PLANNING REPORT NO. 7

LAND USE – TRANSPORTATION STUDY

FORECASTS AND ALTERNATIVE PLANS 1990

volume two

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Southeastern Wisconsin Regional Planning Commission

Land Use-Transportation Study

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in three parts

volume two

FORECASTS AND ALTERNATIVE PLANS

1990

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June, 1966

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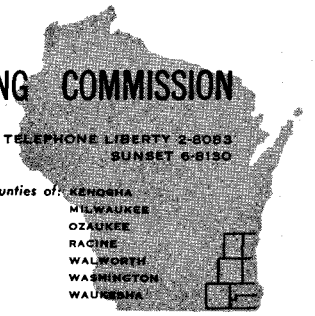

June, 1966

STATEMENT OF THE CHAIRMAN

The Southeastern Wisconsin Regional Planning Commission was created in September 1960 upon the petitions of the seven constituent county boards filed pursuant to the State Regional Planning Enabling Act. This Act provides, in part, that it shall be the function and duty of the Commission to prepare an advisory comprehensive plan for the physical development of the Region. This comprehensive plan is to be so drafted as to give due consideration to the factors of public health, safety, order, conveniency, urgency, and economy in the regional development process. In January 1963 the Commission, with the full approval and financial assistance of the seven member counties, the State Highway Commission of Wisconsin, the U. S. Bureau of Public Roads, and the U. S. Department of Housing and Urban Development, began a three and one-half year regional land use-transportation study, the purpose of this study being to provide two of the key elements of the comprehensive regional development plan: a regional land use plan and a regional transportation system plan.

Three major study reports will be provided. The first report entitled, Inventory Findings 1963, Volume 1, SEWRPC Planning Report No. 7, was published in May 1965. It represents a summary of the factual findings of the many inventories which are required to provide the basis for an analysis of the land use and transportation problems of the Region. This, the second report, is concerned with the formulation of regional development objectives, principles, and standards; the forecasts of future growth in the Region; and the presentation and evaluation of three alternative regional land use-transportation plans designed to meet the anticipated growth and change. This report will provide the basis for the selection of a final regional land use-transportation plan from the aforementioned three alternative regional land use-transportation plans. The third report, due to be released this Fall, will detail the final plan and make recommendations for its implementation.

The three alternative plans covered in this report have been designed in such a manner as to meet the approved objectives for regional development. They were prepared and tested, using advanced planning techniques. The advantages and disadvantages, together with benefits and costs of each separate plan, are fully presented in this report. A most careful review and study of this report by all responsible public officials is respectfully requested. A public hearing hereon will be conducted by the Commission this Fall.

Acknowledgment must be given for the valuable assistance and guidance of the Technical Coordinating and Advisory Committee and the Intergovernmental Coordinating Committee on Regional Land Use-Transportation Planning. A strong attitude of cooperation between the related and participating agencies and this Commission continues to prevail. These advisory Committees provide a nucleus of technicians, as well as a group of informed public officials. The Commission will continue to draw upon them for their sound advice and assistance as it proceeds with its responsibility and duty of providing stable and intelligent guidelines for the future development of this Southeastern Wisconsin Region.

Respectfully,

George C. Berteau

George C. Berteau
Chairman

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ACKNOWLEDGMENTS

The completion of the regional land use-transportation study forecasts and alternative plans and the publication of this report were made possible only through the cooperation and assistance of many individuals, agencies of government, and private businesses within the Region.

The genuine interest shown in the study and the courtesies shown to the Commission staff by the many municipal, county, state, and federal employees, elected governmental officials, business executives, and university faculty, who gave so freely of their time to the study through participation in the work of the Technical Coordinating and Advisory Committee and the Intergovernmental Coordinating Committee and through individual consultation, were most gratifying. Particular acknowledgment is due the governmental agencies which assigned resident staff to the study during preparation of forecasts and alternative plans including the City and County of Milwaukee, the State Highway Commission of Wisconsin, and the U. S. Bureau of Public Roads. Particular acknowledgment is also due the county and municipal planning and engineering staffs within the Region and the Milwaukee & Suburban Transport Corp., for their invaluable assistance in plan preparation.

The assistance, encouragement, and courtesy of all these individuals and agencies are hereby gratefully acknowledged.

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Table of Contents

List of Appendices

List of Tables

List of Figures

List of Maps

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Chapter I
INTRODUCTION

This report is the second in a series of three volumes, which together present the major findings and recommendations of the SEWRPC Regional Land Use-Transportation Study. The first volume, published in May 1965, set forth the basic principles and concepts underlying the study and presented in summary form the basic facts which together describe the existing state of the systems being planned and are, therefore, pertinent to long-range land use and transportation planning in southeastern Wisconsin.

This, the second volume, is concerned with the formulation of regional development objectives, principles, and standards; the forecast of future growth and change in the Region; and the presentation and evaluation of alternative land use-transportation plans designed to meet the anticipated growth and change. This report is intended to provide the basis for the selection of the final regional land use-transportation plan from among the alternative development plans proposed.

The third and final volume of the series will detail the land use-transportation plan finally selected and recommended for implementation. It will propose a staging for land use and transportation system development and will set forth detailed plans for certain selected corridors of transportation movement.

THE LAND USE-TRANSPORTATION PLANNING PROCESS—A BRIEF REVIEW

The nature of the land use-transportation planning problem, the basic principles and concepts underlying the land use-transportation planning process, and the process itself were all described in the first volume of this series; and reference should be made to that volume for a more detailed discussion of the need for, purposes of, and methods of planning for regional land use and transportation system development.

It is important to note in review, however, that the generalized alternative land use-transportation plans presented in this volume have been developed through a seven-step planning process by which the Region and its principal functional relationships can be accurately described, both graphically and numerically; the complex movement of people and vehicles over highway and transit facilities simulated; and the effects of different courses of action with respect to regional land use and transportation system development evaluated. The seven steps involved in this planning process are: 1) study design; 2) formulation of objectives, principles, and standards; 3) inventory; 4) analysis and forecast; 5) plan design; 6) plan test and evaluation; and 7) plan selection and adoption. Plan implementation, although necessarily a step beyond the foregoing planning process, must be considered throughout the process if the plans are to be realized. In fact, one of the primary objectives of the critical plan test and evaluation step is to test plan proposals for feasibility of implementation.

The first of these seven steps in the planning process—study design—has been described and its results set forth in the original study prospectus, in the detailed study design, and in the procedural manuals governing the study.[1] The third step—inventory—has been described and its findings set forth in Volume 1 of this report series.[2] This important step provided the necessary information base for step four—analysis and forecast; step five—plan design; and step six—plan test and evaluation. This volume will describe and present the results of these three steps in the planning process, together with the formulation of objectives and standards. A brief examination of each of these steps is included here in order to clarify their function in the planning

[1] *See SEWRPC Regional Planning Program Prospectus, April 1962; SEWRPC Regional Land Use-Transportation Study Design, August 1963; SEWRPC Procedural Manual No. 1, Organization Charts and Position Descriptions, July 1963; SEWRPC Procedural Manual No. 2, Home Interview Survey, December 1963; SEWRPC Procedural Manual No. 3, Truck and Taxi Survey, May 1964; SEWRPC Procedural Manual No. 4, External Survey, August 1963; SEWRPC Procedural Manual No. 5, Land Use Survey, May 1963; SEWRPC Procedural Manual No. 6, Coding, May 1964.*

[2] *SEWRPC Planning Report No. 7, Volume 1, Inventory Findings - 1963, May 1965.*

sequence. The seventh step in the planning process—plan selection and adoption—together with its results, will be the subject of Volume 3 in this report series.

Formulation of Objectives and Standards

Since planning is a rational process for formulating and meeting objectives, the formulation of objectives is an essential task which must be undertaken before plans can be prepared. The objectives chosen guide the preparation of alternative plans and, when converted to standards, provide the criteria for evaluating and selecting from among the alternatives. Since objectives provide the logical basis for plan synthesis, the formulation of sound objectives is a crucial step in the planning process. Yet, the process of formulating objectives has received relatively little attention in most planning operations. The lack of a comprehensive and tested approach to the problem of formulating objectives, however, provides no valid excuse for neglecting this fundamental task.

It is important to recognize that, because the formulation of objectives involves a formal definition of a desirable physical system by listing, in effect, the broad needs which the system aims to satisfy, the objectives implicitly reflect an underlying value system. Thus, every physical development plan is accompanied by its own unique value system. The diverse nature of value systems in a complex urban society complicates the process of goal formulation and makes it one of the most difficult tasks of the planning process. This difficulty relates in part to the lack of a clear-cut basis for a choice between value systems and in part to the reluctance of public officials to make an explicit choice of ultimate goals. Yet, it is much more important to choose the "right" objectives than the "right" plan. To choose the wrong objectives is to solve the wrong problem; to choose the wrong plan is merely to choose a less efficient physical system. While, because of differing value systems, there may be no single argument to support a given choice of objectives, it is possible to state certain planning principles which provide at least some support for the choice; and this has been done herein.

Objectives cannot be intelligently chosen without knowledge of the causal relationships existing between objectives and means. This suggests that the formulation of objectives is best done by people with prior knowledge of the social, economic, and technical means of achieving the objectives, as well as of the underlying value systems. Even so, it must be recognized that the objectives may change as a selection is attempted from among alternative means or plans. In the process of evaluating alternative plans, the various alternative plan proposals are ranked according to ability to meet objectives. If the best plan so identified nevertheless falls short of the chosen objectives, either a better plan must be synthesized or the objectives must be compromised. The plan evaluation provides the basis for deciding which objectives to compromise. The compromises may take three forms: certain objectives may be dropped because their satisfaction has been proven unrealistic; new objectives may be suggested; or conflicts between inconsistent objectives may be balanced out. Thus, formulation of objectives must proceed hand in hand with plan design and plan implementation as a part of a continuing planning process.

Concern for objectives cannot end with a mere listing of desired goals. The goals must be related in a demonstrable and, wherever possible, quantifiable manner to physical development proposals. Only through such a relationship can alternative development proposals be properly evaluated. This relationship is accomplished through a set of supporting standards for each chosen objective.

Forecasting—The Determination of Future Needs

Although the preparation of forecasts is not planning, the preparation of all plans must begin with some kind of forecast. In any planning effort, forecasts are required of all future events and conditions which are outside the scope of the plan but which will affect plan design or implementation. For example, the future demand for land, transportation, and natural resources will depend primarily upon the size of the future population and the nature of future economic activity within the Region. Control of changes in population and economic activity levels lies largely outside the scope of governmental activity at the regional and local levels, outside the scope of the physical planning process, and certainly outside the scope of a land use-transportation plan. Future population and economic activity levels must, therefore, be forecast. These levels, in turn, determine the aggregate future land use demand. This is not to say, however, that governmental policies at the regional and local levels

cannot influence the course of economic development and consequently of population growth. For example, the provision of efficient regional transportation and utility systems can contribute to favorable industrial location decisions even though the provision of such systems cannot directly generate economic growth.

The preparation of a transportation plan by itself, as has been the practice in some metropolitan areas, requires that the spatial distribution of future land use, too, be considered outside the scope of the plan and, therefore, an element to be forecast. In the SEWRPC regional land use-transportation planning program, however, the spatial distribution of future land use is within the scope of the plan and, therefore, becomes a design rather than a forecast problem. Indeed, the preparation of a forecast of the spatial distribution of land use would be a contradiction of the basic principles and concepts underlying the regional land use-transportation study.

It should be noted, however, that it is necessary to forecast the future gross regional requirements for each of the major land use categories even though it is not necessary to forecast the spatial distribution of these land uses. This is necessary since the land use plans to be prepared must meet these regional needs. These forecasts of gross land use requirements, along with the forecasts of future levels of population and employment on which they are based, and forecasts of income, automobile and truck availability, and public revenues are presented herein.

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 transportation system must be planned for anticipated demand at some future point in time. In the planning of transportation systems, this "design year" is usually established by the expected life of the first facilities to be constructed in implementation of the plan. This also permits associated forecasts to be more readily tempered by predictable changes in technology. Although it may be argued that the design year for land use development should be extended further into the future than that for 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.

Forecast accuracy requirements depend on the use to be made of the forecasts; and, as applied to land use and transportation 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 that range wherein only the timing and not the basic structure of the plans will be affected.

Plan Design

Plan synthesis or design forms 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 ultimately result in sound plans to meet the objectives in light of forecast needs. The outputs of each of the three planning operations—formulation of objectives and standards, inventory, and forecast—become inputs to the design problem of plan synthesis.

The land use plan design problem consists essentially of determining the allocation of a scarce resource—land—between competing and often conflicting demands. This allocation must be accomplished so as to satisfy the aggregate needs for each land use and comply with the design standards derived from the plan objectives, all at a feasible cost. The transportation plan design problem requires a similar reconciliation between travel demand derived from the land use plan adopted, transportation design standards, existing facilities, and new facility costs.

The task of designing two of the major components of an environment for over two million people is a most complex and difficult problem. Not only is each component in itself a major problem in terms of the sheer size of the system to be designed, but the pattern of interaction between the components is exceedingly complex and constantly changing. The land use pattern must enable people to live in close cooperation and yet freely pursue an enormous variety of interests. It must minimize conflicts between population growth and limited land and water resources; maintain an ecological balance of human, animal, and plant life; and avoid gross public health and welfare problems. The transportation system must not only serve and promote a desirable land use pattern but do so without creating a demand which aggravates its own congestion. The combined land use-transportation system must be organized so

that its construction and reconstruction does not constantly disrupt its performance.

The magnitude of such a design problem approaches an almost insoluble level of complexity; yet, no substitute for intuition in plan design has so far been found, much less developed to a practical level. Means do exist, however, for reducing the gap between the necessary intuitive and integrative grasp of the problem and its growing magnitude; and these have been fully applied in the regional land use-transportation study. They center primarily on the application of systems engineering techniques to the quantitative test of both the land use and transportation system plans, as described below under the plan test and evaluation phase. Yet, the quantitative tests involved in these techniques, while powerful aids to the determination of the adequacy of the plan design, are of strictly limited usefulness in actual plan synthesis. Consequently, it is still necessary to develop both the land use and transportation plan by traditional graphic and analytical "cut and try" methods, then to quantitatively test the resulting design by application of simulation model techniques, and then make necessary adjustments in the design until a workable plan has been evolved.

Yet the same mathematical techniques which make quantitative plan test possible may eventually make a more logical and efficient plan synthesis possible. Indeed, such application has been explored by the Commission with promising results for land use plan design application.[3] These techniques are not yet sufficiently developed, however, to be applied practically; and no efforts have been made to apply these techniques to regional land use or transportation plan synthesis.

In order to overcome the limitations of individual intuitive grasp of the design problem, maximum resort was made to team effort in the actual plan synthesis; the knowledge and experience of those state and local planners and engineers most familiar with selected geographic and functional areas was applied to the plan synthesis process through careful committee review and, where necessary, interchange of staff. Finally and most importantly, it should be noted that in both land use and transportation plan synthesis the Commission had at its disposal far more definitive information bearing on the problem than has ever before been available; and this fact alone made the traditional plan synthesis techniques applied far more powerful.

[3] *SEWRPC Technical Report No. 3, A Mathematical Approach to Urban Design, January 1966.*

Plan Test and Evaluation

If the plans developed in the design stage of the planning process are to be practical and workable and thereby realized in terms of actual land use and transportation system development, some measures must be applied as quantitative tests of the feasibility of alternative plans during plan synthesis and in advance of plan adoption and implementation. Traffic simulation models have been developed over the past decade for application in transportation planning that make it possible to determine the existing and potential travel demand on any proposed transportation network.

Using these simulation models, it is possible to test and verify the workability and efficiency of any proposed transportation system network. The quantitative assignment of traffic to the network will reveal areas of over or under capacity and provide the basis for network modification during plan design, ultimately resulting in a practical and efficient transportation system plan for which development costs can be calculated. Such assignment also permits the calculation of user benefits for benefit-cost analyses. Finally, such assignment provides a more precise basis for the application of standards so that the degree to which each alternative transportation plan meets the chosen objectives can be better determined.

While the validity and usefulness of this transportation simulation technique has been proven in other urban transportation studies, similar model techniques suitable for testing the feasibility of proposed land use plans have not yet been successfully applied. Conventional land use planning techniques normally involve quantitative test only to the degree that the aggregate areas allocated to the various land uses in the alternative plans are scaled against the various land use demands. Test and evaluation beyond such scaling of supply versus demand normally involve qualitative evaluation of the degree to which each alternative land use plan meets development objectives and standards and of the legal feasibility of the alternatives. These conventional techniques have all been applied in the land use-transportation study; and,

in addition, the effects of each alternative land use plan on the natural resource base have been both qualitatively and quantitatively evaluated and the financial feasibility of each alternative land use plan established.

Many private decisions by individual land developers, builders, and households, as well as public decisions by units and agencies of government, interact to determine the regional land use pattern. A need, therefore, exists to test the feasibility of any regional land use plan proposals beyond the gross demand tests provided by the expanded conventional land use planning techniques. In the regional land use-transportation study, an experimental land use simulation model capable of representing the decision processes of households and business firms influential in land development has been developed to meet this need. The basic problem of land use plan test using simulation model techniques may be stated as: given a target plan, determine whether this plan can be attained considering behavioral patterns of land developers, builders, and households; public land use controls; and public works programs. Using a land use simulation model, a number of experimental simulation runs can be performed with differing land use control policies and the practicality of the plan determined.

Plan Selection and Adoption

In the land use-transportation study, not one but a number of alternative land use plans were developed, each with its supporting transportation system plan. These are presented herein in summary form. The general approach contemplated for the selection of one plan from among these alternatives is to proceed through the use of the advisory committee structure and hearings to a final decision and plan adoption by the Commission, in accordance with the provisions of the state enabling legislation. Since plan selection and adoption necessarily involve both technical and nontechnical policy determinations, they must be founded in the active involvement throughout the entire planning process of the various governmental bodies, technical agencies, and private interest groups concerned with regional development. Such involvement is particularly important in light of the advisory role of the Commission in shaping regional development. The use of advisory committees and both formal and informal hearings appears to be the most practical and effective procedure available for involving public officials, technicians, and citizens in the planning process and of openly arriving at agreement among the affected governmental bodies and agencies on objectives and on plans which can be jointly implemented.

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Chapter II

OBJECTIVES, PRINCIPLES, AND STANDARDS

INTRODUCTION

As previously noted, planning is a rational process for formulating and meeting objectives; and 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, therefore, are direct and clear cut is a relatively easy task. The seven-county Southeastern Wisconsin Planning Region is, however, 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 combined 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 very 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 recognition, 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 land-use transportation study has been described in Volume 1 of this report. The use of these advisory committees appears to be the most practical and effective procedure available for involving officials, technicians, and citizens in the regional planning process and of openly arriving at decisions and action programs which can shape the future physical development of the Region. Only by combining the accumulated 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 the regional land use-transportation planning objectives, principles, and standards which have been adopted by the Commission after careful review and recommendation by the advisory committees concerned.

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 equally subject to a wide range of interpretation and application. The following definitions have, therefore, been adopted in order to provide a common frame of reference:

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

Objectives, in order to be useful in the regional land use-transportation planning process, must be sound logically and related in a demonstrable and measurable way to alternative physical development proposals. This is necessary because it is the legal duty and function of the Commission to prepare a comprehensive plan for the physical development of the Region and, more particularly, because it is the purpose of the regional land use-transportation study to prepare two of the key elements of such a plan: a land use plan and a transportation plan. Only if the objectives are clearly relatable to physical development and only if they are subject to objective test can an intelligent choice be made from among alternative plans in order to select the one plan or combination of plans which best meets the agreed upon objectives.

Recognizing that: 1) various public and private interest groups within a region as large and diverse as southeastern Wisconsin may have varying and at times conflicting objectives; 2) many of these objectives are of a qualitative nature and, therefore, difficult to quantify; and 3) many objectives which may be held to be important by the various interest groups within the Region may not be related in a demonstrable manner to physical development plans, the Commission has identified two basic types of objectives. These are: general development objectives, which are by their very 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 development objectives have been adopted by the Commission after careful review and recommendation by the Technical Coordinating and Advisory Committee and the Intergovernmental Coordinating Committee on Regional Land Use-Transportation Planning:

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 in the 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 development objectives, a secondary set of more specific objectives can be postulated which will be directly relatable 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 relatable 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.

The specific objectives which have been adopted by the Commission after careful review and recommendation by the advisory committees are herein listed separately for land use and transportation planning purposes. It should be emphasized, however, that land use and transportation are inextricably linked; and, therefore, land use planning objectives cannot be separated from transportation planning objectives. The separate listing of the specific objectives herein is only for convenience of organization and presentation.

Land Use Development Objectives

The specific objectives adopted for the regional land use plan are largely self-descriptive. They are concerned primarily with spatial allocation to, and distribution of, the various land uses, land use compatibility, resource protection, and accessibility. The following specific land use development objectives have been adopted by the Commission after careful review and recommendation by the Technical Coordinating and Advisory Committee and the Intergovernmental Coordinating Committee on Regional Land Use-Transportation Planning:

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 suitable industrial and commercial sites 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 objectives adopted for the regional transportation plan are concerned primarily with a balanced transportation system, alleviating traffic congestion, reducing travel times and accident exposure, and minimizing costs and disruptive

effects upon communities and natural resources. The following specific transportation development objectives have been adopted by the Commission after careful review and recommendation by the Technical Coordinating and Advisory Committee and the Intergovernmental Coordinating Committee on Regional Land Use-Transportation Planning:

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 land and cityscape.

PRINCIPLES AND STANDARDS

Complementing each of the foregoing specific land use and transportation development objectives is a planning principle and a set of planning standards. These are set forth in Tables 1 and 2. Each set of standards is directly relatable to the planning principle, as well as to the objective, and serves to facilitate quantitative application of the objectives in plan design, test, and evaluation. The planning principle, moreover, supports each specific objective by asserting its validity. In the preparation of the necessary planning principles, a careful search of the planning literature failed to reveal a documented set of comprehensive principles which were universally accepted as tenets basic to the physical planning process. It was necessary, therefore, to adapt such principles as could be found to the regional planning effort and then to draw upon the collective experience of the practitioners of the many technical disciplines represented on the Technical Coordinating and Advisory Committee to formulate additional principles to augment those adapted from the literature. Thus, through the combined knowledge of experienced technicians, a set of comprehensive planning principles was formulated which can be used as guidelines in the planning process. While it is probable that the rapidly developing technology of planning will ultimately modify the principles so prepared and will require and suggest additional principles, it is hoped that those herein adopted will form a sound initial basis for future improvement and expansion.

The planning standards herein adopted fall into two groups: comparative and absolute. The comparative standards, because of their very nature, can be applied only through a comparison of alternative plan proposals. An example of such a standard is minimizing the total vehicle miles of travel within the Region. No desirable value can be realistically assigned to this standard. Its application, therefore, must be a comparative one in which the alternative plan resulting in the lowest vehicle miles of travel is deemed to best meet this standard. Absolute standards can be applied individually to each alternate plan proposal since they are expressed in terms of maximum, minimum, or desirable values. An example of such a standard is the desirable maximum walking distance of one-half mile from any home to a local park.

The standards set forth herein should serve not only as aids in the development, test, and evaluation of regional land use and transportation plans but also in the development, test, and evaluation of local land use and transportation plans and in the development of plan implementation policies and programs as well.

OVERRIDING CONSIDERATIONS

In the application of the planning standards and in the preparation of the regional land use-transportation plans, several overriding considerations must be recognized. First, it must be recognized that each proposed transportation plan must constitute an integrated system. It is not possible from an application of the standards alone, how-

ever, to assure such a system since they cannot be used to determine the effect of individual facilities on each other or on the system as a whole. This requires the application of traffic simulation models to quantitatively test the proposed system, thereby permitting adjustment of the spatial distribution and capacities of the system to the existing and future travel demand as derived from the land use plan. Second, it must be recognized that an overall evaluation of each transportation plan must be made on the basis of cost. Such an analysis may show that the attainment of one or more of the standards is beyond the economic capability of the Region and, therefore, that the standards cannot be met practically and must be either reduced or eliminated. Third, it must be recognized that it is unlikely that any one plan proposal will meet all of the standards completely; and the extent to which each standard is met, exceeded, or violated must serve as a measure of the ability of each alternative plan proposal to achieve the specific objectives which the given standard complements. Fourth, it must be recognized that certain objectives and standards may be in conflict, requiring resolution through compromise, and that meaningful plan evaluation can only take place through a comprehensive assessment of each of the alternative plans against all of the standards. Finally, it must be recognized that the standards must be very judiciously applied to areas or facilities which are already partially or fully developed since such application may require extensive renewal or reconstruction programs. Particularly, in this respect, it should also be noted that the land use standards which are concerned with natural resource protection, use, or development relate primarily to those areas of the Region where the resource base has not as yet been significantly deteriorated, depleted, or destroyed. In areas where such deterioration, depletion, or destruction has already occurred, application of the standards may make it necessary to inaugurate programs which would restore the resource base to a higher level of quality, as well as quantity.[1]

[1] *For a detailed analysis of stream water quality conditions and an evaluation of water quality standards, see SEWRPC Technical Report No. 4, Water Quality and Flow of Streams in Southeastern Wisconsin.*

Table 1

LAND USE PLANNING OBJECTIVES, PRINCIPLES, AND STANDARDS

OBJECTIVE NO. 1

A balanced allocation of space to the various land use categories which meets the social, physical, and economic needs of the regional population.

PRINCIPLE

The planned supply of land set aside for any given use should approximate the known and anticipated demand for that use.

STANDARDS

1. For each additional 1,000 persons to be accommodated within the Region at each density, the following minimum amounts of land should be set aside:

Residential Land	Net Area[a]	Gross Area[b]
Low density	250 acres/1,000 persons	312 acres/1,000 persons
Medium density	70 acres/1,000 persons	98 acres/1,000 persons
High density	25 acres/1,000 persons	38 acres/1,000 persons

Governmental and Institutional Land	Gross Area[c]
Regional[d]	3 acres/1,000 persons
Local[e]	6 acres/1,000 persons

Park and Recreation Land[f]	Gross Area[g]
Regional[h]	4 acres/1,000 persons
Local[i]	10 acres/1,000 persons

2. For each additional 100 commercial and industrial employees to be accommodated within the Region, the following minimum amounts of land should be set aside.

	Gross Area[j]
Commercial land[k]	5 acres/100 employees
Industrial land[l]	7 acres/100 employees

OBJECTIVE NO. 2

A spatial distribution of the various land uses which will result in a compatible arrangement of land uses.

PRINCIPLE

The proper allocation of uses to land can avoid or minimize hazards and dangers to health, safety, and welfare and maximize amenity and convenience in terms of accessibility to supporting land uses.

STANDARDS

1. Residential uses should be located within planning units which contain, within a reasonable walking distance, necessary supporting local service uses, such as neighborhood park, local commercial, and elementary school facilities, and should have reasonable access through the appropriate component of the transportation system to employment, commercial and cultural centers, and secondary school facilities.

2. Regional commercial uses should be located in centers of concentrated activity on only one side of an arterial street and should be afforded direct access[m] to the arterial street system.

3. Industrial uses should be located to have direct access to highway facilities and reasonable access through the appropriate component of the transportation system to residential areas and to railway and airport facilities and should not be intermixed with commercial, residential, governmental, recreational, or institutional land uses.

OBJECTIVE NO. 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.

PRINCIPLE

The proper allocation of uses to land can assist in maintaining an ecological balance between the activities of man and the natural environment which supports him.

A. Soils

Principle

The proper relation of urban and rural land use development to soils can serve to avoid many environmental problems, aid in the establishment of better regional settlement patterns, and promote the wise use of an irreplaceable resource.

STANDARDS

1. Urban development, particularly for residential use, shall be located only in those areas which do not contain significant concentrations of soils rated in the regional detailed operational soil survey as poor, questionable, or very poor for such development. Significant concentrations are defined as follows:

   a. In areas[n] to be developed for low-density residential use, no more than 2.5 percent of the gross area should be covered by soils rated in the regional soil survey as poor, questionable, or very poor for such development.

   b. In areas to be developed for medium-density residential use, no more than 3.5 percent of the gross area should be covered by soils rated in the regional soil survey as poor, questionable, or very poor for such development.

c. In areas to be developed for high-density residential use, no more than 5.0 percent of the gross area should be covered by soils rated in the regional soil survey as poor, questionable, or very poor for such development.

2. Rural development, principally agricultural land uses, shall be allocated primarily to those areas covered by soils rated in the regional soil survey as very good, good, or fair for such uses.

3. Land developed or proposed to be developed without public sanitary sewer service should be located only on areas covered by soils rated in the regional soil survey as very good, good, or fair for such development.

B. Inland Lakes and Streams

Principle

Inland lakes and streams contribute to the atmospheric water supply through evaporation; provide a suitable environment for desirable and sometimes unique plant and animal life; provide the population with opportunities for certain scientific, cultural, and educational pursuits; constitute prime recreational areas; provide a desirable aesthetic setting for certain types of land use development; serve to store and convey flood waters; and provide certain water withdrawal requirements.

STANDARDS

1. A minimum of 25 percent of the perimeter or shoreline frontage of lakes having a surface area in excess of 50 acres and of both banks of all perennial streams should be maintained in a natural state.

2. A minimum of 10 percent of the shoreline of each inland lake having a surface area in excess of 50 acres should be maintained for public uses, such as a beach area, pleasure craft marina, or park.

3. Not more than 50 percent of the length of the shoreline of inland lakes having a surface area in excess of 50 acres and of perennial streams should be allocated to urban development except park and outdoor recreational uses.

4. In addition, it is desirable that 25 percent of the shoreline of each inland lake having a surface area less than 50 acres be maintained in either a natural state or some low-intensity public use, such as park land.

5. Flood plain lands[o] should not be allocated to any urban development[p] which would cause or be subject to flood damage.

6. No unauthorized structure or fill should be allowed to encroach upon and obstruct the flow of water in the perennial stream channels[q] and floodways.[r]

C. Wetlands

Principle

Wetlands support a wide variety of desirable and sometimes unique plant and animal life; assist in the stabilization of lake levels and streamflows; trap, store, and release plant nutrients in runoff with a net improvement in the quality of runoff, thus reducing enrichment of surface waters and obnoxious weed and algae growth; contribute to the atmospheric oxygen supply; reduce storm water runoff by providing area for floodwater impoundment and storage; reduce stream sedimentation; and provide the population with opportunities for certain scientific, educational, and recreational pursuits.

STANDARD

All wetland areas[s] adjacent to streams or lakes, all wetlands within areas having special wild-

life values, and all wetlands having an area in excess of 50 acres should not be allocated to any urban development except limited recreation and should not be drained or filled. Adjacent surrounding areas should be kept in open-space use, such as agriculture or limited recreation.

D. Woodlands[t]

Principle

Woodlands assist in maintaining unique natural relationships between plants and animals; reduce storm water runoff; contribute to the atmospheric oxygen supply; contribute to the atmospheric water supply through transpiration; aid in reducing soil erosion and stream sedimentation; provide the resource base for the forest product industries; provide the population with opportunities for certain scientific, educational, and recreational pursuits; and provide a desirable aesthetic setting for certain types of land use development.

STANDARDS

1. A minimum of 10 percent of the land area of each watershed[u] within the Region should be devoted to woodlands.

2. For demonstration and educational purposes, the woodland cover within each county should include a minimum of 40 acres devoted to each major forest type: oak-hickory, northern hardwood, pine species, and lowland forest.

3. A minimum regional aggregate of 5 acres of woodland per 1,000 population should be maintained for recreational pursuits.

E. Wildlife[v]

Principle

Wildlife, when provided with a suitable habitat, will provide the population with opportunities for certain scientific, educational, and recreational pursuits; provide a food source; aid significantly in controlling harmful insects and other noxious pests; and provide an economic resource for the fur and fishing industries.

STANDARD

The most suitable habitat for wildlife, that is, the area wherein fish and game can best be fed, sheltered, and reproduced, is a natural habitat. Since 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.

OBJECTIVE NO. 4

A spatial distribution of the various land uses which is properly related to the supporting transportation and public utility systems in order to assure the economical provision of utility and municipal services.

PRINCIPLE

The transportation and public utility facilities and the land use pattern which these facilities serve and support are mutually interdependent in that the land use pattern determines the demand for, and loadings upon, transportation and utility facilities and these facilities, in turn, are essential to, and form a basic framework for, land use development.

STANDARDS

1. The transportation system should be located and designed to avoid the penetration of residential planning units by through traffic.

2. The transportation system should be located and designed to avoid the penetration of prime natural resource areas by through traffic.

3. The transportation system should be located and designed to provide access not only to all land presently devoted to urban development but to all land well suited for urban development.

4. Transportation terminal facilities, such as off-street parking, should be located in close proximity to the principal land uses to which they are accessory.

5. Land developed or proposed to be developed for medium- and high-density residential use should be located in a gravity drainage area tributary to an existing or proposed public sanitary sewerage system.

6. Land developed or proposed to be developed for medium- and high-density residential use should be located in areas serviceable by an existing or proposed public water supply system.

7. Urban development should be located so as to maximize the use of existing transportation and utility systems.

OBJECTIVE NO. 5

The development and conservation of residential areas within a physical environment that is healthy, safe, convenient, and attractive.

PRINCIPLE

Residential areas developed in designed planning units can assist in stabilizing community property values, preserving residential amenities, and promoting efficiency in the provision of public and community service facilities; can best provide a desirable environment for family life; and can provide the population with improved levels of safety and convenience.

STANDARDS

1. Residential planning units should be physically self-contained within clearly defined and relatively permanent isolating boundaries, such as arterial streets and highways, major park and open-space reservations, or significant natural features, such as rivers, streams, or hills.

2. Residential planning units should contain enough area to provide: housing for the population served by one elementary school and one neighborhood park; an internal street system which discourages penetration of the unit by through traffic; and all of the community and commercial facilities necessary to meet the day-to-day living requirements of the family within the immediate vicinity of its dwelling unit. To meet these requirements at varied residential densities, the following specific standards should be met:[W]

Land Use	Low-Density Development (2 miles square) Percent of Area	Medium-Density Development (1 mile square) Percent of Area	High-Density Development (½ mile square) Percent of Area
Residential	80.0	71.0	66.0
Streets & Utilities	16.5	23.0	25.0
Parks & Playgrounds	1.5	2.5	3.5
Public Elementary School	0.5	1.5	2.5
Other Governmental & Institutional	1.0	1.0	1.5
Commercial	0.5	1.0	1.5
Total	100.0	100.0	100.0

3. Each residential planning unit should be designed to include a wide range of housing types, designs, and costs.

OBJECTIVE NO. 6

The preservation and provision of a variety of suitable industrial and commercial sites both in terms of physical characteristics and location.

PRINCIPLE

The production and sale of goods and services are among the principal determinants of the level of economic vitality in any society, and the important activities related to these functions require areas and locations suitable to their purpose.

STANDARDS

1. New industrial development should be located in planned industrial districts which meet the following standards:

   a. Direct access to high-speed, all-weather highway facilities.
   b. Reasonable access to railroad facilities.
   c. Reasonable access to airport facilities for the movement of both passengers and freight.
   d. Available adequate water supply.
   e. Available adequate sanitary sewer service.
   f. Available adequate storm water drainage facilities.
   g. Available adequate power supply.
   h. Soils rated in the regional soil survey as very good, good, or fair for such development.

2. New local commercial development, which includes activities primarily associated with the sale of convenience goods and services, should be contained within the residential planning units, the total area devoted to the commercial use varying with the residential density:

   a. In low-density areas, land devoted to local commercial centers should comprise at least 0.5 percent of the total gross residential area or about 3.2 acres per square mile of gross residential land use.

   b. In medium-density areas, land devoted to local commercial centers should comprise at least 1.0 percent of the total gross residential area or about 6.4 acres per square mile of gross residential land use.

   c. In high-density areas, land devoted to local commercial centers should comprise at least 1.5 percent of the total gross residential area or about 9.6 acres per square mile of gross residential land use.

3. New regional commercial development, which would include activities primarily associated with the sale of shopper's goods, should be concentrated in regional commercial centers which meet the following minimum standards:

   a. Accessibility to a population of between 75,000 and 150,000 persons located within either a 20-minute one-way travel period or a ten-mile radius.
   b. Direct access to the arterial street system.
   c. Available adequate water supply.
   d. Available adequate sanitary sewer service.
   e. Available adequate storm water drainage facilities.
   f. Available adequate power supply.
   g. A minimum site area of 60 acres.
   h. Soils rated in the regional soil survey as very good, good, or fair for such development.

In addition to the above minimum standards, the following site development standards are desirable:

   provision of off-street parking for at least 5,000 cars.
   provision of adequate off-street loading facilities.
   provision of well-located points of ingress and egress which are controlled to prevent traffic congestion on adjacent arterial streets.
   provision of adequate screening to serve as a buffer between the commercial use and adjacent noncommercial uses.
   provision of adequate building setbacks from major streets.

OBJECTIVE NO. 7

The preservation and provision of open space[x] 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.

PRINCIPLE

Open space is the fundamental element required for the preservation, wise use, and development of such natural resources as soil, water, woodlands, wetlands, and wildlife; it provides the opportunity to add to the physical, intellectual, and spiritual growth of the population; it enhances the economic and aesthetic value of certain types of development and is essential to outdoor recreational pursuits.

STANDARDS[y]

1. Local park and recreation open spaces should be provided within a maximum service radius of one-half mile of every dwelling unit in an urban area, and each site should be of sufficient size to accommodate the maximum tributary service area population at a use intensity of 675 persons per acre.

2. Regional park and recreation open spaces should be provided within an approximately one-hour travel time of every dwelling unit in the Region and should have a minimum site area of 250 acres.

3. Areas having unique scientific, cultural, scenic, or educational value should not be allocated to any urban or agricultural land uses; and adjacent surrounding areas should be retained in open-space use, such as agriculture or limited recreation.

OBJECTIVE NO. 8

The preservation of land areas for agricultural uses in order to provide for certain special types of agriculture, provide a reserve for future needs, and ensure the preservation of those unique rural areas which provide wildlife habitat and which are essential to shape and order urban development.

PRINCIPLE

Agricultural areas, in addition to providing food and fibre, contribute significantly to maintaining the ecological balance between plants and animals; provide locations proximal to urban centers for the production of certain food commodities which may require nearby population concentrations for an efficient production-distribution relationship; and provide open spaces which give form and structure to urban development.

STANDARDS

1. All prime agricultural areas[z] should be preserved.

2. All agricultural lands surrounding adjacent high-value scientific, educational, or recreational resources and covered by soils rated in the regional detailed operational soil survey as very good, good, or fair for agricultural use should be preserved.

In addition to the above, attempts should be made to preserve agricultural areas which are covered by soils rated in the regional detailed operational soil survey as fair if these soils a) occur in concentrations greater than five square miles and surround or lie adjacent to areas which qualify under either of the above standards, or b) occur in areas which may be designated as desirable open spaces for shaping urban development.

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[a] Net land use area is defined as the actual site area devoted to a given use and consists of the ground floor site area occupied by any buildings plus the required yards and open spaces.

[b] Gross residential land use area is defined as the net area devoted to this use plus the area devoted to all supporting land uses including streets, neighborhood parks and playgrounds, elementary schools, and neighborhood institutional and commercial uses, but not including freeways and expressways.

[c] Gross governmental and institutional area is defined as the net area devoted to this use plus the area devoted to supporting land uses, including streets and off-street parking.

[d] Includes federal, state, and county governmental uses; hospitals; cemeteries; colleges and universities; and large region-serving, semipublic institutional uses, such as central YMCA facilities. Presently approximates 3 acres/1,000 persons.

[e] Includes schools and churches. Approximately one-half of this standard is met implicitly if the gross acreage standard for residential use is met. Presently approximates 6 acres/1,000 persons.

[f] This category does not include regional or local open spaces other than those actively used for public park or outdoor recreational purposes; that is, such uses as boulevards, parkways, stadia, environmental corridors, arboreta, zoological gardens, and botanical gardens are not included unless they are a part of or adjacent to an active recreation area.

[g] Gross park and recreation area is defined as equal to net area.

[h] Presently includes only 14 existing parks within the Region classified as being of regional significance, which combined contain 4,432 acres or 2.6 acres per 1,000 persons. These are: the Fox River Park and Petrifying Springs Park in Kenosha County; six of the Milwaukee County Park Commission Metropolitan parks--Brown Deer Park, Grant Park, Greenfield Park, Lake-Juneau Park, Lincoln Park, and Whitnall Park; Hawthorne Hills Park in Ozaukee County; Johnson Park in Racine County; Big Foot Park in Walworth County; and Menomonee Park, Mukwonago Park, and Nagawaukee Park in Waukesha County.

[i] Presently includes 379 neighborhood and community parks, which combined contain 5,698 acres or 3.4 acres per 1,000 persons. A portion of this standard is met implicitly if the gross acreage standard for residential use is met. This implicit portion totals: 1.3 acres per 1,000 persons in a one-half mile square high-density neighborhood; 2.5 acres per 1,000 persons in a one mile square medium-density neighborhood; and 4.5 acres per 1,000 persons in a two mile square low-density neighborhood.

[j] Gross commercial and industrial area is defined as the net area devoted to this use plus the area devoted to supporting land uses, including streets and off-street parking.

[k] Includes all regional, local, and highway-oriented commercial activities plus adjacent streets and on-site parking. Presently approximates 3.4 acres per 100 employees.

[l] Includes all manufacturing and wholesaling activities plus adjacent streets and on-site parking. Presently approximates 4.1 acres per 100 employees.

[m] Direct access implies adjacency or immediate proximity.

[n] Areas, as used in this context, refer to any land unit, 160 acres or more in areal extent, which is subject to development.

[o] Flood plain lands are herein defined as those lands inundated by a flood having a recurrence interval of 100 years where hydrologic and hydraulic engineering data are available and as those lands inundated by the maximum flood of record where such data are not available.

[p] Urban development, as used herein, refers to all land uses except agriculture, water, woodlands, wetlands, and open lands.

[q] A stream channel is herein defined as that area of the flood plain lying either within legally established bulkhead lines or within sharp and pronounced banks marked by an identifiable change in flora and normally occupied by the stream under average annual high-flow conditions.

[r] Floodway lands are herein defined as those lands inundated by a flood having a recurrence interval of 10 years and require hydrologic and hydraulic engineering data for delineation.

[s] Wetland areas are defined as those lands which are partially covered by marshland flora and generally covered with shallow standing water, open lands intermittently covered with water, or lands which are wet and spongy due to a high water table or character of the soil.

[t] The term woodlands, as used herein, is defined as a dense, concentrated stand of trees and underbrush covering a minimum area of 20 acres.

[u] A watershed, as used herein, is defined as a portion of the surface of the earth occupied by a surface drainage system discharging all surface water runoff to a common outlet and which is 25 square miles or larger in areal extent.

[v] Includes all fish and game.

[w] For more detailed description of development densities, population, and dwelling units, see Appendix Table A-1 and A-2.

[x] Open space is defined as land or water areas which are generally undeveloped for residential, commercial, or industrial uses and are or can be considered relatively permanent in character; it includes areas devoted

to park and recreation uses and to large land consuming institutional uses, as well as areas devoted to agricultural use and to resource conservation whether publicly or privately owned.

[y] It was thought impractical to establish spatial distribution standards for open space, per se; therefore, only the park and recreation component of the open-space land use category is listed in the standards according to its local or regional orientation. These local park and recreation spaces may include playlots, playgrounds, playfields, and neighborhood parks. Regional park and recreation spaces include large county or state parks. Other open spaces which are not included in this spatial distribution standard are: forest preserves and arboreta; major river valleys; lakes; zoological and botanical gardens; stadia; woodland, wetland, and wildlife areas; scientific areas; and agricultural lands whose location must be related to, and determined by, the natural resource base.

[z] Prime agricultural areas are defined as those areas which a) contain soils rated in the regional detailed operational soil survey as very good or good for agriculture, and b) occur in concentrated areas over five square miles in extent which have been designated as exceptionally good for agricultural production by agricultural specialists.

Table 2

TRANSPORTATION PLANNING OBJECTIVES, PRINCIPLES, AND STANDARDS

OBJECTIVE NO. 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.

PRINCIPLE

A regional transportation system serves to freely interconnect the various land use activities within the Region, thereby providing the attribute of accessibility essential to the support of these activities. Through its effect on accessibility, the regional transportation system can be used to induce development in desired locations and to separate incompatible land uses.

STANDARDS

1. The relative accessibility provided by the regional transportation system should be adjusted to the land use plan, and areas in which development is to be induced should have a higher relative accessibility than areas which should be protected from development.

2. Highway transportation facilities should be located and designed so as to provide adequate capacity, that is, a volume to capacity[a] ratio equal to, or less than, 1.0 based on 24-hour average weekday traffic volumes, to meet the existing and potential travel demand between the various land uses consistent with the trip generating and trip interaction characteristics of these uses and the resulting forecast of travel. In such location and design, due consideration should be given to the ability of transit service to meet the existing and potential travel demand and serve the land use pattern.

OBJECTIVE NO. 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.

PRINCIPLE

A balanced regional transportation system consisting of highway and transit transportation and terminal facilities is necessary to provide an adequate level of transportation service to all segments of the population, to properly support essential economic and social activities, and to achieve economy and efficiency in the provision of transportation service. The transit component provides transportation service to that segment of the population which does not for various reasons own and operate an auto. Furthermore, transit supplies added transportation system capacity to alleviate the peak loadings on highway facilities and assists in reducing the land use demand for parking facilities in central business districts.

STANDARDS

1. Transit service of an appropriate type should be provided for all routes within the Region wherein the minimum potential average weekday revenue passenger loading equals or exceeds the following values:

Type of Transit Service	Minimum Potential Average Weekday Revenue Passengers	Transit Service Area Radius (miles)
Local Transit[b]	600/day/bus[c]	¼ in high-density residential areas[d] ½ in medium- and low-density residential areas[d]
Modified Rapid Transit[e]		
A. All Day[f]	600/day/bus[c]	3
B. Limited	300/4-hrs./bus[c]	3
Bus Rapid Transit[g]	21,000/day/preempted freeway lane	3
	For separate right-of-way, see Appendix A	3
Rail Rapid Transit[h]	See Appendix A	3

2. Local transit routes should be provided at intervals of no more than one-half mile in all high-density residential areas.

3. Maximum operating headways for all transit service throughout the daylight hours[i] should not exceed 1 hour.

4. The average distance between transit stops should not be less than:

Type of Transit Service	Average Distance Between Stops
Local Transit	660 feet
Modified Rapid Transit	No stops between terminal areas
Bus Rapid Transit	2 miles (for line haul sections)
Rail Rapid Transit	2 miles (for line haul sections)

5. Loading factors should not exceed:

Type of Transit Service	Maximum Loading Factor For Periods Exceeding 10 Minutes[j] (percent)
Local Transit	
A. 10 minute headway on route	100
B. 5-10 minute headway on route	125
C. Less than 5 minute headway on route	140
Modified Rapid Transit	100
Bus Rapid Transit	100
Rail Rapid Transit	100

6. Transit routes should be direct in alignment, with a minimum number of turning movements, and arranged to minimize transfers and duplication of service.

