminal	Fixed Base Operator	Fixed Base Operator	
Auto Parking (Spaces)	N/A[e]	N/A[e]	
Hangared Spaces	8	2	
Paved Tie-downs	6	0	
Turf Tie-downs	3	3	
Paved Apron (Square Yards)	0	0	
Runway		1st Runway	2nd Runway
Alignment	08/26[b]	East/West	North/South
Length (Feet)	2,250	2,600	1,320
Width (Feet)	35	200	200
Surface	Asphalt	Turf	Turf
Lighting	Low Intensity	Low Intensity	Low Intensity
Approach Surface	12/11[c]	--	--
Strength (Pounds)			
Single Wheel Load	--	--	--
Dual Wheel Load	--	--	--
Dual Tandem Wheel Load	--	--	--
Capacity			
Peak Hour (Aircraft Operations)	90	87	
Practical Annual Capacity	172,000	90,000	
Fixed Base Operations			
Operator	Sylvania Airport, Inc.	North Cape Avionics	
Services			
Aircraft Storage	--	--	
General Services	--	--	
Rental	--	--	
Flight Instruction	x	--	
Charter	--	--	
Air Taxi	--	--	
Agricultural Activity	--	--	
Maintenance	x	x	
Fuel	x	--	
Aeronautical Activity			
Based Aircraft			
Single Engine	37	2	
Multiengine	1	0	
Other	0	0	
Total	38[d]	2[d]	
Annual Operations			
Local	8,400	160	
Itinerant	3,600	40	
Military	0	0	
Total	12,000	200	
Comments	Airport used by local industry	Airport used by local industry	

Table C-4 (continued)

Detailed Characteristics	Private Use Airport: Aero Estates (Town of Raymond)	Hill Valley (Town of Waterford)	Horner Farms (Town of Norway)	
Airport				
Classification	BU-C	BU-C	BU-B	
Owner	C. J. Carriveau	William Dingel	Everett Horner	
Attendance				
Month	All Months	All Months	All Months	
Day	Saturday and Sunday	Irregular	All Days except Sunday	
Hours	9 a.m. - 6 p.m.	Daytime	Daytime	
Airport Acreage	57	126	N/A[e]	
Navaids[a]				
Wind Cone	x	x	x	
Segmented Circle	x	--	--	
Airport Beacon Light	--	--	x	
Omnidirectional Range Beacon (VOR)	--	--	--	
Remote VOR	--	--	--	
Nondirectional Radio Beacon	--	--	--	
Runway End Identification Lights	--	--	--	
Control Tower	--	--	--	
Facilities				
Pilot and Passenger Terminal	--	--	--	
Auto Parking (Spaces)	--	--	--	
Hangared Spaces	--	--	--	
Paved Tie-downs	--	--	--	
Turf Tie-downs	--	--	--	
Paved Apron (Square Yards)	--	--	--	
Runway			1st Runway	2nd Runway
Alignment	East/West	North/South	09/27[b]	18/36[b]
Length (Feet)	2,700	3,500	2,075	1,365
Width (Feet)	150	150	100	100
Surface	Turf	Turf	Turf	Turf
Lighting	Unlighted	Unlighted	Low Intensity	Unlighted
Approach Surface	--	--	8/3[c]	7/0[c]
Strength (Pounds)				
Single Wheel Load	--	--	--	--
Dual Wheel Load	--	--	--	--
Dual Tandem Wheel Load	--	--	--	--
Capacity (Aircraft Operations)				
Peak Hour	--	--	--	--
Practical Annual Capacity	--	--	--	--
Fixed Base Operations				
Operator	None	None	None	
Services				
Aircraft Storage	--	--	--	
General Services	--	--	x	
Rental	--	--	--	
Flight Instruction	--	--	x	
Charter	--	--	--	
Air Taxi	--	--	x	
Agricultural Activity	--	x	x	
Maintenance	--	--	--	
Fuel	--	--	--	
Aeronautical Activity				
Based Aircraft				
Single Engine	3	1	1	
Multiengine	1	0	0	
Other	0	0	0	
Total	4[d]	1[d]	1[f]	
Annual Operations				
Local	650	0[e]	280	
Itinerant	50	100	120	
Military	0	0	0	
Total	700	100	400	

Table C-4 (continued)

Detailed Characteristics	Private Use Airport: Lewislynn Farm (Town of Dover)	Private Use Airport: University of Lawsonomy (Town of Mt. Pleasant)
Airport		
Classification	BU-C	BU-C
Owner	J. A. Lewis	E. Bates
Attendance		
Month	All Months	Unattended
Day	All Days	Unattended
Hours	8 a.m. - 4 p.m.	Unattended
Airport Acreage	40	N/A[e]
Navaids[a]		
Wind Cone	x	--
Segmented Circle	--	--
Airport Beacon Light	--	--
Omnidirectional Range Beacon (VOR)	--	--
Remote VOR	--	--
Nondirectional Radio Beacon	--	--
Runway End Identification Lights	--	--
Control Tower	--	--
Facilities		
Pilot and Passenger Terminal	--	--
Auto Parking (Spaces)	--	--
Hangared Spaces	--	--
Paved Tie-downs	--	--
Turf Tie-downs	--	--
Paved Apron (Square Yards)	--	--
Runway		
Alignment	North/South	North/South
Length (Feet)	2,300	1,650
Width (Feet)	150	75
Surface	Turf	Turf
Lighting	Unlighted	Unlighted
Approach Surface	--	--
Strength (Pounds)	--	--
Single Wheel Load	--	--
Dual Wheel Load	--	--
Dual Tandem Wheel Load	--	--
Capacity (Aircraft Operations)	--	--
Peak Hour	--	--
Practical Annual Capacity	--	--
Fixed Base Operations		
Operator	None	None
Services		
Aircraft Storage	--	--
General Services	--	--
Rental	--	--
Flight Instruction	--	--
Charter	--	--
Air Taxi	--	--
Agricultural Activity	--	--
Maintenance	--	--
Fuel	--	--
Aeronautical Activity		
Based Aircraft		
Single Engine	1	0
Multiengine	0	0
Other	0	0
Total	1[d]	0[f]
Annual Operations		
Local	280	0
Itinerant	120	100
Military	0	0
Total	400	100

[a] *Navaids are air navigational aids available on or near an airport which can be used for landing aids.*

[b] *The runway alignment is shown as the magnetic heading to the nearest 10 degrees.*

[c] *The approach surface is the obstruction free runway approach slope clearance plane. Noting the runway alignment and runway approach surface figures for the Burlington Municipal Airport, for example, runway 01 of the first runway presently has an obstacle free approach equivalent to 20:1. Similarly, runway 19 of the first runway has an obstacle free approach equivalent to 40:1.*

[d] *The number of based aircraft is based on the R. Dixon Speas Associates, Inc. Airport Inventory Survey.*

[e] *Data are not available.*

[f] *The number of based aircraft is based on Federal Aviation Administration Airport Master Record Form 5010-1.*

Source: U. S. Department of Transportation, Federal Aviation Administration; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table C-5

DETAILED CHARACTERISTICS OF GENERAL AVIATION AIRPORTS IN WALWORTH COUNTY

Detailed Characteristics	Public Use Airport				
	Big Foot (Town of Walworth)		East Troy Municipal (Village of East Troy)	Gruenwald (Town of Geneva)	
Airport					
Classification	BU-B		BU-A	BU-B	
Owner	John C. Ingalls		Village of East Troy	Linda Gruenwald	
Attendance					
Month	Summer Only		All Months	All Months	
Day	Saturday and Sunday		All Days	All Days	
Hours	Dawn to Dark		Daytime	Daytime	
Airport Acreage	12		40	N/A[b]	
Navaids[a]					
Wind Cone	x		x	x	
Segmented Circle	--		x	--	
Airport Beacon Light	--		--	--	
Omnidirectional Range Beacon (VOR)	--		--	--	
Remote VOR	--		--	--	
Nondirectional Radio Beacon	--		--	--	
Runway End Identification Lights	--		--	--	
Control Tower	--		--	--	
Facilities					
Pilot and Passenger Terminal	360 square yards		Fixed Base Operator	N/A[b]	
Auto Parking (Spaces)	N/A[b]		25	N/A[b]	
Hangared Spaces	10		18	0	
Paved Tie-downs	N/A[b]		0	0	
Turf Tie-downs	N/A[b]		12	0	
Paved Apron (Square Yards)	0		0	0	
Runway	1st Runway	2nd Runway		1st Runway	2nd Runway
Alignment	East/West	North/South	09/27[e]	East/West	Northeast/Southwest
Length (Feet)	3,050	2,300	2,075	2,600	3,000
Width (Feet)	50	95	200	150	100
Surface	Turf	Turf	Turf	Turf	Turf
Lighting	Low Intensity	Unlighted	Low Intensity	Unlighted	Unlighted
Approach Surface	50/20[c]	10/50[c]	27/30[c]	--	--
Strength (Pounds)					
Single Wheel Load	--	--	--	--	--
Dual Wheel Load	--	--	--	--	--
Dual Tandem Wheel Load	--	--	--	--	--
Capacity (Aircraft Operations)					
Peak Hour	90		86	95	
Practical Annual Capacity	126,000		86,000	95,000	
Fixed Base Operations					
Operator	None		Milwaukee Executive Charter and Air Freight, Inc.	None	
Services					
Aircraft Storage	--		--	--	
General Services	--		x	--	
Rental	--		--	--	
Flight Instruction	x		x	x	
Charter	--		x	x	
Air Taxi	--		--	x	
Agricultural Activity	--		x	--	
Maintenance	x		x	x	
Fuel	x		x	x	
Aeronautical Activity					
Based Aircraft					
Single Engine	9		12	4	
Multiengine	0		6	0	
Other	0		0	0	
Total	9[d]		18[f]	4[f]	
Annual Operations					
Local	700		4,000	1,120	
Itinerant	300		1,700	480	
Military	0		0	0	
Total	1,000		5,700	1,600	
Comments	--		--	--	

Table C-5 (continued)

Detailed Characteristics	Public Use Airport: Lake Lawn Lodge (Town of Delavan)	Public Use Airport: Mt. Fuji (Town of Geneva)	Public Use Airport: Playboy (Town of Lyons)
Airport			
Classification	BU-C	BU-C	BU-A
Owner	Ramada Inn	Ed Meltzer	Playboy Club, Inc.
Attendance			
Month	Unattended	Unattended	All Months
Day	Unattended	Unattended	All Days
Hours	Unattended	Unattended	7 a.m. - 7 p.m.
Airport Acreage	22	N/A[b]	N/A[b]
Navaids[a]			
Wind Cone	x	x	x
Segmented Circle	--	--	--
Airport Beacon Light	--	x	x
Omnidirectional Range Beacon (VOR)	--	--	--
Remote VOR	x	--	x
Nondirectional Radio Beacon	--	--	--
Runway End Identification Lights	--	--	--
Control Tower	--	--	--
Facilities			
Pilot and Passenger Terminal	0	0	N/A[b]
Auto Parking (Spaces)	N/A[b]	N/A[b]	N/A[b]
Hangared Spaces	0	N/A[b]	N/A[b]
Paved Tie-downs	N/A[b]	N/A[b]	N/A[b]
Turf Tie-downs	N/A[b]	N/A[b]	N/A[b]
Paved Apron (Square Yards)	0	0	10,000
Runway			
Alignment	North/South	06/24[e]	05/23[e]
Length (Feet)	3,200	2,200	4,070
Width (Feet)	300	100	80
Surface	Turf	Turf	Asphalt
Lighting	Unlighted	Unlighted	Low Intensity
Approach Surface	--	--	--
Strength (Pounds)			
Single Wheel Load	--	--	--
Dual Wheel Load	--	--	--
Dual Tandem Wheel Load	--	--	--
Capacity (Aircraft Operations)			
Peak Hour	86	90	93
Practical Annual Capacity	86,000	95,000	183,000
Fixed Base Operations			
Operator	None	None	Lake Geneva Airways
Services			
Aircraft Storage	--	--	--
General Services	--	--	--
Rental	--	--	--
Flight Instruction	--	--	--
Charter	--	--	x
Air Taxi	--	--	x
Agricultural Activity	--	--	--
Maintenance	--	--	--
Fuel	--	--	x
Aeronautical Activity			
Based Aircraft			
Single Engine	0	0	2
Multiengine	0	0	4
Other	0	0	0
Total	0[f]	0[d]	6[f]
Annual Operations			
Local	100	0	4,000
Itinerant	1,300	100	1,700
Military	0	0	0
Total	1,400	100	5,700
Comments	Potential corporation use if improved	This airport became unavailable for public use since the inventory	--

Table C-5 (continued)

Detailed Characteristics	Public Use Airport: Wag-Aero (Town of Lyons)	Public Use Airport: Wal-Co-Wis Farms (Town of Linn)
Airport		
Classification	BU-C	BU-C
Owner	R. H. Wagner	L. H. Whiting, Jr.
Attendance		
Month	Unattended	Unattended
Day	Unattended	Unattended
Hours	Unattended	Unattended
Airport Acreage	40	N/A[b]
Navaids[a]		
Wind Cone	x	x
Segmented Circle	--	--
Airport Beacon Light	--	--
Omnidirectional Range Beacon (VOR)	--	--
Remote VOR	--	--
Nondirectional Radio Beacon	--	--
Runway End Identification Lights	--	--
Control Tower	--	--
Facilities		
Pilot and Passenger Terminal	--	--
Auto Parking (Spaces)	--	--
Hangared Spaces	--	--
Paved Tie-downs	--	--
Turf Tie-downs	--	--
Paved Apron (Square Yards)	--	--
Runway		
Alignment	Northeast/Southwest	04/22[e]
Length (Feet)	1,700	2,000
Width (Feet)	50	200
Surface	Turf	Asphalt
Lighting	Unlighted	Unlighted
Approach Surface	--	--
Strength (Pounds)	--	--
Single Wheel Load	--	--
Dual Wheel Load	--	--
Dual Tandem Wheel Load	--	--
Capacity (Aircraft Operations)	--	--
Peak Hour	--	--
Practical Annual Capacity	--	--
Fixed Base Operations		
Operator	Maintain-A-Plane	None
Services		
Aircraft Storage	--	--
General Services	--	--
Rental	--	--
Flight Instruction	--	--
Charter	--	--
Air Taxi	--	--
Agricultural Activity	--	--
Maintenance	x	--
Fuel	--	--
Aeronautical Activity		
Based Aircraft		
Single Engine	6	2
Multiengine	0	0
Other	0	0
Total	6[f]	2[f]
Annual Operations		
Local	200	560
Itinerant	1,000	240
Military	0	0
Total	1,200	800

Table C-5 (continued)

Detailed Characteristics	Private Use Airport			
	Heinrichs (Town of East Troy)	Swan (Town of Sugar Creek)		Herbert Twist (Town of Delavan)
Airport				
Classification	BU-C	BU-C		BU-C
Owner	Robert M. Heinrichs	J. P. Swan		Herbert and Muriel Twist
Attendance				
Month	Unattended	Unattended		Unattended
Day	Unattended	Unattended		Unattended
Hours	Unattended	Unattended		Unattended
Airport Acreage	N/A[b]	N/A[b]		160
Navaids[a]				
Wind Cone	x	--		--
Segmented Circle	--	--		--
Airport Beacon Light	--	--		--
Omnidirectional Range Beacon (VOR)	--	--		--
Remote VOR	--	--		--
Nondirectional Radio Beacon	--	--		--
Runway End Identification Lights	--	--		--
Control Tower	--	--		--
Facilities				
Pilot and Passenger Terminal	--	--		--
Auto Parking (Spaces)	--	--		--
Hangared Spaces	--	--		--
Paved Tie-downs	--	--		--
Turf Tie-downs	--	--		--
Paved Apron (Square Yards)	--	--		--
Runway		1st Runway	2nd Runway	
Alignment	North/South	18/36[e]	09/27[e]	11/29[e]
Length (Feet)	1,600	2,200	2,000	2,200
Width (Feet)	30	30	50	200
Surface	Turf	Turf	Turf	Turf
Lighting	Unlighted	Unlighted	Unlighted	Unlighted
Approach Surface	--	--	--	--
Strength (Pounds)				
Single Wheel Load	--	--	--	--
Dual Wheel Load	--	--	--	--
Dual Tandem Wheel Load	--	--	--	--
Capacity (Aircraft Operations)				
Peak Hour	--	--	--	--
Practical Annual Capacity	--	--	--	--
Fixed Base Operations				
Operator	None	None		None
Services				
Aircraft Storage	--	--		--
General Services	--	--		--
Rental	--	--		--
Flight Instruction	--	--		--
Charter	--	--		--
Air Taxi	--	--		--
Agricultural Activity	--	--		--
Maintenance	--	--		--
Fuel	--	--		--
Aeronautical Activity				
Based Aircraft				
Single Engine	1	4		2
Multiengine	0	0		0
Other	0	0		0
Total	1[d]	4[g]		2[f]
Annual Operations				
Local	280	0		560
Itinerant	120	100		240
Military	0	0		0
Total	400	100		800

[a] *Navaids are air navigational aids available on or near an airport which can be used for landing aids.*

[b] *Data are not available.*

[c] *The approach surface is the obstruction free runway approach slope clearance plane. Noting the runway alignment and runway approach surface figures for the East Troy Municipal Airport, for example, runway 09 presently has an obstacle free approach equivalent to 27:1. Similarly, runway 27 has an obstacle free approach equivalent to 30:1.*

[d] *The number of based aircraft is based on Federal Aviation Administration Airport Master Record Form 5010-1.*

[e] *The runway alignment is shown as the magnetic heading to the nearest 10 degrees.*

[f] *The number of based aircraft is based on the R. Dixon Speas Associates, Inc. Airport Inventory Survey.*

[g] *The number of based aircraft is based on Wisconsin aircraft registration records.*

Source: U S. Department of Transportation, Federal Aviation Administration; Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table C-6

DETAILED CHARACTERISTICS OF GENERAL AVIATION AIRPORTS IN WASHINGTON COUNTY

Detailed Characteristics	Public Use Airport: Hahn's Sky Ranch (Town of Wayne)		Hartford Municipal (City of Hartford)		West Bend Municipal (City of West Bend)	
Airport						
Classification	BU-B		BU-A		GU	
Owner	Les Hahn		City of Hartford		City of West Bend	
Attendance						
Month	All Months		All Months		All Months	
Day	All Days		All Days		All Days	
Hours	8 a.m. - 4 p.m.		24		Daytime	
Airport Acreage	25		219		300	
Navaids[a]						
Wind Cone	x		x		x	
Segmented Circle	--		x		--	
Airport Beacon Light	--		--		x	
Omnidirectional Range Beacon (VOR)	--		--		x	
Remote VOR	--		--		--	
Nondirectional Radio Beacon	--		--		x	
Runway End Identification Lights	--		--		--	
Control Tower	--		--		--	
Facilities						
Pilot and Passenger Terminal	Fixed Base Operator		Fixed Base Operator		Fixed Base Operator	
Auto Parking (Spaces)	N/A[b]		30		112	
Hangared Spaces	1		39		47	
Paved Tie-downs	0		3		6	
Turf Tie-downs	15		5		24	
Paved Apron (Square Yards)	0		3,333		N/A[b]	
Runway	1st Runway	2nd Runway	1st Runway	2nd Runway	1st Runway	2nd Runway
Alignment	09/27[c]	18/36[c]	11/29[c]	18/36[c]	06/24[c]	13/31[c]
Length (Feet)	2,610	2,200	3,000	2,300	3,900	4,500
Width (Feet)	100	100	75	250	75	75
Surface	Turf	Turf	Asphalt	Turf	Asphalt	Asphalt
Lighting	Unlighted	Unlighted	Low Intensity	Unlighted	Low Intensity	Low Intensity
Approach Surface	--	--	45/40[e]	16/35[e]	21/33[e]	26/35[e]
Strength (Pounds)						
Single Wheel Load	--	--	4,000	--	--	12,000
Dual Wheel Load	--	--	--	--	--	19,000
Dual Tandem Wheel Load	--	--	--	--	--	--
Capacity (Aircraft Operations)						
Peak Hour	95		112		93	
Practical Annual Capacity	98,000		211,000		175,000	
Fixed Base Operations						
Operator	None		Mr. Zivko		West Bend Flying Service	
Services						
Aircraft Storage	--		--		--	
General Services	x		x		x	
Rental	--		--		--	
Flight Instruction	x		x		x	
Charter	x		--		--	
Air Taxi	--		--		x	
Agricultural Activity	x		--		--	
Maintenance	--		x		x	
Fuel	x		x		x	
Aeronautical Activity						
Based Aircraft						
Single Engine	6		50		54	
Multiengine	1		3		11	
Other	0		0		27	
Total	7[d]		53[f]		92[f]	
Annual Operations						
Local	700		26,700		68,440	
Itinerant	300		30,900		20,600	
Military	0		0		1,500	
Total	1,000		57,600		90,540	
Comments	--		--		Considerable use by local and national corporations	

Table C-6 (continued)

Detailed Characteristics	Private Use Airport	
	Doering Farms (Town of Erin)	Willow Creek (Village of Germantown)
Airport		
Classification	BU-C	BU-C
Owner	Joseph Doering	Sheldon Pollow
Attendance		
Month	Unattended	Unattended
Day	Unattended	Unattended
Hours	Unattended	Unattended
Airport Acreage	N/A[b]	4
Navaids[a]		
Wind Cone	x	x
Segmented Circle	--	--
Airport Beacon Light	--	--
Omnidirectional Range Beacon (VOR)	--	--
Remote VOR	--	--
Nondirectional Radio Beacon	--	--
Runway End Identification Lights	--	--
Control Tower	--	--
Facilities		
Pilot and Passenger Terminal	--	--
Auto Parking (Spaces)	--	--
Hangared Spaces	--	--
Paved Tie-downs	--	--
Turf Tie-downs	--	--
Paved Apron (Square Yards)	--	--
Runway		
Alignment	03/21[c]	07/25[c]
Length (Feet)	2,600	1,200
Width (Feet)	65	160
Surface	Turf	Turf
Lighting	Unlighted	Unlighted
Approach Surface	--	--
Strength (Pounds)	--	--
Single Wheel Load	--	--
Dual Wheel Load	--	--
Dual Tandem Wheel Load	--	--
Capacity (Aircraft Operations)	--	--
Peak Hour	--	--
Practical Annual Capacity	--	--
Fixed Base Operations		
Operator	None	None
Services		
Aircraft Storage	--	--
General Services	--	--
Rental	--	--
Flight Instruction	--	--
Charter	--	--
Air Taxi	--	--
Agricultural Activity	--	--
Maintenance	--	--
Fuel	--	--
Aeronautical Activity		
Based Aircraft		
Single Engine	0	0
Multiengine	0	0
Other	0	0
Total	0[d]	0[f]
Annual Operations		
Local	0	40
Itinerant	100	60
Military	0	0
Total	100	100

[a] *Navaids are air navigational aids available on or near an airport which can be used for landing aids.*

[b] *Data are not available.*

[c] *The runway alignment is shown as the magnetic heading to the nearest 10 degrees.*

[d] *The number of based aircraft is based on Federal Aviation Administration Airport Master Record Form 5010-1.*

[e] *The approach surface is the obstruction free runway approach slope clearance plane. Noting the runway alignment and runway approach surface figures for the Hartford Municipal Airport, for example, runway 11 of the first runway presently has an obstacle free approach equivalent to 45:1. Similarly, runway 29 of the first runway has an obstacle free approach equivalent to 29:1.*

[f] *The number of based aircraft is based on the R. Dixon Speas Associates, Inc. Airport Inventory Survey.*

Source: U. S. Department of Transportation, Federal Aviation Administration; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table C-7

DETAILED CHARACTERISTICS OF GENERAL AVIATION AIRPORTS IN WAUKESHA COUNTY

Detailed Characteristics	Public Use Airport: Aero Park (Village of Menomonee Falls)			
Airport				
Classification	BU-B			
Owner	Mrs. M. Stopar			
Attendance				
Month	All Months			
Day	All Days			
Hours	Daytime			
Airport Acreage	60			
Navaids[a]				
Wind Cone	x			
Segmented Circle	--			
Airport Beacon Light	--			
Omnidirectional Range Beacon (VOR)	--			
Remote VOR	--			
Nondirectional Radio Beacon	--			
Runway End Identification Lights	--			
Control Tower	--			
Facilities				
Pilot and Passenger Terminal	Fixed Base Operator			
Auto Parking (Spaces)	N/A[b]			
Hangared Spaces	0			
Paved Tie-downs	0			
Turf Tie-downs	N/A[b]			
Paved Apron (Square Yards)	0			
Runway	1st Runway	2nd Runway	3rd Runway	
Alignment	05/23[c]	15/33[c]	18/36[c]	
Length (Feet)	1,500	2,400	2,200	
Width (Feet)	200	200	200	
Surface	Turf	Turf	Turf	
Lighting	Unlighted	Unlighted	Unlighted	
Approach Surface	--	--	--	
Strength (Pounds)				
Single Wheel Load	--	--	--	
Dual Wheel Load	--	--	--	
Dual Tandem Wheel Load	--	--	--	
Capacity (Aircraft Operations)				
Peak Hour	85			
Practical Annual Capacity	84,000			
Fixed Base Operations				
Operator	Aero Park Silent Wings, Inc.	Parachute Club, Inc.	Trans-Aire Aviation	Aircraft Sales Co., Inc.
Services				
Aircraft Storage	--	--	--	--
General Services	--	--	--	x
Rental	--	--	x	--
Flight Instruction	x	x	x	--
Charter	--	--	x	--
Air Taxi	--	--	--	--
Agricultural Activity	--	--	--	--
Maintenance	--	--	--	--
Fuel	--	--	x	--
Aeronautical Activity				
Based Aircraft				
Single Engine	6			
Multiengine	0			
Other	5			
Total	11[d]			
Annual Operations				
Local	2,200			
Itinerant	1,000			
Military	0			
Total	3,200			
Comments	Considerable glider activity			