7. The proportion of transit ridership to the central business district of each urbanized area within the Region should be maintained at least at the present level and increased if possible.

8. Modified rapid transit or rapid transit service should be provided as necessary to reduce peak loadings on arterial streets and highways in order to maintain a desirable level of transportation service between component parts of the Region.

9. Parking should be provided at park-and-ride transit stations to accommodate the total parking demand generated by trips which change from auto to transit modes at each such station.

10. Freeways or expressways should be provided for all routes within the Region where all of the following criteria are met:

a. The route provides intercommunity service;
b. The desired speeds or a volume to capacity ratio of 1.0 requires control of access and uninterrupted flow;
c. Alternate routes exist or will be provided to adequately serve local traffic; and

d. Potential average weekday traffic exceeds 25,000[k] vpd. in urban areas and 15,000[k] in rural areas.

11. Arterial streets and highways should be provided at intervals of no more than one-half mile in each direction in high-density residential areas, at intervals of no more than one mile in each direction in medium-density residential areas, and at intervals of no more than two miles in each direction in all low-density residential areas.

12. In the major central business districts of the Region, parking should be provided sufficiently near concentrations of demand so that 80 percent of the short-term parkers need walk no more than one block.[l]

13. On a gross area basis, parking in the major central business districts of the Region should be provided at the following minimum levels:

Urbanized Area Population	Spaces Per 1,000 Auto CBD Destinations[m]
50,000	110
100,000	140
500,000	210
1,000,000	235
2,000,000	255

OBJECTIVE NO. 3

The alleviation of traffic congestion and the reduction of travel time between component parts of the Region.

PRINCIPLE

To support the everyday activities of business, shopping, and social intercourse, a transportation system which provides for reasonably fast, convenient travel is essential. Furthermore, congestion increases the cost of transportation, including the cost of the journey to work, which is necessarily reflected in higher production costs and thereby adversely affects the relative market advantages of businesses and industries within the Region.

STANDARDS

1. The total vehicle-hours of travel within the Region should be minimized.

2. Adequate capacity and a sufficiently high level of geometric design should be provided to achieve the following overall speeds based on potential 24-hour average weekday traffic volumes for arterial street and highway facilities:

Type of Facility	Overall Speed[n] in M.P.H. for Various Type Areas[o]			
	Downtown	Intermediate	Outlying	Rural
A. Arterials:				
1. Freeway	35-55	40-55	55-65	60-70
2. Expressway	25-40	30-45	40-50	50-65
3. Standard Arterials:				
a. Divided	15-25	25-35	35-45	45-60
b. Undivided	15-25	20-35	25-40	40-50
B. Collectors	10-20	15-30	20-35	40-50
C. Locals	5-15	10-20	15-25	30-40

3. The proportion of total travel on freeway, expressway, and rapid and modified rapid transit facilities should be maximized.

OBJECTIVE NO. 4

The reduction of accident exposure and the provision of increased travel safety.

PRINCIPLE

Accidents take a heavy toll in life, property damage, and human suffering; contribute substantially to overall transportation costs; and increase public costs for police and welfare services; therefore, every attempt should be made to reduce both the incidence and severity of accidents.

STANDARDS

1. Traffic congestion and vehicle conflicts should be reduced by maintaining a volume to capacity ratio equal to or less than 0.9, based on 24-hour average weekday traffic volumes.

2. Travel on facilities which exhibit the lowest accident exposure, that is, freeways, expressways, and all forms of transit, should be maximized.[p]

OBJECTIVE NO. 5

A transportation system which is both economical and efficient, meeting all other objectives at the lowest cost possible.

PRINCIPLE

The total resources of the Region are limited, and any undue investment in transportation facilities and services must occur at the expense of other public and private investment; therefore, total transportation costs should be minimized for the desired level of service.

STANDARDS

1. The sum of transportation system operating and capital investment costs should be minimized.

2. The total vehicle miles of travel should be minimized by reducing trip length, total number of trips made, or both.

3. Full use should be made of all existing and committed major transportation facilities, and such facilities should be supplemented only with such additional major facilities as necessary to serve the anticipated travel demand derived from the land use plan at the desired level of service.

OBJECTIVE NO. 6

The minimization of disruption of desirable existing neighborhood and community development and of the deterioration or destruction of the natural resource base.

PRINCIPLE

The social and economic costs attendant to the disruption and dislocation of homes, businesses, industries, and communication and utility facilities, as well as adverse effects on the natural resource base, can be minimized through proper location of transportation facilities.

STANDARDS

1. The penetration of neighborhood units and of neighborhood facility service areas by arterial streets and highways and rapid transit routes should be avoided.

2. The dislocation of families, businesses, and industries should be minimized.

3. Transportation facilities should not be located in or through environmental corridors[q] except as necessary to serve the proper utilization of these areas.

4. The proper use of land for, and adjacent to, transportation facilities should be maximized and disruption of future development minimized through advance reservation of the following minimum rights-of-way for highway facilities: (See Figure 1)

Type of Facility	Right-of-Way Width To Be Reserved
Freeway (6 lane)	300 feet
(8 lane)	325 feet
Expressway (4 lane)	200 feet
Standard Arterial Streets and Highways	130 feet
Collector Streets	80 feet

5. The destruction of historic buildings and of historic, scenic, scientific, and cultural sites should be avoided.

6. The use of land for transportation and supporting terminal facilities should be minimized.

OBJECTIVE NO. 7

A high aesthetic quality in the transportation system with proper visual relation of the major transportation facilities to the land and cityscape.

PRINCIPLE

Beauty in the physical environment is conducive to the physical and mental health and well-being of people; and, as major features of the land and cityscape, transportation facilities have an important impact on the aesthetic quality of the total environment.

STANDARDS

1. Transportation facilities should be located to avoid destruction of visually pleasing buildings, structures, and natural features and to avoid interference with vistas to such features.

2. Transportation facility construction plans should be developed using good geometric, structural, and landscape design standards which consider the aesthetic quality of the transportation facilities and the areas through which they pass.

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[a] For regional planning purposes, the capacity of street facilities was calculated with parking prohibited. See SEWRPC Technical Record Vol. 2 - No. 2, pp. 4-5.

[b] Local transit is defined as the transportation of persons by bus providing relatively frequent service to the general public on regular schedules over prescribed surface streets.

[c] A transit route may be serviced by a single bus if it can make a round trip in one hour or less. As the route length and/or the potential revenue passengers increase, additional buses may be required to service the route.

[d] High-density is defined as 39.5 persons and 12.0 dwelling units per net residential acre; medium-density is defined as 14.3 persons and 4.3 dwelling units per net residential acre; low-density is defined as 4.0 persons and 1.2 dwelling units per net residential acre.

[e] Modified rapid transit is defined as the transportation of persons by buses operating over freeways in mixed traffic lanes.

[f] Daylight hours are defined as the hours between 6:00 a.m. and 8:00 p.m.

[g] Bus rapid transit is defined as the transportation of persons by buses operating over exclusive freeway lanes or private rights-of-way to provide high-speed service.

[h] Rail rapid transit is defined as the transportation of persons by single or dual track rail car trains operating over exclusive grade-separated rights-of-way to provide high-speed service.

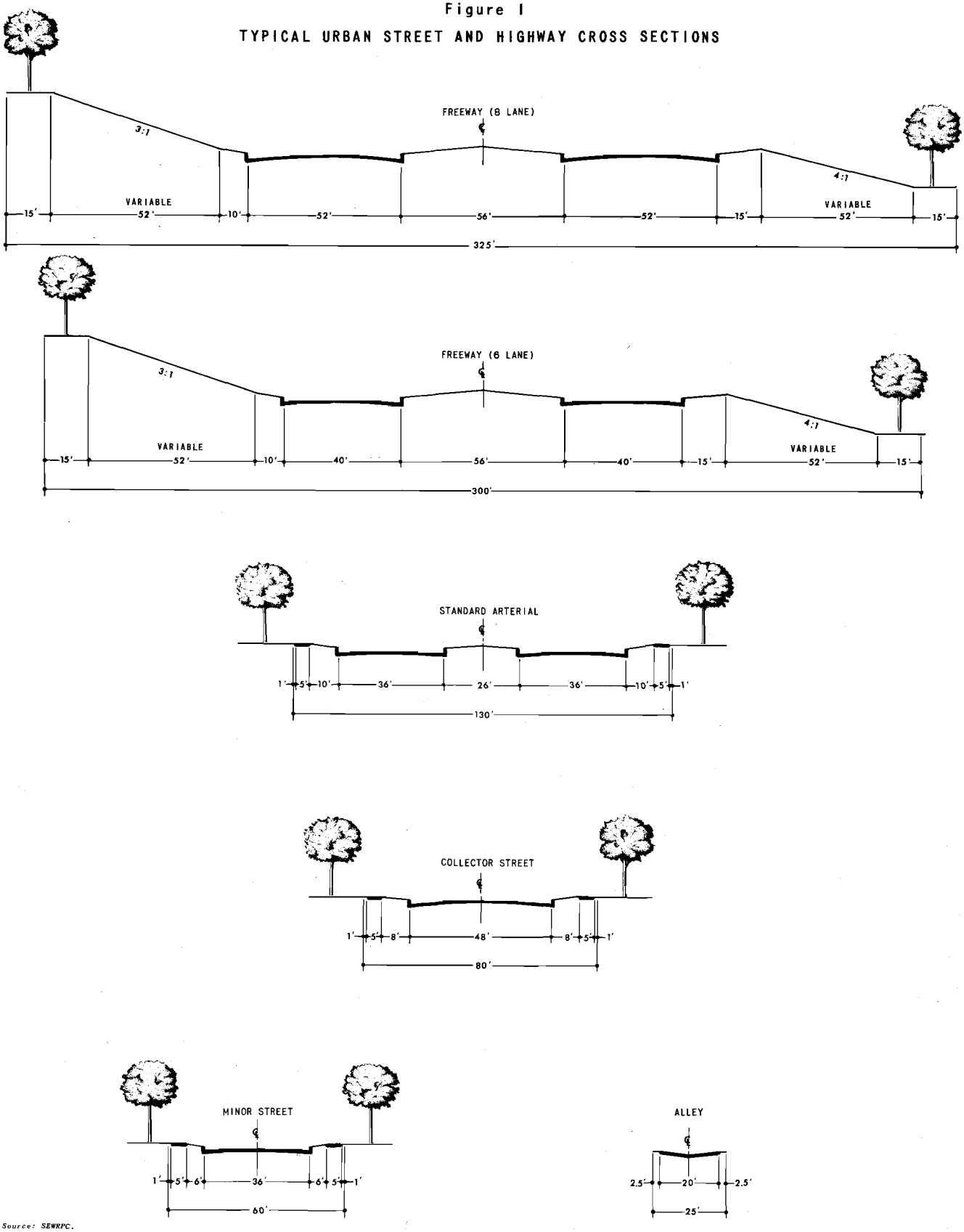
[i] Ibid, footnote f.

[j] These maximum loading factors may be exceeded for periods of up to 10 minutes.

[k] T = 10 percent, K = 8 percent for freeways and 10 percent for all other streets and highways, D = 60/40 for non-CBD links and 50/50 for CBD links.

Figure 1

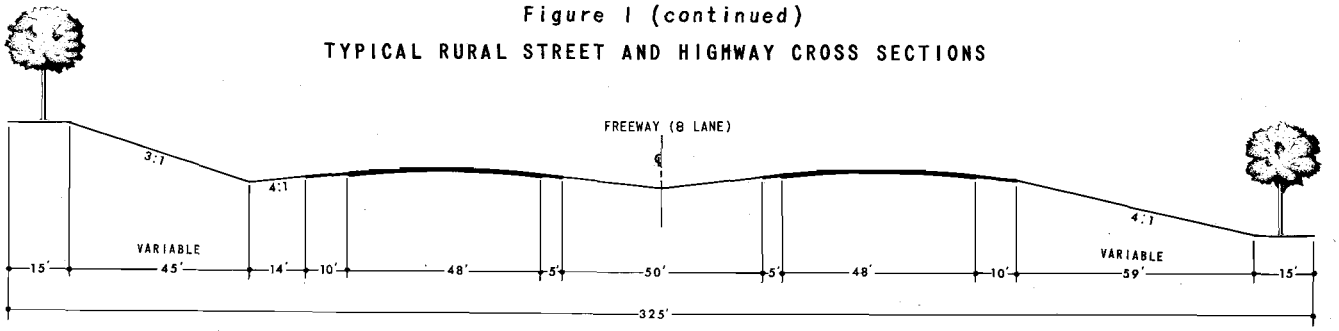
TYPICAL URBAN STREET AND HIGHWAY CROSS SECTIONS

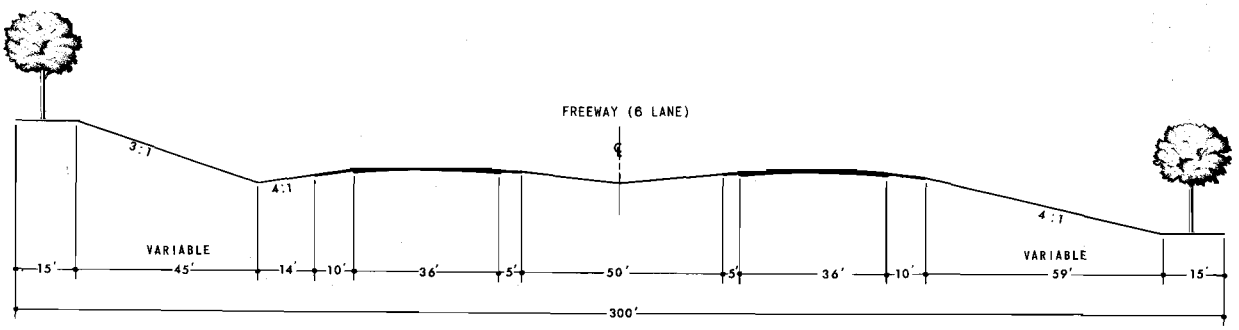


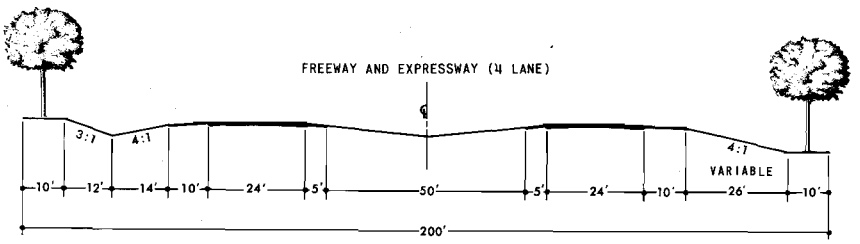
Source: SEWRPC.

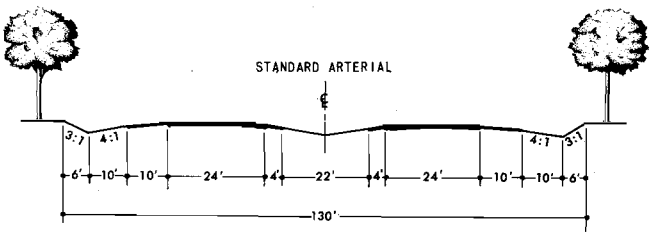
Figure 1 (continued)

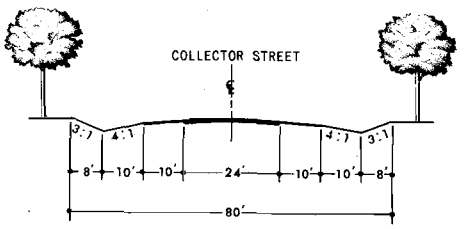
TYPICAL RURAL STREET AND HIGHWAY CROSS SECTIONS

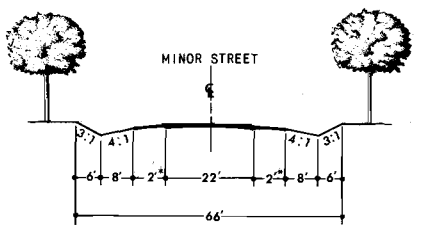












* 8 FT. IF PARKING PERMITTED

Source: SEWRPC.

[l] In 1963 over 85 percent of the downtown parkers walked less than one block in the Milwaukee, Racine, and Kenosha CBD's.

[m]

CBD	Present Level in Population of Urbanized Area	Existing Spaces Per 1,000 Auto Destination
Milwaukee	1,200,000	350
Racine	108,000	200
Kenosha	82,000	270

[n] Overall speed is defined as average speed over the transportation system not including terminal time, is expressed in miles per hour based on 24-hour average weekday traffic, and should not be confused with posted speed limits.

[o] Type of Area is defined in the Highway Capacity Manual, page 20, and discussed in "Capacity of Arterial Network Links," SEWRPC Technical Record Vol. 2 - No. 2.

[p] See Appendix Table A-3 for the accident rates and costs based upon experience within the Region, which will be used to quantitatively compare the transportation plans with respect to this standard.

[q] As defined in Inventory Findings-1963; SEWRPC Planning Report No. 7, Volume 1, pp. 74-77.

Chapter III

ANTICIPATED REGIONAL GROWTH AND CHANGE

INTRODUCTION

Change is one of the basic characteristics of the modern world, and urbanization is one of the most important and far-reaching aspects of this change. No nation, no state, and no region which participates in modern life can escape this increasing urbanization; and no part of daily life can avoid being influenced in some way by forces rooted in this complex process. Since population growth and urbanization appear inevitable in the absence of some world-wide natural or man-made disaster, the question facing public officials and citizen leaders of a region, such as southeastern Wisconsin, is not whether such growth and urbanization will occur but how much will occur and how well it will be shaped and guided in the public interest.

Changes in the population size and composition; changes in employment, income, and public revenue; changes in automobile and truck availability levels; and changes in land use requirements are all inevitable. This chapter presents the results of attempts to forecast, as accurately as possible, the direction and magnitude of these anticipated changes. The methodologies used in the preparation of the necessary forecasts are also presented in summary form. In any consideration of these forecasts, it is important to understand the basic concepts underlying forecasting methods in general and the consequent limitations of any forecast by whatever method it may have been prepared.

Many methods have been developed for forecasting change in a region, such as southeastern Wisconsin. Some of these methods are quite simple; some are highly complex; but all are ultimately based upon historical experience and, in general, rely on a combination of mathematical formulation and professional judgment to analyze this experience and project it into the future. The principal difference between any of the various forecasting methods is generally reflected in the differing emphasis upon these two basic elements. At one extreme a method may involve little or no mathematical formulation and depend almost entirely upon the exercise of professional judgment by a person or group of persons. Because the variables entering into these forecasts are most often not clearly defined, even in the minds of their authors, such forecasts are generally not capable of reduction to a precise procedure which can be expressed mathematically. At the other extreme, a method may depend almost entirely upon mathematical formulation and require little or no exercise of professional judgment. Such forecasts, founded as they are in a precise procedure, may be readily replicated once the rules of the procedure, mathematical or otherwise, are established. These procedural rules may be called forecasting models; and, if expressed in mathematical terms, may be designated as mathematical forecasting models.

It is important to understand that forecasts based upon mathematical forecasting models are not necessarily more accurate than forecasts based largely upon experienced professional judgment, even though such model forecasts are based upon precisely stated rules. Forecasts based upon models, however, have the great advantage that, if the model is proven on the basis of experience to provide accurate forecasts, it may be used on a continuing basis with a high degree of confidence independent of the professional judgment of the user.

To date, no one mathematical or judgmental method for forecasting any of the basic components of regional change has proven to be the most accurate. For this reason, it is generally unwise to rely on the results of a single method of forecasting, but instead to utilize a number of methods; compare the results; and then, after careful consideration of any differences, select the final "best" estimate. This is the procedure that has been generally followed in the Southeastern Wisconsin Regional Land Use-Transportation Study. Once it has been decided to use a number of forecasting methodologies, the selection of the specified models to be applied must be made with the objective of obtaining the most reliable results possible within the imposed time and cost limitations.

Finally, it must be recognized that all forecasts, however made, involve uncertainty and, therefore, must always be used with great caution. Forecasts cannot take into account events which are unpredictable but may have major effects upon future conditions. Such events include wars; epidemics; major social, political, and economic upheavals; and radical institutional changes. Moreover, both public and private decisions of a less radical nature than the foregoing can be made which may significantly affect the ultimate accuracy of any forecast. For these reasons, forecasting like planning must be a continuing process. As otherwise unforeseeable events unfold, forecast results must be revised; and, in turn, plans which are based on such forecasts must be reviewed and revised accordingly.

GENERAL FORECASTING METHODOLOGY

Population and Employment Forecasts

The regional population and employment forecasts required for the regional land use and transportation planning effort were made interdependently; that is, employment estimates were not derived solely from population forecasts prepared by purely demographic analyses nor were population estimates derived solely from employment forecasts prepared by purely economic analyses. Rather, both demographic and economic analyses were applied and a single set of population and employment estimates selected from a comparison and analysis of the results. The basic procedure applied can be summarized in the following steps:

1. Four separate forecasts were made of the regional population to the year 1990 by separate demographic forecasting techniques. These included a component technique, which projected the gross rate of natural increase and net migration over the forecast period; a regression technique, which converted national population forecasts to regional forecasts; a technique of forecasting population developed by C. Horace Hamilton and Josef Perry;[1] and a basic cohort survival technique.

2. Four separate forecasts were made of regional employment to the year 1990 by separate economic forecasting techniques. These included a regression technique, which converted national employment forecasts to regional forecasts; an output and productivity technique, which converted national output and productivity forecasts to regional employment forecasts by a series of step-down regression analyses; an economic base and structure analysis technique developed by R. B. Andrews of the University of Wisconsin;[2] and a regional activity simulation model technique developed by the SEWRPC.[3]

3. The separate population forecasts were converted to employment forecasts, and the separate employment forecasts were converted to population forecasts based on an analysis and forecast of the relationship existing and expected to exist between total regional population and employment.

4. A single "best estimate" set of the related population and employment forecasts was selected from the complete array of forecasts prepared. The selection was made based on an analysis of the distribution of the array of forecasts, supplemented by the judgment of the SEWRPC analysts.

The above procedure produced estimates of total population and employment for the forecast period. Estimates of future age, sex, and household characteristics of the population and of industry breakdowns of the employment were then derived from these total estimates. The age and sex composition estimates were made by applying assumed fertility, mortality, and migration rates to the total population estimates which were consistent with historic changes in these parameters. Household estimates were obtained by forecasting average household size in the Region and, in turn, applying this estimate to the total population estimates. The industry group employment estimates were derived from a review and updating of previous Commission economic base and structure studies. These employment estimates were then compared with the outputs of the regional activity simulation model.

[1] *For the details of this method, see SEWRPC Planning Report No. 4, The Population of Southeastern Wisconsin.*

[2] *For details of, and assumptions underlying, this methodology, see SEWRPC Planning Report No. 3, The Economy of Southeastern Wisconsin.*

[3] *For complete details of this model, see SEWRPC Planning Report No. 1, Regional Planning Systems Study, and SEWRPC Technical Report No. 3, A Mathematical Approach to Urban Design.*

Income Forecasts [4]

Total, per capita, and per household incomes were also forecast for the Southeastern Wisconsin Region. The primary income forecast made was that of per capita income. Per capita income was forecast based on analyses of past per capita income trends in the Region, coupled with a review of national and state per capita income forecasts made by other agencies. Of particular value in this respect were the projections prepared by the National Planning Association for the Outdoor Recreation Resources Review Commission.[5]

The total income forecast was obtained by multiplying the forecast per capita figure by the total population forecasts. Income per household was obtained by dividing the total income estimates by the estimates of the number of households for each forecast year. The assumption here was that the amount of income earned by the non-household population is small enough so as not to distort the average household incomes to a significant degree.

Automobile Availability Forecasts

Forecasts of the number of automobiles available[6] to residents of the Region, that is, the number of automobiles either owned by residents of the Region or garaged at residences within the Region were made for the Region as a whole and for each county within the Region. These forecasts were derived from regional and county population forecasts by dividing the future population levels by projected changes in the ratio of persons per available automobile. Projection of the ratio of population to available automobiles was based upon observed trends over the period 1950 to 1965 for the Region and for each county. Implicit in these forecasts is the assumption that as progressively higher automobile availability levels are attained the rate of increase in automobile availability will decline. Forecasts based on linear extrapolation of present trends in automobile availability, that is, on a constant rate of increase, would ultimately lead to totally unrealistic ratios of population to automobiles. A report prepared by the U. S. Bureau of Public Roads[7] on indicators of saturation in automobile ownership was especially useful in preparing the forecasts. National and state forecasts prepared by other governmental and private agencies were reviewed and also considered in the forecasts.

Truck Availability Forecasts

Forecasts of the number of trucks available[8] to truck operators within the Region were made for the Region as a whole and for each county within the Region. The forecasts were based upon an analysis and projection of observed trends in the registrations of each truck type, that is, light (trucks under 8,000 pounds net weight), medium (trucks 8,000 pounds and over net weight), and heavy trucks (tractor-trailer combinations), farm trucks, and municipal trucks, over the period 1950 to 1965. Also considered in the preparation of the forecasts were changes in population levels and in commercial and industrial development anticipated by 1990 and national and state truck registration forecasts made by governmental and private agencies.

Public Financial Resource Forecasts

Two basic forecasts of public revenues were prepared as a part of the regional land use-transportation study. A forecast was made of the total local government revenues within the Region (county, city, town, village, and school district); and a forecast was made of total highway revenues available for use within the Region by all levels of government—federal, state, and local. The state and federal highway revenues forecast were those directly available for expenditure within the Region by the State Highway Commission of Wisconsin and not channeled through local units of government.

[4] *Income as used here includes income from wages, salaries, self-employment earnings, social security payments, pensions, rent, interest, and other transfer payments. It excludes income received in kind, imputed rental income from owned homes, income from property sales, tax refunds, lump sum insurance payments, gifts, and borrowed money.*

[5] *ORRRC Study Report No. 23, Projection to the Years 1976 and 2000; Economic Growth, Population, Labor Force and Leisure, and Transportation.*

[6] *The number of automobiles available within the Region at any time within a given calendar quarter is estimated to be approximately 90 percent of the total automobiles reported to be registered in the Region for that calendar quarter of the fiscal year by the Wisconsin Motor Vehicle Department. The 10 percent reduction accounts for automobiles scrapped, moved out of the Region, or on used car lots and for those owned and kept in fleets by government and industry and not garaged at residences. The latter are considered to represent only a fraction of 1 percent of total automobiles in use within the Region.*

[7] *Source: Trend in Automobile Ownership and Indicators of Saturation, Walter H. Bottiny, U. S. Bureau of Public Roads.*

[8] *The number of trucks available to truck operators within the Region at any time in a given calendar quarter is estimated to be approximately 94 percent of the total trucks reported to be registered in the Region for that calendar quarter of the fiscal year by the Wisconsin Motor Vehicle Department. The 6 percent reduction accounts for trucks scrapped, moved out of the Region, or on used car lots.*

Total local government revenues were forecast as follows: Per capita revenues were extrapolated to the year 1990 based on the observed trend from 1948 to 1962 for the eight revenue categories listed in Table 14.[9] These per capita figures were then multiplied by forecasts of total population. The revenue estimates for these eight categories were summed to obtain total local government revenues.

Total highway revenues were forecast by summing forecasts of the state and federal monies spent directly in the Region and forecasts of local government highway revenues. Forecasts of the state and federal monies available were based on projections of historic state and federal revenue patterns. It was assumed that state and federal revenues would remain at their 1956 to 1963 average level, even though the federal interstate highway program is scheduled for completion by 1972. Forecasts of local highway revenues were based on forecasts of total local government revenues; that is, the ratio of local revenues for highways to total revenues was assumed to remain constant throughout the forecast period. This ratio was multiplied by the forecast level of total local government revenues to obtain the forecasts of local highway revenues.

The forecasts of state and federal revenues and local government revenues were then summed to obtain the estimates of total revenue available for highway purposes. These total estimates were subsequently broken down into revenues available for construction and revenues available for maintenance and related purposes, based on the existing ratios of construction expenditures to maintenance and related expenditures.

Land Use Forecasts

As already indicated, land use forecasting as conceptualized for the regional land use-transportation study is concerned with total regional needs irrespective of spatial distribution. These regional forecasts of land use needs serve as inputs to the regional land use plan design process; that is, the spatial distribution of land uses accomplished in the land use plan design is scaled against these overall regional needs.

Because no previous areawide land use inventories comparable to the existing regional land use inventory, completed for the base year 1963, were available, certain assumptions were required as a basis for the forecasts which might not have been required if detailed, areawide land use data had been available for more points in time. These assumptions were: that, in the absence of changes in local land use control policies, residential land use demand would continue to reflect recent historic trends to low-density development; that commercial, service, and industrial land use demand would continue to reflect recent historic trends to the concentration of such development on fewer but considerably larger planned sites; and that governmental and institutional land use demand would continue to reflect existing (1963) population to land use ratios. The forecasts prepared under these assumptions represent the demand for land that the incremental increases in the population and economic activity levels within the Region would exert if the more recent development trends continue to 1990.

The major classes of land needs which were forecast include: low-, medium-, and high-density residential land; commercial land; industrial land; transportation, communication, and utility land; governmental and institutional land; and recreation

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[9] *There were two exceptions to the forecast of local government revenues by extrapolation of observed historic trends. These occurred in the "aids" category and the "special assessments" category. In the "aids" category, per capita federal and state aids and grants received by local units of government, including counties and school districts, have increased at the rate of about $2.89 per year from $28.29 per capita in 1958 to $39.85 per capita in 1962. The forecast of aids and grants to 1990 assumed annual increases as follows: 1960 to 1970, $3.00 per capita per year; 1970 to 1980, $3.50 per capita per year; and 1980 to 1990, $4.00 per capita per year.*

In the "special assessments" category, per capita receipts have averaged about $7.00 per capita over the 1958 to 1962 period, whereas receipts from 1948 to 1957 averaged about $3.80 per capita. The forecast of special assessments to 1990 assumed the following receipts: 1960 to 1970, $7.00 per capita; 1970 to 1980, $8.00 per capita; and 1980 to 1990, $9.00 per capita.

These assumptions are predicated on the increased tendency of local municipalities to levy the special assessment on immediate beneficiaries of municipal public works improvements.

The "aids" category forecasts do not include allowances for state or federal aid or grant programs currently available and not utilized within the Region or not currently available. It is probable, however, that before the 1990 forecast date is reached all available programs will be utilized and some new programs may be enacted that will require matching local funds for purposes which have not previously been a part of local revenue or expenditure categories. For example, federal aids are presently available in the form of capital grants for mass transit system improvements; but this program has not as yet been utilized within the Region. If it were utilized, an entirely new category of local revenues and expenditures would be created to accommodate both the receipt of the specific aid funds and the appropriation of local matching funds. Similar possibilities might exist in new programs for the prevention and alleviation of air and water pollution.

land. The general methodology followed in forecasting future land needs was:

1. Low-, medium-, and high-density residential land needs were obtained by application of a land use simulation model.[10] Basically, this model forecasts residential land development in the Region by simulating household and land developer decisions, utilizing forecasts of household increases as the major demand input. These model forecasts were compared with similar forecasts obtained from an analysis of residential land demands which occurred in the Region from 1950 to 1963.

2. Total commercial land needs were forecast by dividing estimates of future commercial and service employment densities into forecasts of commercial and service employment. The density estimates were based on an analysis of existing conditions and on estimates prepared for the City of Milwaukee.[11]

3. Total industrial land needs were forecast by dividing estimates of future industrial employment densities into industrial employment forecasts. Density estimates were based on an analysis of existing industrial areas and proposed industrial districts.

4. Government-institution land needs were forecast by multiplying the existing population to government-institution land use ratio by the forecast population increase.

5. Transportation, communication, and utility land needs were forecast by multiplying the incremental acreage of residential, commercial, industrial, and government-institution land required by 1990 by the respective ratios of transportation, communication, and utility land area to existing residential, commercial, industrial, and government-institution land area.

6. Recreation land needs were forecast by multiplying the existing population to recreation land use ratio by the forecast population increase.

Agricultural and open-space land use needs were not forecast. Instead, the future amount of such land remaining within the Region was determined by subtracting forecasts of the total land needs in all other categories from the total land and water area in the Region.

POPULATION FORECASTS

Historical Background

In the past, population growth in the Region has generally paralleled that of other large metropolitan areas of the United States in that absolute population increases have been large and rates of increase high. The population of the Region has increased by about 750,000 persons in the last 25 years. This compares to a total increase of only one million persons in the preceding 100 years of settlement in the Region. 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 United States population from 1940 to the present time has increased from 0.81 percent to 0.88 percent; and the Region's share of the state population has increased from 34.0 percent to 41.2 percent.

This relatively large and rapid population growth in the Region since 1940 has been the result of changes in the three basic components of population changes: births, deaths, and migration. Over the period birth rates have risen; death rates have declined; and the rate of net migration (excess of in-migrants over out-migrants) has increased. For example, the number of births per 1,000 persons in the Region increased from 15.5 in 1940 to 22.5 in 1963; the death rate has declined from 9.8 deaths per 1,000 persons in 1940 to 9.0 in 1963; and the rate of net migration has increased from 4.5 net in-migrants per 1,000 population in the 1940's to 7.8 net in-migrants per 1,000 population in the 1950's.

As a result of the trends in the components of population change in the Region, the age-sex composition of the population has also been changing. The most significant age composition changes have been in the younger and older age groups. For example, the percentage of the population under

[10] *Details of the structure and operation of this model are available in SEWRPC Planning Report No. 1, Regional Planning Systems Study; SEWRPC Technical Record, Vol. 2 - No. 1, and SEWRPC Technical Report No. 3, A Mathematical Approach to Urban Design.*

[11] *Land Absorption Study, City of Milwaukee, Wisconsin Community Renewal Program, prepared by Real Estate Research Corporation, January 1964.*

15 years of age has increased from 24.5 percent in 1950 to 31.4 percent in 1960; and the percentage of the population over 65 years of age has increased from 8.0 percent in 1950 to 9.0 percent in 1960. The significant change in the sex composition of the Region's population has been the decline in the ratio of males to females. The ratio declined over the period 1950 to 1960 from 0.980 to 0.973. This is generally an extension of a long-term trend resulting from the fact that females tend to have longer life expectancies than males.

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, boardinghouses, or institutions. Since 1950 the number of households in the Region has increased sharply. In 1950 there were about 355,000 households in the Region; in 1963 the number had risen to 482,000. This amounts to the formation of about 10,000 new households per year within the Region. The percentage of the population residing in households has also been increasing. In 1950 approximately 96 percent of the population lived in households; in 1963 that percentage had risen to 98.2. The average household size in the Region since 1950 has ranged between 3.3 and 3.4 persons per household. Conflicting factors affecting household size have been responsible for this relative stability in household size; that is, an increase in one-person households, resulting from a tendency for unmarried persons to maintain homes away from relatives, has generally offset increases in households containing four or more persons.

The Future Population

The population of the Region is forecast to continue to increase rapidly in size and, as indicated in Table 3, is forecast to reach approximately 2,678,000 persons by 1990. This represents an increase of slightly more than 1,000,000 persons over the estimated 1963 regional population level of 1,674,000 persons. Approximately 55 percent of this 1,000,000-person increase is forecast to take place by 1980, the other 45 percent being realized in the decade from 1980 to 1990.

As further indicated in Table 3, it is expected that the regional population will continue to increase at a faster rate than that of the United States and the State of Wisconsin. The regional population is forecast to increase by about 70 percent from 1960 to 1990, compared to a 60 percent increase for the United States and a 51 percent increase for the state. This is consistent with past trends. In the previous 30-year period, from 1930 to 1960, the regional population increased by over 56 percent, the U. S. population by 46 percent. The past 63-year trend in the population of the Region, Wisconsin, and United States, along with the forecasts to 1990, are presented in Figure 2.

As indicated earlier, four separate forecasts of future regional population levels were prepared by

Table 3
POPULATION FORECASTS FOR THE REGION, WISCONSIN, AND THE UNITED STATES (1960 - 1990)
(in Thousands)

Year[a]	Region	Wisconsin[b]	United States[c]
1960	1,574	3,953	180,676
1965	1,718	4,248	194,671
1970	1,870	4,511	208,996
1975	2,035	4,820	225,870
1980	2,223	5,176	245,313
1985	2,435	5,561	266,322
1990	2,678	5,977	288,219
Percent Increase 1960 - 1990	70.1	51.2	59.5

[a] *Population figures for 1960 are as of April 1; population figures for the years 1965-1990, as of July 1.*

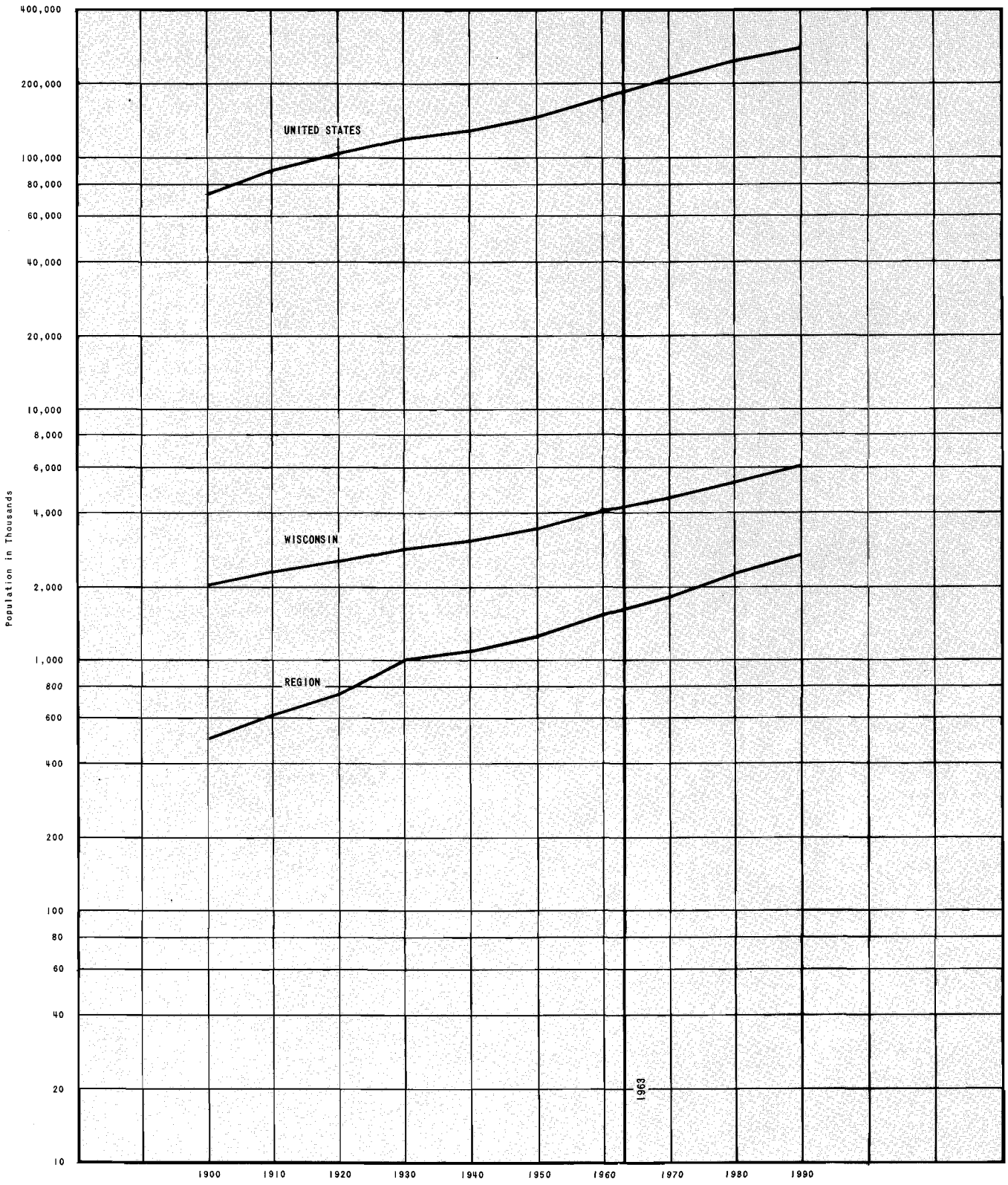
[b] *Prepared by SEWRPC utilizing a continuation of a historic linear relationship between changes in the population of the State of Wisconsin and of the United States.*

[c] *Figures include armed forces abroad and are Series B projections published by the U.S. Bureau of the Census in Current Population Report Series P-25, No. 286, July 1964, pp. 47-55.*

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

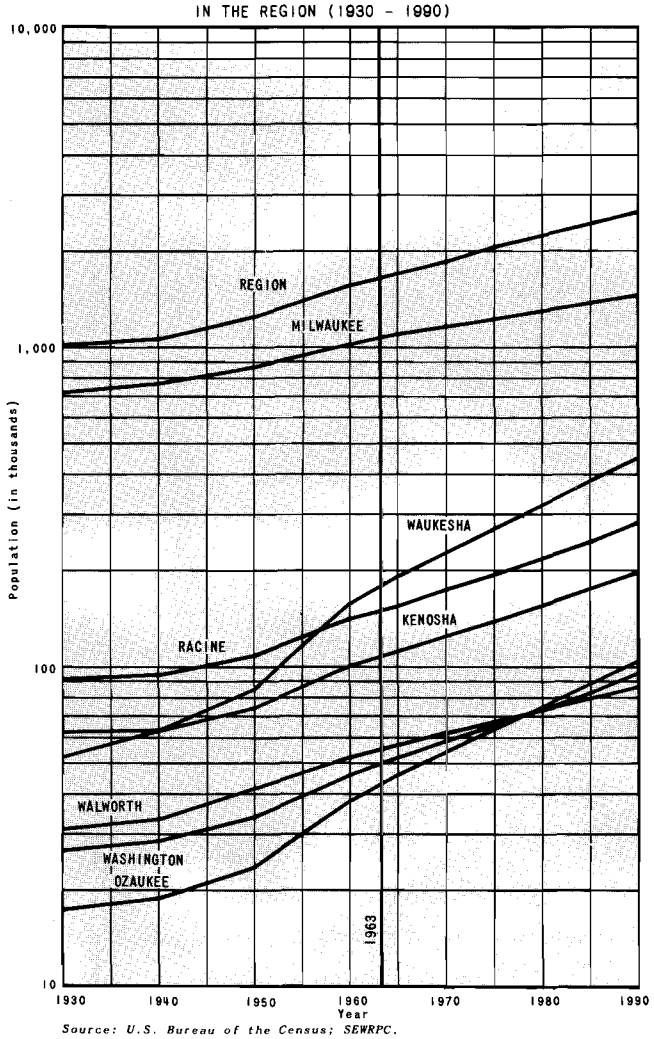
Figure 2

POPULATION TRENDS AND FORECASTS FOR THE REGION, WISCONSIN, AND THE UNITED STATES (1900 - 1990)



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

Figure 3
POPULATION TRENDS AND FORECASTS BY COUNTY
IN THE REGION (1930 - 1990)



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

four different demographic forecasting techniques in order to provide a measure of what the future population levels within the Region might be under varying assumptions. In addition, four separate forecasts of total future regional employment levels were prepared by four different economic forecasting techniques and converted to corresponding future population levels by application of an employed participation rate.[12] It was from among this array of eight separate population forecasts that the "single best" estimate of future population was chosen for regional land use and transportation planning purposes. The highest and lowest series of forecast population levels obtained are shown in Table 4, along with the best estimate series selected to be used in the plan design. All other five forecasts fell within the high and low values shown in the table. The high series was obtained by converting the most recent U. S. Bureau of the Census projections of total national population to regional population levels by correlation and regression techniques. The medium series, which was selected as the "best estimate," was obtained by assuming a rate of natural increase of 1 1/2 percent per year and a net in-migration rate of 1/2 of 1 percent per year, these rates being consistent with historic trends within the Region. The low series was obtained by applying a modified cohort-survival technique.

Each of the seven counties within the Region have significant population growth forecasts for 1990. The greatest absolute gain would occur in Milwaukee County, which would gain 410,000 persons over the forecast period. The greatest percentage increase would occur in Waukesha County, which shows a population increase of 189 percent over the forecast period (see Table 5 and Figure 3).

Not only is the population anticipated to increase rapidly in size, it is anticipated to change in age and sex composition. Some of these changes are indicated in Table 6 and Figure 4. The major changes that are forecast to take place between 1960 and 1990 in these population characteristics may be summarized as:

1. The age group from 0 to 4 years of age, which represents the preschool age population, is expected to increase by approximately 69 percent, a rate slightly lower than that expected for the population as a whole. The total increase in this age group by 1990 is estimated to be about 131,000 persons.

[12] *The employed participation rate is the ratio of total employment to total population. At national, state, and regional levels, there is an observed long-run trend for this ratio to decline.*

Table 4

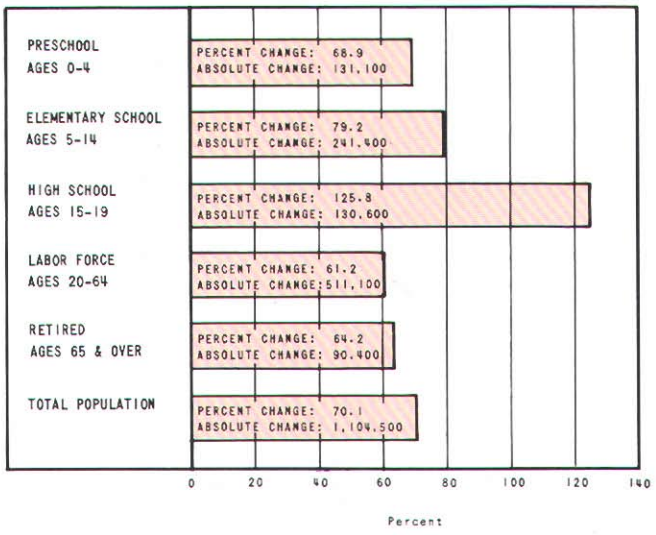
HIGH, MEDIUM, AND LOW POPULATION FORECAST SERIES FOR THE REGION (1960 - 1990)
(in Thousands)

Population Series	1960	1965	1970	1975	1980	1985	1990
High Series	1,574	1,786	1,981	2,195	2,397	2,684	2,979
Medium Series	1,574	1,718	1,870	2,035	2,223	2,435	2,678
Low Series.	1,574	1,689	1,809	1,931	2,064	2,214	2,331

Source: SEWRPC.

Figure 4

PERCENT CHANGE IN TOTAL POPULATION AND IN SELECTED AGE GROUPS IN THE REGION (1960 - 1990)



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

4. The age group from 20 to 64 years of age, which represents the working age population, is expected to increase by approximately 61 percent, a rate slightly lower than that expected for the population as a whole. The total increase by 1990 in this age group, however, is expected to be more than 511,000 persons, or about one-half of the total forecast population change.

5. The age group over 64 years of age, which represents the retired age population, is expected to increase by approximately 64 percent, a rate slightly lower than that expected for the population as a whole. The total increase in this age group by 1990 is estimated to be about 90,000 persons.

Table 5

POPULATION FORECASTS BY COUNTY IN THE REGION (1960 - 1990)
(in Thousands)

Year	Kenosha	Milwaukee	Ozaukee	Racine	Walworth	Washington	Waukesha
1960	100.6	1,036.0	38.4	141.8	52.4	46.1	158.3
1965	112.0	1,103.0	46.0	156.0	57.0	52.0	192.0
1970	125.0	1,170.0	54.0	173.0	62.0	58.0	228.0
1975	139.0	1,236.0	64.0	193.0	67.0	65.0	271.0
1980	157.0	1,305.0	75.0	217.0	73.0	74.0	322.0
1985	177.0	1,375.0	89.0	247.0	80.0	84.0	383.0
1990	202.0	1,446.0	106.0	283.0	87.0	96.0	458.0
Percent Increase 1960 - 1990	100.7	39.5	176.0	99.5	66.0	108.2	189.3

Source: SEWRPC.

2. The age group from 5 to 14 years of age, which represents the elementary school age population, is expected to increase by approximately 79 percent, a rate slightly higher than that expected for the population as a whole. The total increase in this age group by 1990 is estimated to be about 241,000 persons.

3. The age group from 15 to 19 years of age, which represents the high school age population, is expected to increase by approximately 126 percent, a rate considerably higher than that expected for the population as a whole. The total increase in this age group by 1990 is estimated to be about 131,000 persons.

6. The number of males in the population will increase at a slower rate than the number of females, and the ratio of males to females will decline from 0.973 to 0.970.

These forecasts of changes in age and sex composition of the population have certain important implications for long-range land use and transportation planning. Initially, these changes in population characteristics indicate continued need for new elementary educational facilities and an accelerated need for new secondary and college-level educational facilities. Secondly, these changes indicate that the labor force will contain a larger percentage of younger persons and that a great number of men and women under 35 years of age will be employed or seeking work. Finally, these changes indicate that the oldest segment of the

Table 6

AGE AND SEX COMPOSITION FORECASTS FOR THE REGIONAL POPULATION (1960 - 1990)[a]

(in Thousands)

Age Group	1960				1990			
	Males	Females	Total	Percent of Regional Total	Males	Females	Total	Percent of Regional Total
0- 4	96.7	93.5	190.2	12.1	163.2	158.1	321.3	12.0
5- 9	85.1	81.5	166.6	10.6	145.9	141.1	287.0	10.7
10-14	70.4	67.5	137.9	8.8	131.3	127.6	258.9	9.7
15-19	50.4	53.4	103.8	6.6	118.3	116.1	234.4	8.7
20-24	43.7	50.3	94.0	6.0	107.5	107.5	215.0	8.0
25-29	49.8	50.2	100.0	6.4	103.6	104.3	207.9	7.8
30-34	54.2	54.3	108.5	6.9	101.6	101.6	203.2	7.6
35-39	53.4	55.1	108.5	6.9	89.6	89.0	178.6	6.7
40-44	49.4	50.8	100.2	6.4	73.6	73.3	146.9	5.5
45-49	46.7	48.2	94.9	6.0	53.7	57.8	111.5	4.2
50-54	42.1	43.5	85.6	5.4	45.8	51.3	97.1	3.6
55-59	37.9	38.4	76.3	4.8	45.9	48.0	93.9	3.5
60-64	32.4	33.8	66.2	4.2	43.1	48.0	91.1	3.4
65-69	26.4	29.0	55.4	3.5	35.8	44.7	80.5	3.0
70-74	18.9	22.0	40.9	2.6	26.2	35.8	62.0	2.3
75-79	10.8	14.2	25.0	1.6	17.9	27.1	45.0	1.7
80 & over	7.7	11.8	19.5	1.2	15.9	27.8	43.7	1.6
Total	776.0	797.5	1,573.5	100.0	1,318.9	1,359.1	2,678.0	100.0

[a] *For detailed data by county, see Appendix A, Tables A-4 through A-10.*

Source: SEWRPC.

population will continue to increase quite rapidly and that residential and recreational facilities to serve these older age groups will be in demand.

Along with the forecast increases in population will come increases in the number of households in the Region. Forecasts of increases in the number of households have particularly important implications for long-range land use and transportation planning, since it is the household population which creates nearly all the demand for land use and transportation facilities. As shown in Table 7, the number of households in the Region is estimated to increase to 795,000 by 1990. This represents a percentage increase over 1960 of more than 70 percent. Implicit in the forecast are the assumptions that approximately 98 percent of the population will reside in households over the forecast period and that the average household size will be about 3.3 persons, which is slightly lower than the present level. These assumptions are based on past trends in these population characteristics. The slight decrease forecast in average household size reflects the fact that total population projections for the Region assume a decline in the birth rate.

This substantial increase in the number of households within the Region by 1990 portends a substantial increase in the need for residential land.

Table 7

HOUSEHOLD FORECASTS FOR THE REGION (1960 - 1990)[a]

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

[a] *For detailed data by county, see Appendix A, Tables A-11 through A-17*

Source: SEWRPC.

For example, if future development within the Region continued at the average development densities which prevailed from 1950 to 1963, nearly 187,000 additional acres of residential land will be required to accommodate the forecast increase in households. Presently only 130,000 acres of land are devoted to this use.

EMPLOYMENT FORECASTS

Historical Background

Since 1950 employment in the Region has shown a marked increase. During the 13-year period extending from 1950 to 1963, over 100,000 new jobs were created in the Region; and as of 1963 total employment within the Region stood at approximately 635,000. This substantial increase in employment has been responsible for a large share of the population growth experienced in the Region over the same period as expanding employment opportunities attracted job applicants and their families. From 1950 to 1963, net migration added over 130,000 people to the population of the Region.

Employment growth has not, however, been uniform throughout the various industrial groupings in the regional economy. In general, employment growth in the trade and service industry groups has been more rapid than in the manufacturing groups. As a result the regional economy is, in terms of employment, becoming more strongly oriented toward trade and service activities. Nonetheless, manufacturing is still by far the largest employer in the Region and accounted for about two-fifths of all employment in 1963.

In the manufacturing industry groups, the largest employers are those producing machinery, electrical equipment, and transportation equipment. These three general activities accounted for over half of all the manufacturing jobs in the Region in 1963. There is also a considerable amount of employment associated with the production of food and beverage products and primary and fabricated metal products.

Trends in these individual manufacturing industries within the Region indicate that transportation and electrical equipment producers have experienced the fastest growth in employment, thus increasing their shares of total manufacturing employment. The largest employing industry, machinery, has had virtually no long-term employment growth in the period since 1950 and as a result has declined in its share of the total manufacturing employment. Most nondurable goods producers, for example, food, beverage, apparel, leather, paper, and chemicals, have also had little or no long-term employment growth; and their shares of total manufacturing employment have declined.

Future Employment Levels

Employment in the Southeastern Wisconsin Region is forecast to reach 984,000 employees by 1990. This represents a 59.7 percent increase over the 1960 level of about 616,000 employees. This rate of increase is less than the forecast population growth rate of 70.1 percent over the same period, reflecting implicit assumptions that fewer employees will support the regional population in the

Table 8

EMPLOYMENT FORECASTS BY MAJOR INDUSTRY GROUP FOR THE REGION BY CONVENTIONAL TECHNIQUES (1960 - 1990)

(in Thousands)

Industry Group	1960	1963	1970	1980	1990	Percent Change 1960 - 1990
Agriculture	12.9	12.0	10.6	9.1	7.9	- 38.8
Construction & Mining	29.5	29.7	32.5	35.8	39.5	33.9
Manufacturing	253.0	258.2	274.6	299.0	326.5	29.1
Trade	120.2	122.1	132.7	146.6	162.0	34.8
Transportation, Communications, & Utilities	34.8	35.3	38.4	42.5	46.9	34.8
Finance, Insurance, & Real Estate	23.0	24.0	28.7	35.9	44.8	94.8
Services	*142.6*	*153.6*	*188.5*	*259.1*	*356.4*	149.9
Private Services	94.7	101.2	124.1	172.6	240.1	153.5
Government Services & Education	47.9	52.4	64.4	86.5	116.3	142.8
Total	616.0	634.9	706.0	828.0	984.0	59.7

Note: Figures in italics indicate subtotals.

Source: Wisconsin Industrial Commission; SEWRPC.

future and that the size of the labor force relative to total population will decrease. These assumptions appear reasonable, not only in light of recent trends, but in light of trends toward higher educational attainment and earlier retirement ages.

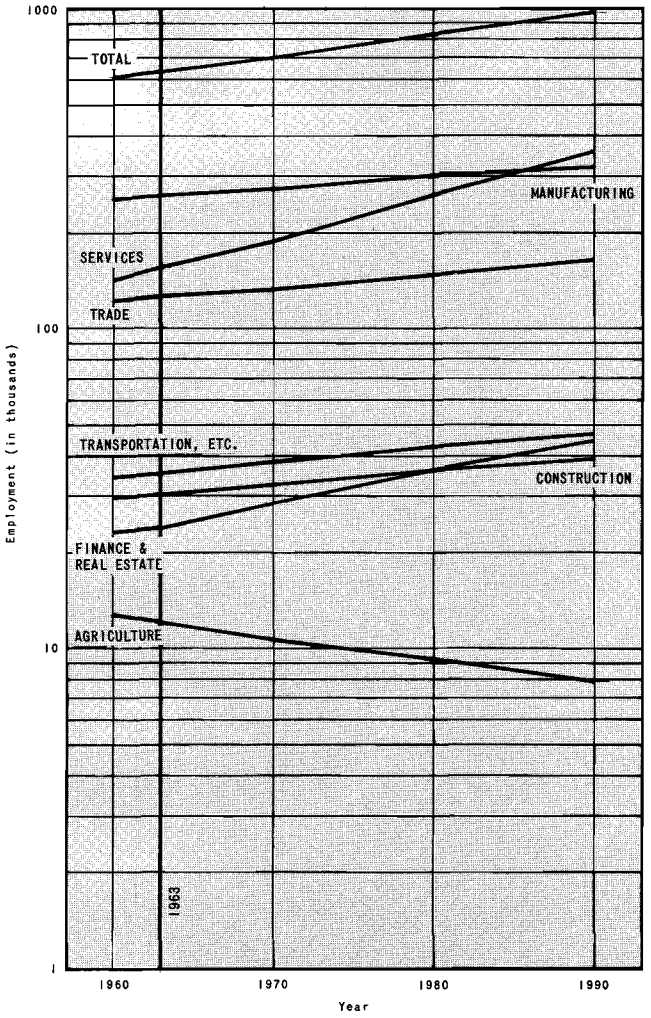
As indicated in Table 8 and Figure 5, agricultural employment is forecast to continue its historic long-term decline; construction and mining, manufacturing, trade, and transportation-communications-utilities employment are all forecast to increase by 1990, at rates ranging from 29 to 35 percent; service employment, including finance, insurance, real estate, other private services, and government services and education are forecast to increase at rates ranging from 95 to 153 percent by 1990.

An alternative forecast of regional economic activity was prepared using the Regional Economic Simulation Model developed by the SEWRPC for this purpose. The model is a dynamic input-output simulation model that generates a synthetic history of the regional economy based on forecasts of national consumer, government, and export spending.[13]

[13] *The model is subdivided into a number of national and regional sectors or industries. Each of these industries has its own set of equations in the model. The interconnection between these industries results from their interaction in the market place. An input-output table depicts the detailed nature of these market place relationships. In the model input-output parameters indicate the composition of the purchases of each industry. The parameters are expressed as ratios of the part of each purchasing dollar that is spent by each industry in every other industry. The input-output table is shown in Appendix Table A-18. The table presents the input-output purchasing ratios for an aggregated set of national industries, who represent the business customers of the Region's industries, and the ratios for inter-regional purchases.*

Figure 5

EMPLOYMENT FORECASTS FOR MAJOR INDUSTRY GROUPS IN THE REGION (1960 - 1990)



Source: SEWRPC.

Table 9

EMPLOYMENT FORECASTS BY MAJOR INDUSTRY GROUP FOR THE REGION BY SIMULATION MODEL TECHNIQUES (1960 - 1990)
(in Thousands)

Employment Type	1960	1963	1970	1980	1990	Percent Change 1960 - 1990
Agriculture	12.9	12.1	10.6	9.1	7.9	- 38.8
Construction & Mining	29.5	32.6	38.9	43.9	49.8	68.8
Manufacturing	253.0	264.7	288.2	327.5	370.2	46.3
Trade	120.2	122.6	127.4	143.8	162.1	34.8
Transportation, Communications, & Utilities	34.8	37.8	43.8	49.5	55.9	60.6
Finance, Insurance, & Real Estate	23.0	22.5	21.5	24.3	29.4	27.8
Services[a]	142.6	161.8	200.1	236.7	282.6	98.1
Total	616.0	654.1	730.5	834.8	957.9	55.5

[a] *Includes Private Services and Government Services and Education, which were not separately forecast by simulation model techniques.*

Source: Wisconsin Industrial Commission; SEWRPC.

The forecasts determined through the use of this model are shown in Table 9. It will be noted that, with respect to total employment, the model forecast is somewhat lower than the non-model forecast in 1990 and somewhat higher in 1970 and 1980. In 1970 the model forecast is 3.4 percent higher than the forecast made utilizing conventional techniques; in 1980 it is 0.8 percent higher; and in 1990, 2.6 percent lower. Overall, the model forecast indicates a rise of 55.5 percent in total employment versus an indicated rise of 59.7 percent for the non-model forecast. The model forecast indicates a higher increase in construction, manufacturing, and utilities employment but a smaller increase in services employment. Because agricultural employment within the Region is highly dependent on the rate of conversion of agricultural land to urban use, agricultural employment was not forecast with the model. Although the differences in some of the components of the two forecasts, such as in manufacturing, construction, and utilities employment, represent significant differences, the differences in the forecast of total employment are well within reasonable probable error ranges, so that the total employment forecasts prepared by the model and non-model techniques can be considered equivalent.

Because of the significant differences in some components of the two sets of forecasts, however, it is important to understand the basic assumptions used in the model forecasts. The more important of these assumptions are:

1. Inter-industry input-output coefficients will remain constant over the forecast period. Although changes in technology will tend to modify these parameters over time, there is not yet sufficient data available in this country to establish trends in input-output coefficients and thereby warrant a more realistic assumption in this respect.
2. The Southeastern Wisconsin Region will maintain its market share of the national market.
3. Present trends in the increase of personnel productivity (output per employee) will continue.[14]

An additional implicit assumption relates to the attainment of the national forecasts of gross national product, consumer, government, and export spending levels shown in Table 10. These national forecasts were common to both the regional model and non-model forecasts.

Differences in the two regional forecasts must implicitly derive from differences in one of three areas: inter-industry effects, changes in the regional share of the national and international economy, and changes in the rate of increase in personnel productivity. All of these three areas are treated explicitly in the model forecasts but necessarily implicitly in the non-model forecasts. A growing but as yet unknown influence on the regional economy is the export market. Since the Region is primarily a capital goods producer, the export market will become increasingly important in its effect upon the regional economy as southeastern Wisconsin expands its service to the developing economies of the world. An examination of the status of the regional economy in 1965 would seem to indicate that both forecasts of future economic activity levels may be somewhat conservative. It would appear to be unwise, however, to allow the current (1965) very

[14] *An overall annual increase in personnel productivity of 2 1/2 percent is indicated by recent trends. Should this rate of increase rise to 3 percent annually, the future regional employment levels could change drastically from those forecast. The possible impact of personnel productivity on future employment levels is illustrated by the fact that a simulation model forecast, which was made assuming an annual increase of productivity of 3 percent instead of 2 1/2 percent, provided a 1990 total employment forecast of approximately 800,000 jobs instead of the 957,900 jobs based upon a 2 1/2 percent increase in productivity.*

Table 10

GROSS NATIONAL PRODUCT, PERSONAL CONSUMPTION EXPENDITURES, GOVERNMENT PURCHASES, AND VALUE OF EXPORTS FORECASTS (1950 - 1990)
(in Billions of 1960 Dollars)

Year	Gross National Product	Personal Consumption Expenditures	Government Purchases	Exports
1950.	362.6	238.4	56.8	15.3
1960.	504.4	328.9	100.1	26.7
1970.	746.0	462.0	160.0	38.0
1980.	1,060.0	662.0	242.0	58.4
1990.	1,510.0	944.0	365.0	91.2

Source: U.S. Department of Commerce; Resources for the Future, Inc.

Table 11
MANUFACTURING EMPLOYMENT FORECASTS BY INDUSTRY FOR THE REGION BY CONVENTIONAL TECHNIQUES (1960 - 1990)
(in Thousands)

Industry Type	1960	1963	1970	1980	1990	Percent Change 1960 - 1990
Food & Related Products	21.3	20.9	20.3	19.3	18.3	-14.1
Textile, Apparel, Leather Products	14.2	14.2	14.2	14.2	14.2	--
Paper & Wood Products	9.5	9.6	9.9	10.2	10.7	12.6
Printing & Publishing	16.3	16.8	18.5	20.9	23.7	45.4
Chemical & Related Products	4.0	4.1	4.5	5.3	5.8	45.0
Primary Metal Products	19.4	19.6	20.9	22.5	24.3	25.3
Fabricated Metal Products	18.3	18.3	19.2	20.2	21.3	16.4
Machinery	58.8	59.6	62.4	65.6	69.0	16.2
Electrical Equipment	40.9	42.9	47.5	57.9	70.6	72.6
Transportation Equipment	33.4	34.3	36.9	40.8	45.0	34.7
Instruments & Related Products	3.4	3.4	3.8	4.4	4.9	44.1
Miscellaneous Manufacturing Products	13.5	14.5	16.5	17.7	18.7	45.0
Total	253.0	258.2	274.6	299.0	326.5	29.1

Source: Wisconsin Industrial Commission; SEWRPC.

high levels of economic activity in the Region to unduly influence the long-term forecasts, even though some of the major regional industries, such as machinery, primary metals, and fabricated metals, have in their current cyclical peaks exceeded the forecast 1970 employment levels of the non-model forecasts.

The changes forecast for the various industries comprising the manufacturing industry group are shown in Table 11. These were prepared by non-model techniques. The industry with the highest employment growth potential within the Region appears to be the electrical equipment industry. Employment in this industry is forecast to increase to over 70,000 employees by 1990, a percentage increase over the 1960 level of 72.6 percent. The largest manufacturing industry employer within the Region at the present time, machinery, is forecast to increase by only 16 percent over the period, reaching a level of 69,000 jobs by 1990. Therefore, the largest manufacturing industry in terms of employment within the Region is expected to be the electrical equipment producers, replacing the machinery producers which presently lead in this respect.

Most of the other manufacturing industries are

Table 12
MANUFACTURING EMPLOYMENT FORECASTS BY INDUSTRY FOR THE REGION BY SIMULATION MODEL TECHNIQUES (1960 - 1990)
(in Thousands)

Industry Type	1960	1963	1970	1980	1990	Percent Change 1960 - 1990
Food & Related Products	21.3	22.5	24.8	27.9	31.3	46.9
Textile, Apparel, Leather Products	14.2	15.5	18.2	20.6	23.2	63.3
Paper & Wood Products	9.5	11.6	15.7	17.8	20.0	110.5
Printing & Publishing	16.3	16.4	17.9	20.2	22.8	39.8
Chemical & Related Products	4.0	4.1	5.7	6.5	7.3	82.5
Primary Metal Products	19.4	20.5	22.7	25.7	29.1	50.0
Fabricated Metal Products	18.3	18.4	20.0	22.7	25.8	40.9
Machinery	58.8	58.9	60.4	70.4	81.1	37.9
Electrical Equipment	40.9	42.0	44.3	50.9	57.8	41.3
Transportation Equipment	33.4	35.7	40.3	45.5	51.2	53.2
Instruments & Related Products	3.4	3.4	3.6	4.1	4.7	38.2
Miscellaneous Manufacturing Products	13.5	13.9	14.6	15.2	15.9	17.7
Total	253.0	262.9	288.2	327.5	370.2	46.3

Source: Wisconsin Industrial Commission; SEWRPC.

forecast to increase in employment by 1990. The exceptions are food and beverage producers and textile, leather, and apparel manufacturers. Food and beverage products manufacturing is highly adaptable to automatic processes, and national forecasts call for an employment decline in this industry. Manufacturing of textile, apparel, and leather products is also forecast to show little change in employment nationally by 1990; and with these producers generally locating in eastern and southeastern states, it is unlikely that there will be appreciable employment growth in these industries in the Southeastern Wisconsin Region over the forecast period.

The model forecasts of manufacturing employment are shown in Table 12, which indicates some differences from the non-model forecasts. The most dramatic difference between the two forecasts is indicated for the machinery industry, the leading manufacturing industry in the Region. The model forecast indicates an increase in employment in this industry of 37.9 percent versus a 16.2 percent increase for the non-model forecast. Increases for other manufacturing industries, such as primary metals and food, are also higher in the model forecast. Five of the industries—machinery, electrical equipment, instruments, primary metals, and fabricated metals—have a strong capital goods orientation and are greatly influenced by business spending. The historic growth in all of these industries has reflected the significant increase in capital goods spending that has occurred nationally in recent years. To maintain the present 2 1/2 percent annual increase in industrial productivity nationally, it is essential that a heavy rate of capital spending be maintained.

The industrialization of the underdeveloped countries of the world in the next 20 years will also require large capital expenditures, particularly in construction equipment and machine tools. These two industries are both important within the Region. If southeastern Wisconsin can maintain or increase its market share in capital goods, it may so benefit from these capital goods trends that both the model forecast as well as the non-model forecast of manufacturing employment may prove to be conservative.

INCOME FORECASTS

Historical Background

In the recent past, incomes of the residents of the Southeastern Wisconsin Region have been rising quite rapidly, both in terms of actual dollar increases and in terms of real dollar increases. (Real dollar increases are those which take into account changes in the purchasing power of the dollar.) In terms of real dollars, per capita income in the Region has increased from $1,786 in 1949 to an estimated $2,398 in 1963. On the same basis, the total amount of income available to residents of the Region has increased from $2.2 billion in 1949 to over $4 billion in 1963.

In percentage terms total personal income in the Region has nearly doubled since 1949. The actual increase over the period was approximately 82 percent. The regional population increase over this same period was only 35 percent. It is evident from these facts that over the last 14 years residents of the Region have been enjoying a substantial increase in their standard of living.

Future Income Levels

Incomes of residents of the Southeastern Wisconsin Region are forecast to continue their postwar upward climb. As indicated in Table 13, the total income available in the Region is forecast to reach over $10 billion by 1990. This increase is based on the assumption that per capita incomes will increase at an average annual rate of 2 percent. This 2 percent per annum increase in per capita income is a continuation of the trend established in the Region between 1949 and 1963 and is consistent with the assumed rates of increase in personnel productivity.

Nationally, per capita income is also forecast to increase by approximately 2 percent per year. Per capita income in the Region should, however, be higher than the national average in 1990. The forecast per capita income for the Region in 1990 is $4,093, while the national per capita income forecast for 1990 is about $3,500. The differences in regional and national per capita levels in 1990 reflect the fact that the highly urbanized Southeastern Wisconsin Region, as is the case for other urbanized regions, presently enjoys a higher than national average per capita income. As further indicated in Table 13, average household incomes are projected to increase to nearly $14,000 by 1990. This represents an increase of 65 percent over the 1963 level.

The income forecasts summarized above have certain important implications for land use and transportation planning. First, these income forecasts indicate that there will be a strong market

Table 13

TOTAL, PER CAPITA, AND PER HOUSEHOLD INCOME FORECASTS IN THE REGION (1949 - 1990)
(in Constant 1963 Dollars)

Year	Total Personal Income	Per Capita Income	Per Household Income
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

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

in the Region for all types of goods and services. This is consistent with the employment projections for the Region previously presented, which indicate that there will be a fairly rapid increase in trade and service industry employment to meet this growing local demand. Second, these income forecasts indicate that there will probably be more two-car families in the Region than at present; and this will generate an increased demand for automobile-oriented transportation facilities. Third, these income forecasts indicate that there may be a future demand for larger and more elaborate homes and a concomitant demand for increasing amounts of residential land. Finally, increased incomes, as well as increased leisure time, will probably result in an increased demand for recreational facilities of all types. All of these probabilities must be considered in the preparation of long-range land use and transportation plans for the Region.

MANUFACTURING OUTPUT AND EXPENDITURE FORECASTS

Forecasts of regional manufacturing output for 1970, 1980, and 1990, prepared by application of the Regional Economic Simulation Model, are shown in Table 14. Output, as measured by sales in constant 1962 dollars, is forecast to almost triple by 1990. Sales of manufacturing industries were estimated at $6,390,700,000 in 1962 and are forecast to be $17,852,700,000 by 1990, a rise of nearly 180 percent.

A more accurate measure of output is the value added by manufacture, which is the difference between current sales and current purchases. Some industries, such as food processing, have a high value of purchased commodities and are not as important in real output as their sales would indicate. Other industries, such as instrument manufacturing, have a higher percentage of value added and are more important than is indicated by their sales volume standing. Total value added by manufacture is forecast to increase from $3,218,400,000 in 1962 to $7,013,000,000 in 1990, an increase of 118 percent. The differences between the percentage increases in the sales and the value added forecasts result from the higher increases in industries with lower ratios of value added. Employment in manufacturing, as noted earlier, is forecast to increase by only 46 percent. The difference between the forecast rates of increase in value added and in employment is explained by anticipated increases in productivity.

Capital expenditures within the Region, which were $282,200,000 in 1962, are forecast to rise to $574,400,000 by 1990, an increase of 103 percent. Since capital expenditures will increase less than output, an increase in capital productivity is required. There has been a steady decline in the capital to output ratios in most industries in recent years as a result of advances in technology.

AUTOMOBILE AVAILABILITY FORECASTS

Historical Background

The number of automobiles available to residents of the Region increased from 294,000 in 1950 to 546,000 in 1965, an increase of approximately 86 percent in 15 years. This increase is equivalent to a uniform growth rate of approximately 4 1/4 percent annually. If the increase in the number of automobiles within the Region were to continue at this same rate, there would be 1,550,000 automobiles available to residents of the Region by 1990. Such a projection, based upon a uniform rate of increase, would, however, lead to an unrealistically low ratio of 1.71 persons per automobile in 1990.

Historically, the ratio of persons per automobile within the Region decreased from 4.23 in 1950 to 3.15 in 1965. While it is likely that this ratio will

Table 14

MANUFACTURING INDUSTRY OUTPUT FORECASTS FOR THE REGION (1962 - 1990)

(in Millions of Dollars)

Industry	Standard Industrial Classification Code	Sales				Percent Change 1962 - 1990	Purchases				Percent Change 1962 - 1990
		1962	1970	1980	1990		1962	1970	1980	1990	
Food	20	$ 983.0	$1,400.0	$ 2,014.0	$ 2,892.0	194.2	$ 517.8	$1,050.0	$1,510.0	$ 2,169.0	318.9
Leather, Apparel, Textiles	22, 23, 31	169.4	255.2	368.7	531.7	146.2	127.1	191.4	276.5	398.8	460.1
Paper, Lumber, Furniture	24, 25, 26	289.1	386.3	558.9	808.1	179.5	181.9	231.7	335.3	484.9	166.6
Printing & Publishing	27	329.4	424.2	612.9	885.5	168.8	114.6	220.5	318.7	460.4	301.7
Chemicals	28	272.2	393.3	569.8	824.7	203.0	101.7	235.9	341.9	494.8	336.5
Primary Metals	33	481.1	474.2	689.0	998.7	107.6	226.0	260.8	379.0	549.2	143.0
Fabricated Metals	34	453.5	625.6	909.3	1,318.0	190.6	218.8	394.1	572.8	830.3	279.5
Machinery, Engines & Turbines	351	299.6	401.3	601.8	892.3	197.8	116.3	232.7	349.0	517.5	345.0
Machinery, Farm	352	215.3	204.3	304.1	446.7	107.5	121.5	130.7	194.6	285.9	135.3
Machinery, Construction & Mining	353	236.8	333.6	505.6	752.1	217.6	93.2	196.8	298.3	443.7	376.1
Machinery, Metalworking	354	86.6	123.5	182.9	268.6	210.2	28.7	60.5	89.6	131.6	358.5
Machinery, Special	355, 356, 357, 358, 359	428.2	441.6	646.9	943.0	120.2	157.7	247.3	362.3	528.0	234.8
Electrical Machinery: Transmission, Distribution & Industrial Apparatus	361, 362, 364, 369	401.0	494.9	727.4	1,063.0	165.1	86.7	247.5	363.7	531.8	513.4
Electrical Machinery & Appliances	363	42.9	70.2	101.3	146.0	240.3	14.6	47.0	67.9	97.9	570.5
Electrical Machinery Components	365, 366, 367	273.6	361.2	527.4	767.0	180.3	80.8	180.6	263.7	383.8	375.0
Transportation Equipment	37	1,253.8	1,871.0	2,705.0	3,896.0	210.7	918.6	1,122.0	1,623.0	2,337.0	154.4
Instruments	38	87.5	100.9	146.9	213.6	144.1	20.6	33.9	49.3	71.7	248.1
Miscellaneous Manufacturing	19, 21, 30, 32, 39	87.7	98.4	142.3	205.7	134.5	45.7	59.0	85.4	123.4	170.0
Total		$6,390.7	$8,459.7	$12,314.2	$17,852.7	179.3	$3,172.3	$5,142.4	$7,481.0	$10,839.7	241.6

Industry	Standard Industrial Classification Code	Value Added by Manufacture				Percent Change 1962 - 1990	Capital Expenditures				Percent Change 1962 - 1990
		1962	1970	1980	1990		1962	1970	1980	1990	
Food	20	$ 465.2	$ 350.0	$ 504.0	$ 723.0	55.4	$ 14.3	$ 26.1	$ 37.4	$ 53.8	276.2
Leather, Apparel, Textiles	22, 23, 31	42.3	63.8	92.2	132.9	214.1	1.9	3.9	5.6	8.1	326.3
Paper, Lumber, Furniture	24, 25, 26	107.2	154.6	223.6	323.2	201.5	8.2	14.1	20.3	29.4	258.5
Printing & Publishing	27	214.8	203.7	294.2	425.1	97.9	64.3	11.5	16.7	24.1	- 62.5
Chemicals	28	170.5	157.4	227.9	329.9	93.5	20.5	14.7	21.3	30.8	50.2
Primary Metals	33	255.1	213.4	310.0	449.5	72.0	12.6	19.2	27.9	40.4	220.6
Fabricated Metals	34	234.7	231.5	336.5	487.7	107.8	4.9	16.4	23.8	34.5	604.0
Machinery, Engines & Turbines	351	183.3	168.6	252.8	374.8	104.5	5.5	14.3	21.4	31.8	478.2
Machinery, Farm	352	93.8	73.6	109.5	160.8	71.4	19.5	4.4	6.5	9.6	- 50.7
Machinery, Construction & Mining	353	143.6	136.8	207.3	308.4	114.8	2.4	6.1	9.2	13.8	475.0
Machinery, Metalworking	354	57.9	63.0	93.3	137.0	136.6	12.5	3.7	5.5	8.1	- 35.2
Machinery, Special	355, 356, 357, 358, 359	270.5	194.3	284.6	415.0	53.4	6.6	12.4	18.2	26.6	303.0
Electrical Machinery: Transmission, Distribution & Industrial Apparatus	361, 362, 364, 369	314.3	247.4	363.7	531.2	69.0	35.7	10.3	15.1	22.1	- 38.0
Electrical Machinery & Appliances	363	28.3	23.2	33.4	48.1	70.0	0.9	1.2	1.7	2.5	177.8
Electrical Machinery Components	365, 366, 367	192.8	180.6	263.7	383.2	98.7	17.6	15.0	57.0	82.9	371.0
Transportation Equipment	37	335.2	749.0	1,082.0	1,559.0	365.7	51.4	66.8	96.6	139.0	170.4
Instruments	38	66.9	67.0	97.6	141.9	112.1	1.8	3.1	4.5	6.6	266.7
Miscellaneous Manufacturing	19, 21, 30, 32, 39	42.0	39.4	56.9	82.3	96.0	1.6	4.9	7.1	10.3	543.8
Total		$3,218.4	$3,317.3	$ 4,833.2	$ 7,013.0	117.9	$ 282.2	$ 248.1	$ 395.8	$ 574.4	103.5

Source: SEWRPC.

continue to decline as more multi-car households are formed, as a practical matter, a lower limit must exist to the ratio of persons per available automobile. It is probable that this lower limit would be approached when there is an automobile available for every licensed driver residing within the Region. Based upon the age distribution of the 1990 regional population forecasts and the estimate that nearly 88 percent of the population within the Region between the ages of 16 and 75 will be licensed to drive, this lower limit of automobile availability may be calculated at 1.85 persons per available automobile. While such a ratio may be possible, it is highly unlikely ever to be attained since not every licensed driver will be able to afford or be inclined to own an automobile.

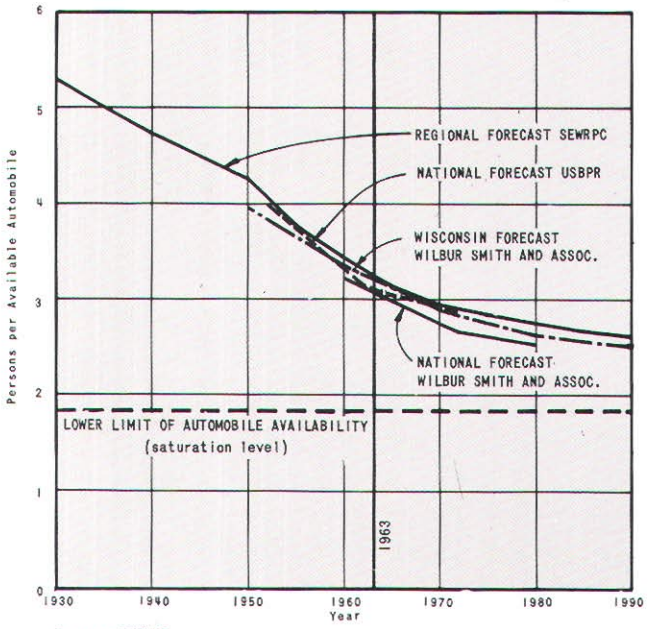
Future Automobile Availability Levels

The number of automobiles available within the Region, as shown in Table 15, is forecast to reach 1,022,800 by 1990. This represents an increase of nearly 477,000 automobiles, or 87 percent, over the 1965 level. The corresponding ratio of persons per available automobile is forecast to decline from 3.15 in 1965 to 2.62 by 1990 and indicates that the lower limit or saturation level in this ratio will not be reached in southeastern Wisconsin by 1990 (see Figure 6).

A comparison of the regional forecast of automobile availability ratios with similar forecasts of national and state ratios, as shown in Figure 6, reveal that a similar leveling out in the curve of persons per available automobile is common to all forecasts. The actual saturation point in the ratio will probably be reached when the ratio of persons per available automobile remains stable over a period of years.

Figure 6

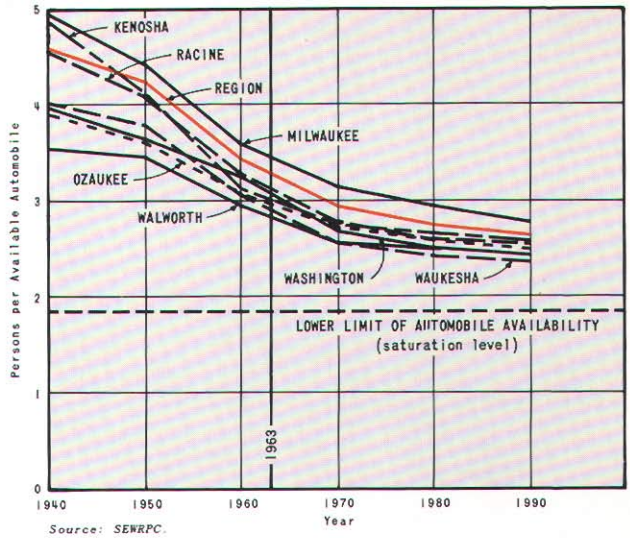
AUTOMOBILE AVAILABILITY TRENDS AND FORECASTS FOR THE REGION (1930 - 1990), WISCONSIN (1950 - 1990), AND THE UNITED STATES (1952 - 1972 AND 1960 - 1980)



Source: SEWRPC.

Figure 7

AUTOMOBILE AVAILABILITY TRENDS AND FORECASTS BY COUNTY IN THE REGION (1940 - 1990)



Source: SEWRPC.

Automobile availability trends and forecasts, together with persons per available automobile ratios, are set forth in Appendix A for each of the seven counties comprising the Region. Existing availability rates were found to vary widely by county, as shown in Figure 7. The lowest ratios of persons per available automobile were found to exist in those counties where residential development has occurred at relatively low densities.

Table 15

AUTOMOBILE AVAILABILITY TRENDS AND FORECASTS FOR THE REGION (1950 - 1990)[a]

Year	Automobiles Available	Persons per Automobile
1950.	293,600	4.23
1955.	372,700	3.76
1960.	461,200	3.41
1965.	545,900	3.15
1970.	639,500	2.92
1975.	722,100	2.82
1980.	812,200	2.74
1985.	911,900	2.67
1990.	1,022,800	2.62

[a] *For automobile availability trends and forecasts by county, see Appendix Table A-19*

Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Consequently, greater decreases were forecast in the persons per available automobile ratios in those counties which were forecast to continue developing rapidly at low and medium densities. Small decreases in the availability ratios were forecast for those counties which are presently either highly urbanized or expected to remain largely rural to 1990.

MOTOR TRUCK AVAILABILITY FORECAST

Historical Background

The growth pattern of motor trucks available to truck operators within the Region during the period 1950 to 1965, unlike the pattern of automobile growth, does not exhibit a strong upward trend. In the 15-year period, the number of trucks available increased from 49.4 thousand in 1950 to 63.4 thousand in 1965, an increase of 14 thousand. This represents an increase over the period of about 28 percent as compared to an increase of 87 percent in automobiles available over the same period.

The relatively slow increase in the number of motor trucks within the Region during this period can be attributed primarily to the comparatively small increase of motor trucks in Milwaukee County, which heavily influences regional totals. In the period 1950 to 1965, the net increase in available trucks in Milwaukee County amounted to only 6 percent, compared to increases of more than 30 percent in Ozaukee, Walworth, and Washington counties; more than 55 percent in Kenosha and Racine counties; and more than 85 percent in Waukesha County.

Future Motor Truck Availability Levels

The number of available trucks within the Region is forecast to increase from 63.4 thousand in 1965 to 86.3 thousand in 1990, an increase of 22.9 thousand, or approximately 36 percent. An analysis of growth trends in each of the various truck classifications indicates that a large proportion of future truck growth in the period 1965 to 1990 will probably occur in the light-weight truck classification. As shown in Table 16 and Figure 8 , light-weight trucks are forecast to increase by 12.4 thousand during this period, an increase of approximately 42 percent. In other classifications, municipally owned trucks are forecast to increase by 4.3 thousand, or approximately 102 percent; tractor trucks are forecast to increase by 4.1 thousand, or approximately 76 percent; medium-weight trucks are forecast to increase by 2.2 thousand, or approximately 14 percent; and farm trucks are forecast to remain nearly constant as modest increases in the rural areas of the Region are expected to offset small decreases in the urbanizing areas. Motor truck availability trends and forecasts are set forth in Appendix A for each of the seven counties comprising the Region.

PUBLIC REVENUE FORECASTS

Historical Background

Along with increases in the amount of personal property, real property, and personal income in the Region and in demand for more public facilities and services have come increases in the amount of revenue collected and spent by local units of gov-

Table 16

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASSIFICATION FOR THE REGION (1950 - 1990)[a]

(in Thousands)

Year	Total	Trucks Under 8,000 Pounds Net Weight	Farm Trucks	Trucks Over 8,000 Pounds Net Weight	Tractor-Trailer Combinations	Municipal Trucks
1950. . . .	49.4	22.8	9.3	15.1[b]	--[b]	2.2
1955. . . .	54.1	24.1	9.3	14.3	3.5	2.9
1960. . . .	59.5	25.6	9.1	16.0	5.4	3.4
1965. . . .	63.4	28.6	9.2	16.0	5.4	4.2
1970. . . .	68.6	31.7	9.2	16.5	6.5	4.7
1975. . . .	73.5	34.2	9.1	17.3	7.4	5.5
1980. . . .	78.2	36.8	9.3	17.5	8.2	6.4
1985. . . .	82.1	38.8	9.3	17.9	8.7	7.4
1990. . . .	86.3	41.0	9.1	18.2	9.5	8.5

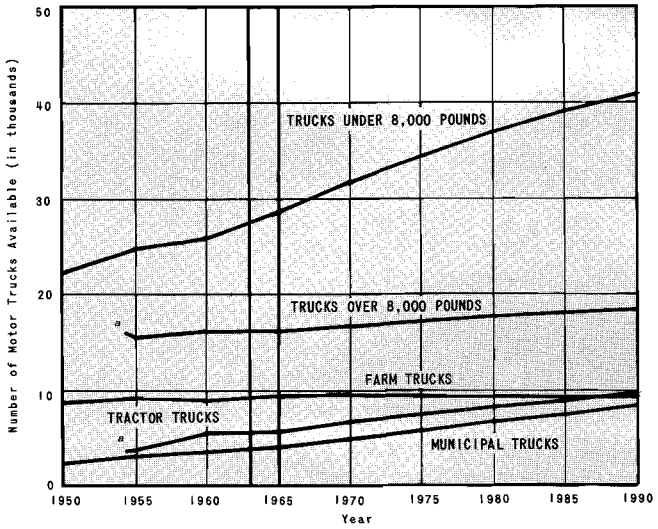
[a] *For motor truck availability trends and forecasts by county, see Appendix Tables A-20 through A-26.*

[b] *Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.*

Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Figure 8

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASS OF TRUCK IN THE REGION (1950 - 1990)



[a] Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.

Source: SEWRPC.

ernment. In the period 1948 to 1962, local government revenue increases averaged 8 percent per year. In 1948 per capita property tax revenue in the Region was approximately $67 per person; in 1962 per capita property tax revenues were slightly more than $161 per person. All other major public revenue sources have also increased on a per capita basis. These general sources include: state collected taxes shared with local governments; state and federal aids; revenues from fines, fees, and related sources; special assessment revenues; commercial revenues, for example, interest, rent, and department and public facility income, revenue from bond sales; and other miscellaneous revenues.

The amount of money available for highway and street construction and maintenance has also been increasing. In 1962 over $100 million was made available for this type of expenditure. It should be noted that about one-third of this $100 million was spent in the Region by the State Highway Commission, utilizing both state and federal monies. These monies are used for the construction and maintenance of the state trunk highway system and the federal interstate highway system. Local highway monies, which have their origin as general revenues and as highway aids received from the state, are generally used for the construction and maintenance of county trunk highways and local streets and highways located within municipal limits.

Future Revenue Levels

Local government revenues in the Region are forecast to increase to over $2 billion by 1990. Much of this revenue, nearly $1 billion by 1990, will come from property taxes. As shown in Table 17 and Figure 9, state and federal aids will likely be the second most important revenue source. Other taxes, which are mainly state shared taxes, commercial revenues, and debt receipts (borrowed funds) will also be important revenue sources. Fines and fees, special assessments, and miscellaneous receipts will continue to be relatively minor sources of local government revenue.

The estimated monies available for highway and street purposes for the 25 years from 1966 to 1990 are shown in Table 18. As shown it is estimated that between 1966 and 1990 approximately $5.7 billion will be available for highway, street, and related purposes. Of this $5.7 billion, $3.6 billion will be available for maintenance and $2.1 billion for construction.

As further shown in Table 18, average annual revenues available for highway and related purposes are forecast to increase substantially. Total revenues available are forecast to increase from

Table 17

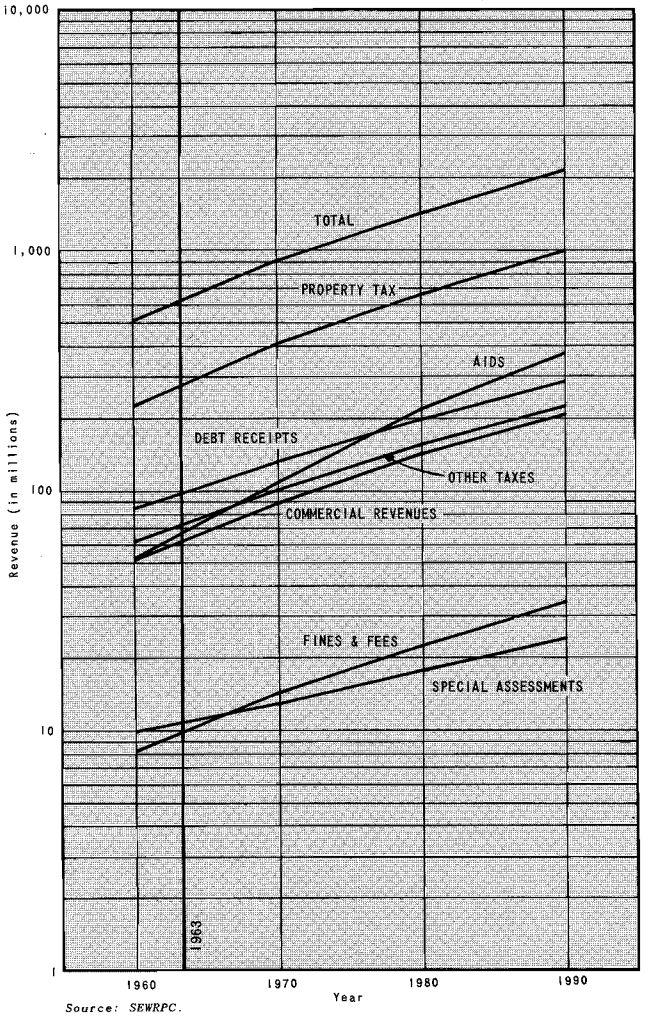
LOCAL GOVERNMENT REVENUE FORECASTS FOR THE REGION (1960 - 1990)
(in Millions of Dollars)

Revenue Category	1960	1970	1980	1990
Property Taxes	226.6	409.5	653.6	988.2
Other Taxes	61.1	100.7	153.1	224.6
Fines & Fees	8.3	14.6	22.9	34.3
Aids	53.1	119.3	219.6	371.7
Special Assessments	10.0	13.1	17.8	24.7
Commercial Revenue	52.5	90.4	140.8	209.8
Debt Receipts	85.1	133.8	198.0	285.4
Other Receipts	15.6	22.4	26.7	32.1
Total	512.3	903.8	1,432.5	2,170.2

Source: Department of State Audit; SEWRPC.