Table C-7 (continued)

Detailed Characteristics	Public Use Airport: Capitol Drive (Town of Brookfield)			Public Use Airport: O'Leary Field (City of Muskego)
Airport				
Classification	BU-B			BU-C
Owner	Mrs. B. Zwrifel			Donald O'Leary
Attendance				
Month	All Months			Unattended
Day	All Days			Unattended
Hours	8 a.m. - Dark			Unattended
Airport Acreage	N/A[b]			N/A[b]
Navaids[a]				
Wind Cone	x			x
Segmented Circle	--			--
Airport Beacon Light	--			--
Omnidirectional Range Beacon (VOR)	--			--
Remote VOR	--			--
Nondirectional Radio Beacon	--			--
Runway End Identification Lights	--			--
Control Tower	--			--
Facilities				
Pilot and Passenger Terminal	Fixed Base Operator			N/A[b]
Auto Parking (Spaces)	N/A[b]			N/A[b]
Hangared Spaces	23			N/A[b]
Paved Tie-downs	0			N/A[b]
Turf Tie-downs	35			N/A[b]
Paved Apron (Square Yards)	0			N/A[b]
Runway	1st Runway	2nd Runway	3rd Runway	
Alignment	03/21[c]	09/27[c]	18/36[c]	East/West
Length (Feet)	1,560	1,700	2,000	1,300
Width (Feet)	100	200	200	70
Surface	Turf	Turf	Turf	Turf
Lighting	Unlighted	Unlighted	Unlighted	Unlighted
Approach Surface	--	--	--	--
Strength (Pounds)				
Single Wheel Load	--	--	--	--
Dual Wheel Load	--	--	--	--
Dual Tandem Wheel Load	--	--	--	--
Capacity (Aircraft Operations)				
Peak Hour	84			87
Practical Annual Capacity	83,000			90,000
Fixed Base Operations				
Operator	Capitol Air Service			None
Services				
Aircraft Storage	--			--
General Services	x			--
Rental	--			--
Flight Instruction	x			--
Charter	--			--
Air Taxi	--			--
Agricultural Activity	--			--
Maintenance	x			--
Fuel	x			--
Aeronautical Activity				
Based Aircraft				
Single Engine	58			2
Multiengine	0			0
Other	0			0
Total	58[d]			2[e]
Annual Operations				
Local	24,500			560
Itinerant	10,500			240
Military	0			0
Total	35,000			800
Comments	Special traffic patterns required due to location near Aero Park			--

Table C-7 (continued)

Detailed Characteristics	Public Use Airport: Waukesha County (Town of Pewaukee)		
Airport			
Classification	GU		
Owner	Waukesha County		
Attendance			
Month	All Months		
Day	All Days		
Hours	Daytime		
Airport Acreage	443		
Navaids[a]			
Wind Cone	x		
Segmented Circle	x		
Airport Beacon Light	x		
Omnidirectional Range Beacon (VOR)	--		
Remote VOR	--		
Nondirectional Radio Beacon	x		
Runway End Identification Lights	--		
Control Tower	x (Added in 1974)		
Facilities			
Pilot and Passenger Terminal	Fixed Base Operator		
Auto Parking (Spaces)	300		
Hangared Spaces	103		
Paved Tie-downs	8		
Turf Tie-downs	78		
Paved Apron (Square Yards)	8,000		
Runway	1st Runway	2nd Runway	3rd Runway
Alignment	10/28[c]	18L/36R[c]	18R/36L[c]
Length (Feet)	4,200	2,170	3,600
Width (Feet)	100	300	75
Surface	Asphalt	Turf	Asphalt
Lighting	Medium Intensity	Unlighted	Low Intensity
Approach Surface	40/40[f]	20/12[f]	50/20[f]
Strength (Pounds)			
Single Wheel Load	12,000	--	20,000
Dual Wheel Load	--	--	27,000
Dual Tandem Wheel Load	--	--	--
Capacity (Aircraft Operations)			
Peak Hour	142		
Practical Annual Capacity	284,000		
Fixed Base Operations			
Operator	Spring City Flying		
Services			
Aircraft Storage	x		
General Services	x		
Rental	x		
Flight Instruction	x		
Charter	x		
Air Taxi	x		
Agricultural Activity	--		
Maintenance	x		
Fuel	x		
Aeronautical Activity			
Based Aircraft			
Single Engine	133		
Multiengine	34		
Other	0		
Total	167[d]		
Annual Operations			
Local	81,400		
Itinerant	35,100		
Military	500		
Total	117,000		
Comments	Used by International Harvester for freight		

Table C-7 (continued)

Detailed Characteristics	Private Use Airport Oconomowoc (Town of Oconomowoc)
Airport	
Classification	BU-C
Owner	R. E. Wessel
Attendance	
Month	Unattended
Day	Unattended
Hours	Unattended
Airport Acreage	N/A[b]
Navaids[a]	
Wind Cone	x
Segmented Circle	--
Airport Beacon Light	--
Omnidirectional Range Beacon (VOR)	--
Remote VOR	--
Nondirectional Radio Beacon	--
Runway End Identification Lights	--
Control Tower	--
Facilities	
Pilot and Passenger Terminal	--
Auto Parking (Spaces)	--
Hangared Spaces	--
Paved Tie-downs	--
Turf Tie-downs	--
Paved Apron (Square Yards)	--
Runway	
Alignment	18/36[c]
Length (Feet)	1,400
Width (Feet)	200
Surface	Turf
Lighting	Unlighted
Approach Surface	--
Strength (Pounds)	
Single Wheel Load	--
Dual Wheel Load	--
Dual Tandem Wheel Load	--
Capacity (Aircraft Operations)	
Peak Hour	--
Practical Annual Capacity	--
Fixed Base Operations	
Operator	None
Services	
Aircraft Storage	--
General Services	--
Rental	--
Flight Instruction	--
Charter	--
Air Taxi	--
Agricultural Activity	--
Maintenance	--
Fuel	--
Aeronautical Activity	
Based Aircraft	
Single Engine	3
Multiengine	0
Other	0
Total	3[e]
Annual Operations	
Local	840
Itinerant	360
Military	0
Total	1,200

[a] *Navaids are air navigational aids available on or near an airport which can be used for landing aids.*

[b] *Data are not available.*

[c] *The runway alignment is shown as the magnetic heading to the nearest 10 degrees.*

[d] *The number of based aircraft is based on the R. Dixon Speas Associates, Inc. Airport Inventory Survey.*

[e] *The number of based aircraft is based on Federal Aviation Administration Airport Master Record Form 5010-1.*

[f] *The approach surface is the obstruction free runway approach slope clearance plane. Noting the runway alignment and runway approach surface figures for the Waukesha County Airport, for example, runway 10 of the first runway presently has an obstacle free approach equivalent to 40:1. Similarly, runway 28 of the first runway has an obstacle free approach equivalent to 40:1.*

Source: U. S. Department of Transportation, Federal Aviation Administration; R. Dixon Speas Associates, Inc.; and SEWRPC.

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Appendix D

DETAILED AIRCRAFT CHARACTERISTICS BY AIRCRAFT TYPE

Aircraft Name	Length	Wingspan	Tail Height	Psgr Door Hts.		Capacity		Turning Radius	Required Apron	Min Gate Spcng	Min Gate Size	Max. Ramp Wt.	Max.T/O Wt.	Max. Ldg. Wt.	Max. Payload	Max.Cargo Vol.	UseableFuel Cap	Runway Length Requirements *		Wt. on Mn Gear
	Ft.	Ft.	Ft.	Front	Back	Max.	Mixed	Ft.	Sq.Yds.	Ft.	Sq. Ft.	Lb.	Lb.	Lb.	Lb.	Cu.Ft.	U.S.Gal.	Take Off Ft	Landing Ft	Lb.
Type AA																				
Long Haul Aircraft																				
Boeing 2707	298'0"	143'5"	53'2"	14'5"	19'5"	298	253	182'0"	5910	178'5"	2783		750000	450,000						
Concorde	191'1"	83'10"	38'0"	16'5"	13'2"	144	144	131'0"	2525	118'10"	1584	389000	385000	240000	31000	709	31028			365000
TU-144	196'10"	90'8"	37'7"			120			2747	125'8"	1320		400000	260000				11000		
Boeing 747	231'10"	195'8"	64'3"	17'2"	17'6"	498	350	172'10"	5903	230'8"	3850	778000	775000	564000	159000	6250	47210	10800	6800	660000
747F	231'10"	195'8"	64'8"	17'11"	(Nose)	-	-	172'10"	5903	230'8"		778000	775000	630000	257900	23690	43150	10800	7400	725000
747 Stretch	280'	205'	64'8"	17'2"	17'6"	625	475		7466	240'	5225	910000	900000	600000	175000	7500				
DC-10-30/40	181'7"	161'4"	58'7"	16'11"	16'1"	270	345	114'4"	3800	196'4"	2970	558000	555000	403000	109906	4618	36522	11000	5500	
10F	181'7"	161'4"	58'7"	16'8"	(Cargo)	-	-	114'4"	3800	196'4"	-	558000	555000	411000	155768	15265	36522	10100	6500	
8-63	187'5"	148'5"	43'0"	11'0"	12'11"	259	200	116'1"	2867	183'5"	2200	358000	355000	258000	71262	2500	24275	11900	6250	335000
8-61	187'5"	142'5"	43'0"	11'0"	12'10"	259	200	101'9"	2765	177'5"	2200	328000	325000	240000	71877	2500	23393	9980	6140	310000
L-500												861500	858500	699500	320000	58250	47537	10600		
Medium Haul Aircraft																				
A-300B-B4	175'6"	147'1"	55'6"	14'11"	18'0"	269	250	111'2"	2662	188'1"	2750	332700	330700	293200	75341	4865	15320	8700	6000	212000
DC-10-10	182'3"	155'4"	58'5"	16'7"	15'11"	345	270	110'4"	3800	190'4"	2970	433000	430000	363500	100336	3017	26501	9000	5054	
10-Stretched	231'4"	161'4"	58'5"	16'7"	15'11"	475	370		5046	196'4"	4070	600000	600000	400000	140000					
L-1011	176'4"	155'4"	55'10"	15'6"	15'5"	330	260	121'3"	2795	190'4"	2860	432000	430000	358000	85000	3268	23900	7780	5750	400000
1011Stretched																				
Type A																				
Boeing 707-320B	152'11"	145'9"	42'1"	10'6"	10'7"	189	140	126'9"	2822	165'9"	1540	336000	333600	215000	47220	1770	23855	10000	5970	310000
707-320C	152'11"	145'9"	42'0"	10'6"	(Cargo)	194	145	126'9"	2822	165'9"	1590	336000	333600	247000	94500	9785	23855	10000	6250	
720	136'2"	130'10"	42'1"	9'9"	9'9"	156	130	113'6"	2282	160'10"	1430	235000	234300	175000	41000	1380	16130	9400	6350	218000
727-200	153'2"	108'0"	34'0"	8'8"	-	189	130	80'4"	2176	138'0"	1430	173000	172000	150000	40600	1505	7680	7940	4800	158000
Advanced 727-200	153'2"	108'0"	34'0"	8'8"	-	189	130	80'4"	2176	138'0"	1430	208000	207500	160000	40000	1485	10000	9000	4800	190000
DC-8-50	150'8"	142'5"	43'4"	11'0"	13'0"	189	135	96'9"	2038	172'5"	1480	328000	325000	217000	51734	1390	23393	9450	5400	300000
8F	150'8"	142'5"	43'4"	11'0"	(Cargo)	-	-	96'9"	2038	172'5"	-	328000	325000	240000	92770	9020	23393	10050	6050	300000