Figure 9

TOTAL PUBLIC REVENUE FORECASTS FOR THE REGION (1960 - 1990)



Source: SEWRPC.

an annual average of $152.5 million in the 1966 to 1970 period to $290.0 million in the 1981 to 1990 period. Over the entire 25-year period, total revenues available will average about $227.8 million, $84.8 million for construction and $143.0 million for maintenance and related spending.

LAND USE FORECASTS

Historical Background

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. In the relatively short span of time between 1950 and 1963, nearly 130,000 acres of land were converted to urban use. Much of this urban development was for residential purposes, but a substantial amount of land also went to commercial, industrial, transportational, governmental, institutional, and recreational use. It is estimated that at least 50 percent, or 65,000 of the 130,000 acres of land converted to urban development between 1950 and 1963, was converted to residential use with the balance being converted to other urban uses, the largest of which was for transportation, mainly streets and highways.

The fact that such a large amount of land was converted to urban use in the last 13 years can be attributed largely to changing residential density patterns; that is, since 1950 much of the residential development in the Region has been at a much lower density than was the case prior to this time.

Commercial and industrial uses have also been absorbing larger amounts of land since 1950. New shopping centers have been providing more on-site parking area than old "strip" type development; and new industrial plants have generally been constructed as single-story buildings, as opposed to the older multi-story "loft" type buildings, and have provided large areas for on-site parking.

Future Land Needs

If recent historic trends in land use development continue between 1963 and 1990, it is estimated that about 296,000 additional acres of land will be required for new development. Approximately 63 percent, or about 187,100 acres, of that development will be devoted to residential use. Of these 187,100 acres of residential development anticipated, it is estimated that 166,100 acres will be demanded for low-density development, 20,500 for medium-density development, and 500 acres for

Table 18

ESTIMATED REVENUES AVAILABLE FOR HIGHWAY AND RELATED PURPOSES IN THE REGION (1966 - 1990)

(in Millions of Dollars)

Revenue Use	1966 - 1970		1971 - 1980		1981 - 1990		1966 - 1990	
	Total	Annually	Total	Annually	Total	Annually	Total	Annually
Revenues Available . .	762.4	152.5	2,033.1	203.3	2,899.8	290.0	5,695.3	227.8
For construction. . .	334.4	66.9	788.3	78.8	997.5	99.8	2,120.2	84.8
For maintenance, etc.	428.0	85.6	1,244.8	124.5	1,902.3	190.2	3,575.1	143.0

Source: State Highway Commission of Wisconsin; SEWRPC.

high-density development. On the average, low-density development will absorb 35,700 square feet per dwelling unit; medium density, 10,000 square feet per dwelling unit; and high density, 3,630 square feet per dwelling unit.

As shown in Table 19, it is estimated that commercial development will require approximately 6,300 acres of land from 1963 to 1990. Much of this land will be devoted to retail trade uses, for example, large regional shopping centers, smaller community shopping centers, neighborhood shoping facilities, and highway-oriented trade establishments. It is estimated that at least 10 new regional shopping centers, comparable to the Mayfair or Capitol Court Centers, will be needed to serve the population by 1990. It is also estimated that about 1,500 acres of these 6,300 acres will be needed for other commercial facilities, such as banks, insurance companies, hotels, and other business and personal service enterprises.

About 4,900 acres of land will be needed for anticipated industrial development in the Region, for example, manufacturing and wholesale operations. It is estimated that about 20 percent of these new developments will occur on land in, or adjacent to, presently established industrial districts. The remaining 80 percent will occur in new planned districts.

Governmental and institutional uses will require about 8,800 acres of land by 1990. This will be in response to the need for educational facilities of all types, hospitals, government office buildings, and a variety of other public and private nonprofit enterprises.

The second largest land consuming activity in the Region—transportation, communication, and utility facilities—will require additional large amounts of land by 1990, the total estimated to be approximately 69,000 acres. Nearly all of this land will be used for local streets, arterial streets, and highway and freeway purposes. Only a small percentage of the 69,000 acres will be required to satisfy needs for rail, bus, and ship terminals; railroad rights-of-way and yards; airports; truck terminals; and communication and utility facilities. It should be noted that the land required for communication and utility lines are accounted for in residential, commercial, industrial, and public land use estimates.

As indicated in Table 19, active recreation activities will require nearly 20,000 additional acres of land by 1990. These recreation areas take the form of large regional parks, community parks, and neighborhood playgrounds. It is anticipated that at least 13 new regional parks, requiring about 5,200 acres of land, will be needed by 1990. The balance of 14,800 acres will be needed for community and neighborhood recreation uses.

Table 19

EXISTING AND FORECAST LAND USE FOR THE REGION (1963 - 1990)

Land Use Category	Existing Land Use 1963			Incremental Demand 1963 - 1990		Total Land Use 1990		
	Acres	Square Miles	Percent of Region	Acres	Square Miles	Acres	Square Miles	Percent of Region
Residential	*129,358*	*202.0*	*7.5*	*187,121*	*292.0*	*316,479*	*494.0*	*18.4*
High Density	34,463	53.0	2.0	498	.7	34,961	53.7	2.1
Medium Density	24,748	39.0	1.5	20,526	32.0	45,274	71.0	2.6
Low Density	70,147	110.0	4.0	166,097	259.3	236,244	369.3	13.7
Commercial[a]	6,706	11.0	0.4	6,257	10.0	12,963	21.0	0.7
Industrial[a]	9,746	15.0	0.6	4,867	7.0	14,613	22.0	0.9
Governmental[b]	14,722	23.0	0.9	8,822	14.0	23,544	37.0	1.4
Transportation[c]	96,117	150.0	5.6	69,022	108.0	165,139	258.0	9.6
Recreation[d]	33,262[e]	52.0	1.9	20,072	31.0	53,334	83.0	3.1
Agriculture & Open Space[f]	1,431,095	2,236.0	83.1	-296,161	-462.0	1,134,934	1,774.0	65.9
Total	1,721,006	2,689.0	100.0	---	---	1,721,006	2,689.0	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Includes public and nonpublic recreation lands.*

[e] *This figure differs from the land use inventory because it includes the entire site areas of existing park and outdoor recreation lands. The land use inventory measured only the area actually utilized for active recreation.*

[f] *Includes woodlands, water, wetlands, other open lands, and quarries.*

Note: Figures in italics indicate subtotals.

Source: SEWRPC.

With the exception of the relatively small amount of land provided through urban renewal,[15] all of the forecast demands for land must be met by the conversion of the existing stock of agricultural, open space, and vacant land in the Region; and, as noted, this will amount to approximately 296,000 acres. One of the primary objectives of the regional land use plan is that this land demand be met without conversion of the prime agricultural land remaining in the Region or the further deterioration or destruction of the underlying natural resource base, even though this may necessitate satisfying the demand with less acreage than the forecast based upon recent historic trends may indicate as required.

As indicated in the methodology section of this chapter, a residential land use demand forecast for 1990 was also prepared by application of the Land Use Demand Forecast Submodel of the Land Use Simulation Model. This demand forecast is based upon the relationship between households and the population density of the land on which the households were located in 1963. The households were classified according to the age of the head of the household, the family income level, and the number of persons in the family. The model is then used to simulate the development of land within the Region over time, beginning with the initial conditions existing in 1963, by generating a demand for new land that is dependent upon the 1963 household-land relationships. In-migrating households and new household formations create a demand for new land. The density pattern of this land demand is calculated using a household type-land use density matrix determined from the 1963 home interview and postal questionnaire surveys.

As shown in Table 20, the major difference between the conventional forecast and the model forecast appears in the demand anticipated for high-density residential land. The conventional forecast indicates an increase of 498 acres over the 1963 level; the model forecast shows no increase in demand for high-density residential land. In total the model forecast indicates a demand for 6,793 more acres of residential land within the Region by 1990 than the conventional forecast. The model application thus indicates a percentage increase in residential land between 1963 and 1990 of about 150, while the conventional forecasts indicate a 145 percent increase. Because of the close agreement of the two independent forecasts of residential land, and because the conventional forecast also included incremental demand totals for the other major land use categories, the conventional forecast was selected as the input to the plan design process.

SUMMARY

One of the very important steps necessary to the formulation of regional development plans is the preparation of forecasts. Forecasts are necessary simply because many facets of regional change cannot, within the structure of a free society, be planned but, rather, must be accommodated. These include population growth and change, economic growth and change, growth and change in the demand for automobiles and trucks, and growth and change in the demand for land to accommodate social, economic, and political activities. This chapter has attempted to forecast on a regional scale the direction and magnitude of these changes to the year 1990.

Based upon the assumption that there will be no major wars; epidemics; social, political, or eco-

[15] *Only one municipality within the Region, the City of Milwaukee, has completed a Community Renewal Program and has an active, large-scale, federally supported, urban renewal program underway. Yet, even under this program, it is proposed to clear and redevelop approximately five square miles of land by the year 2000.*

Table 20

COMPARATIVE RESIDENTIAL LAND USE FORECASTS FOR THE REGION BY CONVENTIONAL AND SIMULATION MODEL TECHNIQUES (1963 and 1990)

Residential Classification	Existing Residential Land Use-1963		Incremental Demand 1963 - 1990				Total Residential Land Use-1990				Percent Change 1963 - 1990	
			Conventional Technique		Simulation Model Technique		Conventional Technique		Simulation Model Technique			
	Acres	Square Miles	Acres	Square Miles	Acres	Square Miles	Acres	Square Miles	Acres	Square Miles	Conventional Technique	Simulation Model Technique
High Density	34,463	53.0	498	0.7	--	--	34,961	53.7	34,463	53.0	1.4	--
Medium Density . . .	24,748	39.0	20,526	32.0	21,365	33.4	45,274	71.0	46,113	72.4	82.9	86.3
Low Density.	70,147	110.0	166,097	259.3	172,549	269.6	236,244	369.3	242,696	379.6	236.7	245.9
Total	129,358	202.0	187,121	292.0	193,914	303.0	316,479	494.0	323,272	505.0	144.6	149.9

Source: SEWRPC.

nomic upheavals; or any radical institutional changes and upon the assumption that recent historic trends in land use development within the Region will continue, the following important changes are likely to take place in the Southeastern Wisconsin Region by the year 1990:

1. The population of the Southeastern Wisconsin Region will increase by approximately 1,000,000 persons over the present population level of approximately 1,674,000 persons. A high proportion of the 1990 regional population of approximately 2,700,000 persons will be in the very old age groups (approximately 9 percent of the regional population will be over 65 years of age in 1990), and an even higher proportion will be in the very young age groups (approximately 41 percent of the future regional population will be under 20 years of age in 1990).

2. Employment in the Region by 1990 will nearly reach the one million level, an increase of 349,000 jobs over the present employment level of approximately 635,000. Many of these jobs will be in manufacturing activities; but a growing proportion will be in trade and service activities, both private and public.

3. Personal income is expected to increase at a rapid rate, so that by 1990 the average household will earn about $14,000 before taxes, an increase of $5,500 over present levels; and total personal income generated in the Region will exceed $10 billion.

4. The amount of money available to local units of government in the Region for providing the necessary public facilities and services by 1990 will increase from $512 million per year to approximately $2.2 billion per year. Monies available for highway, street, and related purposes alone between now and 1990, including state and federal monies, will increase from $153 million per year to approximately $228 million per year.

5. If recent historic development trends continue, approximately 296,100 acres, or over 462 square miles, of land will be required to meet the land use demand for the various new urban activities generated by growth in population and economic activity levels within the Region by 1990. Over 63 percent of this land will be required for new homes, apartments, and other living quarters; and an additional 23 percent will be required for streets and highways. Smaller proportions of land will be needed for commercial, industrial, governmental, institutional, and recreational activities.

6. Automobiles within the Region will increase by approximately 87 percent over the present level of 545,900, while motor trucks will increase by approximately 36 percent over the present level of 63,400.

It is evident from the forecasts summarized above that the Southeastern Wisconsin Region of 1990 will be very different from the Region of today. There will be many more people receiving greater incomes, driving more automobiles, demanding more land and more transportation facilities. Succeeding chapters in this report present alternative land use and transportation proposals designed to meet or alter these anticipated changes and, at the same time, preserve and protect the limited and irreplaceable natural resources of the Region.

Chapter IV

DERIVATION OF LAND-USE TRAVEL DEMAND RELATIONSHIPS AND TRANSPORTATION SYSTEM ANALYSIS AND DESIGN

INTRODUCTION

One of the five basic principles upon which the SEWRPC Regional Land Use-Transportation Study is based, as set forth in Chapter II, Volume 1, of this report, is:

> Transportation facilities must be planned as an integrated system. The capacities of each link in the system must be carefully fitted to traffic loads and the effects of each proposed facility on the remainder of the system quantitatively tested.

This principle is an extremely important one because unless transportation system plans are subject to quantitative test and evaluation, involving the preparation of forecasts of the amount of traffic the system must carry, the adequacy of the plans must remain in doubt from an engineering standpoint. Transportation system plans prepared without quantitative test and evaluation are little more than intuitively created street patterns rather than engineering transportation system designs. Such untested plans do not provide a sound basis for project design or capital investment. Nor can the implementation of such plans provide the desired long-range solution to traffic and transportation problems. Indeed, such plans may create more problems than they purport to solve. The lack of quantitative system test and evaluation is one of the major factors which has in the past contributed to the ineffectiveness of many transportation planning programs carried on at the local level of government, since highway agencies have, of necessity, refused to implement plans which were unsupported by carefully prepared traffic forecasts and assignments.

THE IMPORTANCE OF QUANTITATIVE ANALYSIS

Quantitative traffic analysis is a fundamental requirement of any transportation planning effort but is a particularly important and complex requirement of the urban transportation planning process. Three basic questions are inevitably confronted in the planning and design of a new transportation facility or of an improvement to an existing transportation facility:

1. How will the existing traffic patterns be distributed on the proposed facility? That is, how many persons and vehicles will use the proposed facility upon its completion?

2. How will future traffic patterns be distributed on the proposed facility? That is, how many persons and vehicles will use the proposed facility at the end of its period of physical and economic life?

3. How will the proposed facility affect traffic on the remainder of the transportation system? That is, how many persons and vehicles will be diverted by the proposed facility to or from other facilities comprising the total transportation system?

No transportation facility can be soundly planned, designed, or constructed without answers to these three basic transportation planning questions. It should be noted that these three questions not only recognize that an understanding of present traffic patterns is necessary to sound transportation system planning and design but also recognize that future traffic conditions will be different from present conditions. Existing traffic patterns change in form and intensity as new land use activities are added to the regional complex and as established land use activities are changed or relocated. Thus, sound transportation system planning must recognize the need to consider both existing and future traffic patterns and must do so in an explicit, quantitative manner.

Originally, the only quantitative traffic information available for use in the transportation planning process consisted of existing traffic volume counts. Such counts can only indicate how current traffic patterns are being distributed on the existing transportation network. Alone, such counts are of little value for long-range transportation planning purposes since they do not provide an answer to even the first of the three basic transportation planning questions. For many years, however, the application of growth factors to existing traffic volume counts was the only traffic forecasting device available for planning purposes.

About 25 years ago, the origin and destination study was developed to provide, for the first time, the factual information necessary to acceptably answer the first of the three basic transportation planning questions. Since origin and destination surveys can only collect factual information about existing travel habits and patterns, the data derived from such studies cannot be used directly to answer the second or third transportation planning questions.

About 10 years ago, new transportation planning techniques were developed which provided for the first time quantitative answers to the second and third of the three basic transportation planning questions. These techniques make it possible to calculate future traffic demand quantitatively as a function of regional development patterns instead of deriving such demand, as was necessary in the past, from simple expansions of existing traffic patterns. By considering the future distribution of land use within an urban region as the major factor influencing future traffic patterns, integrated transportation system designs can now be developed which will not only serve the existing traffic patterns within an urban region but which will also serve the entirely new traffic patterns that will evolve with changing development.

These new transportation planning techniques require the formulation and application of mathematical models which permit both the existing and potential traffic demand within an urban region to be simulated and assigned to any given transportation system. The complete sequence of simulation occurs in four stages:[1]

1. Trip generation; in which the total number of future person trips generated in each subarea of the planning area is determined, using relationships found to exist between land use and travel from analyses of the planning inventory data.

2. Modal split; in which the total number of future person trips is divided into those using transit and those using automobiles, and in which the person trips using automobiles are further converted to vehicle trips.

3. Trip distribution; in which the person trips and vehicle trips, including trips made by trucks and taxis, generated in origin zones, are linked to destination zones and the future interzonal travel desire lines established for both transit and highway travel.

4. Traffic assignment; in which the interzonal trips are finally assigned to existing and proposed transit and highway facility networks.

Using this simulation procedure, it is possible to test and verify the workability and efficiency of any proposed transportation system network. The quantitative assignment of existing and future traffic demand to the network will reveal areas of over or under capacity and provide the basis for network modification, ultimately resulting in a practical and efficient transportation system plan for which development and operating costs can be calculated.

Such quantitative test and evaluation of proposed transportation systems has become recognized as one of the necessary activities of any urban transportation planning effort in the United States. Consequently, the general methodology and the form of simulation models involved have become relatively well developed. The specific methods and models, however, must be adapted to the specific geographic area of application. This involves careful development of the basic relationships existing between travel and land use within the planning area and calibration of the simulation models against factual inventory findings. This chapter describes the specific traffic simulation models developed in the regional land use-transportation study for southeastern Wisconsin and used to test quantitatively and evaluate all of the alternative transportation systems developed under the regional land use-transportation study.

TRIP GENERATION

Basic Concepts

Trip generation is the term applied to that phase of the total traffic simulation process wherein the relationships existing between land use and the travel which it produces are determined and quantified. As such, trip generation analysis occupies a critical and difficult position between land use and transportation planning. For trip generation analysis, the travel data is usually expressed in

[1] *The sequence of stages in the traffic simulation process was modified from that listed in Volume 1, Chapter II of this report. It was originally proposed to accomplish the modal split after trip distribution. The sequence of these two stages was, however, revised during the analysis of the inventory data and actual development of the simulation models.*

terms of trip ends which may be conveniently represented as points in space, rather than as trips which, having two ends, must be represented as lines in space.[2] Two sets of trip generation relationships are usually developed. One set is developed for the "production" end of trips generated within the planning area and involves relating trip ends to primarily residential land uses. The other set is developed for the "attraction" end of trips generated within the planning area and involves relating trip ends to primarily nonresidential land use.

Because trips made for different purposes exhibit different patterns in time and space, it is necessary to distribute trips by purpose category. Therefore, in order to provide a more realistic simulation of trip distribution, as well as of trip generation, the trips are usually further classified by purpose; and the various categories of home-based trip productions are correlated with residential land use characteristics, while the various categories of non-home trip productions and the various categories of trip attractions are correlated with nonresidential land use characteristics. In the SEWRPC Regional Land Use-Transportation Study, nine equations relating trip end generation to land use were finally developed, four to explain trip productions from each traffic analysis zone within the Region and five to explain trip attractions.

It should be noted that the term "land use" as used in trip generation analyses has a special meaning. Ideally, from a planning standpoint, it would be desirable to be able to express trip end generation rates in terms of the broad, generalized land use categories used in the existing land use inventories and in the preparation of land use plans. Each of these broad land use categories, however, actually represents a complex of related and unrelated human activities that comprise the reasons for which trips are actually made. Broad land use categories, as such, are, therefore, usually inadequate as a basis for analyzing and forecasting trip end generation. Refinement of these broad land use categories is, therefore, required for trip generation analysis and forecast purposes; and this refinement is usually best expressed in terms of the detailed activities taking place on the land, including the socio-economic characteristics of the people involved.

This concept of trip generation as a function of land use, specifically the type, intensity, and spatial distribution of land use, has already been discussed in Chapter IX, Volume 1, of this report. In that chapter it was pointed out that tripmaking is closely related to the socio-economic characteristics of people and, therefore, can be better correlated with such detailed aspects of land use as population, population density, employment, income level, and automobile availability than with simply the areal extent of the various land use classification categories. These more detailed socio-economic characteristics of land use, however, must be capable of derivation from a forecast of future land use or from a land use plan. Since the ability to predict or control the future location and intensity of land use activity tends to diminish rapidly as the detail of classification increases, a balance must be struck between the transportation planning needs and the land use planning capabilities.

The actual quantitative relationships existing between tripmaking and land use, as herein defined, are usually explored through regression analyses. These analyses seek to identify empirical relationships between sets of observed values, or variants, thought to be associated through some complex of socio-economic or physical causes. One set of observed values is considered to be dependent upon the other and is termed the dependent variable. The other set is termed the independent variable. The technique may, in multiple regression analysis, be extended to include two or more independent variables on which the value of the dependent variable rests. In trip generation analyses, the trip ends are considered as the dependent variable, while certain socio-economic aspects of the land use activities in the planning area are considered the independent variables.

The relationships derived through regression analysis may be expressed mathematically as:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_nx_n$$

where:

y = the dependent variable

a = a constant

b = the calculated partial regression coefficients

x = corresponding independent variables

[2] *In trip generation and distribution, one end of each trip is termed the "production" end, while the other is termed the "attraction" end. For trips beginning or ending at home, termed "home-based trips," the production end is always taken as the home end of the trip while the attraction end is always taken as the non-home end, irrespective of the actual direction of the trip. For trips having neither end at home, termed "non-home-based trips," the origin of the trip is defined as the production end, while the destination is defined as the attraction end.*

The variables in the equation are related not only to y but to each other, and the regression coefficients are indicators of the change in y. Thus, in the foregoing equation, the coefficient b_1 corresponds to a unit change in x_1 when x_2, x_3 ... x_n are held constant (see Figure 10). Regression analysis thus permits the unique equation which describes the mathematical curve which "best fits"[3] the empirical travel and land use data to be specified. As applied in the SEWRPC study, the regression equation used describes a linear relationship which best fits the survey data on a traffic analysis zone basis.

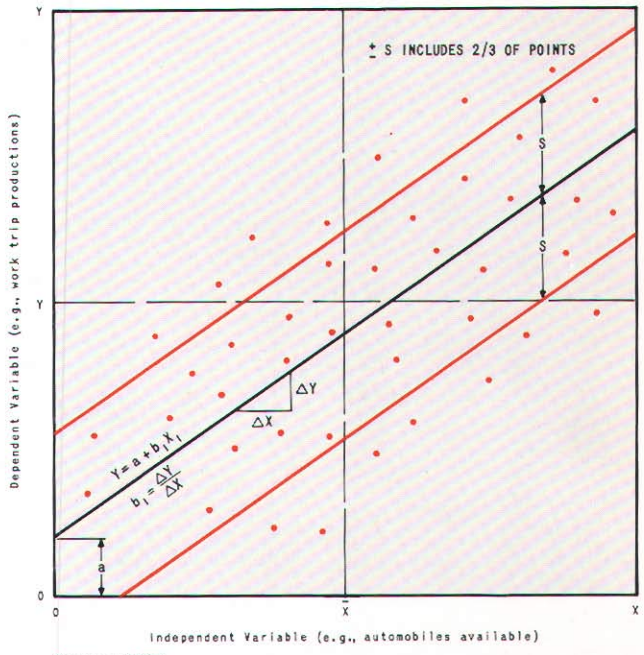
A variation of the regression analysis technique, known as "stepwise multiple regression analysis," permits any number of potential independent variables to be successively examined and those most closely associated with the dependent variable, trips generated, to be selected and incorporated into the final equation. This is accomplished by considering successively the various independent variables, determining the correlation of each variable while accounting for the interrelated effects of all other such variables previously reviewed. Independent variables are retained in the regression equation only if they contribute beyond a preselected level of significance to the explanatory power of the equation. Each "observation" entered for any particular independent variable being considered consists of survey data for a particular traffic analysis zone relating that variable to the dependent variable. The independent variable exhibiting the highest bivariate correlation is entered first, and a constant and coefficient are calculated. In each subsequent step, the independent variable which contributes most to the relationship of those remaining to be examined is entered; and the constant and each additional coefficient recalculated. When the point is reached in the analysis where additional independent variables do not improve the relationship beyond a preselected level, the process is terminated.

The adequacy of the equation developed through the regression analysis may be measured by two statistics: the coefficient of determination, r^2, and the standard error of estimate, s. The former provides a measure of the proportion of the variation in the dependent variable which is "explained" by the independent variables. The closer this coefficient is to 1.0, the greater is the degree of relationship. The standard error of estimate provides a measure of the closeness with which the regression equation fits the observed data from which it was derived. It defines a "confidence band" about the regression line within which two-thirds of observed data points may be expected to fall. It is important to note that the standard error of estimate applies only to the observed data used to derive the regression equation and not to forecast values.

[3] *The "best fit" curve may be defined as that curve for which the sum of the squares of the differences between the observed values of y and those defined by the equation will be a minimum.*

Figure 10

GRAPHIC ILLUSTRATION OF REGRESSION EQUATION AND STANDARD ERROR OF ESTIMATE



Source: SEWRPC.

It should be stressed that regression analysis only determines the nature and degree of statistical association between empirical observations. It should be used as a supplement to, and not a substitute for, logic and sound engineering judgment in the examination of the relationships existing between land use and travel. Careful consideration of the "reasonableness" of the predicting equations developed through regression analysis in light of experienced knowledge of the planning area, the data used in determining the relationships, and the proposed application is absolutely essential.

Derivation of Trip Generation Equations

Various relationships existing within the Region between trip generation rates and a single land use variable were presented in Chapter IX, Volume 1, of this report. These bivariate relationships were determined by regression analyses for person

trips per person and person trips per household as a function of family size, automobile availability, household income, and type of dwelling structure on a zonal basis. The percentage distribution of trips by purpose as related to household trip generation rates and the relationship of trip generation rates to net residential density, major land use categories, and distance from the central business district were also investigated.

These bivariate analyses provided a useful background to proceeding to the next level of trip generation analysis in which the combined effect of several variables on trip generation was investigated. For this next level of analysis, it was decided to examine the survey data at the level at which the data were sampled; that is, at the household level rather than at the traffic analysis zone level at which the relationships derived must finally be applied. This was done in order to avoid the possible masking of important relationships through the grouping of data into zonal totals. In the analysis the home interview survey trip data were first sorted by household size and automobile availability, since these two characteristics showed a strong correlation to trip generation in the bivariate analyses. The trip data were then further stratified within each household size and automobile availability group by: traffic analysis ring, household income, sex and race of the head of the household, age of the head of the household, occupation of the head of the household, and type of dwelling structure. The relationship existing between trip generation and each of the foregoing variables was then determined by calculating regional trip generation rates for various combinations of three independent variables, consisting of household size, automobile availability, and one of the six other variables. Thus, a three-factor combination analyzed might consist, for example, of all four-person households living in single-family dwellings and having one car available. Trip ends per household were determined for each subclassification. The household trip generation rates so determined were stratified by household size, automobile availability, and traffic analysis ring number and plotted as shown in Figure 11. The points plotted are shown interconnected simply to facilitate reading of the graph, and no continuous function should be inferred.

The foregoing analysis indicated that, after the effects of household size and automobile availability on trip production were accounted for, each of the other socio-economic variables examined contributed little to the relationship. It is particularly important to note that the changes in trip generation rates with distance from the central business district revealed neither a strong nor regular relationship. This does not mean that trip generation rates per household do not increase with increasing distance from the central business district. They do, as was shown in Chapter IX, Volume 1, of this report and in reports of major transportation studies conducted in other urban areas. It does mean, however, that the main influence in such increase is not the distance from the central business district per se but rather the increases in household size and automobile availability and the decreases in residential density, which accompany increased distance from the central business district.

The effect of household income on trip generation was also investigated. Figure 12 indicates that while the trip generation rate increases with income level it does so at a decreasing rate, apparently approaching a saturation level at the higher income levels. That an upper level to tripmaking exists beyond which increases in income level will have no effect appears reasonable and is supported by indications of the existence of saturation levels in automobile availability.

Automobile availability and income were found to be highly correlated within the Region, with a coefficient of determination, r^2, of 0.914. It was, therefore, decided that only one should be used as an independent variable in subsequent analyses since the effect of either on the dependent variable will adequately describe the effects of both. Automobile availability was selected in preference to household income for two reasons; it was believed easier to derive from land use plan data, and its relationship to tripmaking did not show the nonlinear leveling which household income did.

Selection of Trip Purpose Categories

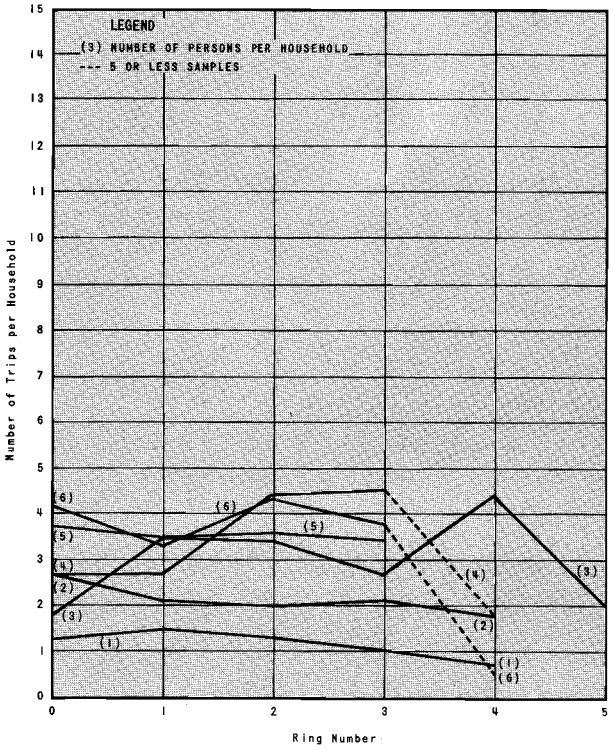
The final phase in the trip generation analysis was to derive on a zonal basis the actual equations which could be used within the Region to predict internal person trip ends for each trip "purpose." As already noted, two sets of trip ends are required for trip distribution by gravity model, one at the "production" end and the other at the "attraction" end of the trips. Consequently, two corresponding sets of trip generation equations were developed.

Home-based trip ends, both production and attraction, were further subclassified by the trip purpose

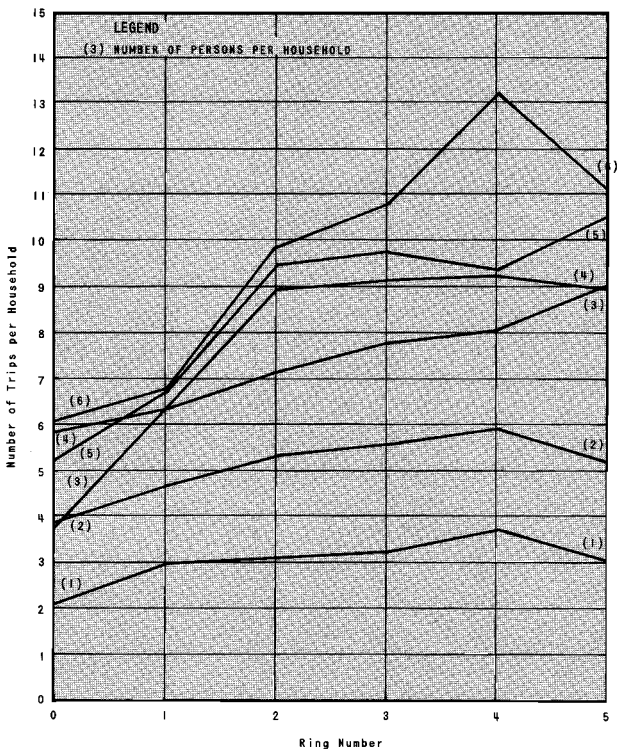
Figure 11

TOTAL PERSON TRIP GENERATION RATES OF HOUSEHOLDS BY AUTOMOBILE AVAILABILITY, HOUSEHOLD SIZE, AND RING NUMBER IN THE MILWAUKEE URBANIZING AREA (1963)

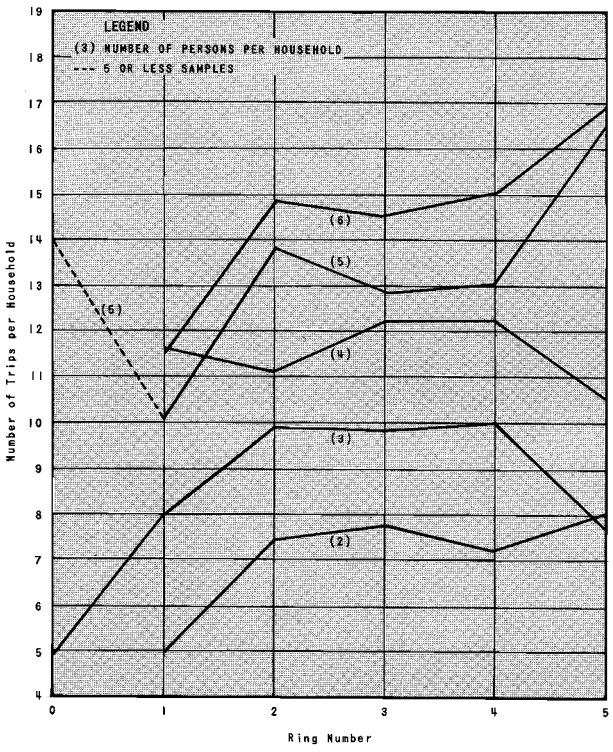
MILWAUKEE HOME INTERVIEW AREA HOUSEHOLD TRIP GENERATION RATE
0 CAR HOUSEHOLDS



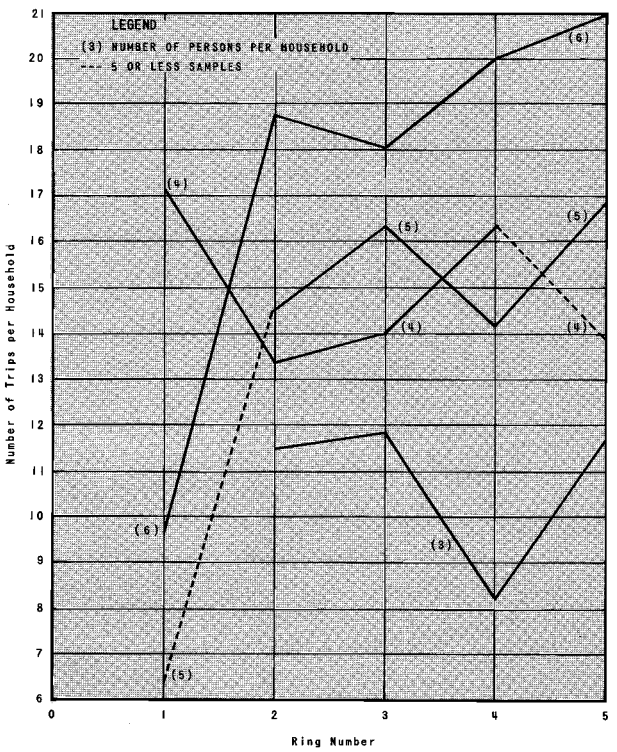
MILWAUKEE HOME INTERVIEW AREA HOUSEHOLD TRIP GENERATION RATE
1 CAR HOUSEHOLDS



MILWAUKEE HOME INTERVIEW AREA HOUSEHOLD TRIP GENERATION RATE
2 CAR HOUSEHOLDS



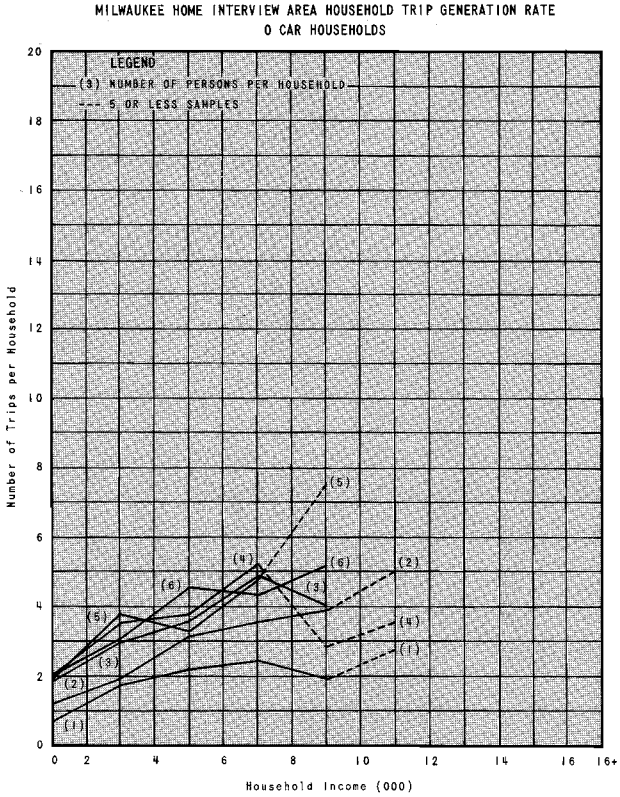
MILWAUKEE HOME INTERVIEW AREA HOUSEHOLD TRIP GENERATION RATE
3 CAR HOUSEHOLDS

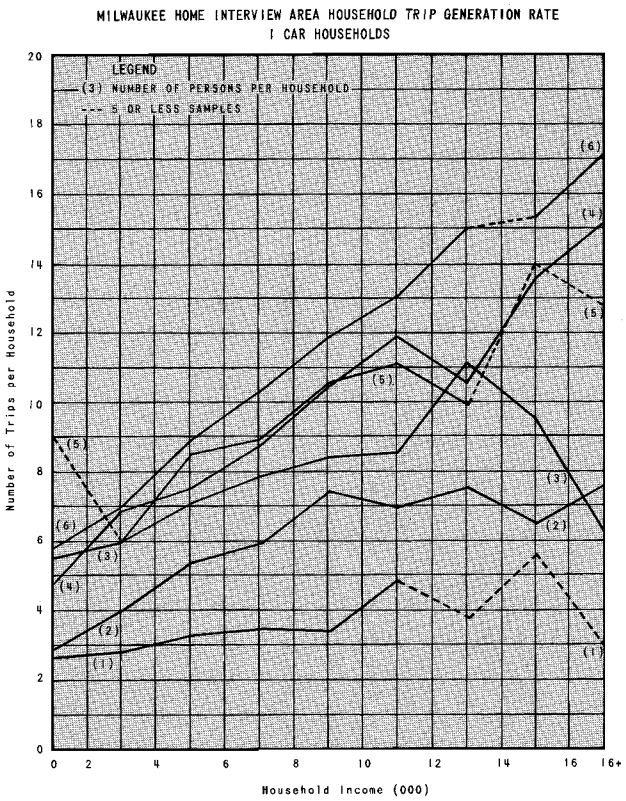


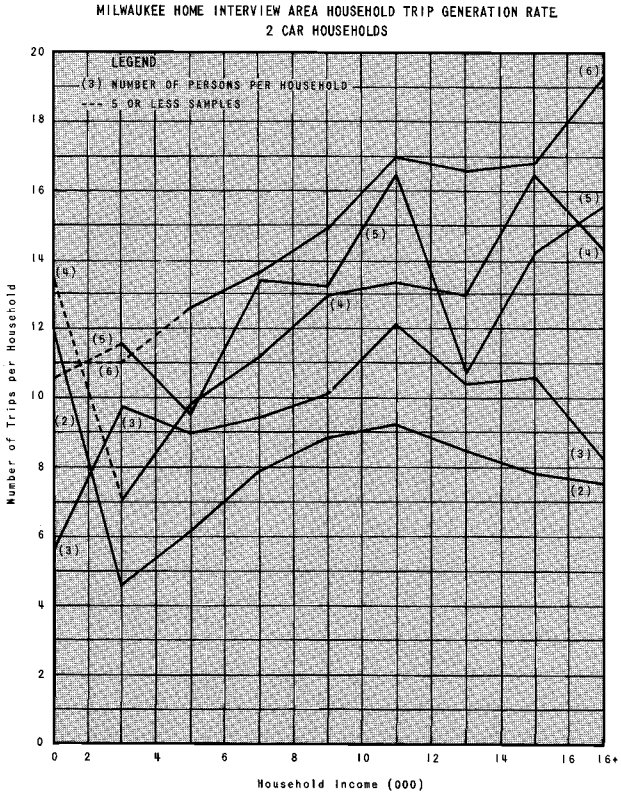
Source: SEWRPC.

Figure 12

TOTAL PERSON TRIP GENERATION RATES OF HOUSEHOLDS BY AUTOMOBILE AVAILABILITY, HOUSEHOLD SIZE, AND HOUSEHOLD INCOME IN THE MILWAUKEE URBANIZING AREA (1963)







Source: SEWRPC.

at the non-home end of the trip. The trip purposes used in this subclassification, corresponding to those coded in the original travel survey data, were: work, personal business, medical-dental, school, social-eat meal, serve passenger,[4] shopping, and recreation. Thus, trips from home-to-work and trips from work-to-home were grouped together as home-based work trips for distribution by gravity model as a single trip purpose category from home locations in a particular zone to job locations in all other zones. In the course of the analysis of home-based trip generation, it was found that trip end production for all trip purposes was strongly influenced by the following specific functions of residential land use: resident population, number of households, land area in residential use, and automobile availability.

Home-based school trips are not realistically distributed by gravity model since the model would treat all schools as possible attractions, not being able to account for the limitations imposed by

[4] *In the process of linking trips to connect the true origin and destination, the trip purpose "change travel mode," coded in the original survey data, was eliminated entirely, while the number of trips with "serve passenger" as the purpose was greatly reduced.*

school service area boundaries. School trips, therefore, were treated as a special category and were not included in the trip generation analyses or gravity model distribution. Trips to and from all schools—elementary, junior and senior high, vocational and technical schools, and colleges and universities—although accounting for nearly 8 percent of total person trips within the Region on an average weekday in 1963, amounted to less than 4 percent of total vehicle trips. Since most schools serve local neighborhoods or communities, vehicle tripmaking to and from such schools has a very small impact on the arterial street and highway network. For traffic analysis purposes, therefore, it was considered adequate for regional transportation planning purposes to let the 1963 pattern of vehicle trips to and from school represent the 1990 pattern of vehicle trips to and from school.

Transit trips to and from schools, however, comprised about 20 percent of the total transit trips made within the Region on an average weekday in 1963. For traffic analysis purposes, therefore, a growth factor was applied to the existing school trip pattern; that is, to the 1963 trip table for such trips. Growth factors were derived and applied to those zones containing institutions which are expected to increase significantly in enrollment by 1990. The growth factors were calculated as the ratio of the estimated 1990 enrollment to the 1963 enrollment and were applied to trip interchanges linking the zone in which the school was located and all other zones contributing trips to the school. Where use of the growth factor was not indicated, the 1963 travel pattern was used to approximate the 1990 pattern. In those areas where new schools are anticipated to be constructed by 1990, a service area was determined for each new school based upon the land use plan. Trip interchanges were then synthesized for each such service area on the basis of comparisons with similar existing service areas.[5]

It was also found that trip attractions for the home-based trip purpose categories of personal business, medical-dental, social-eat meal, and recreation were functions of the same independent variables, although not necessarily in the same relative order of importance. These independent variables were: resident population, retail employment on retail and service land, and land area in retail and service use. Total employment was found significant as an independent variable only for the trip purpose categories of personal business and medical-dental. Moreover, the trip length frequency distributions of all four of the home-based trip purpose categories of personal business, medical-dental, social-eat meal, and recreation were found to be generally similar. It was, therefore, decided to combine all such home-based trip purpose categories, treating them as a single trip purpose group. The resulting internal trip purpose groups for which trip end production and attraction generation equations were derived are: home-based work; home-based shopping; and home-based "other" trips, which include home-based trips for personal business, medical-dental, social-eat meal, recreation, and serve passenger. In addition, trip end production and attraction generation equations were derived for all non-home-based trip purposes as a single category. Each category required a separate gravity model distribution.

The point at which the stepwise regression analysis calculations were terminated in each case, that is, the point at which the addition of subsequent independent variables was judged to add little to the relationship, was generally set at an improvement in the coefficient of determination, r^2, of less than 0.010. At each step the coefficients of the regression equations were tested using Student's t-test to determine that they were significantly different from zero. For the final regression equations, all coefficients were found to be significantly different from zero. The final determination of the number of independent variables to be included in each regression equation was based on both the increase in the coefficient of determination, r^2, and the decrease in the standard error of estimate, s, due to the inclusion of a specific independent variable.

The trip generation equations so derived for calculating total person trip productions and attractions in the Region are set forth in Table 21. The equations are intended to be applied to traffic analysis zones; and the independent variables must, therefore, be expressed in each case as zonal totals. It should be noted that, in the course of the analysis, home-based work trip attractions in the urbanizing areas of the Region were found to exhibit slightly different generation characteristics than did such trip attractions in the remainder of the Region. Therefore, two equations were developed for home-based work trip attractions. Both related trip generation to total employment and differed only in the constant and coefficient.

[5] *Future school service areas are best delineated on the basis of residential planning units; and since such units will only be delineated for the final regional land use plan, the synthesis of future school trips was scheduled only for the final plan design.*

Table 21

TOTAL PERSON TRIP GENERATION EQUATIONS FOR THE REGION[a]

Equations	Coefficient of Determination (r^2)	Standard Error of Estimate (s)	Mean ($\bar{y}$)	Standard Error as a Percent of the Mean
Total Person Trip Productions				
1. Home-Based Work				
Number of Trip Ends = -11.0 + 0.47 (Total Population) + 0.62 (Number of Households)	0.939	43.7	170.8	25.6
2. Home-Based Shopping				
Number of Trip Ends = 6.5 + 1.54 (Number of Automobiles) - 1.36 (Net Area in Residential Use in Acres) - 0.34 (Number of Households)	0.834	40.3	91.5	44.1
3. Home-Based Other				
Number of Trip Ends = -6.4 + 2.47 (Number of Automobiles) -1.78 (Net Area in Residential Use in Acres)	0.872	71.2	194.6	36.6
4. All Non-Home-Based				
Number of Trip Ends = 5.6 + 0.28 (Total Employment) + 0.24 (Total Population) + 0.82 (Total Employment on Retail and Service Land)	0.649	84.1	106.3	79.1
Total Person Trip Attractions				
1. Home-Based Work (Zones in Urbanizing Areas)				
Number of Trip Ends = 2.6 + 1.73 (Total Employment)	0.996	21.6	252.8	8.5
2. Home-Based Work (All Other Zones in Region)				
Number of Trip Ends = 1.0 + 2.22 (Total Employment)	0.786	141.4	170.8	82.8
3. Home-Based Shopping				
Number of Trip Ends = -0.5 + 7.14 (Retail Employment on Retail and Service Land)	0.497	178.0	138.8	128.3
4. Home-Based Other				
Number of Trip Ends = 2.9 + 1.43 (Number of Households) + 0.73 (Total Employment on Retail and Service Land) + 23.48 (Net Area in Retail and Service Use in Acres) + 0.27 (Total Employment)	0.658	115.6	185.7	62.3
5. All Non-Home-Based				
Number of Trip Ends = 3.9 + 0.91 (Number of Households) + 0.97 (Total Employment on Retail and Service Land)	0.585	88.7	106.0	83.7

[a] *The employment variables used in the trip generation equations are intended to represent zonal employment levels on an average weekday and are calculated as a percentage of the total number of existing or forecast jobs available, and assumed filled, in the zone. The latter includes all industrial (manufacturing and wholesaling), retail, service, communication, transportation, utility, governmental and institutional jobs. The percentages applied were derived from a comparative analysis of total 1963 jobs available and the first work trip data obtained in the travel inventories. Based on this analysis, the following percentages were applied: 65 percent for retail, service, and governmental and institutional employment; 81 percent for industrial employment; and 85 percent for transportation, communication, and utility employment. Retail employment was, in turn, calculated as 60 percent of retail and service employment on an average weekday.*

Source: SEWRPC.

Two of the trip generation equations require an input of the automobile availability by zone. This data cannot be derived directly from the land use plan but must be indirectly calculated. Utilizing the same stepwise multiple regression technique, an equation was developed to facilitate this calculation. This equation may be expressed as:

> Number of Automobiles = -41.3 + 0.27 (Total Population) + 0.99 (Net Area in Residential Use in Acres)

The coefficient of determination, r^2, for this equation is 0.904, and the standard error of estimate, s, is 24.3, and the mean, $\bar{y}$, is 89.4. The standard error of estimate is 27.2 percent of the mean.

APPLICATION OF THE TRIP GENERATION EQUATIONS

The derived trip generation equations describe the mathematical relationship, in this case linear, which best fits the survey data. More specifically, they describe the line which best fits zonal totals for such data; and in the analysis all data for each traffic analysis zone constitute one observation. The equations were thus derived from as many observations as there were zones exhibiting the particular type of trip production or attraction being calculated.

The actual zonal totals of any particular type of trip productions or attractions for any particular traffic analysis zone, as determined by the survey, may be higher or lower than the corresponding value calculated from the trip generation equations. Some of the difference between the observed and calculated values is due to the random variation which may be expected in any survey data collected on a sample basis. Some of the difference, however, may be due to some special characteristics of an individual zone which are not treated in the regression procedure. If, in the future, such a zone retains the special characteristics which make it different from the average, it may be assumed that it will continue to produce trips at the same proportionately higher or lower than average rate as it did during the survey period in 1963.

The necessary adjustment in trip generation rates to account for such special zones was dealt with mathematically by calculating for each zone and each trip purpose an adjustment ratio, by dividing the trip productions or attractions determined in the survey by the corresponding 1963 productions or attractions calculated from the trip generation equations. For example, the survey found 18,052 home-based work attractions in traffic analysis zone 3, where the corresponding calculated value is 19,125, or a ratio of 0.944. If zone 3 is not expected to change greatly in its socio-economic characteristics over the forecast period, future work trip attractions would be adjusted at 94 percent of the calculated value.

Such adjustment ratios were calculated for all zones for each category of trip production and attraction but were applied only to those zones where the absolute increase in whatever data comprising the independent variable was less than the corresponding level of these data in 1963. Thus, in the preceding example, it was found that the number of jobs added in zone 3 between 1963 and 1990 would probably be less than the 1963 level of jobs in the zone; and the use of the adjustment ratio was, therefore, deemed appropriate.

In zones where the increase in whatever data comprising the independent variable was greater than the corresponding level of these data in 1963, the change was generally considered to be of such magnitude that whatever unique characteristic the zone originally possessed would probably change; and, therefore, the derived trip generation equation, unadjusted, would provide the best estimate of future trip generation. In all cases, trip ends were calculated both with and without the application of the adjustment factor; and judgment was used to select the final production or attraction values used for each zone. Thus, for example, in the small municipalities in Walworth County, the adjustment ratio was applied even where a large percentage of growth was expected, since these zones exhibited trip production rates markedly lower than the regional average.

MODAL SPLIT

The second major stage in the traffic forecast process is the determination of the division of future person trips between the two major modes of travel: public mass transit and private automobile. The division is expressed as the percentage of all person trip ends that will use mass transit, and this percentage is determined for each traffic analysis zone within the planning area by a modal split model relating transit utilization to selected characteristics of the land use development and transportation systems. In this manner, the total universe of future travel demand is derived from future land use through the application of the trip generation equations; and the demand for transit

and highway service is, in turn, determined as a proportion of the total future travel demand.

The determination of modal split is, in effect, a determination of the market demand within the planning area for mass transit service. This demand is determined by many individual decisions, and many factors may influence each individual choice between use of public and private transportation. When analyzed, however, on an aggregated basis within the context of an urbanizing region, the demand for transit service can best be related to certain socio-economic, land use, and transportation characteristics. Important among these are automobile availability, income level, household type, intensity of land use, trip purpose, and the relative quality and availability of transit and highway service. A detailed analysis of modal choice behavior within the Region identified three variables as the prime factors affecting transit utilization: trip purpose, automobile availability, and the relative quality and availability of transit and highway service as measured by the accessibility ratio.

This detailed analysis revealed also that transit trips made for different purposes, like total person trips, had sufficiently different characteristics, with respect to average trip length, trip length distribution, and spatial distribution measured in travel time, to warrant separate treatment. Graphical analyses also indicated that the proportion of trips that households within the Region make by transit is closely related to automobile availability. For households having no automobile available, the proportion of total trip productions made by transit was 64.6 percent. This proportion dropped sharply to 7.4, 3.5, and 2.0 percent for households having, respectively, one, two, and three or more automobiles available for tripmaking.

The ability to account for the effect of the relative quality of transportation service provided by the public transit and highway systems on the relative utilization of these systems constitutes one of the most critical criteria which a modal split model must meet for planning application. The accessibility ratio was selected as a measure of the relative quality of these services. This ratio measures for each zone the relative ease by which any trip-attracting activity in all other zones within the Region can be reached by the two modes of travel: the greater ease by highway system relative to public transit system, the higher the accessibility ratio. More specifically, the accessibility ratio was defined as the accessibility index over the highway network divided by the accessibility index over the transit network.[6] Eight sets of accessibility indices were computed for each traffic analysis zone within the Region, one for each of four trip purposes by each of the two transportation modes. These were reduced by division to four sets of accessibility ratios. Analyses indicated that the proportion of trips made by transit decreased as the accessibility ratio increased (see Figure 13).

By combining the effect on transit utilization of automobile availability and relative quality of service, as defined by the accessibility ratios, modal

[6] *The accessibility index from any given zone, i, within the Region to any other given zone, j, is defined as the product of the trip attractions, either transit or automobile, in zone j times the gravity model friction factor for the zonal interchange determined from the travel time for that interchange. These products are summed from zone i to all other zones in the Region to obtain the accessibility index for zone i. The index may be defined mathematically as:*

$$V_i = \sum_{j=1}^{n} A_j(F_{ij})$$

where V_i = *the accessibility index for zone i with respect to all other zones,*

A_j = *the trip attractions in zone j,*

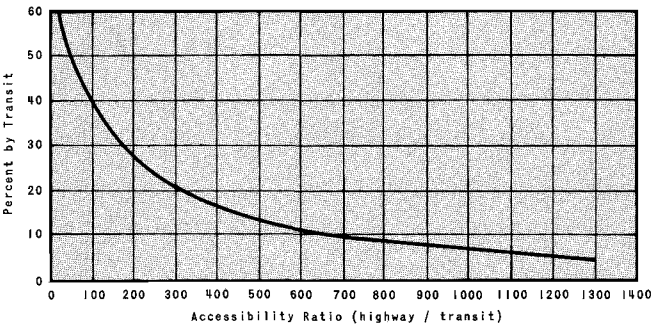
F_{ij} = *the gravity model travel time friction factor for travel from zone i to zone j on the particular transportation network being considered,*

n = *the number of traffic analysis zones in the Region.*

The gravity model friction factor is defined as the inverse of the door-to-door travel time raised to some power, b, which varies with the travel time and may be defined in mathematical terms as:

$$F_{ij} = \frac{1}{t^b}$$

Figure 13
ACCESSIBILITY RATIO VERSUS PERCENT TRANSIT USAGE
HOME-BASED WORK PURPOSE MILWAUKEE HOME INTERVIEW AREA



Source: SEWRPC.

split relationships[7] were developed which defined a three-dimensional surface whose orthogonal axes are: the automobile availability expressed in average number of automobiles per household per zone, the accessibility ratio, and the percent transit utilization as shown in Figure 14. Thus, the percentage of total trip end productions that will be made by public transit can be determined for any traffic analysis zone within the Region, give the automobile availability and accessibility ratio for the zone.

Large differences in transit utilization were found to exist between the Milwaukee and the Racine and Kenosha urbanized areas. The latter two urbanized areas exhibited markedly similar characteristics and were, therefore, considered together. The differences between the Milwaukee and the Racine and Kenosha areas were accounted for by the development of two separate sets of relationships defining the modal split. In all, seven relationships were finally used: four for the Milwaukee urbanized area and three for the Racine and Kenosha urbanized areas. The Milwaukee urbanized area relationships were developed for four trip purposes: home-based work, home-based shop, home-based other, and non-home-based. The Racine and Kenosha urbanized area equations were developed for three trip purposes: home-based work; home-based other, including shop; and non-home-based. In calculating the percentage of trip productions utilizing transit, a linear interpolation procedure was applied which, in effect, served to connect known points on the three-dimensional surface defined by the relationships with straight lines to simplify determination of intermediate values.[8]

APPLICATION OF MODAL SPLIT MODEL

In the application of the modal split model to future total person trip productions by zone, it was first necessary to calculate transit trip attractions, as these were necessary to compute the accessibility ratios. Multiple regression techniques were utilized for this purpose, and a regression equation was derived for each of the trip purposes as shown in Table 22.

[7] *Points on the three-dimensional surface were calculated for each trip purpose category by dividing the total transit trip productions by the total person trip productions, as derived from the travel inventory, for specified intervals of automobile availability and accessibility ratio. The discrete points so determined approximated a continuous three-dimensional surface.*

[8] *See SEWRPC Technical Record, Vol. 2 - No. 6, "A Modal Split Model for Southeastern Wisconsin."*

Utilizing these relationships, transit trip attractions were calculated for each traffic analysis zone within the Region, the resulting values examined and, if necessary, modified by judgment. By subtracting these transit trip attractions by zone, it was possible to calculate the person trip attractions utilizing automobile. An average automobile occupancy factor in 1963 was then computed for each traffic analysis district and applied to the resulting 1990 automobile person trip attractions by zone to arrive at the auto driver trip attractions.

Auto driver trip attractions, along with door-to-door highway travel times and corresponding gravity model travel time friction factors, were then used to calculate the automobile accessibility indices. Similarly, transit trip attractions and door-to-door transit travel times between zones and the corresponding gravity model travel time friction factors were used to calculate transit accessibility indices. These travel times were initially based upon preliminary future highway and transit networks. The accessibility ratios were then computed by dividing the highway indices by the transit indices for each trip purpose for each zone within the Region.

The resulting accessibility ratios and future automobile availability provided the inputs to the modal split model from which the percent transit utilization was determined. The utilization factors were applied to the total person trip productions, derived from the trip generation equations, to compute the number of transit trip productions in each zone by purpose. These, in turn, were subtracted from total trip productions to obtain automobile person trip productions. Automobile occupancy factors derived at the district level for 1963 were then applied at zonal level to compute corresponding 1990 auto driver trip productions. Finally, the total automobile and transit trip productions and attractions were balanced separately so that the same number of each kind of trip was produced and attracted within the Region as a whole. Resulting values produced the inputs into the next stage of the traffic simulation process: trip distribution.

TRIP DISTRIBUTION

The conversion of trip productions and attractions to trip interchanges, that is, the linking of the origins and destinations derived in the trip generation analysis to form trips, is the third major stage in the traffic simulation process. The resulting zonal trip interchanges constitute the basis for the assignment of future traffic loads to

alternative transportation networks. The zonal trip interchanges are determined by the application of mathematical formulas called traffic distribution models and provide a common basis for simulating the future travel patterns that can be expected to result from a variety of different land use development patterns and highway and transit systems.

The most widely used trip distribution model is the so-called "gravity model." The basic concept underlying the gravity model is that trip interchange between two subareas of the Region is a direct function of the number of trip ends (activity) in each subarea and some inverse function of their spatial separation. This function of spatial separation adjusts the relative attraction of each zone for the ability, desire, or necessity of the tripmaker to overcome the travel distance involved. Mathematically, the gravity model may be stated as follows:

$$T_{ij} = P_i \frac{\frac{A_j}{d_{ij}^{\,b}}}{\frac{A_1}{d_{i1}^{\,b}} + \frac{A_2}{d_{i2}^{\,b}} + \ldots + \frac{A_n}{d_{in}^{\,b}}}$$

where:

T_{ij} = trips produced in zone i and attracted to zone j

P_i = trips produced by zone i

A_j = trips attracted by zone j

d_{ij} = the spatial separation between zones i and j, generally expressed in terms of travel time

b = an empirically determined exponent which expresses the average areawide effect of spatial separation between zones on trip interchange

n = the number of traffic analysis zones within the planning area

The exponent b varies with trip purpose, and previous research in the field indicated that when the spatial separation was expressed as travel time between zone centroids the exponent for work trips was about 1.0, for shopping trips about 2.0, and for social trips about 3.0. Since the distance appeared in the denominator in the original version of the gravity model formula, a decrease in the exponent means that spatial separation becomes a less restrictive factor on travel interchange. In other words, people are willing to travel farther for a purpose such as work than for purposes such as shopping or social functions. Research also indicated that the exponent was not constant but increased as the spatial separation increased. Moreover, the value of the exponent was found to vary from urban area to urban area, particularly in the less important trip purpose categories.

Consequently, it is necessary to develop and calibrate a specific gravity model individually for each region under study, as well as for each of several trip purpose categories. This is done through empirical application of the data collected in the travel inventory. Moreover, since past experience has demonstrated that the exponent of travel time is not necessarily constant for all intervals of such time and that travel patterns are affected by various social and economic characteristics of the travelers, it has become common practice to express the gravity model formula in the following form:

$$T_{ij} = \frac{P_i A_j F_{ij} K_{ij}}{\sum_{j=1}^{n} A_j F_{ij} K_{ij}}$$

where:

F_{ij} = an empirically derived travel time friction factor which expresses the average areawide effect of spatial separation on trip interchange between zones which are t_{ij} minutes apart

K_{ij} = an adjustment factor applied on a zone-to-zone basis to allow for the incorporation of the effect on travel patterns of social, economic, or historic characteristics not otherwise accounted for in the model formulation, and

T_{ij}, P_i, and A_j are as previously defined

The use of the set of travel time friction factors to express the effect of spatial distribution on zonal trip interchange as a modification of the classic inverse exponential function serves to improve the fit of the synthetic trip length frequency distribution to the empirical data. It also provides for the consideration that the effect of spatial separation generally increases as the separation itself increases.

DERIVATION OF GRAVITY MODEL PARAMETERS

Five separate parameters are required as inputs to the gravity model. Two are concerned with land use: the number of trips produced and the number

Table 22

TRANSIT TRIP ATTRACTION GENERATION EQUATIONS FOR THE REGION

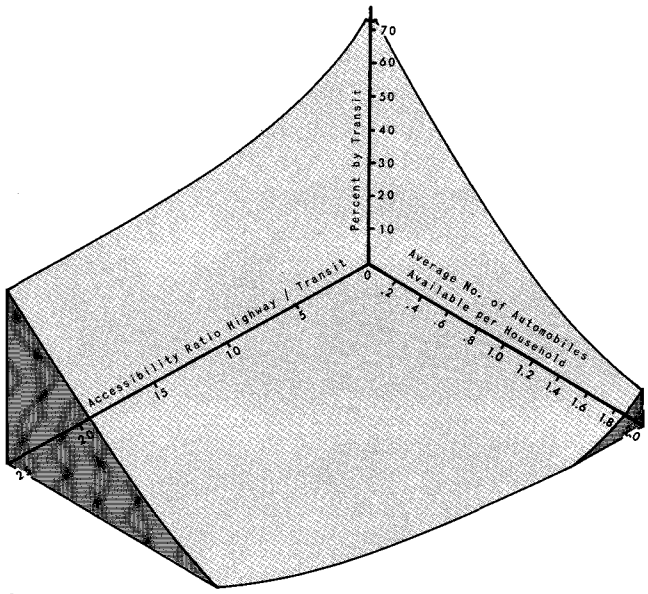
Equations	Coefficient of Determination (r^2)	Standard Error of Estimate (s)	Mean ($\bar{y}$)	Standard Error as a Percent of the Mean
1. Home-Based Work Number of Trip Ends = 455 + 1.09 (Total Employment on Retail and Service Land) − 0.53 (Number of Automobiles Available) + 0.42 (Total Employment)	0.833	47.9	60.9	78.6
2. Home-Based Shopping Number of Trip Ends = -248 + 3.21 (Retail Employment on Retail and Service Land)	0.663	56.8	131.3	43.3
3. Home-Based Other Number of Trip Ends[a] = 287 + 0.16 (Total Employment on Retail and Service Land) - 1.50 (Net Area in Retail and Service Use in Acres) + 0.04 (Total Employment) + 0.29 (Retail Employment on Retail and Service Land)	0.403	339.6	387.5	87.7
4. Non-Home-Based Number of Trip Ends = 124 + 0.28 (Employment on Retail and Service Land) - 0.08 (Number of Automobiles Available)	0.584	14.2	13.1	108.5

[a] *Calculated using data only from zones with more than 100 home-based other transit trip attractions.*

Source: SEWRPC.

Figure 14

MODAL SPLIT SURFACE FOR HOME-BASED WORK TRIPS IN THE MILWAUKEE URBANIZING AREA



Source: SEWRPC.

of trips attracted by each traffic analysis zone. The gravity model distributes all home-based trips as trips from the home-based end to the non-home-based end, regardless of the actual direction of the trip. By thus distributing two trips, the model assumes an even directional split; that is, for every trip which begins at home, one returns directly to home. For trips having neither end at home, the model distributes one-way trips between the zones of origin (productions) and destinations (attractions). The third parameter deals with the spatial separation between zones expressed in total travel time. This travel time consists of a minimum travel time between zones over the highway or transit network plus the terminal time at both ends of the trip and transfer times for transit trips. The fourth parameter is the travel time friction factor which expresses the effect that spatial separation has on trip interchange and thereby measures the impedance to interzonal travel. A travel time friction factor is derived for each one-minute increment of travel time, and the factor is mathematically expressed as being

inversely proportional to the travel time between zones raised to a power which is related to the travel time increment. Finally, the zonal adjustment factor must be known; and this is derived from the characteristics of the origin and destination zones. This factor is essentially the ratio necessary to adjust the model so as to match the real travel patterns observed between subareas of the Region in the origin and destination surveys. This factor accounts quantitatively for effects which can generally be identified qualitatively through experienced knowledge about the areas affected. For example, the k factor would account for the fact that residents of the south side of Milwaukee are less likely to shop in the Milwaukee central business district than the unfactored model would indicate.

Calibration of the Gravity Model

In order to apply the gravity model to a specific planning area, it is necessary to calibrate the model so that it will accurately reflect the travel characteristics existing within the planning area.

The calibration process actually determines the numerical values of the travel time friction factors and the zonal adjustment factors so that the model accurately simulates the trip interchanges determined in the travel inventory. These numerical values are assumed to remain constant over time, thereby providing a model which can be used to simulate the future trip interchange pattern, given future trip productions, attractions, and travel times between subareas of the Region. Research studies indicate that this basic assumption is valid unless drastic changes occur in the level of service provided by the transportation system or radical changes occur in the distribution of human activity throughout the Region. A total of eight individual gravity model equations were calibrated, one for each major trip purpose category by each mode of transportation.

In the calibration process, the actual (survey) and model origin-destination trip interchanges are grouped for each purpose and mode of travel into one-minute time increments and plotted as a "trip length frequency distribution," as shown in Figure 15. The gravity model must be able to satisfactorily reproduce this distribution before it can be considered calibrated for the planning area. In addition, two other criteria should also be met:[9] The actual and model average trip lengths for the planning area should not differ by more than 3 percent, and the actual and model total travel within the planning area measured in vehicle hours or person hours of travel should not differ by more than 3 percent.

In the calibration process, a first approximation of the friction factors was calculated while the zonal adjustment factors were all assumed as 1.0. This first approximation can be made by several methods: 1) using friction factors from other metropolitan regions of similar size, 2) assuming all factors as equal to 1.0, or 3) calculating the friction factors using an inverse exponential equation. The third method was chosen for application in southeastern Wisconsin. Travel time friction factors were calculated for each one-minute increment for all trip purposes. The values so calculated were then used as inputs for the first calibration run of the gravity model, along with the productions, attractions, and interzonal travel times from the origin-destination survey.

The output from this run was then plotted as a trip length frequency distribution. The three criteria were checked; and if met, the model was considered to be calibrated. Usually two or three such runs were necessary before the criteria were met. For the second and subsequent trials, new friction factors were derived by multiplying, for each one-minute increment of time, the old friction factors by the ratio of number of trips in the particular group under consideration to all trips for both actual and model values. This may be expressed mathematically as:

$$F_{new} = F_{old} \times \frac{OD\%}{GM\%}$$

where:

F_{new} = travel time factor for next trial

F_{old} = travel time factor used in previous trial

OD% = percentage of trips in that increment divided by all trips for all increments for origin-destination survey trips

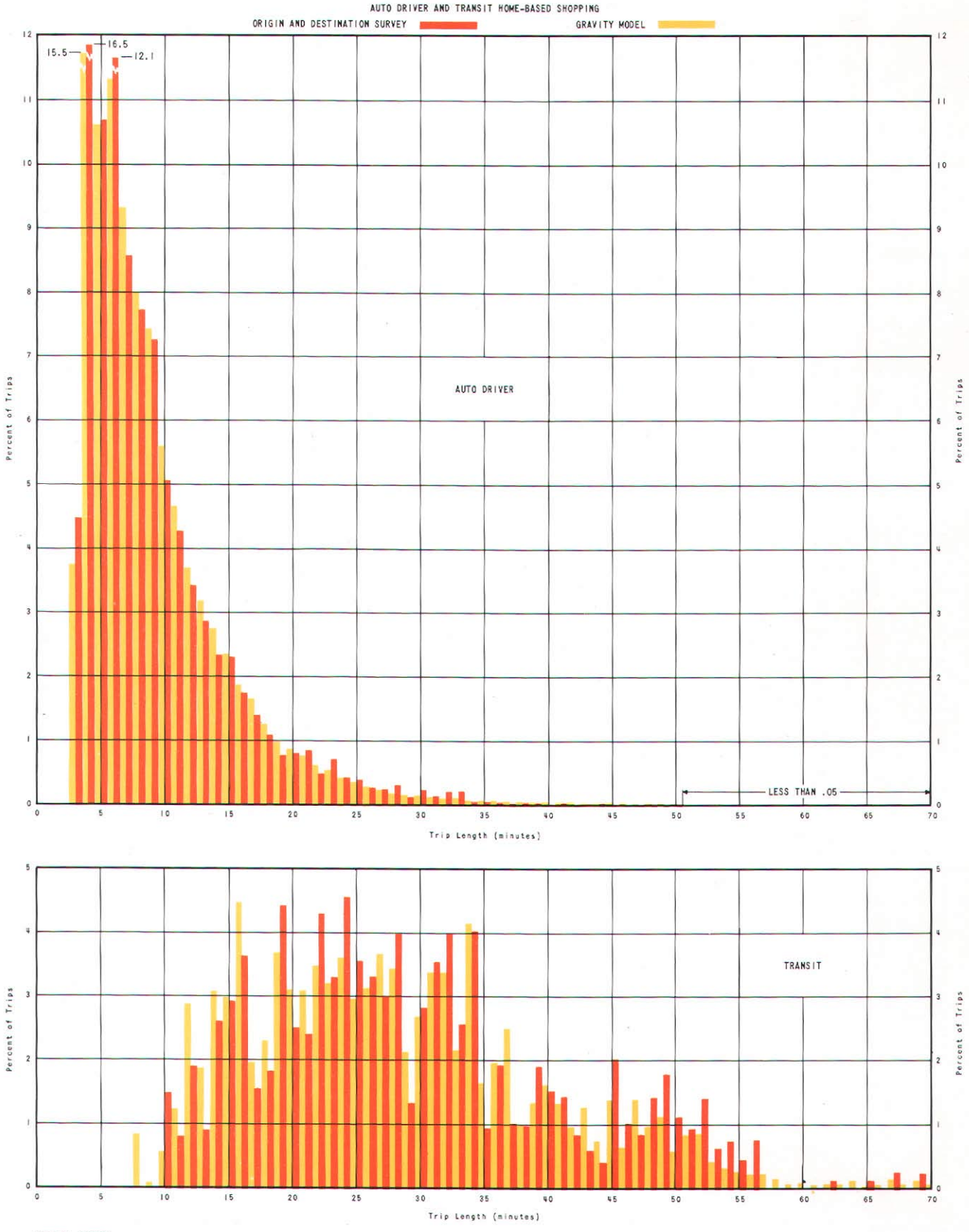
GM% = percentage of trips in that increment divided by all trips for all increments from previous gravity model trial

The new set of friction factors was then plotted on log paper, and a smooth curve fitted to the plotted points (see Figure 16). Values can then be read from the curve for each minute increment of time and used as inputs to the next calibration trial of the model.

[9] *See Calibrating and Testing a Gravity Model For Any Size Urban Area, U.S. Bureau of Public Roads, July 1963, Chapter IV, p. 41.*

Figure 15

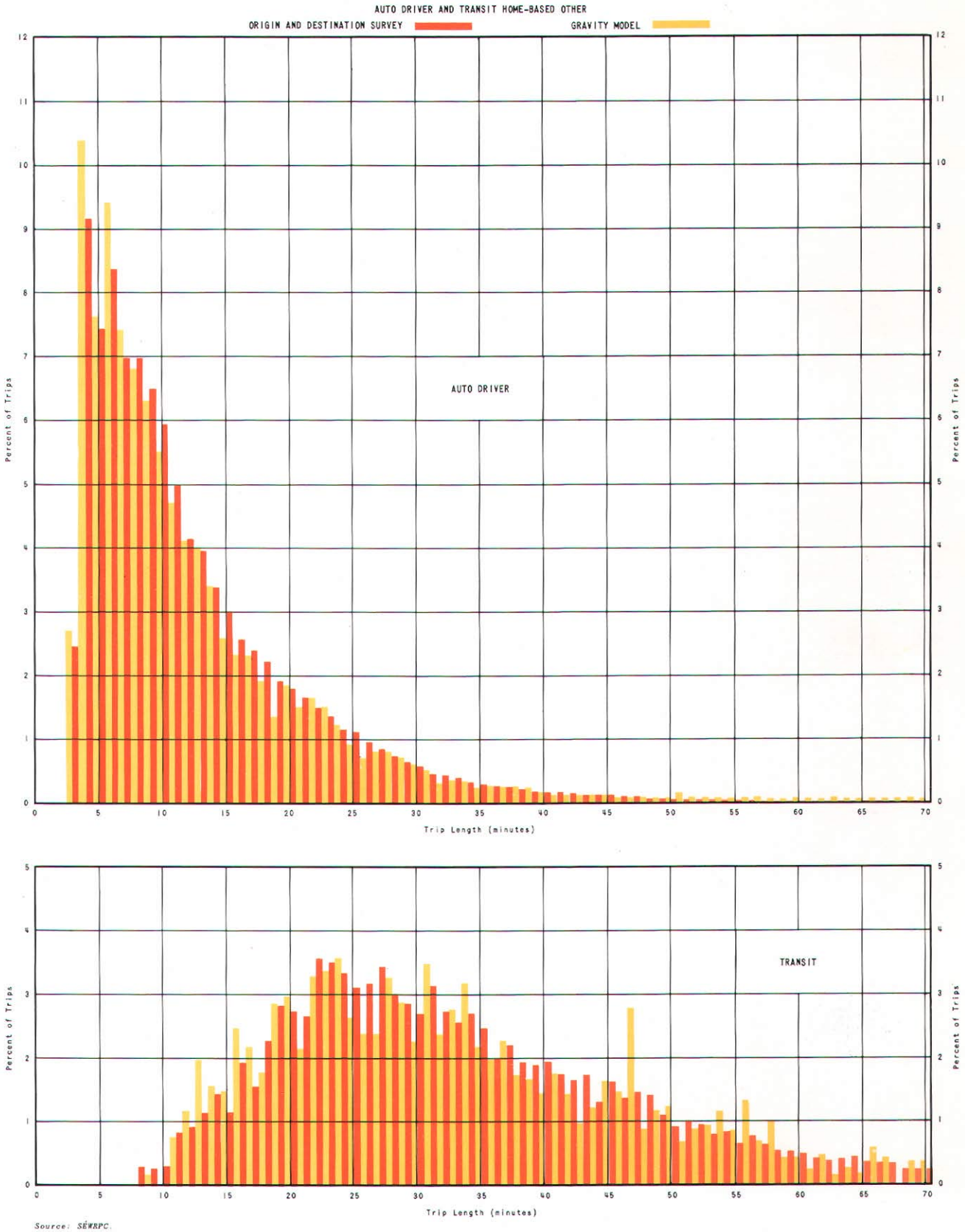
COMPARISON OF ORIGIN AND DESTINATION SURVEY AND GRAVITY MODEL TRIP LENGTH FREQUENCY DISTRIBUTIONS BY TRIP PURPOSE FOR INTERNAL AUTO DRIVER AND FOR TRANSIT PERSON TRIPS IN THE REGION (1963)



Source: SEWRPC.

Figure 15 (continued)

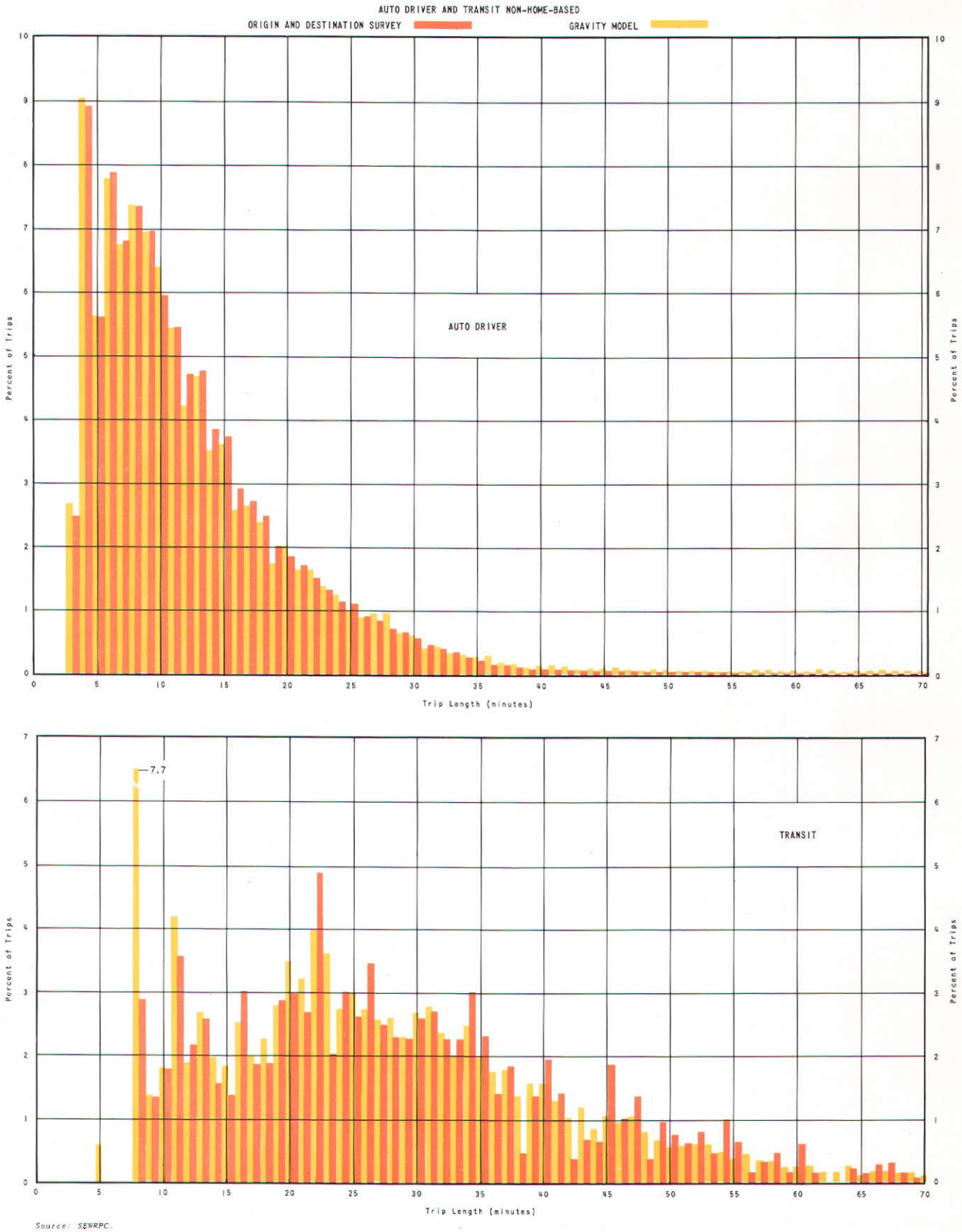
COMPARISON OF ORIGIN AND DESTINATION SURVEY AND GRAVITY MODEL TRIP LENGTH FREQUENCY DISTRIBUTIONS BY TRIP PURPOSE FOR INTERNAL AUTO DRIVER AND FOR TRANSIT PERSON TRIPS IN THE REGION (1963)



Source: SEWRPC.

Figure 15 (continued)

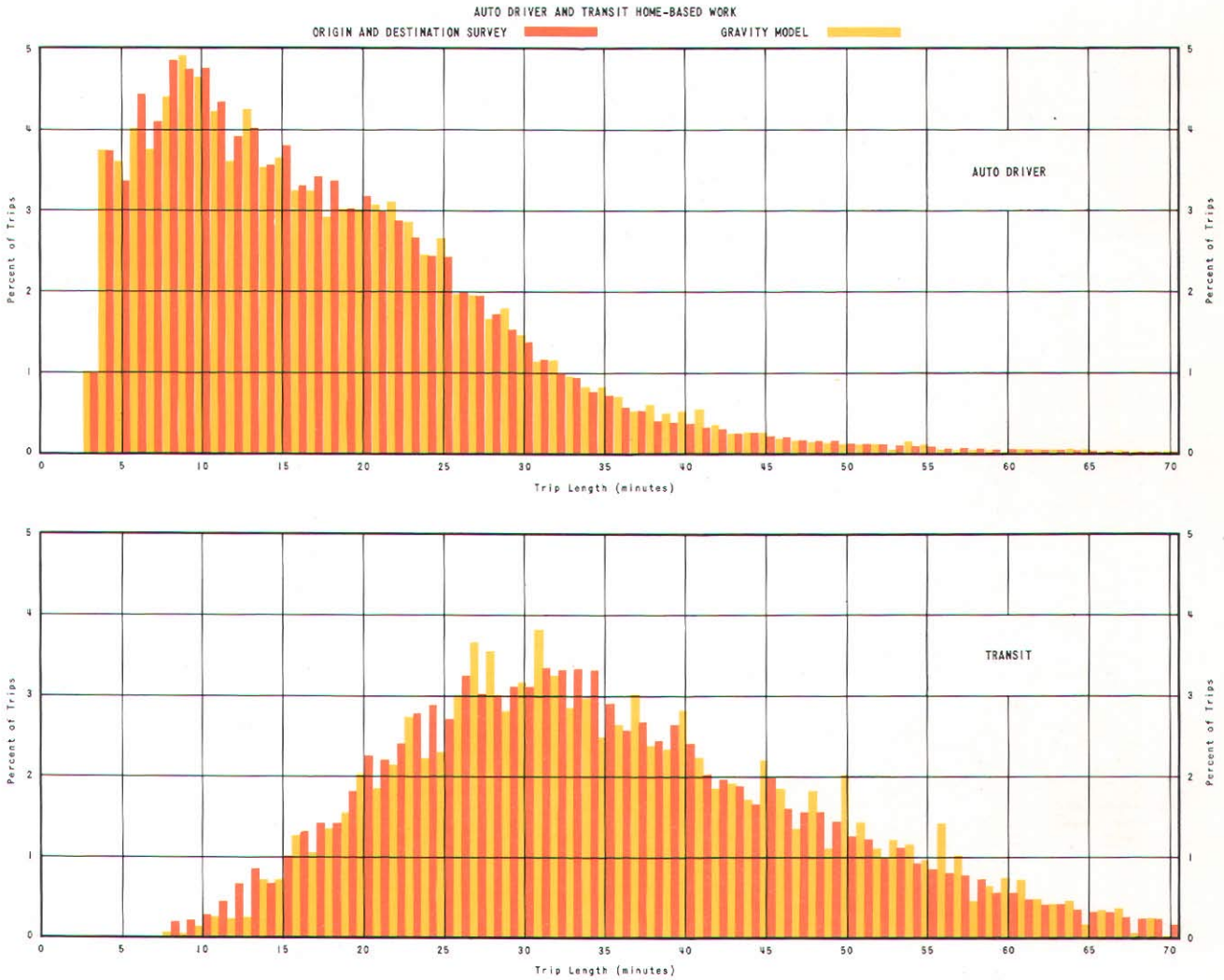
COMPARISON OF ORIGIN AND DESTINATION SURVEY AND GRAVITY MODEL TRIP LENGTH FREQUENCY DISTRIBUTIONS BY TRIP PURPOSE FOR INTERNAL AUTO DRIVER AND FOR TRANSIT PERSON TRIPS IN THE REGION (1963)



Source: SEWRPC.

Figure 15 (continued)

COMPARISON OF ORIGIN AND DESTINATION SURVEY AND GRAVITY MODEL TRIP LENGTH FREQUENCY DISTRIBUTIONS BY TRIP PURPOSE FOR INTERNAL AUTO DRIVER AND FOR TRANSIT PERSON TRIPS IN THE REGION (1963)



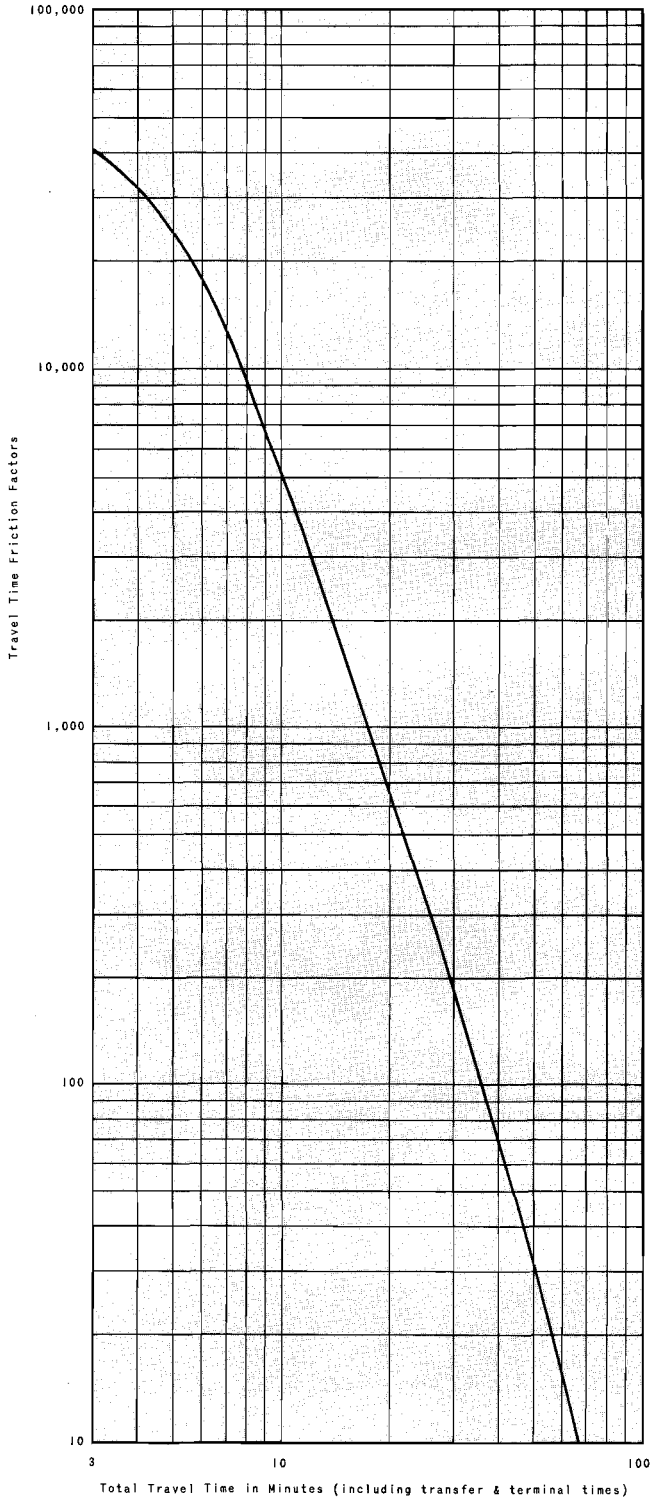
Source: SEWRPC

The final set of travel time friction factors so derived are displayed in Figure 17 for auto driver and transit modes.

An analysis of the differences in trip interchange patterns between the origin-destination data and model results was performed to determine the need for zonal adjustment factors. Selected movements from certain districts to the Milwaukee central business district (CBD), between the more populous traffic analysis districts of the Region, and from certain traffic analysis districts to major employment and commercial centers were inspected to determine if the model greatly over or underestimated these interchanges. Where the difference between the actual and estimated interchange was 30 percent or more, and where a knowledge of the historic, socio-economic, or physical characteristics of the districts involved indicated that such differences might be reasonably explained, a zonal adjustment factor was developed which brought the estimated zonal interchange closer to the actual zonal interchange. As in the case of the friction factor calibrations, three trials were necessary to satisfactorily match all of the zonal interchanges, thus completing the calibration process.

Figure 16

GRAPHIC ILLUSTRATION OF A SMOOTH CURVE FITTED TO A SET OF TRAVEL TIME FRICTION FACTORS FOR HOME-BASED OTHER AUTO-DRIVER TRIPS IN THE REGION



Source: SEWRPC.

TRUCK TRIPS

Truck Trip Generation[10]

To measure the existing relationships between truck tripmaking and land use within the Region, stepwise multiple regression analyses were made relating truck trip ends as the dependent variable at the zonal level to the independent variables of population; total employment; total employment on retail land; households; net acres of retail and service land use; net acres of residential land use; net acres of industrial land use; and net acres of transportation, utility, and communication land use.

The truck trip generation equation derived from these analyses may be stated as:

> Number of truck trip ends = 318 + 0.30 (Total Employment) + 0.14 (Total Population) + 7.90 (Net Acres of Retail and Service Land).

The coefficient of determination, r^2, for this equation is 0.603; the standard error of estimate, s, is 5.4; and the mean, $\bar{y}$, is 10.5.. The standard error of estimate is 51.4 percent of the mean.

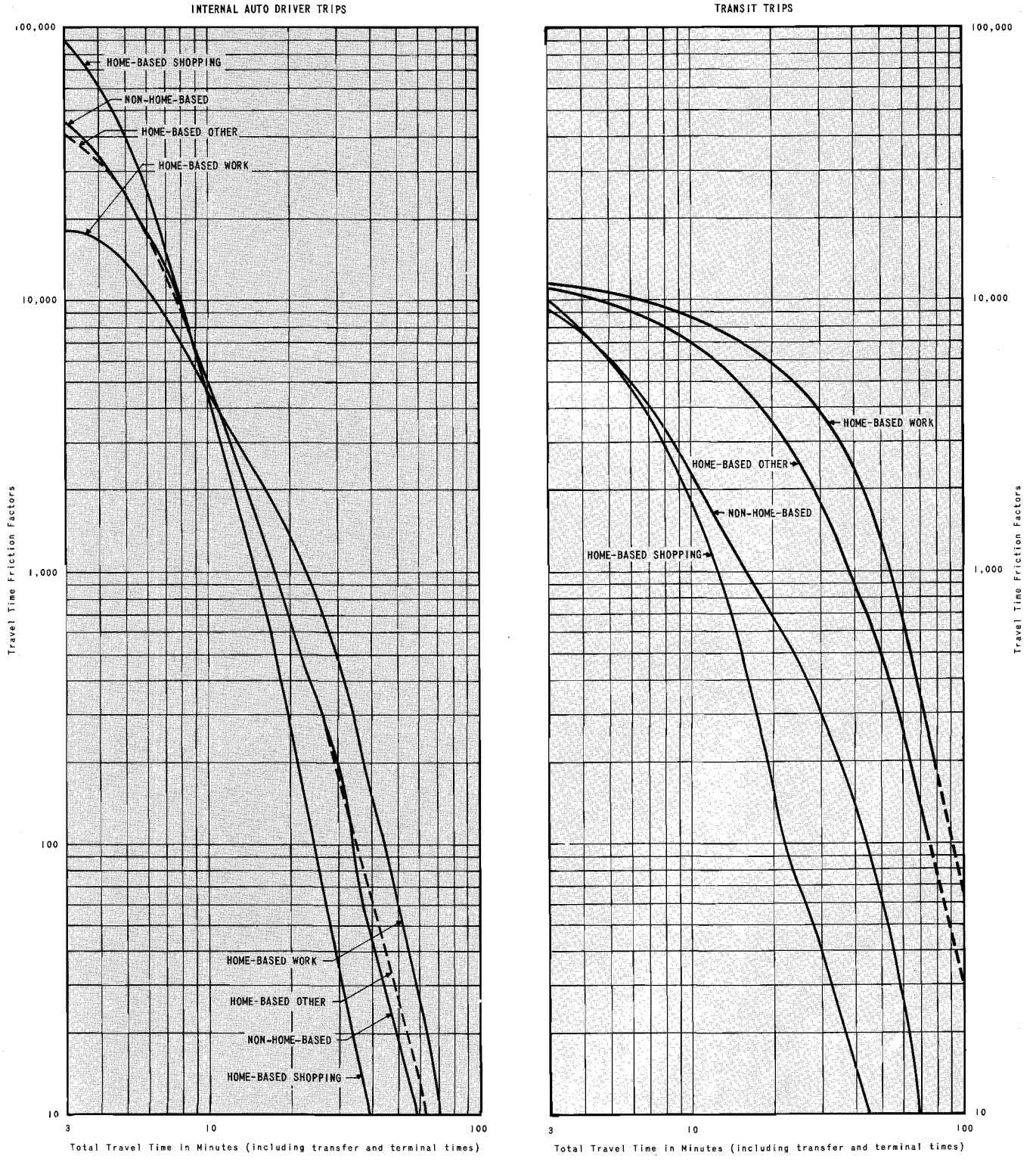
The truck trip generation equation was applied in two separate calculations in the same manner as the person trip end and automobile availability equations. This procedure accounted for zones with unique truck trip generation characteristics. In special instances where, after careful examination, neither calculation appeared to produce a reasonable value, truck trip end values were assigned to the zones, using the two sets of estimates as guidelines and considering certain land use data not present in the regression equation or, in other instances, considering empirical knowledge of truck trip generation characteristics.