Aircraft Name	Length	Wingspan	Tail Height	Psgr.Door Hts.		Capacity		Turning Radius	Required Apron	Min Gate Spcng	Min Gate Size	Max.Ramp Wt.	Max.T/O Wt.	Max. Ldg. Wt.	Max.Payload	Max.Cargo Vol.	UseableFuel Cap.	Runway Length Requirements *		Wt. on Mn Gear
	Ft.	Ft.	Ft.	Front	Back	Max.	Mixed	Ft.	Sq.Yds.	Ft.	Sq.Ft.	Lb.	Lb.	Lb.	Lb.	Cu. Ft.	U.S.Gal.	Take Off Ft	Landing Ft	Lb.
Type B																				
BAC 1-11	92'6"	88'6"	23'9"	6'8"		89			1115	108'6"		92500	92000	84000		510	3965	5960	4650	
Boeing 727-100	134'4"	108'0"	34'0"	8'8"	-	131	95	70'4"	1920	133'0"	1045	170000	169000	142500	35100	900	7680	8100	4800	154000
727-100C	134'4"	108'0"	34'0"	8'8"	-	131	95	70'4"	1920	133'0"	1045	170000	169000	142500	40500	4166	7680	8310	4700	152000
737-100	94'4"	93'0"	36'9"	8'7"	8'11"	113	90	56'9"	885	118'0"	990	111000	110700	101000	31830	650	4747	5700	4000	99000
737-200	100'4"	93'0"	36'9"	8'8"	8'10"	125	100	57'7"	942	118'0"	1100	114000	113700	103000	32465	875	4747	7100	3750	99000
737-200C	100'4"	93'0"	36'9"	8'8"	8'10"			57'7"	942	118'0"	1100	116000	115500	103000			4950	6550	4290	
DC-9-10	104'5"	89'5"	27'6"	7'10"	-	109	70	59'7"	954	114'5"	770	91500	90700	81700	24838	2762	3693	5420	5020	84000
9-30	119'4"	93'4"	27'6"	7'9"	-	114	90	68'6"	1130	118'4"	990	109000	108000	99000	30145	4167	3679	7400	5500	100000
L-188	104'7"	99'0"	34'1"	8'6"	9'3"	104	74	65'1"	1388	119'0"			116000	95650	26500		6520	4720	4300	
Convair 580	81'6"	105'4"	28'2"					67'4"					53200	50700			2680	4700	4160	
Type C																				
Citation	43'6"	43'9"	14'4"	2'6"	-	8	8	27'0"				11650	11500	11000			535	3575	2590	
Falcon-D	56'3"	53'6"	17'8"			12	12					28660	28660	26036			1340	6000	3900	
Gulfstream II	79'11"	68'10"	24'6"			19	19					62500	62000	58500			3452	5000	3190	
Jet Commander																				
JetStar -8	60'4"	54'4"	20'4"			12	12					42500	42000	35000	2926		2660	6000	6260	
Learjet 23	43'3"	35'7"	12'7"			8	8					12750	12500	11880			840			
25	47'4"	35'7"	12'3"			10	10					15500	15000	13300			910	5186	3715	
Yak-40	66'10"	82'0"	21'4"	6'1"	-	27	27	65'1"	570	102'0"	297	30400	30200	29210			970	2800	3000	
FH-227	83'1"	95'2"	27'6"	3'7"	3'7"	56	45				484	45500	45500	45000			1420	4650	4220	

Aircraft Name	Length	Wingspan	Tail Height	Psgr. Door Hts.		Capacity		Turning Radius	Required Apron	Min Gate Spcng	Min Gate Size	Max. Ramp Wt.	Max. T/O Wt.		Max. Ldg. Wt.	Max. Payload	Max. Cargo Vol.	Useable Fuel Cap	Runway Length Requirements *		Wt. on Mn Gear
	Ft.	Ft.	Ft.	Front	Back	Max.	Mixed	Ft.	Sq. Yds.	Ft.	Sq. Ft.	Lb.	Lb.		Lb.	Lb.	Cu. Ft.	U.S. Gal.	Take off Ft	Landing Ft	Lb.
Type D																					
Beech Baron	29'8"	37'10"	9'7"			6	4	23'11"	357			5400	5400		5400	2285	51.5	112	1255	1370	
99	44'6"	45'11"	14'4"		4'9"	15		30'5"	528			10450	10400		10400	4861	60.9	370	2330	2680	
King-Aire	40'7"	50'4"	15'8"		4'9"	13		30'5"				10650	10600		10600	4195	62.0	470	2255	2246	
Bonanza	31'6"	45'3"	11'4"			6	4	21'2"				5500	5500		5500	1700		134	1344	1215	
Gulfstream I	64'0"	78'4"	22'10"			26	21	47'2"	1534			36000	36000		36000	3300	128	10462	3500	2740	
Piper Aztec	30'1"	37'0"	10'4"			4	4	22'3"	342			5200	5200		5200	2267		144	1250	1620	
Twin Comanche	25'2"	36'0"	8'4"			6	4	22'3"				3725	3725		3725	1342		120	1530	1875	
Aero Commander	35'1"	49'0"	14'9"			8	4	22'1"				6750	6750		6750	2402		156	1375	1235	
Cessna 310	29'6"	36'11"	9'11"			4	4	25'6"				5200	5200		5200			143	1716	1582	
Type E																					
Cessna 150	23'9"	32'8"	8'7"			2	2	21'5"	267			1600	1600		1600	610		38	1385	1075	
210	28'3"	36'9"	9'7"			4	4	23'6"	338			3400	3400		3400	1440		90	1365	1355	
172	26'11"	36'2"	8'9"			4	4	23'0"				2300	2300	1043	2300	1025		42	1525	1250	
Mooney Mark 22	27'0"	35'0"	9'10"			5	5	22'8"				3680	3680		3680	1240		92	2079	1549	
Piper Cherokee	27'8"	32'10"	7'11"			7	6	21'3"				3400	3400		3400	1712	28	84	1360	1000	

**FAR Field Length Requirements based on: Standard Day; Sea Level; Zero Wind: Zero Gradient.*

Source: R. Dixon Speas Associates, Inc.

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Appendix E

SYSTEM MAPS OF THE FIVE AIR CARRIERS SERVING THE REGION THROUGH GENERAL MITCHELL FIELD: DECEMBER 1975

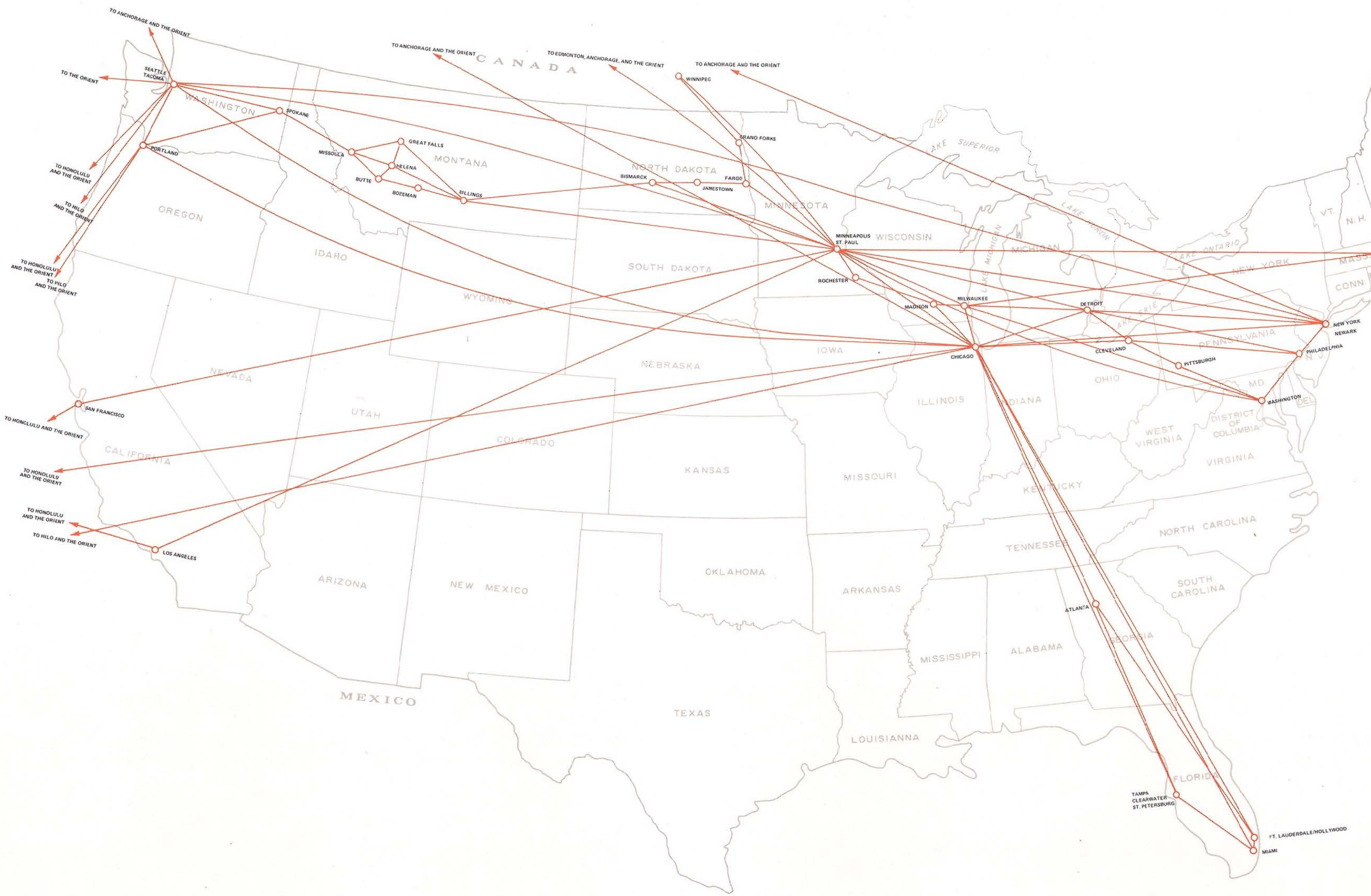
EASTERN AIRLINES

Source: Eastern Airlines, Inc.

NORTH CENTRAL AIRLINES

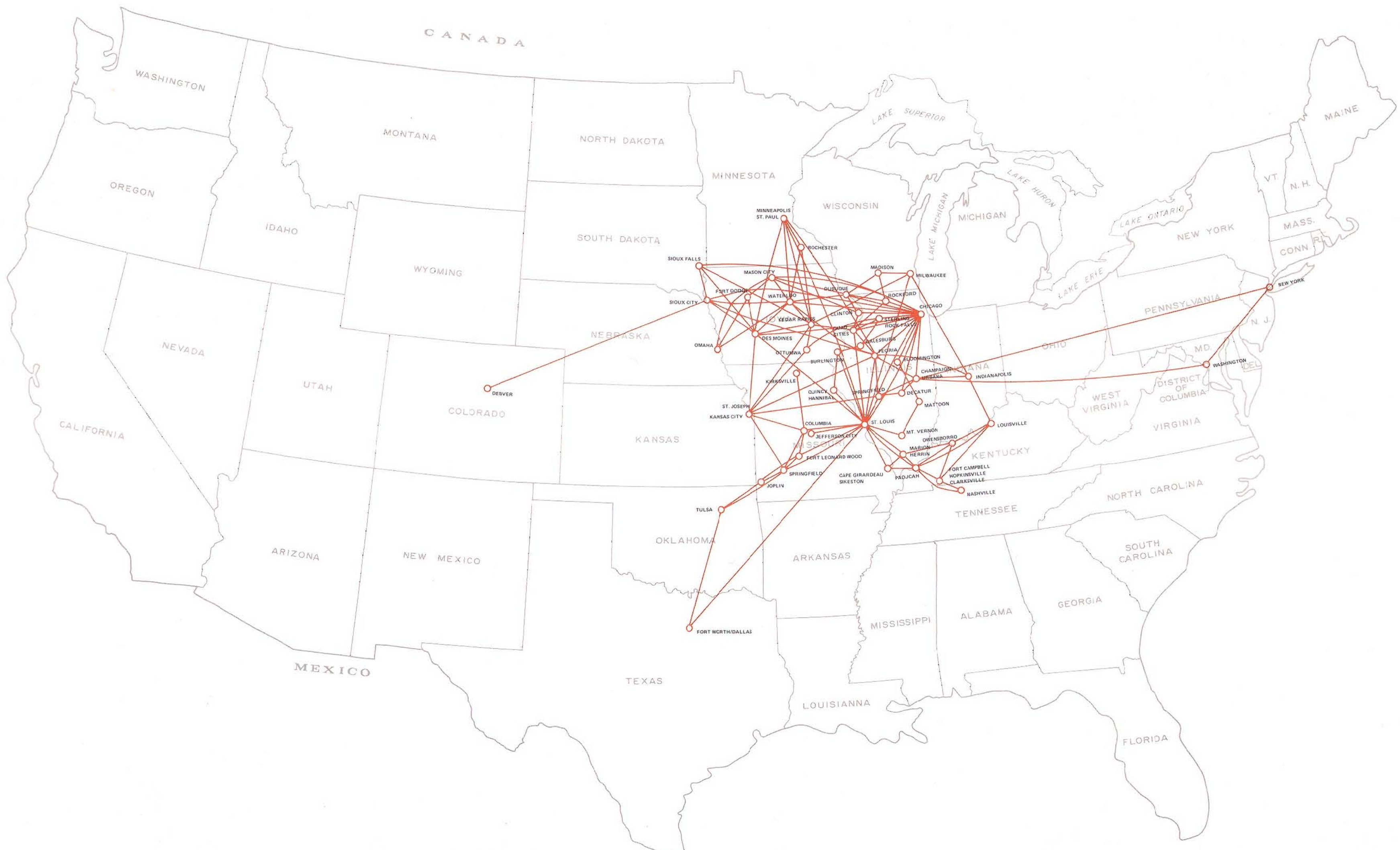
Source: North Central Airlines, Inc.