Truck Trip Distribution

Like person trips, truck trips have unique charac-

[10] *Taxi trip ends were included with truck trip ends in the trip generation analyses because these trips comprised less than one-third of 1 percent of the total vehicle trips made within the Region on an average weekday and displayed characteristics similar to truck trip characteristics, including primarily non-home-based, short average trip lengths, and pickup and delivery functions.*

Figure 17
TRAVEL TIME FRICTION FACTORS FOR INTERNAL AUTO DRIVER AND TRANSIT TRIPS IN THE REGION



Source: SEWRPC.

teristics which vary with truck type and with the land use activity served, particularly with respect to whether the service is provided to industries or residences. Therefore, the distribution of such trips by gravity model presents a problem. As previously noted, the gravity model distributes all productions to all attractions for each particular class of trip. If all truck trips were grouped into one class, the gravity model would distribute trips without differentiating between the various functions served. For example, grocery delivery truck trips might be distributed to quarries, industrial raw material delivery trips to residences, and household furniture to industrial sites. This problem could be overcome by classifying truck trip productions and attractions into similar truck type and industry groups and distributing each individually. It was decided that this approach would be excessively time consuming and in the end might result in groups too small for statistical reliability.

Therefore, instead of the gravity model, a simpler growth factor technique, known as the Fratar expansion method, was utilized. This method is based on the premise that the future distribution of trips from any given traffic analysis zone within a planning area is directly proportional to the present movement of trips out of the zone modified by a growth factor determined for both the zones of origin and destination. The growth factor to be applied is obtained by dividing the estimated future trip ends for a zone by the present number of trip ends:

$$F_i = \frac{T_i}{t_i}$$

where:

F_i = the growth factor for zone i

T_i = the future trip ends for zone i

t_i = the present trip ends for zone i

Present trip ends for each traffic analysis zone within the Region were obtained from the travel inventory for use in calculating the growth factors, while the future trip ends were obtained from application of the truck trip end generation equations formulated for this purpose. The future trip interchange between any zone, i, within the planning area and any other zone, j, is then calculated by application of the following formula:

$$T_{ij} = t_{ij} F_j \frac{\sum_{j=1}^{n} (t_{ij} F_i)}{\sum_{j=1}^{n} (t_{ij} F_j)}$$

where:

T_{ij} = the future number of trips between zone i and zone j

t_{ij} = the present number of trips between zone i and zone j

n = the number of traffic analysis zones within the planning area

F_i = the growth factor for zone i

F_j = the growth factor for zone j

Application of the method provides two values for the future trip interchange between any pair of traffic analysis zones within the Region, once computed based on the growth factor for zone i and once computed based on the growth factor for zone j. The most probable number of future trips between zones i and j is taken as the average of the two trip interchange values so computed.

The average trip interchanges between each zone and all other zones are then totaled to obtain the total number of future trip ends generated in the zone:

$$T_i = \sum_{i=1}^{n} (t_{ij} F_i)$$

The trip ends so calculated will not agree with the trip ends calculated for the same zone by application of the future trip generation equation. Modified growth factors are then calculated by dividing the future trip ends determined from the trip generation equation by the trip ends determined from the first trial application of the trip interchange formula, and the formula is again applied. This iterative process is repeated until the two values derived for the trip ends balance within 3 percent for 99 percent of the zones within the planning area, at which point the model is considered to be calibrated.

The future truck trip distribution obtained by this expansion procedure was then combined with the other vehicle trip distributions to obtain the final vehicle trip values for traffic assignment.

EXTERNAL TRIPS

Generation

An external trip may be defined as any trip that

crosses the exterior boundaries of the Region at least once. The definition includes both trips which have one end within the Region, that is, trips which cross the boundary but either originate or terminate within the Region (internal-external trips), and those which pass through the Region (external-external trips). A procedure to forecast the future level of such tripmaking was developed by the State Highway Commission of Wisconsin as part of their work in preparing a state highway plan. This procedure calculates a constant annual percentage rate of increase for each major route crossing the external boundaries of the Region from recent trends in the traffic volumes on these routes. The calculated growth rates are then applied on an annual basis to the 1963 average daily traffic on each route. Application of this procedure to the 34 major highways crossing the boundaries of the Region resulted in an estimated increase in total external vehicle trips for all major highways crossing the external boundaries of the Region of from 87,400 trips (ADT) in 1963 to 264,000 trips (ADT) in 1990, through trips being counted only once in these totals. This is equivalent to a uniform annual growth rate of 4.2 percent.

Forecasts of automobile availability within the Region indicated an annual growth rate of 2.7 percent, which when applied to 1963 external automobile trips, as determined from the external survey made in the summer of 1963 and, therefore, representing average summer weekday volumes, amounted to an increase of 88,000 trips, from 86,000 in 1963 to 174,000 in 1990. Adding external truck trips to these totals resulted in a total increase of 96,000 trips, from 102,000 in 1963 to 198,000 in 1990. Allowing for more rapid increase in external trip volumes than in vehicle availability, due to the growth of recreation and travel induced by improved highway facilities, and compensating for seasonal variation in the 1963 survey data, a growth factor of 3.4 percent per year was chosen as the most probable value and was concurred in by the planning staff of the State Highway Commission. This amounted to an increase from a total of 102,000 to a total of 250,000 external trips (ADT) by 1990, through trips being counted once. This amounts to an increase in the number of vehicles crossing the regional boundaries on an average weekday of 174,000 vehicles, from 91,000 in 1963 to 265,000 in 1990. A vehicle making a through trip is counted twice in the latter totals, since only vehicle trips crossing the regional boundaries are distributed.

Since the distribution of the external trips had been made by the State Highway Commission, it only remained necessary to decrease the state estimate of external trips at each major external cordon crossing point by 4 percent to match the agreed upon control total derived from the application of the 3.4 percent annual growth factor.

Truck trips represented 15 percent of all external trips made in 1963, or a total of 16,000 trips per average weekday, through trips being counted once. Because the growth rate in automobile availability is forecast to be greater than that in truck availability over the period 1963 to 1990, a decline in external truck trips as a proportion of total external trips is anticipated. Accordingly, it was forecast that truck trips would represent 12 percent of all external trips made in 1990, or a total of 30,000 trips per average weekday, through trips being counted once. These 30,000 truck trips were allocated to each external station in the same proportion of truck trips to the total external trips that existed in 1963 at each external station.

External Trip Distribution

The external truck trips were subtracted from total external vehicle trips for each external station, and the resulting automobile trips (220,000) were distributed by Fratar expansion. The external truck trips were separately distributed by Fratar expansion in combination with the internal truck trips.

TRAFFIC ASSIGNMENT

The fourth and final major stage in the traffic forecasting and analysis process consists of the assignment of the zonal trip interchanges derived in the distribution phase to specific routes of the alternative transportation system. The same basic traffic assignment process may be used to estimate future traffic loads on the various segments of the highway or transit systems or to simulate existing loads on these systems. To simulate the existing traffic loads, the actual interzonal traffic movements determined from the origin and destination survey are used as input to the assignment process; to simulate future traffic loads, the forecast of interzonal traffic movements prepared in the distribution analysis are used as input. The output is an estimate of the existing or future traffic volumes to be carried by each segment of the transportation system, by direction, complete with turning movements at intersections.

The assignment of future traffic demand to the existing and proposed transportation systems was accomplished separately for the highway and transit system and in several steps. The first step in the assignment process involved the preparation of the two major inputs: 1) a matrix, or table, of trip interchange volumes between all of the traffic analysis zones within the planning area and 2) preparation of a complete and definitive description of the spatial location, capacity, and operating characteristics of the specific transportation system to be tested. For assignment of existing traffic demand to the highway and transit systems, the trip interchange tables prepared from the origin and destination survey were used directly. For assignment of future traffic demand to the highway system, seven individual trip interchange tables, which were direct outputs of the application of trip distribution models, had to be combined to provide total zonal trip interchange volumes: internal vehicle trips by automobile for each of the five trip purposes used in the trip distribution phase, external vehicle trips by automobile, and internal and external truck and taxi trips. For assignment of trips to the transit system, five individual trip interchange tables had to be combined, consisting of the transit person trip interchange tables for each of the five trip purposes used in the distribution analysis.

The definitive description of the highway and transit system to be tested involved the design of the highway and transit networks; the preparation of highway and transit network maps; and the collection, coding, and transfer to punch cards of data describing the location, capacity, and operating speeds on each link in the two networks so that the operation of the systems could be simulated, a process which has been fully documented in other SEWRPC publications.[11] The existing highway and transit networks were prepared in accordance with these documented procedures to provide a direct input into the traffic assignment process. Highway and transit facility plan proposals could then be readily tested by the insertion of new links into the network or by the modification of data describing existing links in the network, representing, respectively, new facility construction or the improvement of existing facilities.

The second step in the assignment process involves the calculation, from the descriptions of the transportation networks, of two sets of minimum time paths from all zones within the Region to all other zones within the Region, one for automobile travel and one for transit travel. This was accomplished by a process of systematic search and accumulation of travel time over individual links, using a method by which the minimum time paths are calculated by a systematic comparison of travel time for all links in the system in successively outward steps from the starting node until the shortest time path to all nodes has been computed. As each node in the network is considered, the method accumulates travel times back to the starting node and records the immediately preceding node in the direction of travel to return to this centroid. Thus, the shortest travel time and route through the system between the starting node and all other nodes is systematically recorded and mapped. The resulting minimum time path routes are referred to as "trees" and represent the shortest door-to-door travel time between any two zones within the Region, including walk time at either end of the trip, wait-and-transfer times for transit trips, and park and unpark times for automobile trips.

In the next step, the zone-to-zone trip volumes are assigned to all links; that is, to all individual route segments comprising the minimum time path for the various interchanges. Thus, traffic volumes are accumulated on the links for all zonal interchanges, resulting in a complete assignment of traffic demand to the network. Since all of the trips are so assigned to the shortest time paths through the networks, some of the volumes on the individual links of the networks may exceed the actual capacity of the transportation facilities, thus affecting the travel time used to determine the minimum time paths. The output of the assignment program at this stage is termed an "unrestrained" assignment. The ratios of the assigned volumes to the capacity for each link in the network are then computed. The travel times are then reduced for those links having a volume to capacity ratio of less than 1.0 and increased for those links having a ratio greater than 1.0. Minimum time paths are recalculated, and the trip interchanges are reassigned on the basis of these revised minimum time paths through the network.

[11] *For a detailed description of the procedure used in the preparation of the highway and transit networks, see SEWRPC Planning Report No. 7, Inventory Findings - 1963, Chapter VII; and SEWRPC Technical Record, Vol. 1 - No. 2, "Arterial Network and Traffic Analysis Zones"; SEWRPC Technical Record, Vol. 1 - No. 5, "Inventory of the Arterial Street Network"; SEWRPC Technical Record, Vol. 2 - No. 2, "Capacity of Arterial Network Links"; and SEWRPC Technical Record, Vol. 1 - No. 3, "Rail and Transit Inventory and Design of the Transit Network."*

Thus, the speed at which each segment of the transportation system can be traveled is changed to simulate the effect of increasing congestion in the system; and the resulting capacity restraint serves to modify the unrestrained assignment volumes and provide a more realistic distribution of traffic on the system. For the transit system, capacity restrained assignments were not used because the physical capacities of the transit facilities within the Region were not approached.

It should be noted that the procedure used results in the calculation of traffic loadings expressed in terms of 24-hour average weekday traffic volumes, which in this form are comparable to the network capacities derived from the transportation system inventories conducted under the regional land use-transportation study. These 24-hour average weekday traffic volumes can be converted to peak hour volumes by the application of the appropriate factors shown in Table 23.

Calibration

In order to calibrate the assignment procedure, the trip interchanges derived from the 1963 origin and destination survey were assigned to the existing highway and transit networks and compared with corresponding actual volumes determined by field counts. For the comparison so indicated, modifications were made in the information coded into the networks describing the transportation system so that the simulated traffic volumes could satisfactorily correspond with the observed volumes. Such modifications included for the highway network: adjustments in link speeds, addition or deletion of selected loading links, and modification in the location of load nodes; and for the transit network, modification in walk, wait, and transfer times.

TRANSPORTATION SYSTEM DESIGN

Introduction

It is in the system design phase of the land use-transportation study that future transportation networks are synthesized to satisfy the regional land use and transportation development objectives and standards formulated for the study, while meeting the overriding criteria of system integration and continuity. The design of future transportation networks is a highly complex process, requiring not only the assimilation of large amounts of information and the development and application of traffic simulation models but also the exercise of experienced engineering judgment. To a considerable extent, the process is one of finding successive approximations to the best design solution, with specific solutions being proposed to specific system problems in each iteration, then tested through application of the traffic simulation models. The more comprehensive and detailed the knowledge and understanding of the regional traffic patterns to be served, the more readily can sound design solutions be found to satisfy the development objectives.

Proper utilization of the traffic assignments, derived from application of the traffic simulation models, thus requires careful analysis of the assigned volumes to find possible design solutions to indicated problems. Such utilization also requires the conversion of these volumes to a form useable in plan evaluation to determine the degree to which the plan objectives and standards are met by the design solutions. The analyses made for system design and evaluation purposes involve application of certain well-developed engineering techniques, the most important of which warrant brief description here.

Table 23

FACTORS TO CONVERT AVERAGE WEEKDAY TRAFFIC VOLUMES TO PEAK HOURLY VOLUMES FOR ARTERIAL STREETS AND HIGHWAYS IN THE REGION

Facility Type	Milwaukee Central Business District		Remainder of Region	
	Peak Hour Both Directions	Peak Hour Peak Direction	Peak Hour Both Directions	Peak Hour Peak Direction
Freeways	0.080	0.040	0.080	0.048
Expressways & Arterials	0.100	0.050	0.100	0.060

Source: SEWRPC.

Identification of Transportation System Deficiencies

The first step in regional transportation system plan design is to determine the deficiencies of the existing transportation system under future land use and travel demand conditions. The identification of these deficiencies constitutes one of the most important inputs to the development of future alternative transportation networks.

In this respect, it should be noted that the physical inventory of the transportation system conducted as a part of the regional land use-transportation study necessarily dealt only with the highway and transit systems as they existed within the Region in the base year 1963. Because the regional land use-transportation planning program was created within the context of many ongoing state and local planning and plan implementation programs, however, it was recognized that certain additional transportation facilities not in existence in 1963, nevertheless, had to be recognized as "committed facilities" which would be constructed before the design year 1990 regardless of the results of the regional planning program. These facilities consisted primarily of highway improvement projects under various stages of development from official commitment of funds for engineering design and construction, through acquisition of right-of-way, to actual construction underway. The cancellation of such committed projects would not only be extremely costly and uneconomical but, in many cases, administratively and politically impossible. Therefore, an inventory of all such projects was conducted by contacting all line agencies within the Region having responsibilities for highway improvements; and data concerning the design features of all committed facilities were obtained. The inventory results were reviewed by the Technical Coordinating and Advisory Committee on Regional Land Use and Transportation Planning, and the recognition as committed facilities of the projects agreed upon. These committed facilities were then added to the existing highway network as indicated on Map 1 and future trips assigned to the resulting "existing plus committed" network used to identify the resulting system deficiencies under future conditions.

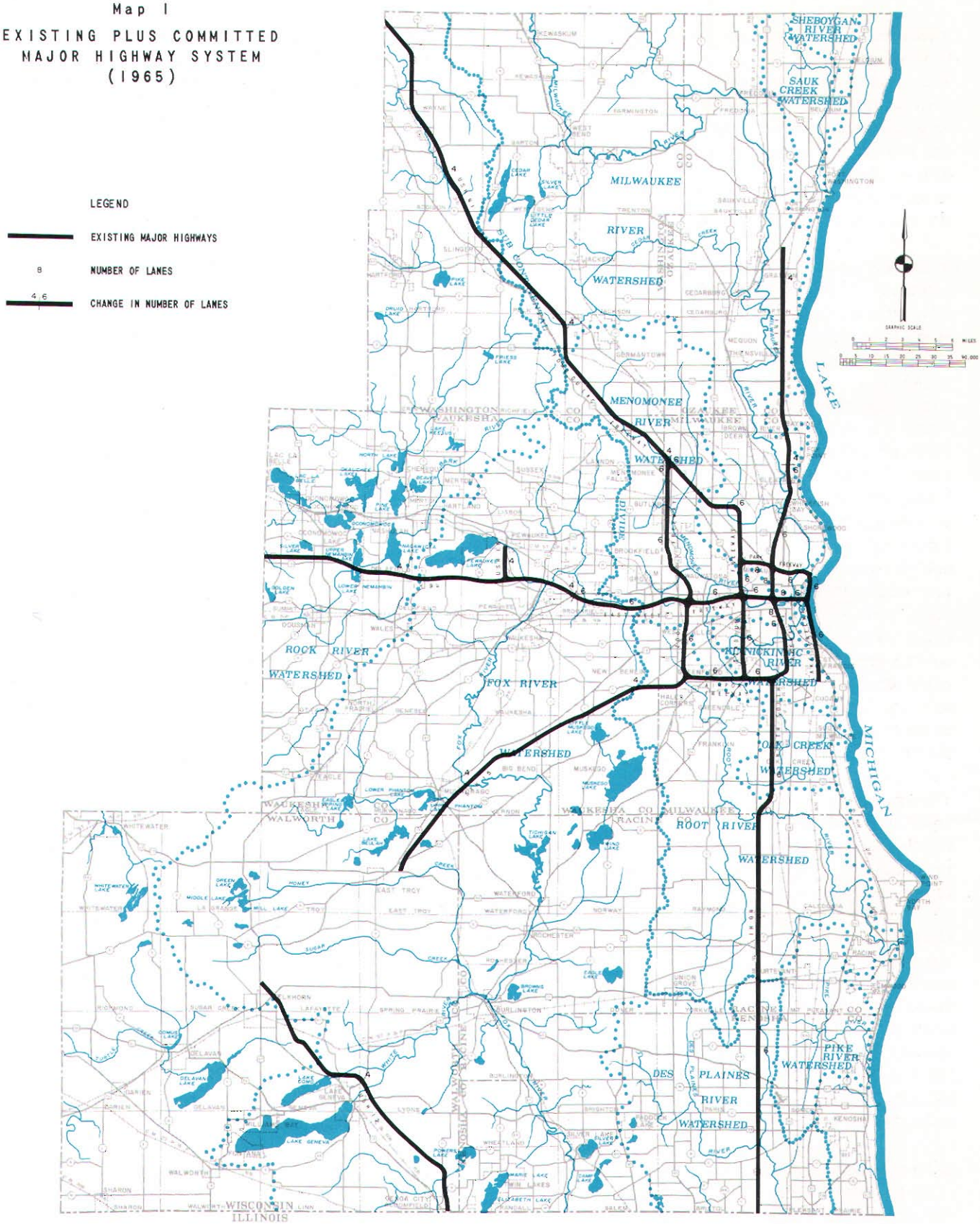
Although the regional transit system existing in 1963 consisted primarily of buses operating over the existing street and highway systems, and no major capital investments in fixed privately owned rights-of-way or line structures had been committed by the private corporations operating the transit vehicles, several proposals for improvement in transit service were considered to be committed. These proposals consisted of the institution of modified rapid transit service over certain freeways in Milwaukee County. The resulting existing plus committed transit network served as the base network to which initial assignments of future transit travel demand were made.

In any transportation system analysis, the possibility always exists that the existing plus committed transportation facilities may prove adequate to meet the future travel demand, in which case no further transportation system improvements are required by the design year. This was found to be the situation within the Region with respect to the majority of the standard arterial streets and highways and local transit routes. This situation, however, was not found to exist with respect to the freeways, expressways, certain important standard arterial streets and highways, and certain major transit routes within the Region. Although the identification of these major network links having excessively high volume-to-capacity ratios under future load conditions provided a good indication of network deficiencies, sole reliance for system design could not be placed on such identification. This is because future traffic assignments alone will not identify the characteristics of the trips causing the overloads and, thereby, will not effectively suggest possible design solutions to most effectively eliminate these overloads.

To provide the additional information required, special screen line, spider network, and selected link analyses were made using the traffic simulation models. In the screen line analyses, traffic distribution within major corridors of transportation movement were examined along sections across the corridors which cut all of the major transportation facilities serving the corridors. The sections, or screen lines, were delineated on the basis of an analysis of the results of the initial traffic assignments. The distribution and characteristics of the traffic crossing the screen line on the major facilities within the corridor were then determined and compared with the distribution of the physical capacity of the various facilities serving each such corridor, the total transportation system capacity in the corridor evaluated against the loads, and the possible diversion of traffic between over- and underloaded facilities within the corridor analyzed.

Map I

EXISTING PLUS COMMITTED
MAJOR HIGHWAY SYSTEM
(1965)



The freeways and expressways depicted are those already existing and those now committed for construction by governmental agencies. If no additional capital were invested in freeways and expressways this would be the extent of the future system of such highways within the Region, such a course of action would minimize construction costs but maximize user costs.

Tripmakers within an urban region tend to regard the transportation facilities as a single system. Since highway service is virtually ubiquitous within the Region, if direct routes do not exist between two subareas of the Region, the trips between these areas will still be made but by less direct routes. Also, as the more desirable transportation facilities between two subareas of the Region become overloaded, additional trips between these areas will still be made, but on less direct routes utilizing facilities that have available capacity. Traffic loads, therefore, are continuously redistributed as existing facilities become overloaded and new facilities are constructed until a state of equilibrium is approximated in the system. If the volume of future trips between certain concentrations of trip origins and destinations within the Region is sufficiently large, the construction of a direct transportation facility linking such concentrations may be justified to assist in achieving the desired equilibrium in the system. The need for such direct facilities becomes particularly acute if the circuitous movement of heavy traffic volumes between portions of the Region results in the overloading of facilities required to serve other travel demands. To facilitate identification of the demand for such direct movement between subareas of the Region, the Region was divided into traffic analysis areas consisting of combinations of adjacent traffic analysis zones, as indicated on Map 2. In this way, the shorter local trips could be treated as intra-area trips; and only the longer inter-area trips displayed as the major inter-area travel desire lines. Thus, considerably fewer traffic movements could be studied to ascertain major future travel desires on spider networks connecting the planning subareas within the Region.[12]

Finally, a better understanding of the characteristics of trips utilizing overloaded links in the network was gained through selected link analyses. This involved the selection of a small number of heavily overloaded links in the existing plus committed network and identification of the origins and destinations of all trips passing through these links. Thus, it was possible to identify the specific interzonal trips which utilize heavily overloaded facilities and analyze the feasibility of rerouting these trips over other portions of the system. This technique provided a particularly powerful tool to identify circuitous travel paths and facilities requiring additional capacity to relieve overloads on more direct routings (see Map 3).

On the basis of the analyses of the assignment of future trips to the existing plus committed transportation facilities, utilizing the techniques described, the need for new facilities was identified and a transportation system plan synthesized for each alternative regional land use plan. The assignment of future trips was then made to the existing plus committed plus proposed system of highway and transit facilities and the analysis procedure repeated until a practical and workable transportation system design had been evolved. Thus, proposals advanced to overcome indicated deficiencies in the transportation system were tested and evaluated. The results of these tests and evaluations are discussed for each alternative land use-transportation plan combination in the following chapters of this report dealing with the description of the alternative plans.

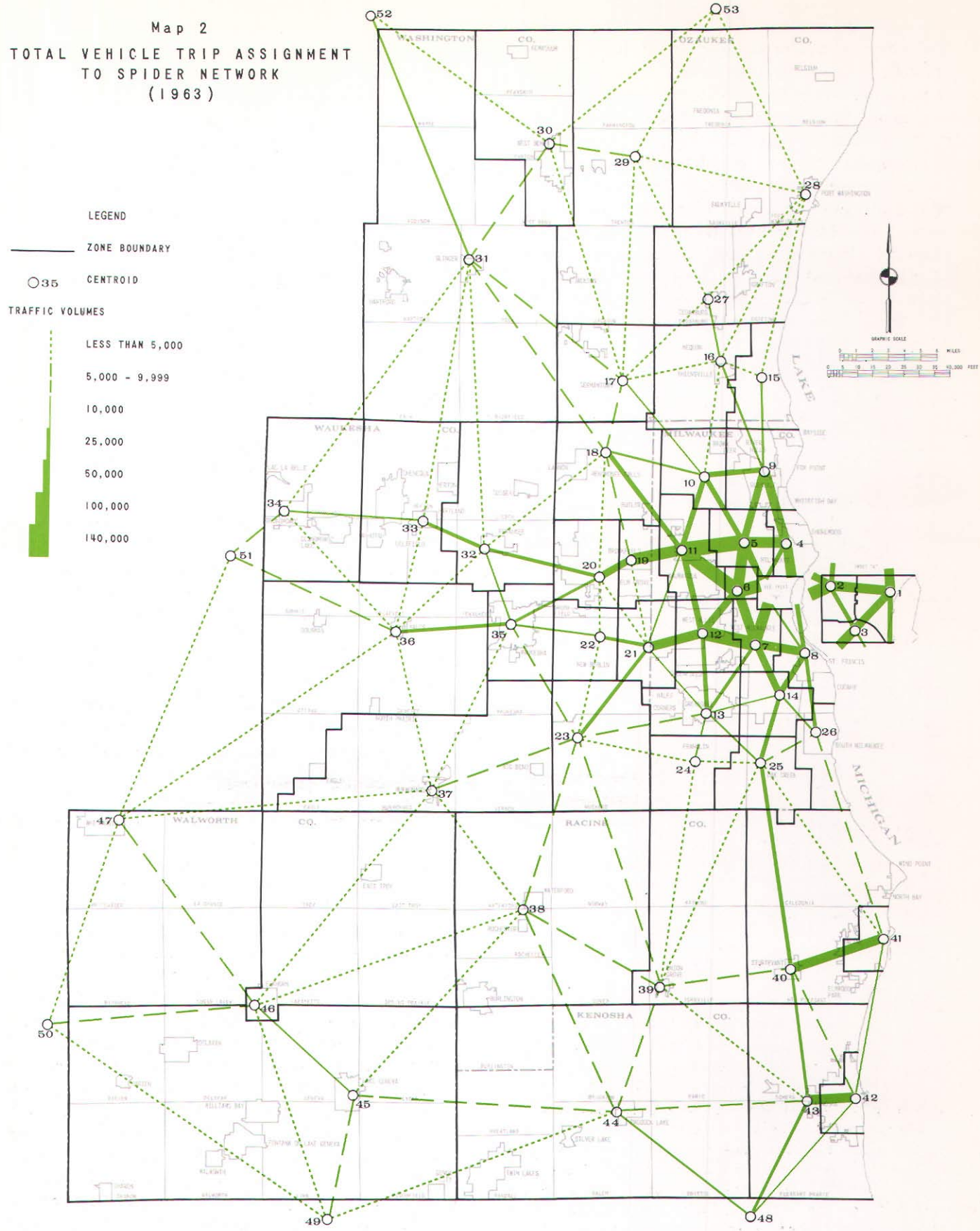
Sources of Design Solutions

It is important to note that, in the regional transportation plan synthesis, preliminary design solutions to be tested and evaluated were drawn from three sources. The first source consisted of four highway improvement proposals advanced through the Technical Coordinating and Advisory Committee on Regional Land Use-Transportation Planning by the State Highway Commission of Wisconsin, the seven county highway agencies concerned, and the local municipal planning and public works agencies within the Region. These improvement proposals originated with experienced professional engineers in the employ of the state, county, and local units of government who had a very intimate knowledge of, and long-standing experience with, highway traffic and transportation systems within the Region.

The second source for design solutions was developed directly from the traffic assignments and subsequent network analyses, wherein solutions to correct system deficiencies became apparent through the knowledge acquired of the existing and probable future traffic patterns within the Region and the manner in which these were being distributed on the existing plus committed network.

The third source for design solutions was developed indirectly from the land use planning process, wherein suggestions for service based upon land use development objectives were advanced.

[12] *Similar results can also be achieved by assignment of selected trip length categories to the existing plus committed transportation network.*

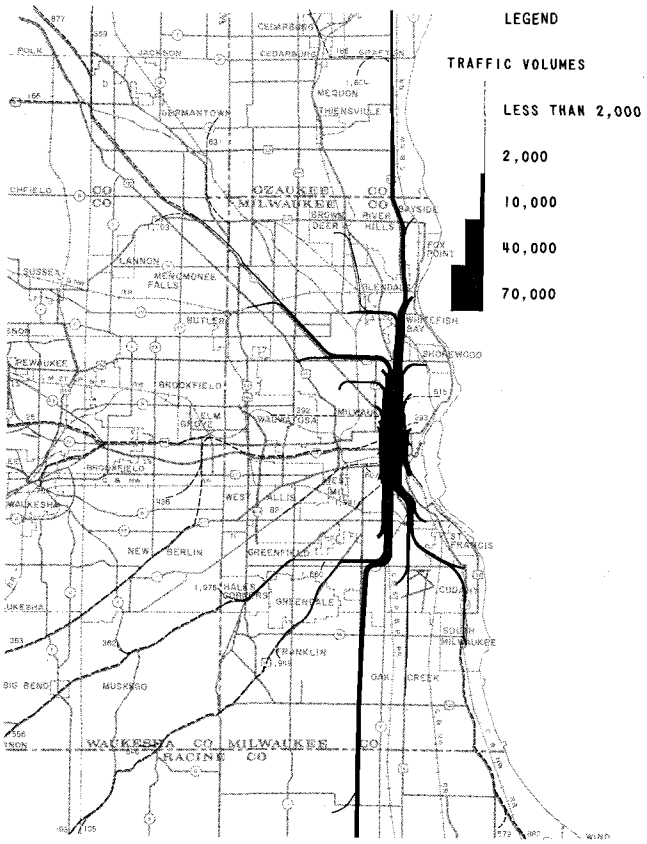


The pattern of 1963 vehicular travel on a hypothetical transportation network connecting traffic analysis areas in the Region is shown on this diagram. Major travel concentrations are primarily confined to Milwaukee County and to eastern Racine and Kenosha Counties.

Wherever the traffic assignments indicated that the existing plus committed network was inadequate to meet the future traffic demand, members of the Technical Coordinating and Advisory Committee were consulted for possible system improvements which might alleviate the deficiency. These improvements were then added to the network and the resulting system tested. Where design solutions drawn from the first source proved inadequate to properly alleviate system deficiencies or where no solution had been so proposed, resort was made to the second source of design solutions. The third source for design solutions were primarily advanced for the newly developing areas within the Region.

Map 3

SELECTED LINK ANALYSIS
Southbound Traffic Entering The
Central Interchange From The North



The flow of only that traffic which will pass over the southbound side of the North-South Freeway behind the Milwaukee County Courthouse is shown in this diagram from its districts of origin on the north side of the selected link to its districts of destination on the south side of the selected link. The diagram illustrates the fact that, within the Region, traffic on any high volume route section is moving between origins and destinations which are widely dispersed.

Transit System Plan Synthesis

Because existing transit facility capacity within the Region is not a meaningful factor in system utilization, no parallel analysis to the highway network deficiency analysis could be practically developed from which transit plan proposals could be synthesized. Moreover, transit service, unlike highway service, is not generally available throughout the entire Region; and, therefore, certain trips cannot be made solely by transit. Consequently, the potential demand for transit service in areas of the Region not presently served could not be readily assessed. This made the development of a transit system plan in some respects more difficult than the development of a highway system plan.

Three sources of design solutions to be used in the synthesis of future transit systems were utilized. The first consisted of a set of future transit service proposals that had been advanced by the transit companies operating within the Region and by local units of government. These consisted primarily of the extension of existing service into developing areas of the Region and the improvement of service through the institution of modified rapid transit service provided in the form of buses operating over the developing freeway network. The second source of such design proposals consisted of a set of future transit service proposals postulated on the basis of an analysis of the socio-economic and existing travel characteristics in the Region. These consisted primarily of the improvement of existing service and provision of new service in major corridors of transportation movement that the analyses indicated possessed a high transit traffic potential, especially those corridors which possessed inadequate highway capacity but served areas of the Region with high- and medium-density residential development and low automobile availability. A third source of such design proposals grew directly out of the network analyses in the form of future provision of rapid transit service in corridors of especially heavy travel demand. In every case, the transit system improvements proposed were tested to determine whether the potential passenger traffic demand would justify incorporation into the final alternative transportation systems.

EVALUATION OF TRANSPORTATION NETWORKS

Since the entire transportation plan synthesis was directed toward the attainment of the regional land use and transportation system development objectives set forth in Chapter II, it was essential to evaluate the resultant transportation system plans in light of their ability to meet these objectives. This was done through application of the supporting standards formulated for each development objective. The application of the traffic simulation models provided certain outputs which could be readily used to quantitatively evaluate the system being tested against the development standards. These outputs included:

1. Total Vehicle Miles and Hours of Travel: The traffic simulation model output provides an estimate of the total number of vehicle miles and hours of travel within the Region as a whole by each of three functional facility types: freeways and expressways, standard arterial streets and highways, and ramps, and for each of the two subareas of the Region. The resultant total vehicle miles of travel values directly provide a basis for the application of certain regional transportation development objectives and standards, namely:

Objective	Standard
3	1
3	3
4	2
5	1
5	2

2. Accessibility Indices: The denominator of the gravity model used for trip distribution provides a measure of accessibility for each traffic analysis zone within the Region and thereby provides a basis for the application of certain regional transportation development objectives and standards, namely:

Objective	Standard
1	1

3. Overall speeds: The traffic simulation model output also provides an estimate of average overall speeds for the highway networks as a whole and for each of three functional facility types: freeways and expressways, arterial streets and highways, and ramps. These are also provided for the networks by functional facility types in each of the two subareas of the Region. The resultant overall speeds directly provide a basis for the application of certain regional transportation development objectives and standards, namely:

Objective	Standard
3	2
5	1

4. Accidents: The traffic simulation model output also permits ready computation of accident type, frequency, and cost through application to the vehicle miles of travel of estimated accident rates calculated from regional data collected by the State Highway Commission of Wisconsin and the SEWRPC. The accident estimates can be computed by functional type of facility and subarea of the Region. The resulting accident data can be used in the application of certain regional transportation system development objectives and standards, namely:

Objective	Standard
4	2
5	1

5. User Costs: The traffic simulation model outputs can also be readily converted to user cost data by the application of unit operating, accident, and time cost figures to the total travel and overall speed data for both highway and transit facilities. The resultant cost data can be used in the application of:

Objective	Standard
5	1

It is important to note that the foregoing outputs can be used to compute for any given transportation plan proposal the change in total vehicle miles and hours of travel accessibility indices, overall speeds, accidents, user costs, and volume to capacity ratios from the base year to future conditions.

OVERRIDING CRITERIA

As was noted in Chapter II, several overriding considerations must be recognized in the application of the regional development objectives and standards. First, it must be recognized that each proposed transportation facility plan must constitute an integrated and continuous system. This requires the application of the traffic simulation models to test quantitatively the proposed system

as previously described, thereby permitting adjustment of the spatial distribution and capacities of the system to the existing and future traffic loadings derived from the land use plan. Second, it must be recognized that the concepts of economic analysis and economic selection are vital to the public planning process. Sound economic analysis of benefits and costs should be an important guide in the selection of the most suitable plan.

In addition to the consideration involved in deciding that a potential benefit is worth its cost, consideration must also be given to possible alternative benefits that could be received for alternative expenditures within the limits of available resources. When consideration is made of investment for future benefits, one alternative that should always be considered is the benefit which could be received from investment in the money market. This benefit is expressed in the prevailing interest rate.

Personal and private decisions, while implying at least subjective consideration of benefits and costs, broadly defined, are not necessarily based upon either formal or objective evaluation of monetary benefits and costs. Public officials, however, have a responsibility to evaluate objectively and explicitly the monetary benefits and costs of alternative investments to assure that the public will receive the greatest possible benefits from limited monetary resources. It is, then, a functional principle that every public expenditure should return to the public a value at least equal to the amount expended plus the interest income foregone from the ever-present alternative of private investment.

Therefore, economic analysis is a fundamental requirement of responsible public planning; and all plans should promise a return to the public at least equal to the expenditure plus interest. Since implementation of the transportation plan should return benefits to the public equal to, or greater than that which could be obtained through private investment, an interest rate of 6 percent compounded annually was used in the economic evaluation of the plans.

Benefit-Cost Analysis

The benefit-cost analysis method of evaluating government investments in public works came into general use after the adoption of the Federal Flood Control Act of 1936. The act stated that waterways should be improved "if the benefits to whomsoever they may accrue are in excess of the estimated costs." Monetary value of benefits has since been defined as the amount of money which an individual would pay for that benefit if he were given the market choice of purchase. Monetary costs are taken as the total value of resources used in the construction of the project.

Benefits must exceed costs in order for a project to be justified, but this criterion alone is not sufficient to justify the investment. Although a project may have a benefit-cost ratio greater than one, it may be less than the benefit-cost ratio of an alternative project which would accomplish the same objectives. In order to assure that public funds are invested most profitably, alternative plans or projects should, therefore, be investigated and analyzed.

Benefit-cost analyses must be based on a specified number of years, usually equal to the physical or economic life of the project. In transportation planning it is generally advisable to amortize the capital costs over the same number of years for which the traffic forecasts have been made, since the risk involved in the use of capital increases as the amortization exceeds the traffic forecast period. Consequently, 25 years is often selected for the period of economic analyses in transportation planning. Although this period is shorter than that used to evaluate many other types of public works improvements, it results in less risk based upon traffic predictions; elimination of the need to include in the analyses pavement and structure reconstruction costs after the original pavements and structures have reached the end of their physical life; elimination of the need to account for the possible competition of futuristic means of transportation; and recognizes the inability to anticipate other social, economic, and technological changes which may occur in the more distant future and which may influence project benefits and costs.

In considering a single highway facility improvement project, the selection of a period of economic analysis can be relatively simple and direct. In considering an entire highway transportation system, however, which entails the staged construction of varying components of the system in a series of public works projects over a long period of time, there is no single period of physical and economic life which can be readily assigned to the total system. Consequently, the period of economic analysis selected must be long enough to permit a reasonable amortization of the costs incurred in, and reasonable accrual of the benefits

derived from, construction and operation of the total system. This period is estimated to be 40 to 50 years, considerably longer than the 20- to 25-year analysis period for single facilities. During the longer period, all of the staged facilities comprising the total recommended system will have reached the end of their physical life and will presumably require replacement. Moreover, the total system will not accommodate the forecast traffic demands in an optimal manner until shortly after the completion of the last facilities staged for construction under the recommended plan implementation program, and, therefore, will not return maximum benefits until beyond the end of the planning period. Since the travel demand is unknown beyond the plan design period, however, it is necessary to assume that benefits would accrue at the 1990 level to the year 1995 and diminish gradually over a 20-year period thereafter as facilities constructed become obsolete and as traffic congestion again increases. Salvage values can thus be assumed to be zero for all proposed facilities comprising the proposed system.

Benefits and Costs

The benefits and costs from a project can be classified as direct (primary), measurable in monetary terms, and as intangible (secondary). Intangible benefits and costs either are of such a nature that no monetary value can be assigned to them or are so obscure that calculation of the monetary value is impractical. In the regional transportation planning studies, direct costs were considered to include right-of-way acquisition, construction, and maintenance costs; direct benefits were considered to include reductions in operating, accident, and time costs. Intangible costs include disruption of community patterns, businesses, and industries; division of neighborhood and community service areas; and deterioration or destruction of the natural resource base and of scenic, historic, or cultural features. Intangible benefits include increased land values, increased economic activity, and increased efficiencies in community services.

Project Costs

The direct costs of the transportation plans were estimated as the sum of the construction costs of physical elements of the plan, the cost of acquiring land, and the costs of maintenance. Costs of constructing and maintaining structural facilities were calculated using unit prices which reflect the magnitude of work, the location in the Region, and regional labor costs. The cost of land acquisition was based on present market prices for urban improved, urban unimproved, and agricultural land within the Region.

Relationship of Economic and Financial Analysis

It is important to note the distinction between economic feasibility and financial feasibility. An analysis of financial feasibility involves an examination of the liquidating characteristics of the project from the point of view of the particular government agency undertaking the project. The relevant matters are the monetary disbursements and monetary receipts of the project. The financial analysis determines whether or not the prospective available funds are adequate to cover all of the costs.

On the other hand, the economic analysis determines if the project benefits regardless of to whom they accrue exceed the project costs regardless of by whom they are incurred. Since one of the objectives of government is to promote the general welfare, it is necessary to consider the effect of a proposed project on the entire community involved and not just on the income and expenditures of a particular agency. The results of the economic evaluation of the benefits and costs may, therefore, differ considerably from an evaluation of the income and expenditure patterns of a particular governmental agency.

SUMMARY

In the preceding chapter, derivation of the land use-travel demand relationships and systems engineering techniques used to design, test, and evaluate the alternative transportation plans have been described. These relationships and techniques are important, not only because they provide the technical basis for the design of a future regional transportation system which is fitted to the traffic loads that it must carry, but also because they provide the practical link between land use and transportation system planning. Utilizing these methods and techniques, the integrated transportation systems necessary to serve each of the three alternative land use plans postulated for the Region have been prepared, tested, and evaluated. The results are described in the following chapters of this report.

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Chapter V

REGIONAL DEVELOPMENT ALTERNATIVES

INTRODUCTION

It has already been pointed out in this report that further population growth and urbanization in southeastern Wisconsin appear inevitable and that the question facing public officials and citizen leaders within the Region is not whether such growth and urbanization will occur but how it might best be shaped and guided in the public interest. An urbanizing region, such as southeastern Wisconsin, can develop in a number of ways; and any one of a number of ultimate regional development patterns can conceivably meet agreed-upon regional development objectives to some degree. Each such alternative development pattern, however, represents a particular response both to the manner in which growth has occurred to date and to established regional development objectives. One of the most critical tasks in planning for the orderly development of an urbanizing region, therefore, consists of selecting from among the alternatives available the ultimate development pattern which offers the greatest potential for attaining the agreed-upon development objectives.

Volume 1 of this report presented in summary form pertinent data on the demographic, economic, and public financial resource base; the natural resource and public utility base; the historic and existing land use patterns; and the transportation facilities and travel characteristics of the Region, all as a necessary basis for the preparation of alternative plans for the physical development of the Region. In addition, the preceding chapters of this volume have presented forecasts of future population and economic activity levels, land use requirements, and automobile and truck availability within the Region, along with regional development objectives, principles, and standards as additional bases for the preparation of such plans. This chapter presents a series of three alternative regional land use plans, each with its supporting transportation system plan, prepared upon the foundation of factual planning and engineering data collected and analyzed in the regional land use-transportation study, together with the results of quantitative tests of the transportation system plans.

The three alternative regional development plans are: a Controlled Existing Trend, a Corridor, and a Satellite City Plan. Each represents an attempt to meet the regional development objectives, principles, and standards with a basically different design. While many variations of the three basic regional development patterns presented in the alternative plans are possible, the three patterns selected represent the basic choices with respect to future development patterns practically available to the Region.

The Controlled Existing Trend Plan represents a conscious continuation of historic development trends, with urban development occurring in concentric rings along the full periphery of, and outward from, the existing major urban centers within the Region. Within each major urban area of the Region, the resulting development pattern is continuous, both radially and circumferentially, and is linked to the urban land market and to the commercial and industrial activities of the larger central cities.

The Corridor Plan represents a conscious concentration of new urban development along radial corridors centered on major transportation routes emanating from the existing major urban centers within the Region. Urban growth would thus still occur outward from the major urban centers, but higher densities of development would be emphasized. Within each major urban area of the Region, the resulting development pattern would be continuous radially but discontinuous circumferentially, with wedges of open space alternating with radial corridors of urban development. Development would be linked to the commercial and industrial activities of the larger central cities even more strongly than under the Controlled Existing Trend Plan.

Finally, the Satellite City Plan represents a conscious concentration of new development in outlying communities of the Region, relatively independent of the commercial and industrial activities of the larger central cities and separated from the larger existing urban centers by large areas of open space. The resulting urban development pattern

would be discontinuous radially but continuous circumferentially.

A fourth alternative is that of continued existing trend development in the absence of any attempt to guide this development on an areawide basis in the public interest. This alternative, to be presented in Volume 3 of this report, is not a plan, but a forecast of unplanned development, and is intended to serve not as a recommendation but as a basis of comparison for the evaluation of benefits of the regional land use plan finally selected as best for the attainment of regional development objectives. This comparison will be presented in Volume 3 of this report.

LAND USE PLAN DESIGN METHODOLOGY

The methodology applied in the preparation of regional transportation plans has been described in the preceding chapter of this report. Two methodologies were applied simultaneously in the preparation of the alternative regional land use plans. The first was a design-oriented mapping activity concerned primarily with the spatial distribution of the various land uses within the Region, relating these to existing development and to the natural resource base through application of physical planning and engineering principles. While the planning techniques applied in this procedure were traditional and well established, a great deal more information about the physical features of the Region, important to plan design, was available than has normally been the case in such land use planning activities.

This information, summarized in Volume 1 of this report, included definitive data on the following natural features of the Region: topography and drainage patterns; soils; surface water; and recreational resource areas, including wildlife habitat, woodlands, wetlands, historic sites, and existing and potential park and related open-space sites. Particularly important with respect to the relationship of these natural features to regional development is the concept of the environmental corridor as an elongated area which encompasses the most important and highest quality elements of the regional natural resource base, including the best remaining surface water, forests, and wetlands; wildlife habitat; and historic, scenic, scientific, and cultural sites. It was pointed out in Volume 1 of this report that failure to protect these environmental corridors from improper development must ultimately result in the loss of the remaining prime potential park and related open-space sites, deterioration or destruction of the best remaining wildlife habitat, further encroachment of urban development on the natural floodways and flood plains of perennial streams and watercourses, loss of water impoundment areas and reduction of ground water recharge, loss of the largest and best remaining forests, and continued deterioration of surface water quality within the Region.

In addition to the physiographic data, the information base for the physical planning techniques also included definitive data on existing development within the Region, including: data on the existing distribution of population and economic activity, existing land use, existing highway and transit facilities, and existing public utility facilities; and on proposals for future development within the Region, including: local community plans and zoning ordinances and proposed utility service areas.