NORTHWEST AIRLINES



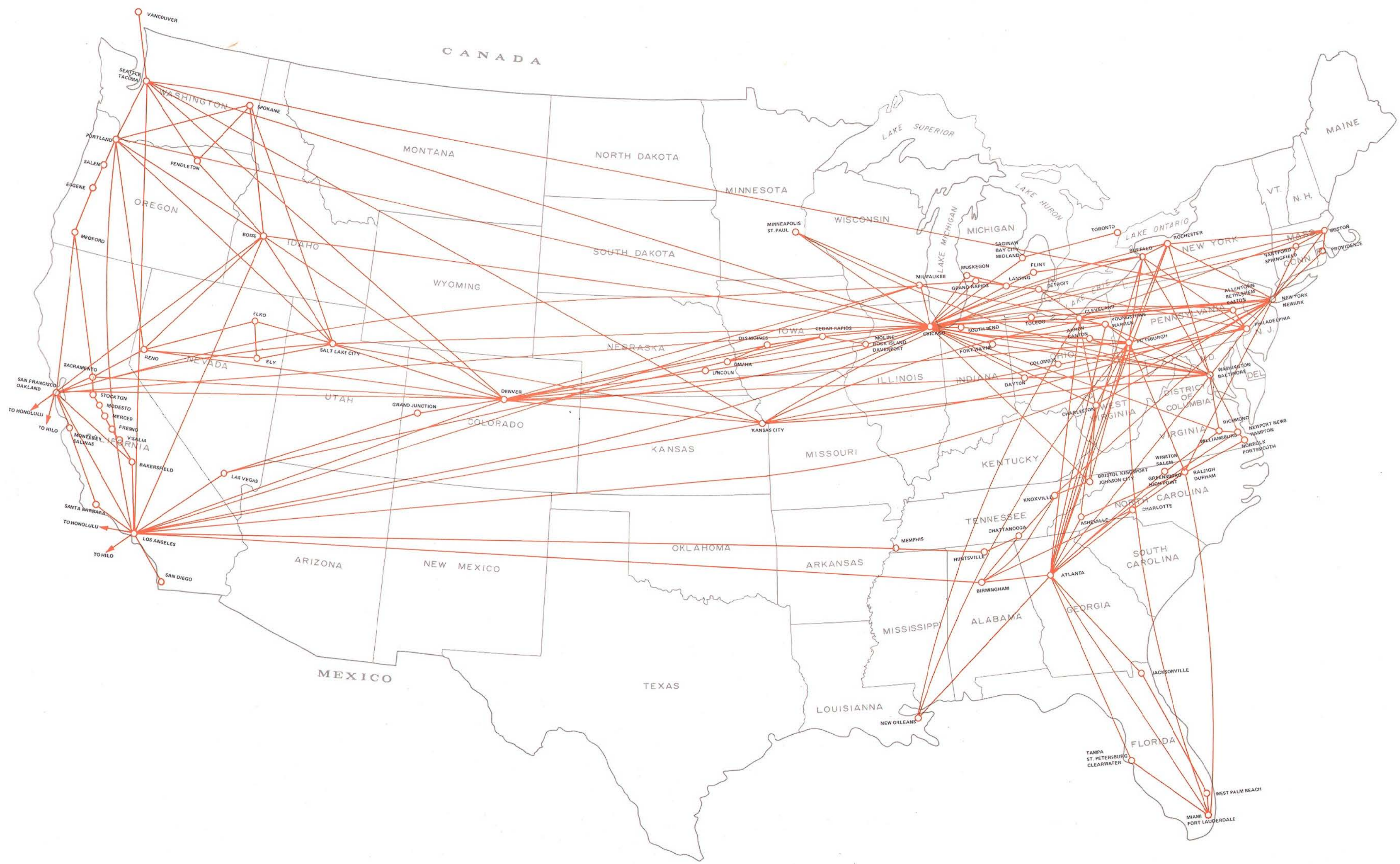
Source: Northwest Airlines, Inc.

OZARK AIRLINES



Source: Ozark Airlines, Inc.

UNITED AIRLINES



Source: United Airlines, Inc.

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Appendix F

AIRPORT SURVEY FORMS

SEWRPC FORM AS-3 9/71

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
AIRPORT SURVEY ENPLANING PASSENGERS

AIRLINE ABREVIATIONS

OS – AIR MICHIGAN
EA – EASTERN
NC – NORTH CENTRAL
NW – NORTHWEST
OZ – OZARK
UA – UNITED
ZW – AIR WISCONSIN

SAMPLE NUMBER

AIRLINE GATE FLIGHT NO. PASSENGER NO.

DATE: ____________

INTERVIEWER: ____________

SHEET ____ OF ____ SHEETS

NO. IN PARTY	AGE	SEX	RACE	ORIGIN INFORMATION			MODE	DESTINATION INFORMATION			PART OF ROUND TRIP	HOME ADDRESS	NON-REGION RESIDENTS ONLY			INCOME
				ADDRESS	LAND USE	TRIP PURPOSE		ULTIMATE DESTINATION	CBD	TRIP PURPOSE			BUS.	NATURE OF BUSINESS	KIND OF FIRM OR ORGANIZATION	
		M F	W B O R						Y N		Y N		Y N			
		M F	W B O R						Y N		Y N		Y N			
		M F	W B O R						Y N		Y N		Y N			
		M F	W B O R						Y N		Y N		Y N			
		M F	W B O R						Y N		Y N		Y N			
		M F	W B O R						Y N		Y N		Y N			

LAND USE CODES

1. RESIDENTIAL
2. HOTEL/MOTEL
3. COMMERCIAL
4. MANUFACTURING
5. TRANS, COMM. UTIL.
6. INSTITUTIONAL-GOV'T.
7. RECREATIONAL
8. AGRICULTURAL
9. OPEN LANDS & WATER AREAS

TRIP PURPOSE CODES

1. HOME
2. PLACE OF WORK
3. WORK-CONNECTED BUSINESS
4. PERSONAL BUSINESS
5. SCHOOL
6. MEDICAL/DENTAL CARE
7. SOCIAL/RECREATION, (INC. VACATION)
8. MILITARY DUTY/LEAVE
9. CONVENTION/SEMINAR
10. CHANGE MODE OF TRAVEL
11. SERVE PASSENGER
12. SHOPPING
13. OVERNIGHT ACCOMMODATION
14. OTHER (SPECIFY)

MODE OF TRAVEL CODES

1. PRIVATE CAR
2. RENTAL CAR
3. HOTEL/MOTEL COURTESY CAR
4. AIRPORT LIMOUSINE
5. TAXICAB
6. MOTOR BUS
7. COMMERCIAL AIR
8. AIR TAXI
9. PRIVATE AIRPLANE
10. 2 AXLE TRUCK
11. MULTI-AXLE TRUCK
12. OTHER (SPECIFY)

HOUSEHOLD ANNUAL INCOME RANGE

A. = $ 0 – $ 3,999
B. = 4,000 – 7,999
C. = 8,000 – 11,999
D. = 12,000 – 15,999
E. = 16,000 – 19,999
F. = 20,000 – 23,999
G. = 24,000 AND OVER

SEWRPC FORM AS-2-9/71

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
GENERAL AVIATION AIRPORT USER SURVEY

SAMPLE NUMBER

AIRPORT ____________

DATE ___/___/71

TIME ___:___

WEATHER
VFR ___ IFR ___

INTERVIEWER: ____________

VEHICLE OCCUPANCY: INBOUND ____________ OUTBOUND ____________

NO. IN PARTY	AGE	SEX	RACE	ORIGIN INFORMATION			MODE	PURPOSE AT AIRPORT	DESTINATION INFORMATION			MODE	HOME ADDRESS	INCOME	INTERVIEWER COMMENTS
				ADDRESS	LAND USE	PURPOSE AT			ADDRESS	LAND USE	PURPOSE AT				
		M F	W B O R												
		M F	W B O R												
		M F	W B O R												
		M F	W B O R												
		M F	W B O R												
		M F	W B O R												

LAND USE CODES

1. RESIDENTIAL
2. HOTEL/MOTEL
3. COMMERCIAL
4. MANUFACTURING
5. TRANS. COMM. UTIL.
6. INSTITUTIONAL-GOV'T.
7. RECREATIONAL
8. AGRICULTURAL
9. OPEN LANDS AND WATER AREAS

TRIP PURPOSE CODES

1. HOME
2. PLACE OF WORK
3. WORK-CONNECTED BUSINESS
4. PERSONAL BUSINESS
5. SCHOOL
6. MEDICAL/DENTAL CARE
7. SOCIAL/RECREATION(INC. VACATION)
8. MILITARY DUTY/LEAVE
9. CONVENTION/SEMINAR
10. CHANGE MODE OF TRAVEL
11. SERVE PASSENGER
12. SHOPPING
13. OVERNIGHT ACCOMMODATION
14. INSTRUCTION
15. PICK UP AND/OR DISCHARGE GOODS
16. SERVICE CALL
17. BASE OF OPERATION
18. OTHER (SPECIFY)

MODE OF TRAVEL CODES

1. PRIVATE CAR
2. RENTAL CAR
3. HOTEL/MOTEL COURTESY CAR
4. AIRPORT LIMOUSINE
5. TAXICAB
6. MOTOR BUS
7. COMMERCIAL AIR
8. AIR TAXI
9. PRIVATE AIRPLANE
10. 2 AXLE TRUCK
11. MULTI-AXLE TRUCK
12. OTHER (SPECIFY)

HOUSEHOLD ANNUAL INCOME RANGE

A. = $ 0 – $ 3,999
B. = $ 4,000 – $ 7,999
C. = $ 8,000 – $ 11,999
D. = $ 12,000 – $ 15,999
E. = $ 16,000 – $ 19,999
F. $ 20,000 – $ 23,999
G. = $ 24,000 AND OVER

SEWRPC FORM AS-1-9/71

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
GENERAL AVIATION AIRPORT PILOT SURVEY

SAMPLE NUMBER

DATE __ /__ /71

TIME __ : __

WEATHER
VFR__ IFR__

INTERVIEWER: ______

AIRPORT ______

LOCAL FLIGHT: Y N

ORIGIN-DESTINATION DATA

ORIGIN INFORMATION			MODE	FLIGHT PLAN	PURPOSE AT AIRPORT	DESTINATION INFORMATION			MODE	FLIGHT PLAN
ADDRESS	LAND USE	PURPOSE AT				ADDRESS	LAND USE	PURPOSE AT		
				NONE IFR VFR SVFR						NONE IFR VFR SVFR

LAND USE CODES

1. RESIDENTIAL
2. HOTEL/MOTEL
3. COMMERCIAL
4. MANUFACTURING
5. TRANS,COMM. UTIL.
6. INSTITUTIONAL-GOV'T
7. RECREATIONAL
8. AGRICULTURAL
9. OPEN LANDS & WATER AREAS

GROUND PURPOSE CODES

1. HOME
2. PLACE OF WORK
3. WORK-CONNECTED BUSINESS
4. PERSONAL BUSINESS
5. SCHOOL
6. MEDICAL/DENTAL CARE
7. SOCIAL/RECREATION,
8. MILITARY DUTY/LEAVE
9. CONVENTION/SEMINAR
10. CHANGE MODE OF TRAVEL
11. SERVE PASSENGER
12. SHOPPING
13. OVERNIGHT ACCOMMODATION
14. OTHER (SPECIFY)

AIR PURPOSE CODES

15. RETURN TO BASE OF OPERATION
16. PICK UP/DISCHARGE AIRLINE PASSENGERS
17. PICK UP/DISCHARGE OTHER PASSENGERS
18. PICK UP/DISCHARGE CARGO
19. INSTRUCTION/PROFICIENCY
20. AIR CARRIER CONNECTION
21. CHANGE MODE OF TRAVEL
22. WORK-CONNECTED BUSINESS AT AIRPORT
23. PERSONAL BUSINESS AT AIRPORT
24. SOCIAL RECREATION AT AIRPORT
25. FUEL AND/OR SERVICING
26. OTHER (SPECIFY)

MODE OF TRAVEL CODES

1. PRIVATE CAR
2. RENTAL CAR
3. HOTEL/MOTEL COURTESY CAR
4. AIRPORT LIMOUSINE
5. TAXICAB
6. MOTOR BUS
7. COMMERCIAL AIR
8. AIR TAXI
9. PRIVATE AIRPLANE
10. OTHER (SPECIFY)

PILOT DATA

AGE	SEX	RACE	HOME ADDRESS	PREVIOUSLY INTERVIEWED WITH THIS AIRCRAFT	NO. OPERATIONS FROM THIS FACILITY 12 MONTHS	LICENSE/RATINGS	INCOME
	M F	W B O R		Y N	______	1. STUDENT __ 2. PRIVATE __ 3. COMMERCIAL __ 4. AIR TRANSPORT __ 5. INSTRUMENT RATING __ 6. MULTI—ENGINE RATING __ 7. INSTRUCTOR RATING __	

CREW AND PASSENGER DATA

NO. OF CREW
OUT BOUND __ INBOUND __

NO. OF PASSENGERS
OUT BOUND __ INBOUND __

CARGO DATA

COMMODITY	WEIGHT	POINT OF ORIGIN	POINT OF DESTINATION

AIRCRAFT DATA

AIRCAFT NO.	HOME BASE	MAKE— MODEL	ENGINE TYPE	ENGINE NUMBER
N			PTJ	

EQUIPMENT

1. TRANSCEIVER(S) ______
2. VOR RECEIVER(S) ______
3. VOR/LOC INDICATOR(S) ______
4. FULL IFR PANEL ______
5. GLIDE SLOPE RECEIVER ______
6. MARKER BEACON RECEIVER ______
7. FLIGHT DIRECTOR ______
8. AUTOMATIC DIRECTION·FINDER ______
9. DISTANCE MEASURING EQUIPMENT ______
10. TRANSPONDER ______
11. WEATHER RADAR ______
12. DEICING EQUIPMENT ______
13. AUTO PILOT TYPE ______

Appendix G

DEFINITIONS OF EQUIPMENT ON GENERAL AVIATION AIRCRAFT

Automatic Direction Finder: A navigational radio used for "homing in" on high, medium, and low frequency radio stations.

Automatic Pilot: A device used to automatically guide aircraft. One type of device controls aircraft along one or all three of its axes. The other type can be connected to navigational instruments to handle instrument approaches and maintain altitude and heading.

Deicing Equipment: A unit designed to keep wings free of frost and ice.

Distance Measuring Equipment (DME): A navigational radio used to determine the distance between the aircraft and a DME station.

Flight Director: A single-panel instrument that combines navigational instruments, including automatic direction finder, VOR/LOC indicator, artificial horizon, etc. This unit is usually connected to an automatic pilot, which allows the pilot to navigate and control the aircraft with one instrument.

Full IFR Panel: The minimum instrumentation required to operate under instrument flight rules, and required in addition to the instrumentation required to operate under visual flight rules. Each group is comprised of the following: navigational and communication radio appropriate to the facilities being used, rate of turn indicator, bank indicator, sensitive altimeter, clock with sweep second hand, ammeter or warning light, artificial horizon, and directional gyroscope.

Glide Scope Receiver: A unit designed to receive the vertical slope signal transmitted by the instrument landing system and depicted on VOR/LOC receiver.

Marker Beacon Receiver: A unit receiving positional marker signals located along the approach path for an instrument landing system.

Transceiver: A voice transmitter and receiver used for air-to-ground and air-to-air communication.

Transponder: A unit transmitting radar signals which appear as two parallel bars on ground-based radar scopes as well as radar scopes on other aircraft. Some transponders also transmit altitude information to ground radar.

Visual Omnirange Receiver/Localizer Indicator (VOR/LOC): An instrument used to interpret VOR navigational signals in terms of bearing to and from a station, as well as on and off course indications.

Visual Omnirange Receiver (VOR): A unit designed to receive very high frequency (VHF) omnidirectional radio navigational aids.

Weather Radar: Radar normally found only in twin-engine or larger aircraft to gather information on weather ahead of the aircraft.

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Appendix H

STAGING OF RECOMMENDED IMPROVEMENTS AT AIRPORTS INCLUDED IN THE RECOMMENDED REGIONAL AIRPORT SYSTEM PLAN

Table H-1

STAGING PLAN FOR THE BURLINGTON MUNICIPAL AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		BU	30,904	$2.00	$ 61,808	$ --	$ --	$ --	$ --
		BU	36,530	1.80	65,754	--	--	--	--
	Land Acquisition	BU	42,156	1.60	67,450	607,500	455,626	75,937	75,937
		BU	47,782	1.40	66,895	--	--	--	--
	Extend Runway 11/29	BU	53,408	1.20	64,090	865,000	648,750	108,125	108,125
1980-1984	Navaids	BT	59,034	1.00	59,034	131,200	98,400	16,400	16,400
	Apron (1/2)	BT	64,660	1.00	64,660	265,100	198,826	33,137	33,137
		BT	70,286	1.00	70,286	--	--	--	--
	Terminal (2/3)	BT	75,912	1.00	75,912	333,500	--	35,000	298,500
	Auto Parking (2/3)	BT	81,538	0.90	73,384	38,000	--	--	38,000
1985-1989		BT	87,164	0.80	69,731	--	--	--	--
		BT	95,871	0.80	76,697	--	--	--	--
	Construct Runway 1/19	BT	104,578	0.80	83,662	913,300	684,976	114,162	114,162
	Navaids	BT	113,285	0.80	90,628	86,300	64,726	10,787	10,787
		BT	121,992	0.80	97,594	--	--	--	--
1990-1995	Improve Access Road	BT	130,600	0.75	97,950	75,000	56,250	9,375	9,375
	Apron (1/2)	BT	142,171	0.70	99,520	265,100	198,826	33,137	33,137
	Terminal (1/3)	BT	153,742	0.65	99,932	166,500	--	35,000	131,500
	Auto Parking (1/3)	BT	165,313	0.65	107,453	19,000	--	--	19,000
		BT	176,883	0.65	114,974	--	--	--	--
	Total	--	--	--	$1,607,414	$3,765,500	$2,406,380	$471,060	$888,060

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table H-2

STAGING PLAN FOR THE EAST TROY MUNICIPAL AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		BU	24,000	$1.15	$ 27,600	$ --	$ --	$ --	$ --
		BU	34,000	1.15	39,100	--	--	--	--
		BU	44,000	1.10	48,400	--	--	--	--
		BU	54,000	1.10	59,400	--	--	--	--
	Land Acquisition	BU	64,000	1.05	67,200	194,000	145,500	24,250	24,250
1980-1984		BU	74,000	1.00	74,000	--	--	--	--
	Construct Runway 9/27	BU	84,000	0.75	63,000	275,800	206,850	34,475	34,475
	Navaids Runway 9/27	BU	94,000	0.50	47,000	61,100	45,826	7,637	7,637
	Apron (1/2)	BU	104,000	0.45	46,800	167,900	125,926	20,987	20,987
		BU	114,000	0.40	45,600	--	--	--	--
1985-1989		BU	124,000	0.35	43,400	--	--	--	--
	Terminal	BU	131,200	0.30	39,360	507,000	--	35,000	472,000
	Auto Parking	BU	138,400	0.30	41,520	62,900	--	--	62,900
		BU	145,600	0.25	36,400	--	--	--	--
		BU	152,800	0.25	38,200	--	--	--	--
1990-1995		BU	160,000	0.20	32,000	--	--	--	--
	Apron (1/2)	BU	168,760	0.20	33,752	167,850	125,888	20,981	20,981
	Construct Runway 18/36	BU	177,520	0.20	35,504	223,400	167,550	27,925	27,925
	Navaids Runway 18/36	BU	186,280	0.20	37,256	36,800	27,600	4,600	4,600
		BU	195,040	0.20	39,008	--	--	--	--
	Total	--	--	--	$894,500	$1,696,750	$845,140	$175,855	$675,755

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Table H-3

STAGING PLAN FOR THE GENERAL MITCHELL FIELD: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979	Resurface Runways[a]	SAT	236,702	$5.00	$ 1,183,510	$ 4,520,000	$ 3,390,000	$ 565,000	$ 565,000
		SAT	238,175	5.10	1,214,692	4,520,000	3,390,000	565,000	565,000
	Land Acquisition	SAT	239,648	5.20	1,246,169	2,060,000	1,545,000	257,500	257,500
	Maintenance Facilities	SAT	241,121	5.30	1,277,941	1,930,000	1,447,500	241,250	241,250
	Mark and Light Obstructions	SAT	242,594	5.40	1,310,007	250,000	187,500	31,250	31,250
1980-1984	Terminal Facilities	SAT	244,067	5.50	1,342,368	12,300,000	--	35,000	12,265,000
		SAT	245,540	5.60	1,375,024	--	--	--	--
		SAT	247,013	5.70	1,407,974	--	--	--	--
	Extend Runway 1R/19L	SAT	248,486	5.80	1,441,218	2,400,000	1,800,000	300,000	300,000
	GA Terminal	SAT	249,959	5.90	1,474,758	270,000	--	--	270,000
1985-1989	Terminal Facilities	SAT	251,432	6.00	1,508,592	15,460,000	--	35,000	15,425,000
		SAT	252,905	6.00	1,517,430	--	--	--	--
	Realign Runway 7L/25R	SAT	254,378	6.00	1,526,268	1,720,000	1,290,000	215,000	215,000
		SAT	255,851	6.00	1,535,106	--	--	--	--
		SAT	257,324	6.00	1,543,944	--	--	--	--
1990-1995	Terminal Facilities	SAT	258,800	6.00	1,552,800	10,300,000	--	35,000	10,265,000
		SAT	261,300	6.00	1,567,800	--	--	--	--
		SAT	263,800	6.00	1,582,800	--	--	--	--
	Extend Runway 7R/25L	SAT	266,300	6.00	1,597,800	1,380,000	1,035,000	172,500	172,500
	Extend Runway 1L/19R	SAT	268,800	6.00	1,612,800	3,490,000	2,617,500	436,250	436,250
	Total	--	--	--	$28,819,001	$65,120,000	$20,092,500	$3,453,750	$41,573,750

[a] *Runway resurfacing project was initiated in 1974. Total project costs are included in this table.*

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table H-4

STAGING PLAN FOR THE GRUENWALD AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		BU	6,600	$0.45	$ 2,970	$ --	$ --	$ --	$ --
		BU	14,100	0.45	6,345	--	--	--	--
		BU	21,600	0.45	9,720	--	--	--	--
		BU	29,100	0.45	13,095	--	--	--	--
		BU	36,600	0.45	16,470	--	--	--	--
1980-1984	Land Acquisition	BU	44,100	0.45	19,845	449,800	337,350	56,225	56,225
		BU	51,600	0.45	23,220	--	--	--	--
		BU	59,100	0.45	26,595	--	--	--	--
		GU	66,600	0.45	29,970	--	--	--	--
	Construct Northeast/ Southwest Runway	GU	74,100	0.45	33,345	572,000	429,000	71,500	71,500
1985-1989	Navaids Northeast/ Southwest Runway	GU	81,600	0.45	36,720	121,750	91,314	15,218	15,218
		GU	88,000	0.45	39,600	--	--	--	--
	Apron (1/2)	GU	94,400	0.45	42,480	152,050	114,038	19,006	19,006
		GU	100,800	0.45	45,360	--	--	--	--
	Terminal	GU	107,200	0.45	48,240	565,500	--	35,000	530,500
1990-1995	Auto Parking	GU	113,600	0.45	51,120	62,600	--	--	62,600
	Apron (1/2)	GU	120,360	0.45	54,162	152,050	114,038	19,006	19,006
	Utility	GU	127,120	0.45	57,204	18,000	--	--	18,000
	Construct Northwest/ Southeast Runway	GU	133,880	0.45	60,246	449,000	336,750	56,125	56,125
	Navaids Northwest/ Southeast Runway	GU	140,640	0.45	63,288	75,250	56,438	9,406	9,406
	Total	--	--	--	$679,995	$2,618,000	$1,478,928	$281,486	$857,586

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Table H-5

STAGING PLAN FOR THE HARTFORD MUNICIPAL AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		BU	73,512	$0.30	$ 22,053	$ --	$ --	$ --	$ --
		BU	77,490	0.35	27,121	--	--	--	--
		BU	81,468	0.35	28,513	--	--	--	--
		BU	85,446	0.40	34,178	--	--	--	--
	Land Acquisition	BU	89,424	0.40	35,769	333,500	250,126	41,687	41,687
1980-1984	Extend Runway 11/29	GU	93,402	0.45	42,030	123,500	92,626	15,437	15,437
	Navaids Runway 11/29	GU	97,380	0.45	43,821	113,400	85,050	14,175	14,175
		GU	101,358	0.45	45,611	--	--	--	--
	Apron (1/2)	GU	105,336	0.45	47,401	192,250	144,188	24,031	24,031
		GU	109,314	0.45	49,191	--	--	--	--
1985-1989		GU	113,300	0.45	50,985	--	--	--	--
	Construct Runway 2/20	GU	121,260	0.45	54,567	254,800	191,100	31,850	31,850
	Navaids Runway 2/20	GU	129,220	0.40	51,688	46,800	35,100	5,850	5,850
	Apron (1/2)	GU	137,180	0.40	54,872	192,250	144,188	24,031	24,031
	Auto Parking	GU	145,140	0.35	50,799	64,200	--	--	64,200
1990-1995	Terminal	GU	153,100	0.30	45,930	624,000	--	35,000	589,000
	Utility	GU	163,505	0.30	49,051	29,000	--	--	29,000
		GU	173,910	0.30	52,173	--	--	--	--
		GU	184,315	0.30	55,294	--	--	--	--
		GU	194,720	0.30	58,416	--	--	--	--
	Total	--	--	--	$899,463	$1,973,700	$942,378	$192,061	$839,261