Graphical analysis of the data assembled in the planning inventories on physiographic and cultural features influencing regional development permitted the delineation and quantification of "developable" land areas within the Region; that is, areas which, while presently not developed for urban use, were suitable and could be assumed available for such use. The developable land area was determined for each U. S. Public Land Survey quarter section within the Region by subtracting from the quarter section total the area within the quarter section included in primary environmental corridors, the area covered by unsuitable soils, and the area covered by existing urban development. It should be noted that the detailed operational soil surveys,[1] conducted as a part of the regional land use-transportation study, identified and delineated areas of nearly level (0.0 to 1.9 percent), gently rolling (2.0 to 5.9 percent), rolling (6.0 to 11.9 percent), moderately steep (12.0 to 19.9 percent), and steep (20.0 and greater percent) slopes, as well as those areas of the Region covered by soils unsuited for any type of urban use, soils unsuited for urban use with septic tank sewage disposal systems, and the best agricultural soils. When combined with overlays of existing, proposed, and possible public sanitary sewer service areas, the soils data provided a particularly important input to the plan design process. The perennial stream network and watershed pattern within the Region were also important influences

[1] See *SEWRPC Planning Report No. 8, The Soils of Southeastern Wisconsin.*

in this regard. Some watershed boundaries clearly delineated portions of the Region which cannot be readily sewered, thus reinforcing the desirability of maintaining such areas in open use. Conversely, some watershed boundaries clearly delineated portions of the Region well located for extension of gravity flow sanitary sewer service and subsequent urbanization.

Future land uses were then distributed proportionately to the resulting developable land areas by the following five major use categories: high, medium, and low-density residential; neighborhood and community commercial, other than that allocated to major multi-purpose commercial centers; and industrial, other than that allocated to major industrial centers. New residential development was assumed to occur in planned units containing supporting local park, institutional, governmental, transportation (streets and highways), and commercial land uses. Sites for major multi-purpose commercial centers;[2] major industrial centers;[3] major state, regional, and county parks;[4] and major public airports were located individually.

The physiographic features of the Region, together with existing development features, were thus used to prescribe the nature and relative intensities of future regional development. The primary environmental corridors, together with the major watershed divides, were used to separate land intended for future large-scale urban development from open or rural land and comprised the basic framework for a continuous system of permanent park and open-space area within the Region. No urban development was allocated to these corridors in any of the alternative plans. In addition, certain woodlands and wetlands outside these corridors were also kept free from development, as were areas subject to periodic inundation. The existing patterns of urban development within the Region, together with local proposals for future development in the form of existing plans and zoning ordinances and utility service areas, were used to assist in the delineation of those areas of the Region in which future urban development might reasonably become an extension of present development and of the degree of departure from established patterns of use and intensity which might reasonably be achieved in areas of new development. The pattern of existing and committed transportation facilities was generally used to delineate radial corridors within which major urban development might be encouraged. Finally, the major intersections on the existing and committed transportation systems were used to establish points at which more intensive concentrations of urban development might occur.

Combined with this traditional physical land use planning process was a socio-economic oriented land use demand projection and allocation process, employing both traditional and simulation model techniques, wherein the regional population and economic activity level forecasts were converted to land use demand and distributed geographically to major subareas of the Region through historic trend analyses and simulation model techniques.[5] The actual alternative regional land use plans were prepared by successive iterations of these dual processes until an approximate balance was achieved between the demand forecasts and the graphic distribution of future land uses.

CONTROLLED EXISTING TREND PLAN DESCRIPTION—LAND USE

Introduction

The first alternative regional land use plan to be considered is one which examines the ramifications of a continuation of present development trends within the Region. This plan places heavy emphasis on the continued effect of the urban land market in determining the location, intensity, and character of future development. It does, however, propose to regulate, in the public interest, the effect of the market on development in order to provide for a more orderly and economic regional

[2] *Major multi-purpose commercial centers were defined as large-scale clusters of community serving commercial activities, including compatible retailing and office uses, generally located in planned integrated centers designed to modern standards.*

[3] *Major industrial centers were defined as large planned industrial districts of approximately 640 acres in area having access to high-speed all-weather highways and to railroads, serviced by adequate utilities and storm water drainage facilities, and located on soils well suited to industrial development.*

[4] *For regional planning purposes, two types of public park and recreation areas were considered—regional and local. Regional park and recreation areas include both state and county parks. Local park and recreational areas include both neighborhood and community parks. Land for neighborhood parks was allocated in the planning process as part of the spatial distribution of residential land uses. Land for community parks was not specifically allocated in the planning process, but rather it was assumed that the need for community parks would be satisfied by acquiring site areas within the environmental corridors as community development takes place.*

[5] *See SEWRPC Technical Report No. 3, A Mathematical Approach to Urban Design, and SEWRPC Technical Report No. 5, The Regional Economic Simulation Model.*

development pattern and to avoid intensification of areawide development and environmental problems within the Region, thereby channeling freely operating market forces in accordance with the established regional development objectives.

Under this plan the historic growth trends would be altered by restricting intensive urban development to those areas of the Region having both soils suitable for such development and gravity drainage sanitary sewer service readily available. The most basic regional development objectives would be achieved by protecting from urban development the floodways and flood plains of the perennial streams, by protecting from development the best remaining woodlands and wetlands, and by developing an integrated system of park and open-space areas centered on the primary environmental corridors. Under this plan the allocation of future land use within each county of the Region is such as to approximate the forecast population levels and, to the extent possible, the proposals contained in existing community development plans and zoning documents. An understanding of the regional growth pattern proposed by this alternative can be obtained from review of the graphical presentation of the plan shown on Map 4 and of the statistical presentations set forth in Tables 24 through 35.

Table 24

EXISTING AND PROPOSED RESIDENTIAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

County	Residential Land Use											
	High-Density			Medium-Density			Low-Density			Total		
	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres
Kenosha. .	2,511	135	2,646	2,673	6,038	8,711	6,729	1,014	7,743	11,913	7,187	19,100
Milwaukee.	21,080	2,512	23,592	8,697	18,583	27,280	12,207	2,797	15,004	41,984	23,892	65,876
Ozaukee. .	471	--	471	1,324	3,326	4,650	7,542	3,049	10,591	9,337	6,375	15,712
Racine . .	4,069	200	4,269	2,752	6,953	9,705	6,550	3,637	10,187	13,371	10,790	24,161
Walworth .	1,701	--	1,701	2,871	2,173	5,044	7,284	--	7,284	11,856	2,173	14,029
Washington	1,752	39	1,791	1,673	3,602	5,275	4,004	325	4,329	7,429	3,966	11,395
Waukesha .	2,879	14	2,893	4,758	16,776	21,534	25,831	4,236	30,067	33,468	21,026	54,494
Regional Total	34,463	2,900	37,363	24,748	57,451	82,199	70,147	15,058	85,205	129,358	75,409	204,767

Source: SEWRPC.

Table 25

RESIDENTIAL DENSITY CLASSIFICATIONS USED IN REGIONAL PLAN PREPARATION

Residential Density Classification	Net Lot Area per Dwelling Unit	No. of Dwelling Units per Net[a] Residential Acre	No. of Persons per Net Residential Acre	No. of Dwelling Units per Gross Acre	No. of Persons per Gross[b] Square Mile
Low.	19,820 - 209,090 sq.ft.[c]	0.2 - 2.2	0.5 - 7.2	0.2 - 1.7	350 - 3,499
Medium	6,333 - 19,819 sq.ft.	2.3 - 6.9	7.3 - 22.8	1.8 - 4.7	3,500 - 9,999
High	2,430 - 6,332 sq.ft.[d]	7.0 - 17.9	22.9 - 59.2	4.8 - 11.8	10,000 - 25,000

[a] *A net residential acre includes only land actually devoted to residential use; that is, land within the "site" boundaries including the building ground area coverage together with the necessary "on-site" yards and open spaces.*

[b] *A gross residential square mile includes the net area devoted to residential use plus the supporting land uses, such as streets, parks, schools, churches, and neighborhood shopping centers.*

[c] *Residential development on lots having net areas larger than five acres is not considered to be urban.*

[d] *A population density of 25,000 persons per gross square mile was considered to be the maximum desirable population density level within the Region.*

Source: SEWRPC.

Residential Development

The Controlled Existing Trend Plan would accommodate the expected regional population increase of one million persons by 1990 primarily through an outward expansion of existing urban areas. The future intensity and distribution of residential development would be established largely through the operation of the urban land market, modified in the public interest by adaptation to certain physiographic and cultural features of the Region, particularly primary environmental corridors and possible gravity drainage sanitary sewer service areas. The plan would tend to discourage leapfrog residential development in outlying areas of the Region, both through enforcement of rural development densities in these outlying areas and through encouragement of higher density development in those areas of the Region which can be most readily served by sanitary sewer.

Under this plan over 74 percent of all new urban residential development within the Region would be located within 20 miles of the central business district of Milwaukee. Future residential development within the Region would occur primarily at medium densities, and new urban residential development would consist primarily of single-family housing located in planned residential development units, interspersed with town houses and garden apartments.

As indicated in Table 24, more than 75,000 acres of new residential development would be added to the existing stock of residential land within the Region. More than half of this increment would be developed in Milwaukee and Waukesha counties. Over three-fourths, or more than 57,000 acres, of the additional residential acreage would be developed at medium densities, with net lot sizes ranging from about 6,300 to 19,800 square feet per dwelling unit (see Table 25); and about one-fifth, or 15,000 acres, would be developed at low densities, with net lot sizes ranging from 19,800 to 209,000 square feet per dwelling unit. Most of the 2,900 additional acres of new high-density residential development, with net lot sizes ranging from 2,400 to 6,300 square feet per dwelling unit, would occur in Milwaukee County, which would exhibit an increase of more than 2,500 acres in this density range.

Population Distribution

Under the Controlled Existing Trend Plan, future population levels within each county of the Region would vary only slightly from the forecast levels set forth in Chapter III of this report, as indicated in Table 26. Kenosha, Ozaukee, Walworth, and Washington counties would each show a slightly greater population increase under this plan alternate than indicated by the demographic forecast, while Milwaukee, Racine, and Waukesha counties would show a slightly lesser increase. It is important to note that these slight variations are the result of an assumed conscious effort to direct new residential land use development into those areas of the Region which can be readily serviced by public sanitary sewer while, at the same time, restricting such growth in areas either unsuited to urban development or in which increased urban development would tend to destroy, deplete, or deteriorate some high-value elements of the natural resource base.

Table 26

EXISTING AND PROPOSED POPULATION DISTRIBUTION IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

(Population in Thousands)

County	1963 Population	Forecast Increment 1963 - 1990		Planned Increment 1963 - 1990		1990 Population	
		Number	Percent Change	Number	Percent Change	Forecast	Planned
Kenosha	106.7	95.3	89.3	99.5	93.2	202.0	206.2
Milwaukee	1,086.3	359.7	33.1	354.5	32.6	1,446.0	1,440.8
Ozaukee	41.6	64.4	154.8	65.5	157.4	106.0	107.1
Racine	150.6	132.4	87.9	122.6	81.4	283.0	273.2
Walworth	55.5	31.5	56.7	35.5	63.9	87.0	91.0
Washington	49.5	46.5	93.9	54.9	110.9	96.0	104.4
Waukesha	184.2	273.8	148.6	271.1	147.1	458.0	455.3
Regional Total	1,674.4	1,003.6	59.9	1,003.6	59.9	2,678.0	2,678.0

Source: SEWRPC.

Table 27

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

County	Total Area in Square Miles	Existing (1963)									Proposed (1990)[a]				
		Developed Area in Square Miles	Public Sewer Service				Public Water Supply				Developed Area in Square Miles	Public Sewer Service and Public Water Supply[b]			
			Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served	Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served		Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served
Kenosha . . .	278.3	27.6	14.0	50.7	79,160	74.2	13.6	49.2	78,670	73.7	46.8	43.0	91.9	197,350	95.7
Milwaukee . .	242.2	152.5	142.3	93.3	1,075,000	98.9	129.1	84.6	1,029,800	94.7	232.9	232.9	100.0	1,446,000	100.0
Ozaukee . . .	234.5	15.9	6.2	38.9	20,340	48.8	5.5	34.5	19,512	46.8	35.1	34.4	98.0	93,870	87.6
Racine. . . .	339.9	37.8	19.1	50.5	112,600	74.7	18.3	48.4	120,590	80.0	70.7	66.2	93.6	244,000	89.3
Walworth. . .	578.1	24.0	8.6	35.8	28,925	52.1	11.5	47.9	31,270	56.3	30.9	19.2	62.1	64,000	70.3
Washington. .	435.5	11.8	6.1	51.7	23,050	46.5	5.8	49.1	23,150	46.7	23.9	20.0	83.7	82,950	79.4
Waukesha. . .	580.6	70.1	20.7	29.5	79,950	43.3	16.2	23.1	69,490	37.6	149.7	133.0	88.8	418,500	91.9
Regional Total	2,689.1	339.7	217.0	63.9	1,419,025	84.7	200.0	58.8	1,372,482	81.9	590.0	548.7	93.0	2,546,670	95.0

[a] *All sanitary sewer facilities required to serve the 1963 to 1990 urban development are tributary to existing systems, except for those tributary to the system locally proposed to serve the City of Delafield in Waukesha County.*

[b] *It was assumed that public water supply facilities would be extended within all public sanitary sewer service areas.*

Source: SEWRPC.

Sewer and Water Service

Under the Controlled Existing Trend Plan, all of the proposed new urban development within the Region would be served by public sanitary sewer facilities tributary to existing and locally proposed systems and by public water supply facilities. As indicated in Table 27, about 549 square miles, or 93 percent, of the total developed area of the Region and about 2,547,000 persons, or 95 percent of the population of the Region, would be served by public sanitary sewer and water supply facilities by 1990. In 1963 about 217 square miles, or 64 percent of the developed area of the Region, and about 1,419,000 persons, or 85 percent of the population of the Region, were served by public sanitary sewer facilities. About 200 square miles, or 59 percent of the developed area of the Region, and 1,372,500 persons, or 82 percent of the population of the Region, were served by public water supply facilities. It should be noted that by 1990 all of the developed area of, and all of the population within, Milwaukee County and 98 percent of the developed area of, and 88 percent of the population within, Ozaukee County would be served by public sewer and water facilities.

Commercial and Industrial Development

As indicated in Chapter III, employment within the Region is forecast to increase by about 349,000 jobs between 1963 and 1990; and more than 65 percent of this increase is anticipated to occur in the commercial and industrial employment groups. Many of these new employment opportunities will be located in existing employment centers within the Region, while others will be located in new employment centers presently not in existence. Six new major industrial centers and ten new major multi-purpose commercial centers are proposed under the Controlled Existing Trend Plan. These new centers would employ a total of 35,000 and 15,000 persons, respectively, or a total of about 22 percent of the anticipated growth in the commercial and industrial employment groups. The other 78 percent, or approximately 182,000 new employment opportunities, would be located in existing employment centers or in smaller unplanned employment centers included in the various local development areas. The six new planned major industrial centers are proposed to be located in the cities of Burlington, Kenosha, Milwaukee, New Berlin, Oak Creek, and Racine; and all are provided for in local plans. The ten new planned major multi-purpose commercial centers are proposed to be located in the cities of Brookfield, Franklin, Kenosha, Milwaukee, New Berlin, Oak Creek, Racine, and West Allis and the villages of Germantown and Menomonee Falls. Six of these ten new commercial centers have been provided for in local plans.

Table 28 indicates the commercial and industrial land use changes proposed under the Controlled Existing Trend Plan. More than 5,100 acres of commercial development and 5,000 acres of industrial development would be added to the existing stock of these land use categories. Milwaukee County would account for the largest acreage increase in both categories. In the commercial land use category, the greatest percentage increase would occur in Waukesha County, where a gain of more than 121 percent, or 1,300 acres, is proposed. Racine County would account for the greatest percentage increase in the industrial land use category, where a gain of 1,000 acres, or just over 118 percent, is proposed.

Table 28

EXISTING AND PROPOSED COMMERCIAL AND INDUSTRIAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

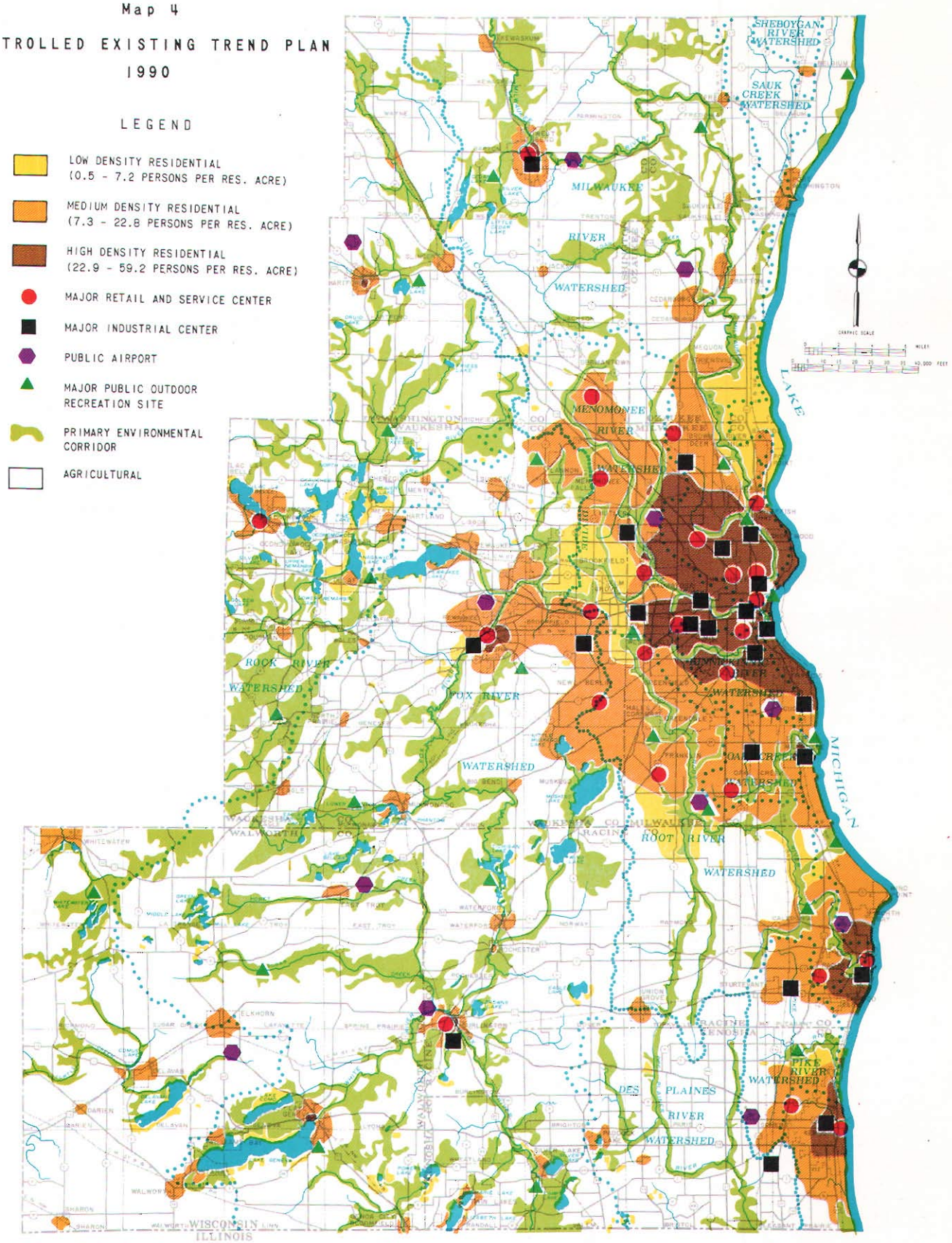
County	Commercial Land Use				Industrial Land Use			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	532	509	1,041	95.6	809	795	1,604	98.2
Milwaukee	3,035	1,913	4,948	63.0	5,234	1,820	7,054	34.7
Ozaukee	361	299	660	82.8	370	177	547	47.8
Racine	753	604	1,357	80.2	885	1,049	1,934	118.5
Walworth	615	140	755	22.7	862	88	950	10.2
Washington	287	303	590	105.5	455	143	598	31.4
Waukesha	1,123	1,364	2,487	121.4	1,131	992	2,123	87.7
Regional Total	6,706	5,132	11,838	76.5	9,746	5,064	14,810	51.9

Source: SEWRPC.

Map 4

CONTROLLED EXISTING TREND PLAN

1990



The Controlled Existing Trend Plan represents an effort to concentrate new urban development within the Region in close proximity to existing, highly developed community facilities or their logical extensions and to protect the remaining high quality land and water resources of the Region from further deterioration and destruction by the preservation of primary environmental corridors. Within each major urban area of the Region, the resulting development pattern would be limited to the urban land market and the commercial and industrial activities of the larger central cities.

Employment Distribution

Table 29 indicates the estimated total number of jobs existing in each county within the Region in 1963 and the incremental growth to 1990 that would occur under the Controlled Existing Trend Plan. The largest increase in total jobs would occur in Milwaukee County, where a gain of 157,000, or 33 percent, is indicated. The second largest increase would occur in Waukesha County, where a gain of nearly 68,000 jobs, or more than 200 percent, is indicated. Except for Milwaukee County, each county would increase its proportionate share of total regional employment by 1990. Milwaukee County, which contained more than 74 percent of the total regional employment in 1963, would show a decrease to about 64 percent of total regional employment by 1990.

Governmental[6] and Transportation[7] Land Use

As indicated in Table 30, the Controlled Existing Trend Plan would add more than 6,000 acres of governmental land uses and nearly 29,000 acres of transportation land uses to the existing stock in these categories, a 42 percent and 30 percent increase, respectively. The new governmental and transportation uses include among others: the new United States Post Office and Milwaukee Union Depot complex; two new university extension centers; and a new four-year state university campus, as well as new high schools, churches, and hospitals. Milwaukee County would gain more than 2,100 acres of governmental land and nearly

[6] *Includes institutional uses and on-site parking.*

[7] *Includes communications and utilities uses.*

Table 29

EXISTING AND PROPOSED EMPLOYMENT IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

County	1963 Employment		Planned Employment Increment 1963 - 1990		1990 Planned Employment Distribution	
	Number	Percent of Region	Number	Percent Change	Number	Percent of Region
Kenosha	41,900	6.6	38,800	92.6	80,700	8.2
Milwaukee	471,700	74.3	157,100	33.3	628,800	63.9
Ozaukee	10,800	1.7	15,700	145.3	26,500	2.7
Racine	52,100	8.2	45,400	87.1	97,500	9.9
Walworth	12,700	2.0	10,100	79.5	22,800	2.3
Washington	12,100	1.9	14,300	118.1	26,400	2.7
Waukesha	33,600	5.3	67,700	201.4	101,300	10.3
Regional Total	634,900	100.0	349,100	54.9	984,000	100.0

Source: Wisconsin Industrial Commission; SEWRPC.

Table 30

EXISTING AND PROPOSED GOVERNMENTAL[a] AND TRANSPORTATION[b] LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

County	Governmental Land Use				Transportation Land Use			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	1,059	616	1,675	58.1	8,492	2,793	11,285	32.8
Milwaukee	6,995	2,147	9,142	30.6	30,442	9,676	40,118	31.7
Ozaukee	796	443	1,239	55.6	7,010	2,077	9,087	29.6
Racine	1,499	818	2,317	54.5	11,163	3,766	14,929	33.7
Walworth	1,090	193	1,283	17.7	10,552	1,150	11,702	10.8
Washington	762	328	1,090	43.0	10,344	1,501	11,845	14.5
Waukesha	2,521	1,713	4,234	67.9	18,114	7,878	25,992	43.4
Regional Total	14,722	6,258	20,980	42.5	96,117	28,841	124,958	30.0

[a] *Includes institutional uses and on-site parking.*

[b] *Includes communications and utilities uses.*

Source: SEWRPC.

9,700 acres of transportation land uses, increases greater than those shown for any other county. In terms of percentage increase, Waukesha County would rank first in both land use categories, with a 68 percent increase in governmental land use and a 43 percent increase in transportation land use.

Open Space—Recreational Land Use

Under the Controlled Existing Trend Plan, more than 7,900 acres of land would be added to the existing stock of recreational land use. This represents an increase of about 24 percent over the 1963 acreage. It should be noted, however, that this additional recreation land represents only the recommended increase in land devoted to public recreation use. Included in these 7,900 acres are 11 new major regional parks. These include parks located: 1) on the Lake Michigan shore east of Lake Church in Ozaukee County; 2) on the Milwaukee River southwest of Fredonia in Ozaukee County; 3) on Pike Lake between Hartford and Slinger in Washington County; 4) on Lucas Lake southwest of West Bend in Washington County; 5) on the Oconomowoc River in the northern part of the Town of Merton in Waukesha County; 6) on Ottawa Lake in the southern part of the Town of Ottawa in Waukesha County; 7) southeast of the City of Waukesha in Waukesha County; 8) on Rice Lake southeast of the City of Whitewater in Walworth County; 9) on Sugar Creek in the Town of LaFayette in Walworth County; 10) on the Lake Michigan shore in the Town of Caledonia in Racine County; and 11) on the Root River in the southern part of the City of Franklin in Milwaukee County. Because the number, size, and location of new nonpublic recreation areas are generally unknown until actual development is imminent, such areas cannot be readily anticipated and included in any regional plan. As indicated in Table 31, the largest increase in land devoted to public recreation use would occur in Waukesha County, where more than 1,500 acres would be added, an increase over 1963 of 25 percent. The greatest percentage increase would occur in Ozaukee County, where a gain of just over 70 percent, or 1,100 acres, is indicated.

Open Space—Agricultural and Other Open Land Uses

Under the Controlled Existing Trend Plan, the expansion of urban activities into presently rural areas of the Region would result in the conversion of more than 128,600 acres of rural land uses to urban uses between 1963 and 1990. This would be equivalent to an average annual rate of conversion of about 4,800 acres, or 7.5 square miles. The rural land uses to be converted to urban uses presently serve at least two important functions within the Region. As a land use, they provide open areas that serve to lend form and shape to urban development; provide invaluable opportunities for passive recreation; and serve to preserve, protect, and in some cases enhance certain elements of the natural resource base. As an economic activity, these lands provide employment opportunities and a source of income in the regional economy, as well as providing the urban areas of the Region with certain necessary agricultural and mineral products. It should be noted that, in addition to being subject to conversion to urban uses, rural

Table 31

EXISTING AND PROPOSED RECREATIONAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

County	Recreational Land Use			
	Existing[a] (1963) Acres	Planned[b] Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	3,118	578	3,696	18.5
Milwaukee	12,080	1,356	13,436	11.2
Ozaukee	1,614	1,135	2,749	70.3
Racine	2,316	895	3,211	38.6
Walworth	6,017	1,408	7,425	23.4
Washington	2,041	1,017	3,058	49.8
Waukesha	6,076	1,541	7,617	25.3
Regional Total	33,262	7,930	41,192	23.8

[a] *Includes the entire site area of public and nonpublic recreational uses.*

[b] *Includes only that increment which is for public recreational use.*

Source: SEWRPC.

lands are often subject to conversion from one rural use to another. For example, the drainage of wetlands for conversion to agricultural use has been occurring within the Region at the rate of about 1.6 percent per year since 1934, with rates ranging as high as 3.0 percent per year in some counties of the Region.[8]

As indicated in Table 32, much of the urban expansion, over 104,000 acres, would take place on land that is now in agricultural uses and would result in a decrease of almost 10 percent in the existing stock of agricultural land within the Region. New urban development in Waukesha County alone would require the conversion of more than 30,000 acres, or nearly 14 percent of the 1963 agricultural acreage within that county, while in Milwaukee County such development would require the conversion of 27,000 acres, or about 77 percent of the remaining agricultural acreage, to urban use by 1990.

The other major open land category, consisting of woodlands, water, wetlands, and quarries, would be reduced within the Region as a whole by about 25,000 acres, or 7 percent, by 1990. The predominant land use within this category which would be subject to urban development is that of woodlands. These provide a highly desirable setting for urban residential development, and most woodlands directly in the path of urban growth and o insufficient size to warrant permanent preservation would be converted and probably destroyed. Many of the remaining woodland areas would lend themselves to low-density residential development, which if carefully planned could result in the preservation of much of the existing tree and shrub growth. As indicated in Table 32, more than 13,000 acres, or over 68 percent, of the remaining other open lands would be converted to urban use in Milwaukee County.

As indicated in Volume 1 of this report, areas particularly well suited for highly productive agricultural use within the Region were delineated under the regional planning inventories on the basis of the results of the detailed soil surveys and ratings by agricultural specialists. The areas so delineated were termed prime agricultural areas. These areas were found to total 440,000 acres, or about 40 percent of the total land in agricultural use within the Region. Table 33 indicates that the plan would propose to convert over 22,600 acres, or about 5 percent, of these prime agricultural areas from agricultural to urban use. The largest conversion would occur in Racine County in which over 6,300 acres, or about 8.5 percent, of the remaining prime agricultural area would be converted.

Open Space—Environmental Corridors

As defined in Volume 1 of this report, primary environmental corridors consist of elongated areas which encompass the most important and highest quality elements of the regional natural resource base, including the best remaining surface water; forests; wetlands; wildlife habitat; and scenic, historic, scientific, and cultural sites. The lineal pattern which these corridors form within the Region is shown on Map 4, and the area of these corridors lying within each county of the Region is set forth in Table 34. More than 311,000 acres, or approximately 18 percent of the total land and water acreage of the Region, are encompassed within the primary environmental corridors. Wau-

[8] *Source: Wisconsin Conservation Commission.*

Table 32

EXISTING AND PROPOSED AGRICULTURAL AND OTHER OPEN LAND[a] USES IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

County	Agricultural Land Use				Other Open Lands			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	116,391	- 11,086	105,305	- 9.5	35,781	- 1,392	34,389	- 3.8
Milwaukee	35,121	- 27,085	8,036	-77.1	20,103	-13,719	6,384	-68.2
Ozaukee	105,199	- 9,416	95,783	- 8.9	25,326	- 1,090	24,236	- 4.3
Racine	153,636	- 16,494	137,142	-10.7	33,923	- 1,428	32,495	- 4.2
Walworth	266,251	- 3,540	262,711	- 1.3	72,737	- 1,612	71,125	- 2.2
Washington	192,271	- 6,238	186,033	- 3.2	65,143	- 1,020	64,123	- 1.5
Waukesha	216,275	- 30,235	186,040	-13.9	92,938	- 4,279	88,659	- 4.6
Regional Total	1,085,144	-104,094	981,050	- 9.5	345,951	-24,540	321,411	- 7.0

[a] *Includes woodlands, water, wetlands, and quarries.*

Source: SEWRPC.

Table 33

EXISTING AND PROPOSED PRIME AGRICULTURAL LANDS[a] IN THE REGION BY COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

County	Prime Agricultural Lands			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	72,870	- 5,979	66,891	- 8.2
Milwaukee	7,959	- 5,905	2,054	-74.1
Ozaukee	41,455	- 890	40,565	- 2.1
Racine	74,321	- 6,330	67,991	- 8.5
Walworth	121,919	- 585	121,334	- 0.4
Washington	53,916	- 1,712	52,204	- 3.1
Waukesha	71,512	- 1,278	70,234	- 1.7
Regional Total	443,952	-22,679	421,273	- 5.1

[a] *Prime agricultural lands are defined as those areas which 1) contain soils rated in the regional detailed operational soil survey as very good or good for agriculture, and 2) occur in concentrated areas over five square miles in extent and which have been designated as exceptionally good for agricultural production by agricultural specialists.*

Source: SEWRPC.

Table 34

ENVIRONMENTAL CORRIDOR AREA IN THE REGION BY COUNTY: 1990

County	Gross Corridor Area[a]		Urban Development Within Corridor[b]		Net Corridor Area[c]	
	Acres	Percent of Total	Acres	Percent of Gross Corridor	Acres	Percent of Gross Corridor
Kenosha	24,919	8.0	2,595	10.5	22,324	89.5
Milwaukee	13,694	4.4	6,997	51.1	6,697	48.9
Ozaukee	19,875	6.4	2,000	10.1	17,875	89.9
Racine	31,680	10.2	2,766	8.8	28,914	91.2
Walworth	79,450	25.5	5,953	7.5	73,497	92.5
Washington	52,682	16.9	2,823	5.4	49,859	94.6
Waukesha	88,916	28.6	5,948	6.7	82,968	93.3
Regional Total	311,216	100.0	29,082	9.4	282,134	90.6

[a] *These totals differ slightly from those presented in Volume 1 of this report because of a subsequent refinement in the corridor delineation utilizing the results of the detailed operational soil survey data which were not available for the entire Region at the time of publication of Volume 1.*

[b] *Includes residential, commercial, industrial, governmental, institutional, recreational, and transportation uses.*

[c] *Includes water and wetlands, woodlands, agricultural lands, and other generally open or unused lands, except those contained within the major park lands.*

Source: SEWRPC.

kesha County contains almost 89,000 acres, or nearly 29 percent, of the corridor acreage, while Walworth County, with 79,000 acres, contains slightly more than 25 percent. Highly urbanized Milwaukee County contains only 13,000 acres, or just over 4 percent of the corridor acreage within the Region. Approximately 9 percent of the land area within the corridors is devoted to urban uses, and only in Milwaukee County does the amount of land in urban uses within the corridors exceed the amount of land in non-urban uses. The net corridor acreage includes woodlands, water, wetlands, agricultural, and open land uses.

Table 35 indicates the acreage of each land use within the net corridor area for each county. Nearly 45 percent of the net corridor area, or about 127,000 acres, is in water and wetland uses; just over 30 percent, or 86,000 acres, is in agricultural use; and nearly 62,000 acres, or about 22 percent, is in woodlands. Over 47 percent of the corridor lands in Ozaukee County are in wetlands, and the water and wetland categories combined comprise about 50 percent of the net corridor areas in both Waukesha and Washington counties. The largest existing land use category within the Racine County, Walworth County, and Milwaukee

Table 35

LAND USE WITHIN THE NET ENVIRONMENTAL CORRIDOR AREA IN THE REGION BY COUNTY: 1990

County	Net Corridor Area		Water		Wetlands		Agriculture and Related		Woodlands		Other Open Lands	
	Acres	Percent of Total	Acres	Percent of Net Corridor	Acres	Percent of Net Corridor	Acres	Percent of Net Corridor	Acres	Percent of Net Corridor	Acres	Percent of Net Corridor
Kenosha	22,324	7.9	3,433	15.4	8,309	37.2	7,419	33.2	2,445	11.0	718	3.2
Milwaukee	6,697	2.4	346	5.2	1,421	21.2	2,640	39.4	1,115	16.7	1,175	17.5
Ozaukee	17,875	6.3	1,406	7.9	8,475	47.4	4,313	24.1	3,032	17.0	649	3.6
Racine	28,914	10.2	3,593	12.4	6,774	23.5	13,300	46.0	4,804	16.6	443	1.5
Walworth	73,497	26.1	13,089	17.8	16,132	22.0	22,221	30.2	19,951	27.1	2,104	2.9
Washington	49,859	17.7	3,433	6.9	19,969	40.0	14,075	28.2	11,496	23.1	886	1.8
Waukesha	82,968	29.4	14,801	17.9	25,653	30.9	21,720	26.2	18,696	22.5	2,098	2.5
Regional Total	282,134	100.0	40,101	14.2	86,733	30.7	85,688	30.4	61,539	21.8	8,073	2.9

Source: SEWRPC.

County segments of the corridor pattern is agricultural. The Controlled Existing Trend Plan would propose to develop none of the net corridor area, since maintenance of essential open uses in the net corridor areas is vital to the protection of the natural resource base and to maintenance of the overall quality of the regional environment. It should be noted that of the total net corridor area about 40,000 acres, or 14 percent, are covered by surface water, leaving 242,000 acres, or 14.1 percent of the total land area of the Region, as land area within the corridors requiring protection.

CONTROLLED EXISTING TREND PLAN DESCRIPTION—TRAFFIC DEMAND AND TRANSPORTATION FACILITIES

Introduction

The traffic demand generated by a given land use plan can be met by various combinations of transportation facilities. The traffic load can, at one end of a range of facility arrangement possibilities, be distributed in relatively small volumes over a large number of standard arterial streets and highways, providing a relatively low level of service, or, at the opposite end of the range, can be concentrated in relatively high volumes on a small number of high-capacity freeways, providing a relatively high level of service. Many combinations of facilities, which would meet the anticipated traffic demand are possible over the range between these two extremes. The ultimate balance achieved in the system design between loads and service levels is dictated by those transportation facilities that have already been committed, the transportation system development objectives and standards to be met, consideration of system integration and continuity, and the attendant benefits and costs, as well as the pattern of land uses to be served. Some of these considerations may be conflicting so that the transportation system plan that is finally selected represents a compromise between the theoretical and the practical, between the desirable and the possible, and between the demand for transportation service and the ability to pay for it.

The methodology for developing transportation system plans has been described in the previous chapter of this report in which the importance of quantitatively testing the final system plans by application of the anticipated traffic loads derived from the proposed land use pattern to be served and evaluating the plans on the basis of these tests against rationally formulated transportation system development objectives and standards was stressed. Only in this way can the adequacy and practicality of transportation plan proposals be properly assessed. This methodology was applied to all three alternative land use plans to obtain an analysis of the future transportation demand generated by the proposed land use patterns and to design a transportation system to meet this demand.

Quantity of Future Traffic Demand

A prerequisite to the design of a transportation system that will serve and support a given land use pattern is the determination of the quantity and spatial location of the demand for transportation service generated by the land use proposals. In the derivation of future traffic demand, all of the simulation models were applied at the traffic analysis zone level. Presentation of the resulting detailed traffic demand data in conventional report format is impractical, but it is important to note that these detailed data are available from SEWRPC files upon specific request. For the purpose of presenting the traffic demand data in this report, it was necessary to aggregate the detailed zonal data to obtain regional totals which could be used to present and analyze the major travel characteristics of each alternative land use plan at the regional scale. It is also important to note that all travel and traffic demand values are estimates of

probable future conditions and, while necessarily expressed as exact numbers, in reality necessarily reflect the variabilities and uncertainties inherent in any forecasting procedure.

It is estimated that, if fully developed, the land use pattern proposed by the Controlled Existing Trend Plan would generate a total of 6,015,000 internal person trips within the Region on an average weekday in 1990. This represents an increase of 69.8 percent over the 3,543,000 internal person trips generated within the Region on an average weekday in 1963. This percentage increase in internal person trip production contrasts with an increase in population within the Region of about 60 percent and in automobile availability of about 98 percent over the same period of time. Present (1963 survey) and future internal person trip production within the Region by trip purpose is indicated in Table 36. The largest proportion of the internal person trips increase is expected to occur in the home-based shopping, home-based other, and non-home-based tripmaking categories, which together are estimated to increase by 88 percent. Home-based work trips are estimated to increase by 45 percent over the 27-year period from 1963 to 1990.

The average number of internal person trips generated per capita is estimated to increase from 2.12 in 1963 to 2.25 in 1990, while the average number of internal person trips generated per household is estimated to increase from 7.34 to 7.57. Average internal trip lengths within the Region expressed in minutes of travel time are expected to remain substantially unchanged for all trip purpose categories for both internal auto driver and transit person trips under the Controlled Existing Trend Plan, as indicated in Tables 37 and 38.

Mode of Travel

It is estimated that, under the Controlled Existing Trend Plan, transit trip production within the Region on an average weekday would increase by

Table 36

TOTAL INTERNAL PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey[a]	Percent of Total	1990 Controlled Existing Trend Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	1,008,000	28.5	1,466,000	24.4	45.4
Home-Based Shopping .	516,000	14.6	1,054,000	17.5	104.3
Home-Based Other. . .	1,131,000	31.9	2,185,000	36.3	93.2
Home-Based School . .	249,000	7.0	252,000	4.2	1.2
Non-Home-Based. . . .	639,000	18.0	1,058,000	17.6	65.6
Total	3,543,000	100.0	6,015,000	100.0	69.8

[a] *All 1963 origin and destination home interview survey data were factored by 117 percent to meet observed traffic volumes crossing selected screen lines. See "Screen Line Adjustment of Trip Data," SEWRPC Technical Record, Vol. 2 - No. 5.*

Source: SEWRPC.

Table 37

AVERAGE TRIP LENGTHS FOR INTERNAL AUTO-DRIVER TRIPS IN THE REGION: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

Trip Purpose Category	Average Trip Length in Minutes		
	Modified 1963 Survey	1990 Controlled Existing Trend Plan	Percent Change 1963 - 1990
Home-Based Work	17.87	17.31	- 3.1
Home-Based Shopping . . .	9.20	9.58	4.1
Home-Based Other.	12.38	12.77	3.1
Non-Home-Based.	12.55	12.75	1.6
Weighted Average	13.74	13.43	-2.3

Source: SEWRPC.

Table 38

AVERAGE TRIP LENGTHS FOR INTERNAL TRANSIT TRIPS IN THE REGION: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

Trip Purpose Category	Average Trip Length in Minutes		
	Modified 1963 Survey	1990 Controlled Existing Trend Plan	Percent Change 1963 - 1990
Home-Based Work	35.89	37.88	5.5
Home-Based Shopping . . .	28.50	25.33	-11.1
Home-Based Other[a]	32.51	32.67	0.5
Non-Home-Based.	28.37	32.31	13.9
Weighted Average	33.63	34.88	3.7

[a] *Home-based school trips are not included.*

Source: SEWRPC.

about 9.9 percent, from 324,000 trips in 1963 to 356,000 trips by 1990. A slightly smaller proportion of the total internal travel generated within the Region by 1990 would be made on transit facilities, decreasing from approximately 9.3 percent in 1963 to approximately 5.9 percent by 1990, including all trips within the transit service areas formerly made by school bus. The relative utilization of transit and private automobiles under the land use pattern proposed by the Controlled Existing Trend Plan is indicated by trip purpose categories in Tables 39 and 40. The largest increase in transit trip production, 105 percent, is estimated to occur in the home-based school trip purpose category. (This is based on the assumption that expanded transit service would serve outlying urban areas now dependent on school bus service.) The largest decrease, 36 percent, is estimated to occur in the non-home-based trip purpose category. Home-based work transit trips are estimated to decrease by about 5 percent, while home-based shopping trips are estimated to increase by about 10 percent.

It is estimated that, under the Controlled Existing Trend Plan, a total of 3,905,000 internal auto driver trips would be generated within the Region on an average weekday in 1990. This represents an increase of about 80 percent over the 1963 level of 2,166,000 such trips. This increase in internal auto driver trips is substantially the same as the anticipated 79 percent increase in internal person trips made by automobile (auto driver and auto passenger trips). The anticipated increases in internal auto driver trips by trip purpose categories are indicated in Table 40, while the anticipated increase in internal automobile person trips within the Region by 1990 under the Controlled Existing Trend Plan is indicated in Table 41.

Total vehicle trip production on an average weekday under this plan is estimated to increase by 79 percent from 2,568,000 vehicle trips in 1963 to 4,598,000 in 1990. As shown in Table 42, the largest increases in trip production are anticipated to occur in internal automobile and internal truck trips, while the largest percentage increases in

Table 39

INTERNAL TRANSIT PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Controlled Existing Trend Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	154,000	47.5	146,000	41.0	- 5.2
Home-Based Shopping .	30,000	9.3	33,000	9.3	10.0
Home-Based Other. . .	55,000	17.0	38,000	10.7	- 30.9
Home-Based School . .	60,000	18.5	123,000	34.5	105.0
Non-Home-Based. . . .	25,000	7.7	16,000	4.5	- 36.0
Total	324,000	100.0	356,000	100.0	9.9

[a] *Includes trips made by transit and school bus within the transit service area.*

Source: SEWRPC.

Table 40

INTERNAL AUTO DRIVER TRIP GENERATION IN THE REGION: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Controlled Existing Trend Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	699,000	32.3	1,030,000	26.4	47.4
Home-Based Shopping .	317,000	14.6	657,000	16.8	107.3
Home-Based Other. . .	675,000	31.2	1,398,000	35.8	107.1
Home-Based School . .	24,000	1.1	24,000	0.6	--
Non-Home-Based. . . .	451,000	20.8	796,000	20.4	76.5
Total	2,166,000	100.0	3,905,000	100.0	80.3

Source: SEWRPC.

Table 41

INTERNAL AUTOMOBILE PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Controlled Existing Trend Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	854,000	27.0	1,320,000	23.3	54.6
Home-Based Shopping .	486,000	15.4	1,021,000	18.0	110.1
Home-Based Other. . .	1,076,000	34.1	2,147,000	37.9	99.5
Home-Based School . .	129,000	4.1	129,000	2.3	--
Non-Home-Based. . . .	614,000	19.4	1,042,000	18.4	69.7
Total	3,159,000	100.0	5,659,000	100.0	79.1

Source: SEWRPC.

Table 42

TOTAL VEHICLE TRIP GENERATION IN THE REGION: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN

Trip Class	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Controlled Existing Trend Plan	Percent of Total	Percent Change 1963 - 1990
Internal Automobile .	2,166,000	84.3	3,905,000	84.9	80.0
External Automobile[a].	86,000	3.4	202,000	4.4	134.9
Internal Truck[b] . . .	300,000	11.7	460,000	10.0	53.3
External Truck[a] . . .	16,000	0.6	31,000	0.7	93.8
Total	2,568,000	100.0	4,598,000	100.0	79.0

[a] *Through trips counted once.*

[b] *Includes taxis.*

Source: SEWRPC.

trip production are anticipated to occur in external automobile and external truck trips. The proportion of trips by vehicle class would not, however, change significantly from 1963 to 1990 under this plan.

Pattern of Future Vehicle Trips

The increased vehicular travel demand generated by the Controlled Existing Trend Plan would continue to be centered in and around the three largest urbanizing areas in the Region: Milwaukee, Racine, and Kenosha. The future regional traffic pattern would remain predominantly radial, centering on the City of Milwaukee, with the heaviest movements occurring to the west and south (see Map 5). The highest future travel desire line densities are anticipated to occur in Milwaukee County and eastern Waukesha, Racine, and Kenosha counties. This is in contrast to conditions in 1963 where travel desire line densities of similar magnitude remained confined to the central area of Milwaukee County (see Map 6).

Under the Controlled Existing Trend Plan, the largest growth in vehicular travel from 1963 to 1990 is anticipated to occur in the outlying areas surrounding the existing urban complexes within the Region (see Map 7). The rapidly urbanizing areas in southern Milwaukee County and eastern Waukesha County would experience the largest travel increase over 1963. Racine and Kenosha counties would also show large increases in travel, predominantly in the eastern portions of these counties.

Major traffic corridors within the Region would also experience increases in travel demand. In both the north-south and east-west corridors close to the alignment of IH 94, the future travel demand is anticipated to increase greatly under the Controlled Existing Trend Plan. Large increases in travel desire would occur in the northwest corridor radiating from the City of Milwaukee along USH 41 and along the Lake Michigan shore both north and south of Milwaukee. In the central area of Milwaukee County, a heavy increase in east-west travel desire would occur (see Map 5). North-south travel desires in eastern Waukesha and southern Milwaukee County are anticipated to increase. For the most part, the 1963 pattern of minimum interaction between the smaller cities within the Region would be continued, although it is anticipated that the cities of Waukesha, Racine, and Kenosha would increase their interaction with the Milwaukee area somewhat.