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Table H-6

STAGING PLAN FOR THE KENOSHA MUNICIPAL AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		GU	81,300	$0.45	$ 36,585	$ --	$ --	$ --	$ --
		GU	85,500	0.45	38,475	--	--	--	--
	Land Acquisition	GU	89,700	0.45	40,365	1,782,000	1,336,500	222,750	222,750
		GU	93,900	0.45	42,255	--	--	--	--
	Apron (1/3)	GU	98,100	0.45	44,145	145,000	108,750	18,125	18,125
1980-1984	Terminal (1/3)	GU	102,300	0.45	46,035	212,500	--	35,000	177,500
	Auto Parking (1/3)	GU	106,500	0.45	47,925	20,300	--	--	20,300
	Improve Runway 14/32	GU	110,700	0.45	49,815	416,600	312,450	52,075	52,075
	Navaids Runway 14/32	GU	114,900	0.45	51,705	70,600	52,950	8,825	8,825
		GU	119,100	0.45	53,595	--	--	--	--
1985-1989	Improve Runway 6R/24L	GU	123,300	0.45	55,485	203,700	152,776	25,462	25,462
	Navaids Runway 6R/24L	GU	132,680	0.45	59,706	152,500	114,376	19,062	19,062
	Terminal (2/3)	GU	142,060	0.45	63,927	425,000	--	35,000	390,000
	Auto Parking (2/3)	GU	151,440	0.45	68,148	40,600	--	--	40,600
	Apron (2/3)	GU	160,820	0.45	72,369	287,700	215,776	35,962	35,962
1990-1995	Construct Runway 6L/24R	BT	170,200	0.45	76,590	3,137,500	2,353,126	392,187	392,187
	Navaids Runway 6L/24R	BT	182,720	0.65	118,768	72,500	54,376	9,062	9,062
		BT	195,240	0.65	126,906	--	--	--	--
		BT	207,760	0.65	135,044	--	--	--	--
		BT	220,280	0.65	143,182	--	--	--	--
	Total	--	--	--	$1,371,025	$6,966,500	$4,701,080	$853,510	$1,411,910

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Table H-7

STAGING PLAN FOR THE OZAUKEE COUNTY AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		BU	7,000	$0.30	$ 2,100	$ --	$ --	$ --	$ --
		BU	18,000	0.30	5,400	--	--	--	--
	Land Acquisition	BU	29,000	0.30	8,700	434,000	325,500	54,250	54,250
		BU	40,000	0.30	12,000	--	--	--	--
		BU	51,000	0.30	15,300	--	--	--	--
1980-1984	Construct North/South Runway	GU	62,000	0.30	18,600	572,000	429,000	71,500	71,500
	Navaids	GU	73,000	0.30	21,900	121,900	91,426	15,237	15,237
		GU	84,000	0.30	25,200	--	--	--	--
		GU	95,000	0.30	28,500	--	--	--	--
	Apron (1/2)	GU	106,000	0.30	31,800	228,450	171,338	28,556	28,556
1985-1989	Terminal (1/2)	GU	117,000	0.30	35,100	324,850	--	35,000	289,850
	Auto Parking (1/2)	GU	126,180	0.30	37,854	35,900	--	--	35,900
	Utility Service	GU	135,360	0.30	40,608	18,000	--	--	18,000
		GU	144,540	0.30	43,362	--	--	--	--
	Apron (1/2)	GU	153,720	0.30	46,116	228,400	171,300	28,550	28,550
1990-1995	Terminal (1/2)	GU	162,900	0.30	48,870	324,850	--	35,000	289,850
	Auto Parking (1/2)	GU	175,320	0.30	52,596	35,900	--	--	35,900
		GU	187,740	0.30	56,322	--	--	--	--
	Construct East/West Runway	GU	200,160	0.30	60,048	449,000	336,750	56,125	56,125
	Navaids	GU	212,580	0.30	63,774	75,250	56,438	9,406	9,406
	Total	--	--	--	$654,150	$2,848,500	$1,581,752	$333,624	$933,124

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc.; and SEWRPC.

Table H-8

STAGING PLAN FOR THE RACINE COMMERCIAL AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		BT	47,000	$0.80	$ 37,600	$ --	$ --	$ --	$ --
	Taxiway Construction	BT	50,000	0.80	40,000	400,000	300,000	50,000	50,000
	Apron (1/2)	BT	53,000	0.80	42,400	119,450	89,588	14,931	14,931
	Relocate Hangars	BT	56,000	0.80	44,800	18,800	14,100	2,350	2,350
	Navaids	BT	59,000	0.80	47,200	211,500	158,626	26,437	26,437
1980-1984	Mark and Light Obstructions	BT	62,000	0.80	49,600	37,500	28,126	4,687	4,687
		BT	65,000	0.80	52,000	--	--	--	--
		BT	68,000	0.80	54,400	--	--	--	--
		BT	71,000	0.80	56,800	--	--	--	--
	Land Acquisition	BT	74,000	0.80	59,200	5,744,000	4,308,000	718,000	718,000
1985-1989	Street Relocation	BT	77,000	0.80	61,600	200,000	150,000	25,000	25,000
	Terminal	BT	80,400	0.80	64,320	532,500	--	35,000	497,500
	Auto Parking	BT	83,800	0.80	67,040	58,700	--	--	58,700
	Apron (1/2)	BT	87,200	0.80	69,760	119,450	89,588	14,931	14,931
		BT	90,600	0.80	72,480	--	--	--	--
1990-1995	Strengthen Runways	BT	94,000	0.80	75,200	512,500	384,376	64,062	64,062
		BT	97,200	0.80	77,760	--	--	--	--
		BT	100,400	0.80	80,320	--	--	--	--
		BT	103,600	0.80	82,880	--	--	--	--
		BT	106,800	0.80	85,440	--	--	--	--
	Total	--	--	--	$1,220,800	$7,954,400	$5,522,404	$955,398	$1,476,598

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Table H-9

STAGING PLAN FOR THE SYLVANIA AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source: Federal	Funding Source: State	Funding Source: Local
1975-1979		BU	20,700	$0.35	$ 7,245	$ --	$ --	$ --	$ --
		BU	29,400	0.35	10,290	--	--	--	--
		BU	38,100	0.35	13,335	--	--	--	--
		BU	46,800	0.35	16,380	--	--	--	--
		BU	55,500	0.35	19,425	--	--	--	--
1980-1984		BU	64,200	0.35	22,470	--	--	--	--
		BU	72,900	0.35	25,515	--	--	--	--
	Land Acquisition	BU	81,600	0.35	28,560	474,500	355,876	59,312	59,312
		BU	90,300	0.35	31,605	--	--	--	--
		BU	99,000	0.35	34,650	--	--	--	--
1985-1989	Runway Construction	BU	107,700	0.35	37,695	499,200	374,400	62,400	62,400
	Navaids	BU	113,300	0.35	39,655	104,800	78,600	13,100	13,100
		BU	118,900	0.35	41,615	--	--	--	--
	Apron (1/2)	BU	124,500	0.35	43,575	126,850	95,138	15,856	15,856
		BU	130,100	0.35	45,535	--	--	--	--
1990-1995	Utility	BU	135,700	0.35	47,495	18,000	--	--	18,000
	Terminal	BU	141,640	0.30	42,492	471,250	--	35,000	436,250
	Auto Parking	BU	147,580	0.30	44,274	62,550	--	--	62,550
	Apron (1/2)	BU	153,520	0.25	38,380	126,850	95,138	15,856	15,856
		BU	159,460	0.20	31,892	--	--	--	--
	Total	--	--	--	$622,083	$1,884,000	$999,152	$201,524	$683,324

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Table H-10

STAGING PLAN FOR THE TIMMERMAN FIELD: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source: Federal	Funding Source: State	Funding Source: Local
1975-1979		GU	175,553	$0.20	$ 35,110	$ --	$ --	$ --	$ --
	Land Acquisition	GU	183,153	0.21	38,462	540,000	405,000	67,500	67,500
	Navaids	GU	190,753	0.22	41,965	68,900	51,676	8,612	8,612
	Apron (1/2)	GU	198,353	0.23	45,621	219,250	164,438	27,406	27,406
		GU	205,953	0.24	49,428	--	--	--	--
1980-1984	Terminal (1/2)	GU	213,553	0.25	53,388	378,300	--	35,000	343,300
	Auto Parking (1/2)	GU	221,153	0.26	57,499	28,450	--	--	28,450
	Pave Runway 15R/33L	GU	228,753	0.27	61,763	258,000	193,500	32,250	32,250
		GU	236,353	0.28	66,178	--	--	--	--
	Land Acquisition	GU	243,953	0.29	70,746	500,000	375,000	62,500	62,500
1985-1989	Pave Runway 4R/22L	GU	251,553	0.30	75,465	245,700	184,276	30,712	30,712
	Apron (1/2)	GU	261,882	0.30	78,564	219,250	164,438	27,406	27,406
	Widen Runways 15L/33R and 4L/22R	GU	272,211	0.30	81,663	237,200	177,900	29,650	29,650
		GU	282,540	0.30	84,762	--	--	--	--
		GU	292,869	0.30	87,860	--	--	--	--
1990-1995	Terminal (1/2)	GU	303,200	0.30	90,960	378,300	--	35,000	343,300
	Auto Parking (1/2)	GU	310,855	0.30	93,256	28,450	--	--	28,450
		GU	318,510	0.30	95,553	--	--	--	--
	Land Acquisition	GU	326,165	0.30	97,849	500,000	375,000	62,500	62,500
		GU	333,820	0.30	100,146	--	--	--	--
	Total	--	--	--	$1,406,238	$3,601,800	$2,091,228	$418,536	$1,092,036

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Table H-11

STAGING PLAN FOR THE WAUKESHA COUNTY AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		GU	149,572	$0.80	$ 119,657	$ --	$ --	$ --	$ --
		GU	157,615	0.80	126,092	--	--	--	--
		GU	165,658	0.80	132,526	--	--	--	--
	Land Acquisition	GU	173,701	0.80	138,960	1,535,000	1,151,250	191,875	191,875
		GU	181,744	0.80	145,395	--	--	--	--
1980-1984	Relocate CTH TJ	BT	189,787	0.80	151,829	187,000	140,250	23,375	23,375
	Extend Runway 10L/28R	BT	197,830	0.75	148,372	557,500	418,126	69,687	69,687
	Navaids Runway 10L/28R	BT	205,873	0.70	144,111	147,500	110,626	18,437	18,437
		BT	213,916	0.65	139,045	--	--	--	--
		BT	221,959	0.65	144,273	--	--	--	--
1985-1989	Resurface Runway 18/36	BT	230,000	0.65	149,500	140,000	105,000	17,500	17,500
	Navaids Runway 18/36	BT	238,480	0.65	155,012	75,000	56,250	9,375	9,375
	Apron	BT	246,960	0.65	160,524	943,300	707,476	117,912	117,912
	Construct Runway 10R/28L	BT	255,440	0.65	166,036	260,000	195,000	32,500	32,500
		BT	263,920	0.65	171,548	--	--	--	--
1990-1995	Terminal	BT	272,400	0.65	177,060	607,500	--	35,000	572,500
	Auto Parking	BT	280,320	0.65	182,208	41,400	--	--	41,400
		BT	288,240	0.65	187,356	--	--	--	--
		BT	296,160	0.65	192,504	--	--	--	--
		BT	304,080	0.65	197,652	--	--	--	--
	Total	--	--	--	$3,129,660	$4,494,200	$2,883,978	$515,661	$1,094,561

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Table H-12

STAGING PLAN FOR THE WEST BEND MUNICIPAL AIRPORT: 1975-1995

Staging Period	Improvement Item	Airport Classification	Annual Operations	Cost Per Operation	Annual Operation and Maintenance Cost	Capital Investment	Funding Source		
							Federal	State	Local
1975-1979		GU	81,144	$0.60	$ 48,686	$ --	$ --	$ --	$ --
		GU	83,630	0.62	51,850	--	--	--	--
	Land Acquisition	GU	86,116	0.64	55,114	542,100	406,576	67,762	67,762
		GU	88,602	0.66	58,477	--	--	--	--
	Relocate STH 33	GU	91,088	0.68	61,939	519,000	389,250	64,875	64,875
1980-1984	Extend Runway 6/24	BT	93,574	0.70	65,501	870,000	652,500	108,750	108,750
	Navaids Runway 6/24	BT	96,060	0.75	72,045	143,750	107,814	17,968	17,968
		BT	98,546	0.80	78,836	--	--	--	--
		BT	101,032	0.80	80,825	--	--	--	--
		BT	103,518	0.80	82,814	--	--	--	--
1985-1989	Aprons	BT	106,000	0.80	84,800	664,200	498,150	83,025	83,025
	Strengthen Runway 13/31	BT	117,160	0.80	93,728	421,250	315,938	52,656	52,656
	Navaids Runway 13/31	BT	128,320	0.80	102,656	81,300	60,976	10,162	10,162
		BT	139,480	0.75	104,610	--	--	--	--
	Utility	BT	150,640	0.70	105,448	29,000	--	--	29,000
1990-1995	Terminal	BT	161,800	0.65	105,170	645,000	--	35,000	610,000
	Auto Parking	BT	177,440	0.65	115,336	53,100	--	--	53,100
		BT	193,080	0.65	125,502	--	--	--	--
		BT	208,720	0.65	135,668	--	--	--	--
		BT	224,360	0.65	145,834	--	--	--	--
	Total	--	--	--	$1,774,839	$3,968,700	$2,431,204	$440,198	$1,097,298

Source: Wisconsin Department of Transportation, Division of Aeronautics; R. Dixon Speas Associates, Inc., and SEWRPC.

Appendix I

STEPS INVOLVED IN INITIATING AN AIRPORT IMPROVEMENT PROJECT

HOW TO INITIATE AN AIRPORT IMPROVEMENT PROJECT

The legal basis for initiation of an airport project is covered in Section 114.33 of the Wisconsin Statutes. That Statute requires that initiation shall be by a petition filed with the Wisconsin Secretary of Transportation by the governing body or bodies of the counties, cities, villages, or towns desiring to sponsor the project. Sample petition resolutions are attached for both an improvement project and a master planning project. The completed petition should be mailed to the Division of Aeronautics, 4802 Sheboygan Avenue, Madison, Wisconsin 53702. After receipt of the petition, the State will conduct a public hearing in the matter and the Secretary of Transportation shall make his finding within a reasonable time after the hearing. If the finding is generally favorable, the Secretary will submit it to the Governor for his approval.

The Division of Aeronautics will assemble all necessary documents and submit the application for federal aid when federal aid is requested. The sponsor will enter into an agency agreement with the Secretary of Transportation permitting the Secretary to act in all matters concerning the project on behalf of the sponsor.

The Division of Aeronautics will then handle all of the details towards completing the projects, including obtaining a consultant for project design, preparation of an environmental impact statement, advertising for bids, awarding of the construction contract, construction inspection, and receiving and paying all bills.

Typically a total of thirty-four steps are required for completion of a construction project and fourteen for a master plan project. These steps are outlined on the attached flow charts.

PETITION RESOLUTION

RESOLVED, By the Common Council of the City of ________________ that, whereas, it is deemed to be the best interest of the City of ________________ to petition for State and Federal Aid for improvement of the ________________ Airport:

THEREFORE, BE IT RESOLVED, By the Common Council of said City that the Mayor and City Clerk by, and they hereby are, authorized to execute and file with the Secretary of Transportation a petition for such aid and a hearing; that said petition in the following form is hereby approved, to wit:

"PETITION FOR AIRPORT PROJECT

By the City of ________________, ________________ County, Wisconsin

TO THE SECRETARY OF TRANSPORTATION:

(In care of Wisconsin Department of Transportation, Division of Aeronautics.)

Your petitioner, desiring to sponsor an airport development project with Federal Aid and State Aid in accordance with the applicable State and Federal laws, respectfully represents and shows:

1. That the airport project which your petitioner desires to sponsor is necessary for the following reasons:
2. That the airport which it is desired to develop should generally conform to the requirements for a ________________ type airport as defined by the Federal Aviation Administration.
3. That the location deemed most suitable is generally described as:
4. The character, extent and kind of improvements desired under the project are as follows:

WHEREAS, the foregoing proposal for airport improvements has been referred to the City Plan Commission for its consideration and report prior to council action as required by Wisconsin Statutes Chapter 62.23(5).

THEREFORE, You are requested to hold a hearing of the matter as required by law and to take such action thereafter as may be deemed to be justified by the law and the facts of the case."

____
Mayor

Introduced: Date ________________
Passed: Date ________________
Attest: ________________
City Clerk

I do hereby certify that the above and foregoing is a true, accurate, and complete copy of the original resolution No. _____, introduced and passed by the Common Council on ________________, 19 ___.

Signed ________________
City Clerk

PETITION RESOLUTION

RESOLVED, By the Common Council of the City of ________________, that, whereas, it is deemed to be to the best interest of the City of ________________ to petition for State and Federal Aid for an airport planning project for the ________________ Airport.

THEREFORE, BE IT RESOLVED, By the Common Council of said City that the Mayor and City Clerk be, and they hereby are, authorized to execute and file with the Secretary of Transportation a petition for such aid; that said petition in the following form is hereby approved, to wit:

"PETITION FOR AIRPORT PLANNING PROJECT

By the City of ________________, ________________ County, Wisconsin.

TO THE SECRETARY OF TRANSPORTATION:
(Attention: Wisconsin Department of Transportation, Division of Aeronautics)

Your petitioner, desiring to sponsor an airport planning project with Federal Aid and State Aid in accordance with the applicable State and Federal laws, respectfully represents and shows.

1. That the airport project which your petitioner desires to sponsor is necessary for the following reasons:
2. That the plan which it is desired to develop should generally conform to the requirements of an Airport Master Planning Grant as defined by the Federal Aviation Administration.
3. That the area to be studied is generally described as:

THEREFORE, you are requested to take such action as may be deemed to be justified by the law and the facts of the case."

____
Mayor

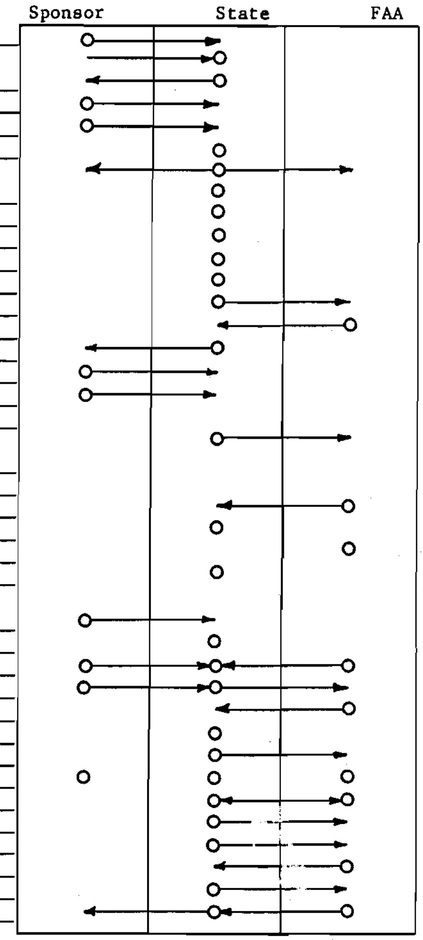
Introduced: Date ________________
Passed: Date ________________
Attest: ________________
City Clerk

I hereby certify that the above and foregoing is a true, accurate, and complete copy of the original Resolution No. ______, introduced and passed by the Common Council on ________________, 19___.

Signed ________________
City Clerk

DOCUMENT FLOW CHART
for
APPROVED EXISTING AIRPORT
INVOLVING STATE AND FEDERAL AIDS

1. Petition for aid
2. Hearing for project justification
   a) Examiners report
3. Agency agreement and resolution by sponsor (ALP, EIAR, Land appraisals)
4. Sponsor funds
5. Engineers and appraisers contract
6. Environmental Impact Assessment Report
   a) Available to the public for 30 days
   b) DNR Review
7. Environmental Hearing
8. Preparation of Preapplication for federal aid
9. A-95 (45 da.)
10. Submit Preapplication for federal aid
11. F.A.A. Notice of Project Programming and Allocation of Funds
12. Finding
13. Agency Agreement and resolution by sponsor
14. Sponsors funds (Plans & Specs, Land, Construction, Zoning Map)
15. Engineers Contract
16. F.A.A. Project Application
    a) Submittal of Plans & Specifications for Review
    b) Title Opinion on Existing Airport, Leases and agreements
17. Approval to Take Bids
18. Advertisement for Bids
19. F.A.A. Grant Offer
20. F.A.A. Grant Offer Accepted
21. Ratification of Grant Agreement by Sponsor and Distribution of Grant Agreement and Copies
22. Award of Construction Contract
23. Approval of Award of Construction Contract
24. Title Opinions on New Property
25. Approval to Start Work
26. Notice to Proceed to Contractor Issued
27. Request for Partial Payment of Federal Funds
28. Final Inspection of Completed Project
29. Acceptance of the Work
30. Submission of "As Built Plans" (Construction and ALP)
31. Request for Final Payment of Federal Funds
32. Federal Audit of Project Funds
33. Reclaim Disallowed Costs
34. Final Settlement



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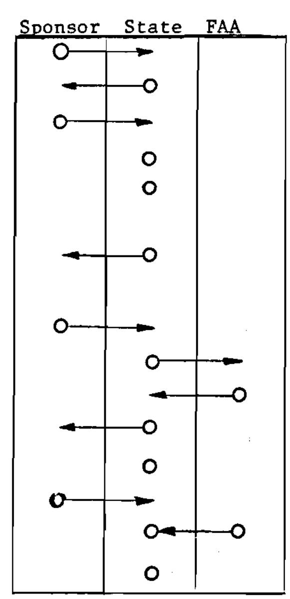
DOCUMENT FLOW CHART
MASTER PLAN PROJECTS

1. Petition for Project
2. Recommendation of Consultant
3. Sponsor Concurrs with Recommendation
4. Consultant's Proposal Submitted
5. DOA Requests & Receives Clearing House Notification
6. Request Designation of Secretary as Agent, and Reservation of Funds
7. "Resolution Designating Secretary as Agent", "Agency Agreement", and "Fund Resolution"
8. Compile Documentation and Submit Grant Application
9. Grant Offer
10. Finding
11. Grant Acceptance
12. Ratification of Grant and Submittal of Funds
13. Contract with Consultant with Approval from FAA
14. "Notice to Proceed" to Consultant



Source: Wisconsin Department of Transportation, Division of Aeronautics.

Appendix J

MODEL RESOLUTION FOR ADOPTION OF THE REGIONAL AIRPORT SYSTEM PLAN FOR SOUTHEASTERN WISCONSIN

WHEREAS, the Southeastern Wisconsin Regional Planning Commission, which was duly created by the Governor of the State of Wisconsin in accordance with Section 66.945(2) of the Wisconsin Statutes on the 8th day of August 1960 upon petition of the Counties of Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha, has the function and duty of making and adopting a master plan for the physical development of the Region; and

WHEREAS, the Southeastern Wisconsin Regional Planning Commission has completed and adopted a regional land use plan and a regional transportation plan at its meeting held on the 1st day of December 1966; and

WHEREAS, the Southeastern Wisconsin Regional Planning Commission has:

1. Collected, compiled, processed, and analyzed various types of demographic, economic, land use, natural resource base, and airport and aircraft data and materials pertaining to the development of the Region.

2. Prepared objectives, principles, and standards for regional airport system development.

3. Forecast regional growth and change as related to population and aviation activity demand.

4. Developed, compared, and evaluated alternative airport system plans for the Region.

5. Selected and adopted on the ______ day of __________ 1976 a regional airport system plan to the year 1995; and

WHEREAS, the aforementioned inventories, analyses, objectives, principles, standards, forecasts, alternative plans, and adopted plan are set forth in a report entitled SEWRPC Planning Report No. 21, <u>A Regional Airport System Plan for Southeastern Wisconsin</u>, published in December 1975; and

WHEREAS, the Commission has transmitted certified copies of its resolution adopting such regional airport system plan, together with the aforementioned SEWRPC Planning Report No. 21, to the local units of government; and

WHEREAS, the (Name of Local Governing Body) has supported, participated in the financing of, and generally concurred in the regional planning programs undertaken by the Southeastern Wisconsin Regional Planning Commission and believes that the regional airport system plan prepared by the Commission is a sound and valuable guide not only to the development of the Region, but also of the community, and the adoption of such plan by the (Name of Local Governing Body) will assure a common understanding by the several governmental levels and agencies concerned and enable these levels and agencies of government to program the necessary areawide and local plan implementation work; and

WHEREAS, the (Name of Local Governing Body) did on the ______ day of __________ 19 __ approve a resolution adopting the regional transportation plan.

NOW, THEREFORE, BE IT HEREBY RESOLVED that pursuant to Section 66.945(12) of the Wisconsin Statutes, the (Name of Local Governing Body) on the _______ day of ___________ 19__ hereby adopts the regional airport system plan previously adopted by the Southeastern Wisconsin Regional Planning Commission as set forth in SEWRPC Planning Report No. 21 as a guide for regional and community development.

BE IT FURTHER HEREBY RESOLVED that the _____________ Clerk transmit a certified copy of this resolution to the Southeastern Wisconsin Regional Planning Commission.

____
(President, Mayor, or Chairman of the Local Governing Body)

ATTESTATION:

____
(Clerk of Local Governing Body)

R. DIXON SPEAS ASSOCIATES, INC.

William H. Wilkinson
Senior Vice-President

Larry N. Fagan
Assistant Vice-President

Mark J. Ryan
Assistant Vice-President

Howard A. Loewenstein
Associate Planner

WISCONSIN DEPARTMENT OF TRANSPORTATION

Donald M. Cammack
Chief Planning Engineer

Vern A. Reding
Engineer

Richard P. Walwrath
Engineer

Robert G. Anderson
Planning Analyst

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Kurt W. Bauer, P.E.
Executive Director

Keith W. Graham
Assistant Director

Harlan E. Clinkenbeard
Assistant Director

Philip C. Evenson
Chief Community Assistance Planner

Mark P. Green
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