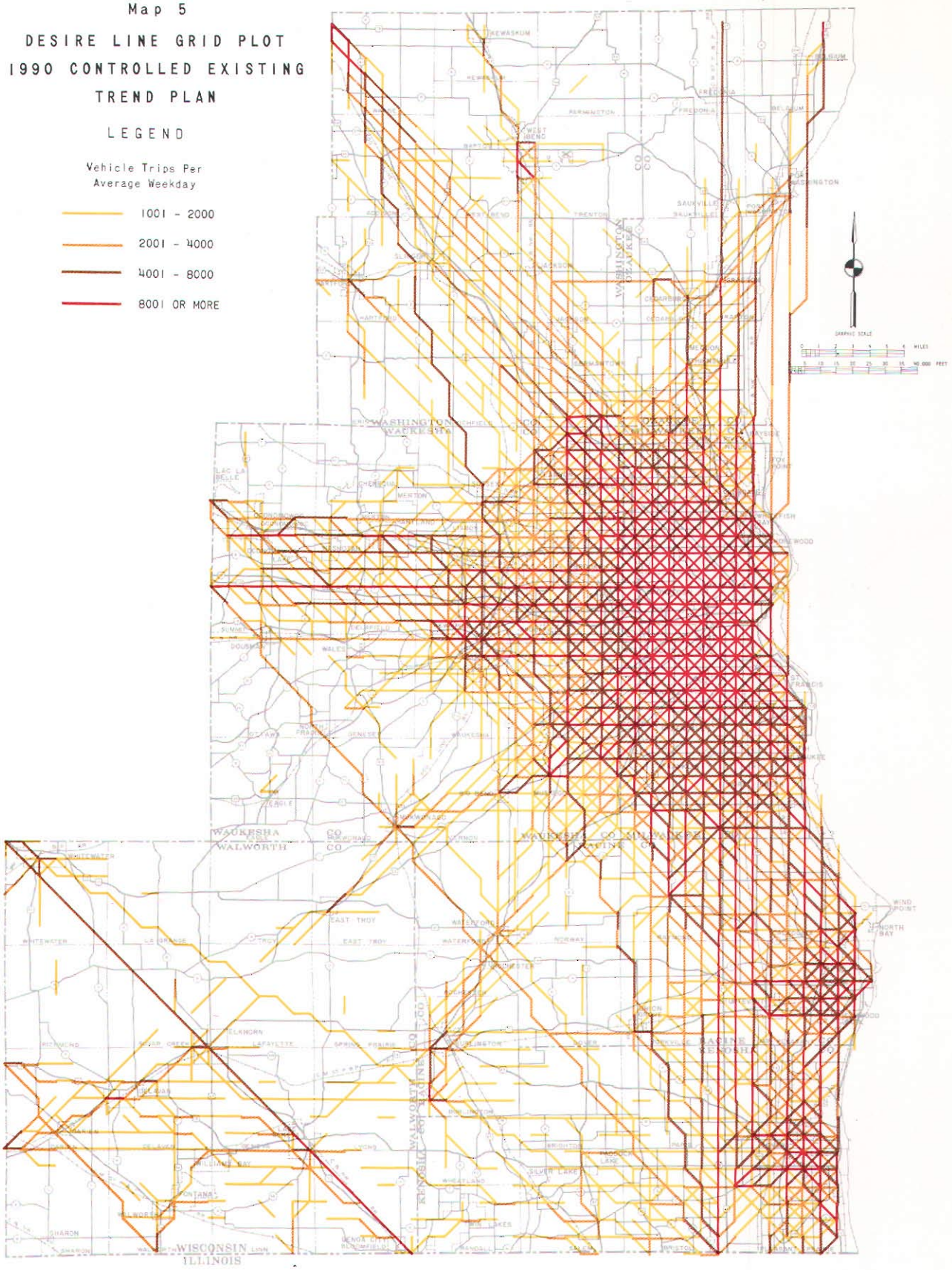
Description of the Existing Plus Committed Highway Network

One possible course of action which could be followed with respect to the provision of transportation service to the developing Region would be to make no additional improvements to the existing system over those already committed. This course of action would attempt to serve the future travel demand within the Region entirely by means of the existing plus committed transportation facilities and may be thought of as a course of action minimizing capital investment while maximizing operating costs. Beyond this "do nothing" policy alternative, a range of facility improvements is possible which would seek to achieve a balance between capital investment and operating costs by providing the additional transportation system capacity necessary to serve the future traffic demand at a selected level of service. In any case, the existing plus committed transportation system becomes the focal point for initial analysis, in that it forms the final system that would result from pursuit of the first policy and the point of departure from which to pursue the second policy.

Certain major traffic-carrying facilities within the Region form the basic framework of the entire existing plus committed surface transportation network. These consist of a complex of modern 4-, 6-, and 8-lane freeways and expressways and represent a committed base exerting a major influence on the design of future major highway facilities. Moreover, the existing and committed complex of freeway and expressway facilities also significantly influences proposals for alterations in the standard arterial street and highway system, in that it is usually less costly to modify the surface arterial facilities to conform to the major freeway facilities than to modify the freeway facilities to conform to the surface arterial facilities. The existing plus committed freeway and expressway system within the Region is shown on Map 1. Major facilities comprising this system include a north-south freeway from the state line to the vicinity of Port Washington in Ozaukee County and an east-west freeway from the central business district of Milwaukee west to the Waukesha-Jefferson County line. This basic T formation is supplemented by inner and outer loops of freeways in Milwaukee County and by two major freeways and expressways radiating in a northwesterly and southwesterly direction from the periphery of the outer loops.

Map 5

DESIRE LINE GRID PLOT
1990 CONTROLLED EXISTING
TREND PLAN



The future regional traffic pattern is anticipated to remain predominantly radial under the Controlled Existing Trend Plan, centering on the City of Milwaukee with the heaviest movements occurring to the west and south. The highest future traffic desire line densities are anticipated to occur in Milwaukee County and eastern Racine and Kenosha counties.

Map 6

DESIRE LINE GRID PLOT
1963 GENERAL EXISTING
LAND USE

LEGEND

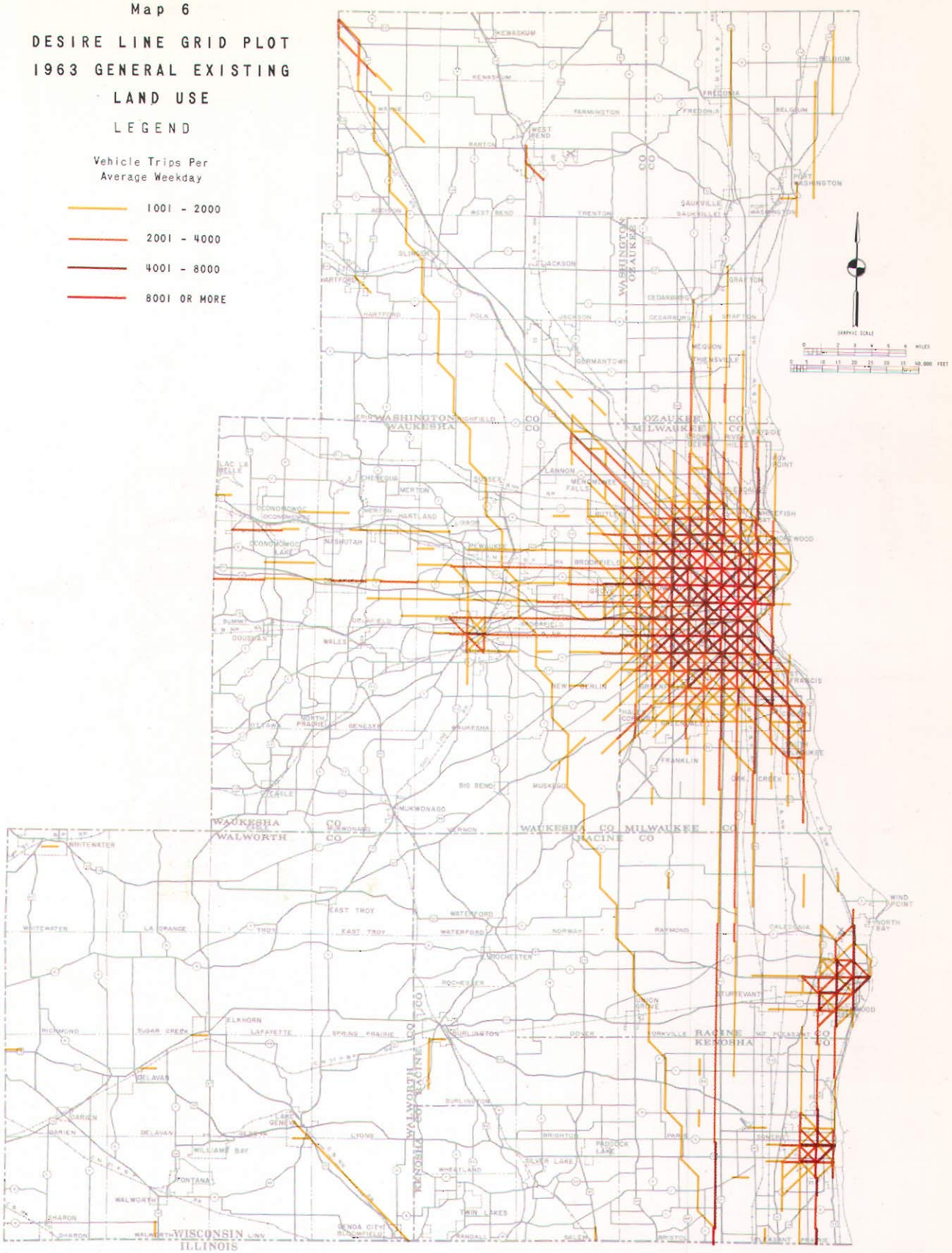
Vehicle Trips Per
Average Weekday

1001 - 2000

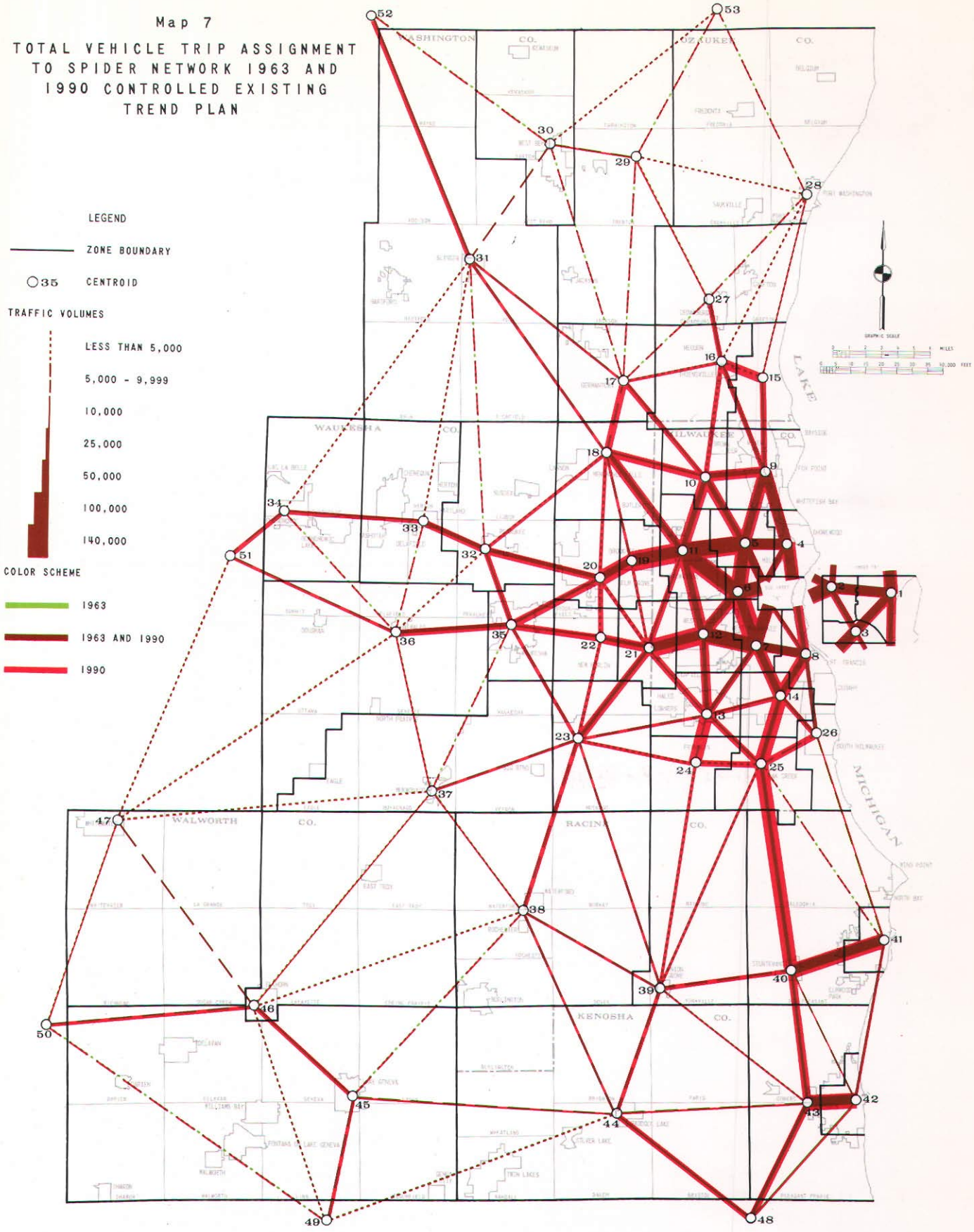
2001 - 4000

4001 - 8000

8001 OR MORE



The importance of the radial movements centered on the major urban areas within the Region is evident in this desire line grid plot. The scale of such movement around the Milwaukee urbanizing area stands in clear contrast to that of the other urbanizing areas in the Region. The lack of a strong desire for movement between urbanizing areas is apparent. Several of the significant through movements from Illinois to points north and west of the Region are clearly discernable but are shown to be of only light to moderate volume.



The pattern of vehicular travel on a hypothetical transportation network connecting traffic analysis areas in the Region is shown on this diagram for existing development and for the controlled existing trend plan alternative. The largest growth in vehicular travel is expected to occur in the outlying areas of the Region surrounding the existing urban complexes within the Region; especially in eastern Waukesha, Racine, and Kenosha counties.

The East-West Freeway in Milwaukee County and its westerly extension through Waukesha County as IH 94 has been completed as a 4-lane freeway from the Waukesha-Jefferson County line to USH 18 near Waukesha and from there to the Central Interchange in Milwaukee as a 6-lane freeway. The remaining 6- and 8-lane section from the Central Interchange east to the Lake Freeway is scheduled for completion by 1969.

Two sections of the North-South Freeway have been completed, a 4-lane section of IH 94 from the state line to the Racine-Milwaukee County line, a 4-lane section of USH 141 from Brown Deer Road to just south of W. Silver Spring Drive and as a 6-lane freeway from this point south to W. North Avenue in the City of Milwaukee. This entire facility is to be constructed by 1972 as a 6-lane freeway from the state line north to just south of W. Silver Spring Drive in Milwaukee County, except for a short 8-lane section between the Menomonee River Valley and the Park Freeway, and as a 4-lane section from just south of W. Silver Spring Drive north to the vicinity of the City of Port Washington.

The Stadium Freeway in Milwaukee County is partially completed as a 6-lane facility from about W. North Avenue south to the East-West Freeway and as a 4-lane facility from there to W. National Avenue. It is scheduled for completion as a 6-lane freeway from the Airport Freeway north to the East-West Freeway by 1972. The Zoo Freeway, USH 45, is also partially completed as a 6-lane facility and is scheduled for completion from the Airport Freeway north to its junction with the Fond du Lac Freeway by 1967. The Airport Freeway, IH 894, is scheduled for completion as a 6-lane facility by 1966. The Park Freeway is committed for construction by 1972 as an 8-lane freeway from its interchange with the Stadium Freeway to its interchange with the North-South Freeway and as a 6-lane section from there to the Lake Freeway. The Lake Freeway is committed for construction as a 6-lane freeway from the Park Freeway southerly to the vicinity of E. Layton Avenue and will include a 6-lane high-level bridge over the Milwaukee Harbor entrance.

The Fond du Lac Freeway (STH 145) is a 6-lane freeway from W. Hampton Avenue to the vicinity of the Milwaukee County Line. From this point a 4-lane expressway, USH 41 continues northwest across Washington County. USH 16 is also a 4-lane expressway from CTH SS south of the Village of Pewaukee to IH 94.

STH 15 is committed for reconstruction as a 4-lane freeway from the junction of the Airport and Zoo freeways in Milwaukee County to the vicinity of the Village of East Troy in Walworth County. USH 12 is similarly committed to be reconstructed as a 4-lane freeway from the state line northwesterly across Walworth County to STH 67 in the vicinity of the City of Elkhorn.

It should be stressed that, while the maps and descriptions of the existing plus committed arterial street and highway system in this report are limited primarily to the developing freeway and expressway system, the actual networks to which future traffic demand was assigned included the entire arterial street and highway network and incorporated all committed improvements to this network. These committed improvements range from minor reconstruction and widening projects to total reconstruction of certain standard arterial streets and highways. The increase in traffic carrying capacity effected by these committed improvements was reflected in the link capacities and operating speeds of the existing plus committed highway network, and the total existing plus committed system was used as a point of departure for system design.

Traffic Assignment to the Existing Plus Committed Highway Network[9]

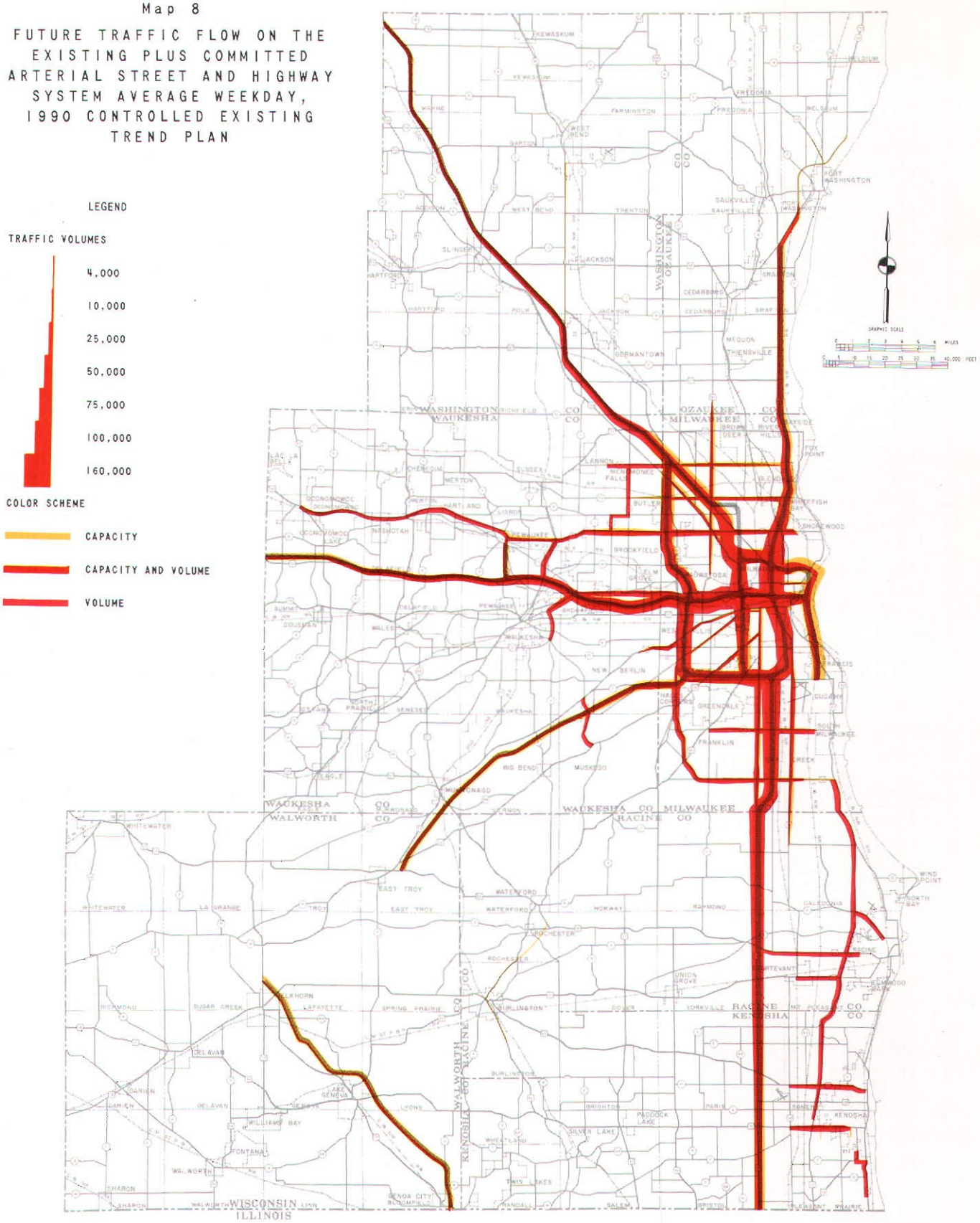
The anticipated travel demand expected to be generated by the controlled existing trend land use plan was assigned to the existing plus committed arterial street and highway network to determine its ability to carry the future travel demand generated by the proposed land use pattern and to isolate capacity deficiencies. The anticipated future traffic volumes are shown on Map 8 for the major regional highway facilities, together with the capacity of these facilities. Also indicated are those portions of the system for which the future traffic loads are expected to exceed the design capacity.[10]

[9] *While the presentation of traffic assignment results will be limited, because of practical considerations of map scale and report length, to the freeway and expressway facilities, it is important to note that assignments were made to the entire arterial street and highway network; and the complete results are on file in the Commission offices.*

[10] *The design capacity values of facilities were calculated by the procedure set forth in SEWRPC Technical Record Vol. 2 - No. 2, "Capacity of Arterial Network Links." These design capacity values correspond to the design flow rate for level of service "C" as set forth on page 1 of the Highway Capacity Manual-1965, Highway Research Board, Special Report 87.*

Map 8

FUTURE TRAFFIC FLOW ON THE EXISTING PLUS COMMITTED ARTERIAL STREET AND HIGHWAY SYSTEM AVERAGE WEEKDAY, 1990 CONTROLLED EXISTING TREND PLAN



Severe traffic congestion would occur on the regional arterial system if no further transportation system improvements were made. Particularly severe congestion would occur on much of the Milwaukee County Freeway System.

The largest capacity deficiencies occur on the East-West and North-South freeways. Traffic loads on the East-West Freeway would exceed design capacity from Moorland Road in Waukesha County east to the Central Interchange, with the most severe congestion occurring just west of the Stadium Interchange. Traffic loads on the North-South Freeway would exceed design capacity from W. Hampton Avenue south to W. Ryan Road, with the highest volume-to-capacity ratio of 1.5 occurring just north of the Hillside Interchange. In Racine and Kenosha counties, the volume-to-capacity ratios on IH 94 range from 0.7 at the state line to 1.3 just north of STH 20.

In Milwaukee County traffic loads on the Zoo, Stadium, and Airport freeways are expected to be close to or over capacity for their entire lengths. On the Zoo Freeway, the volume-to-capacity ratios are expected to range from 0.7 just north of W. Silver Spring Drive to 1.3 just south of the Zoo Interchange. The volume-to-capacity ratios on Fond du Lac Avenue (USH 41) and the Stadium Freeway are expected to range from 0.7 near the Waukesha-Milwaukee County line to 1.2 just south of the Stadium Interchange. Volume-to-capacity ratios on the Airport Freeway are expected to range from 0.8 just east of the Stadium Freeway to 1.1 just west of the North-South Freeway. The capacities of the Lake and Park freeways would be adequate to carry the future traffic loads along their entire lengths.

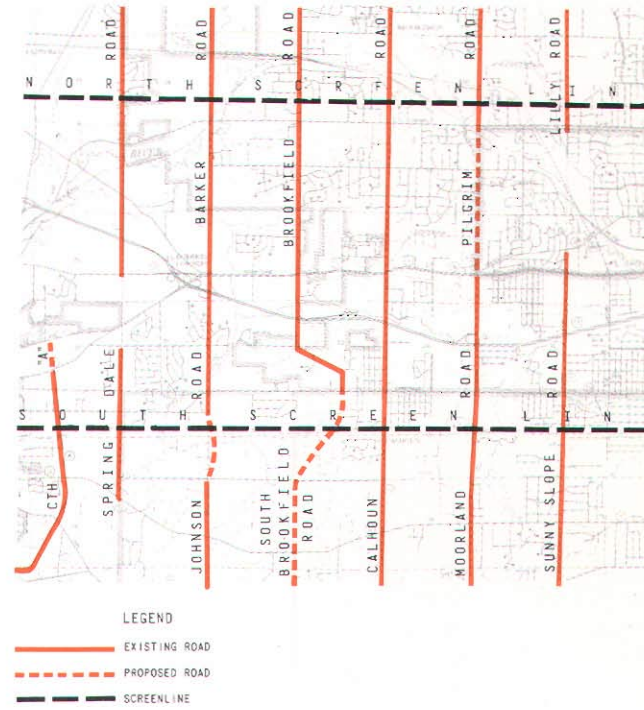
Description of the Proposed Highway Network

Based on analyses of the traffic assignment to the existing plus committed highway network, a planned arterial street and highway network was developed to serve the proposed land use pattern by carrying the anticipated future travel demand at the level of service specified in the transportation objectives and standards and alleviating the capacity deficiencies inherent in the existing plus committed network. The planned network was evolved from successive trials of a series of highway improvements and additions designed to alleviate specific network deficiencies.

A good example of the evolutionary procedure applied is found in the design of facilities to serve the rapidly urbanizing area of eastern Waukesha County. Two east-west screen lines were drawn from Sunnyslope Road to CTH A south of the East-West Freeway and from Barker Road to Lilly Road north of the East-West Freeway (see Map 9). Analysis of simulated future traffic crossing these screen lines, together with consideration of alternative means of providing the required capacity, indicated the most appropriate system of facilities to alleviate the capacity deficiencies on the north-south arterials within this rapidly urbanizing area. Under the controlled existing trend plan alternative, all north-south arterials within this area are anticipated to experience a large increase in traffic over the 1963 traffic volumes (see Figure 18). For several of the arterials, the 1990 volumes may be expected to more than double in the 27-year period; and the future volumes would generally exceed the present design capacities of all arterials. The least costly solution to providing the capacity to meet this anticipated travel load would be the improvement of the existing facilities as standard arterials. The results of this approach are shown in Figure 18. The total volumes crossing each screen line were found to increase due to the additional traffic attracted to the improved facilities. Traffic volumes would continue to exceed the capacities of several important facilities.

Map 9

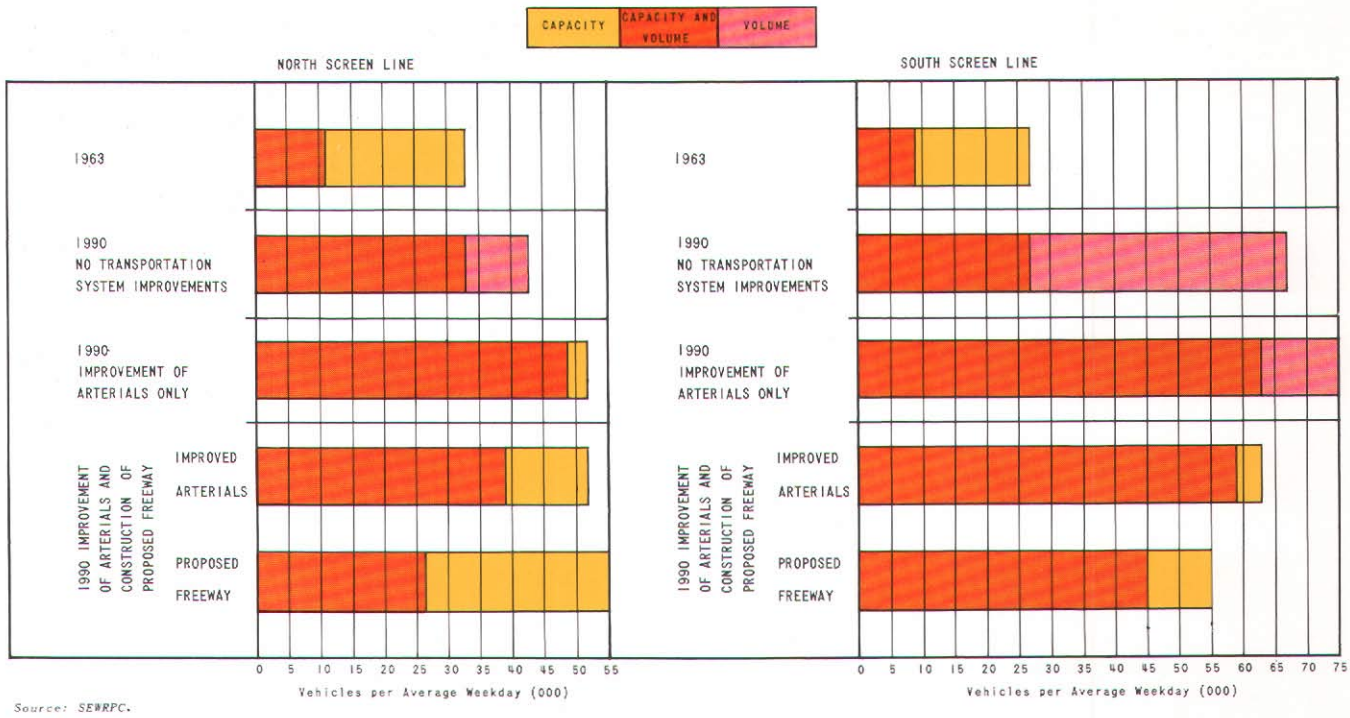
SCREEN LINE LOCATION MAP



This map indicates the location of two east-west screen lines used in the transportation planning analyses which were drawn to intercept all north-south traffic in eastern Waukesha County. Using data obtained from an analysis of existing and future traffic crossing these screen lines, together with data obtained from analysis tools, the most appropriate system of transportation facilities could be proposed to carry the expected large increase in traffic in this rapidly urbanizing portion of the Region.

Figure 18

SCREEN LINE ANALYSIS FOR EASTERN WAUKESHA COUNTY
1963 AND 1990 CONTROLLED EXISTING TREND PLAN



Source: SEWRPC.

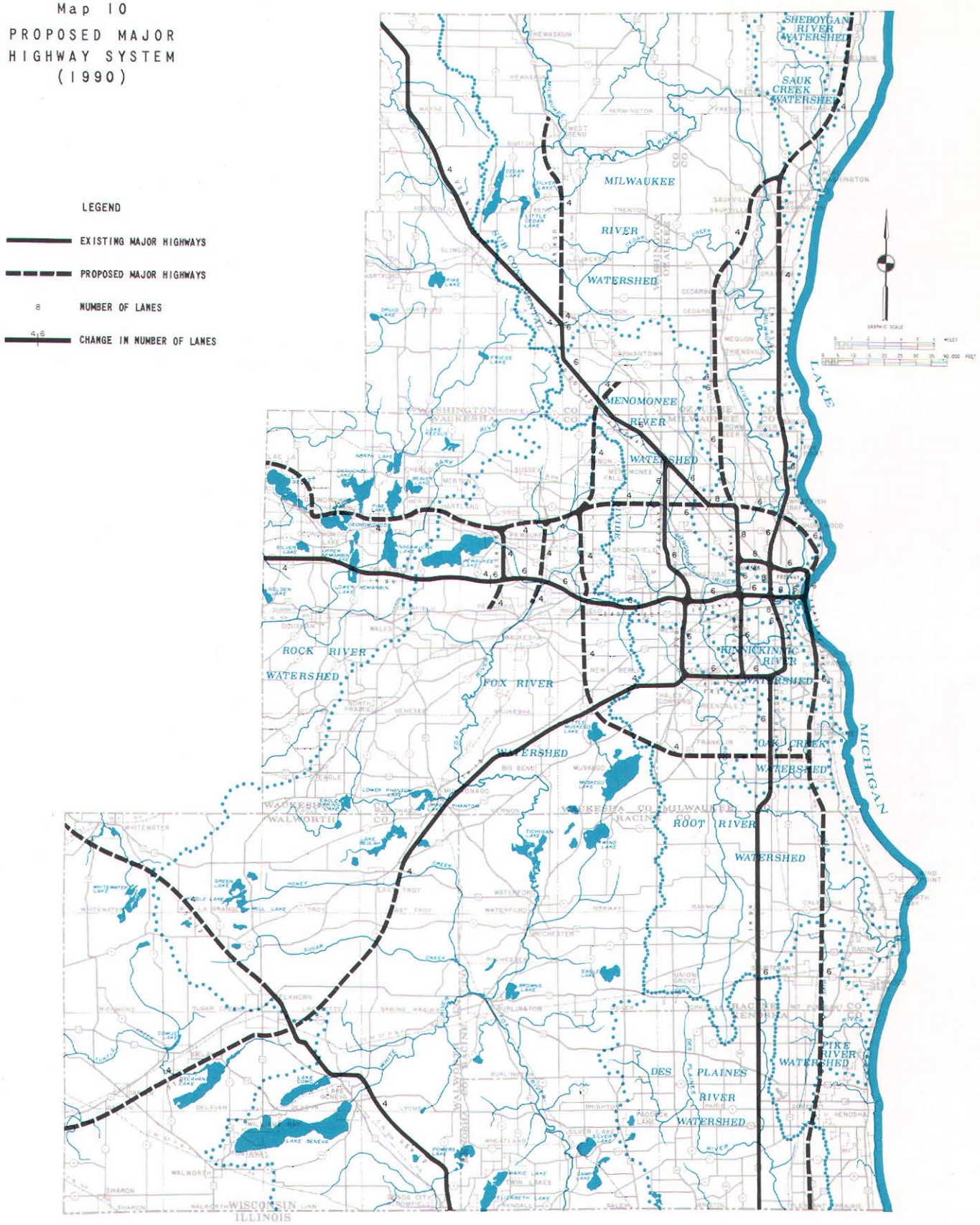
An additional network modification was, therefore, tested, which provided a higher level of highway service in the corridor by the addition of a north-south freeway. The inclusion of this high service level facility was found to reduce the total volume crossing the southerly screen line on the north-south standard arterials within the area by 16,000 vehicles per average weekday, or 21 percent, and by 10,000 vehicles per average weekday, or also 21 percent, on the northerly screen line. The volumes on all of the standard arterials except Lilly Road were reduced. The volumes on Moorland Road and on CTH A were reduced by over 25 percent. In addition, 14,000 vehicle per day were diverted to the proposed north-south freeway from the Zoo Freeway, USH 45, thereby relieving the high traffic demand on this facility. The proposed freeway was, therefore, included in the proposed highway network. In addition, it was proposed to improve the north-south standard arterials to a level sufficient to carry the reduced, but still substantial, future traffic demand on these facilities. Using similar procedures, a future highway network was designed for the entire Region and tested as an integrated whole.

Several facility additions to the regional freeway and expressway network were included in the future highway network finally proposed (see Map 10). The longest high service level type of facility proposed would parallel IH 94 and would provide relief for this heavily traveled freeway for its entire length within the Region. The relief facility is proposed as a 6-lane freeway at the state line, continuing due north through eastern Kenosha and Racine counties as a 6-lane freeway and connecting to the southerly terminus of the committed Lake Freeway. North of the Lake Freeway, a 6-lane freeway section would connect the Lake Freeway with an east-west freeway having an alignment in the vicinity of W. Hampton Avenue. This east-west facility is proposed to continue as a 6-lane freeway to its interchange with the Zoo Freeway, except for a short 8-lane section between the Stadium and Fond du Lac freeways. To the west of the Zoo Freeway, the facility is proposed as a 4-lane freeway to the Waukesha-Jefferson County line northwest of Oconomowoc. Beyond the regional boundary, it would connect to USH 16.

A northerly extension of the Stadium Freeway is proposed as an 8-lane freeway from the Park Freeway to the new freeway in the vicinity of W. Hampton Avenue and as a 6-lane freeway from this point to STH 167. From this interchange the facility is proposed as a 4-lane freeway to the

Map 10

PROPOSED MAJOR HIGHWAY SYSTEM (1990)



The preliminary regional transportation plan proposes an expanded network of four, six, and eight lane freeways to serve the rapidly developing Region. Over 255 miles of new freeways are proposed which would carry over 40 percent of the total vehicle miles of travel within the Region on an average weekday in 1990.

north crossing existing USH 141 northeast of the City of Port Washington and paralleling USH 141 into Sheboygan County.

A 4-lane freeway is proposed from the intersection of existing USH 141 and STH 57, paralleling existing STH 57 to the north and ending just north of the interchange with the northerly extension of the Stadium Freeway, at which point it merges with existing STH 57.

In Waukesha County a 4-lane north-south freeway, previously mentioned, is proposed from an interchange with USH 41-45 in the southwest of the Village of Germantown in Washington County to just south of new STH 15, thence continuing on an east-west alignment through southern Milwaukee County between W. Rawson Avenue and STH 100 to an interchange with the Lake Freeway in the City of Oak Creek. IH 94 from USH 18 to a point one mile east of CTH G is proposed to be upgraded to a 6-lane freeway. STH 164 is proposed to be upgraded to a 4-lane expressway from the extension of the new freeway in the vicinity of W. Hampton Avenue to the vicinity of the northern limits of the City of Waukesha. A new 4-lane expressway section is proposed just west of CTH T from USH 18 to USH 16 at a point one mile north of IH 94.

USH 41-45 is proposed to be upgraded to a 6-lane freeway to the split between USH 41 and USH 45 due south of the City of West Bend, with USH 41 continuing as a 4-lane freeway to the regional boundary. USH 45 is proposed to be upgraded to a 4-lane freeway from the USH 41-USH 45 interchange north to the City of West Bend, continuing as a 4-lane freeway around the west side of the City of West Bend and terminating at a junction with USH 45 to the north of the City of West Bend.

In Walworth County STH 15 is proposed to be completed as a 4-lane freeway from its committed terminus east of the Village of East Troy southwesterly to the Walworth-Rock County line. USH 12 is also proposed to be completed as a 4-lane freeway from its committed terminus at STH 67 north of the City of Elkhorn to the regional boundary west of the City of Whitewater.

Major changes and additions are also proposed to the arterial street and highway system. The addition of travel lanes and facility upgrading are proposed wherever the assignments indicate that the traffic-carrying capacity of a standard arterial street or highway is insufficient to carry the anticipated 1990 traffic load. Several entirely new arterial highways, as well as several new sections of arterial highways connecting existing sections, are further proposed. These new facilities are located primarily in newly developing areas of the Region. Other freeway and arterial proposals may be investigated after alternative plan presentation and review by request of state and local units of government concerned. Modifications in the arterial street and highway system, although not shown in this report because of map scale limitations, are, nevertheless, an integral part of the highway network proposed to serve the controlled existing trend land use plan alternative. The total mileage of proposed new and improved street and highway facilities is summarized by functional type and cost in Table 43.

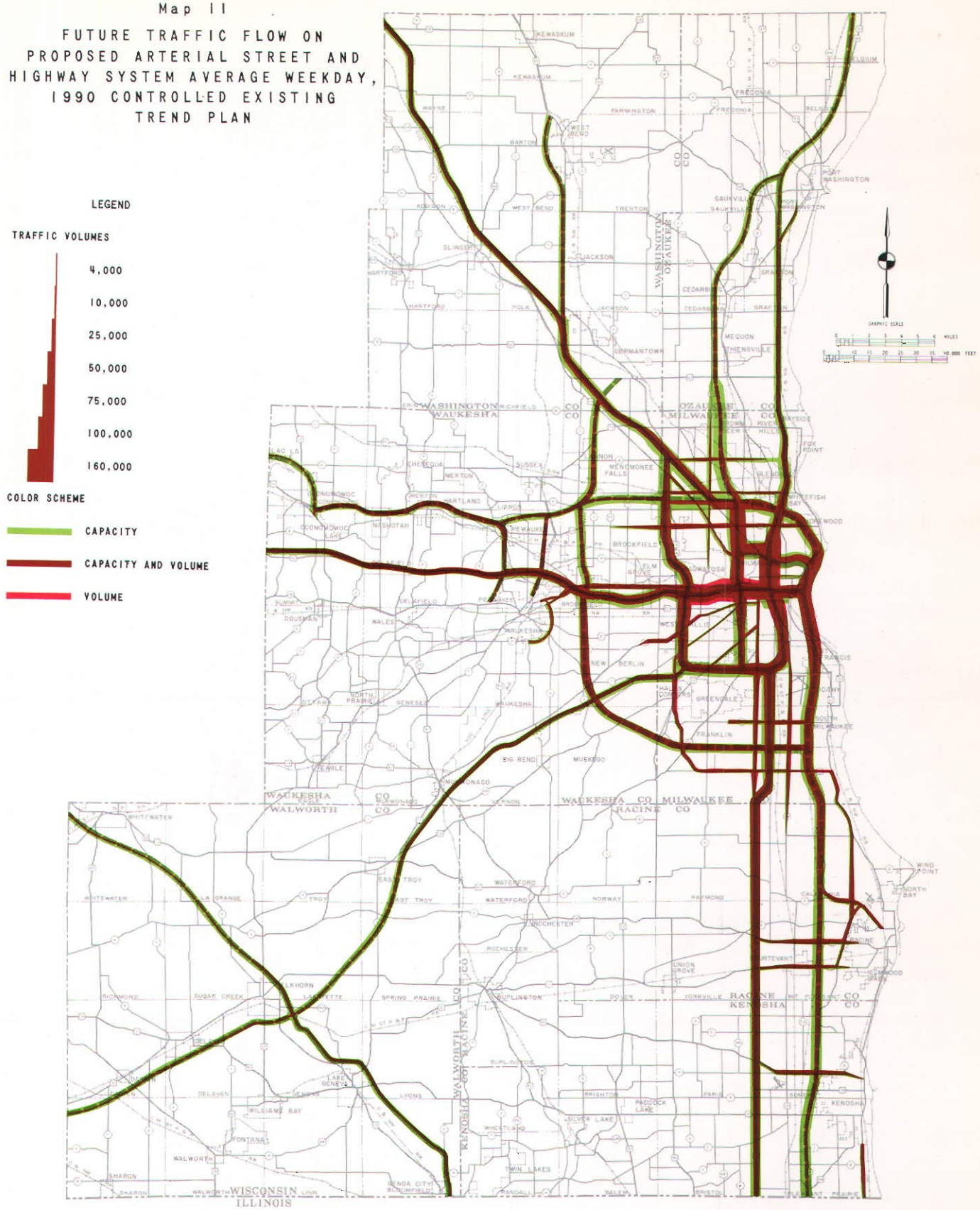
Traffic Assignment to the Proposed Highway Network

The anticipated future travel demand generated by the land use pattern proposed in the Controlled Existing Trend Plan was assigned to the proposed highway network, and the results of this assignment are summarized on Map 11 for the major highway facilities within the Region. The assignment indicates that the proposed network would be generally adequate to serve the future traffic demand generated by the Controlled Existing Trend Plan. The capacity of the East-West Freeway (IH 94) would be adequate to carry the anticipated future traffic volumes from the westerly boundary of the Region east to the Zoo Interchange. From this interchange to the Central Interchange, the traffic loads on this freeway would exceed the design capacity, with the most severe congestion still occurring just west of the Stadium Interchange. The capacity of the East-West Freeway would again be adequate to meet the anticipated traffic demand from the Central Interchange east to the Lake Freeway. The capacity of the North-South Freeway would be adequate to carry the anticipated traffic volumes from the state line north to the Central Interchange. From this interchange north to just south of W. Capitol Drive, the anticipated traffic volumes would exceed the capacity with the highest volume-to-capacity ratio anticipated being 1.1 just north of the Central Interchange. The capacity of the remainder of the North-South Freeway and its extension into Ozaukee County (USH 141) would be adequate to its northerly terminus at the Ozaukee-Sheboygan County line.

In Milwaukee County the capacities of the existing and committed Zoo, Airport, Park, and Lake free-

Map 11

FUTURE TRAFFIC FLOW ON PROPOSED ARTERIAL STREET AND HIGHWAY SYSTEM AVERAGE WEEKDAY, 1990 CONTROLLED EXISTING TREND PLAN



Future traffic volumes on all major arterial streets and highways in the proposed system would be below design flow rates except for some short segments of certain freeways in Milwaukee County.

Table 43

MILES AND CONSTRUCTION COSTS OF PROPOSED NEW AND IMPROVED ARTERIAL STREET AND HIGHWAY FACILITIES IN THE REGION - CONTROLLED EXISTING TREND PLAN
(Costs in Millions of 1966 Dollars)

Functional Facility Type	New Facilities[a]		Improved Facilities		Total	
	Miles	Construction Cost	Miles	Construction Cost	Miles	Construction Cost
Standard Arterial:						
2-lane	91.5	$ 19.117	101.8	$ 22.755	193.3	$ 41.872
4-lane	26.6	13.873	335.2	189.836	361.8	203.709
6-lane	2.2	2.183	142.8	148.926	145.0	151.109
Subtotal	*120.3*	*35.173*	*579.8*	*361.517*	*700.1*	*396.690*
Expressway:						
4-lane	3.5	6.060	6.5	3.502	10.0	9.562
6-lane	--	--	--	--	--	--
Subtotal	*3.5*	*6.060*	*6.5*	*3.502*	*10.0*	*9.562*
Freeway:						
4-lane	180.1	237.313	32.8	22.304	212.9	259.617
6-lane	69.0	208.558	41.5	31.244	110.5	239.802
8-lane	6.6	25.876	--	--	6.6	25.876
Subtotal	*255.7*	*471.747*	*74.3*	*53.548*	*330.0*	*525.295*
Total	379.5	$512.980	660.6	$418.567	1,040.1	$931.547

[a] *Includes committed facilities which had not been programmed through calendar year 1966.*

Source: SEWRPC.

ways and the proposed new East-West Freeway in the vicinity of W. Hampton Avenue would all be adequate to carry the anticipated future traffic loads for their entire lengths. The Stadium Freeway and its northerly extension to its terminus at USH 141 would also have a volume-to-capacity ratio of 1.0 or less for its entire length. The capacity of USH 41 from its northerly terminus at the Washington-Dodge County line to its southerly terminus at the proposed new freeway in the vicinity of W. Hampton Avenue would be adequate to meet the anticipated traffic loads over its entire length, as would be the capacity of the proposed new north-south freeway in eastern Waukesha County and its easterly extension in southern Milwaukee County.

The capacities of the proposed USH 16 Freeway extended westerly from the proposed new freeway in the vicinity of W. Hampton Avenue through Waukesha County to the regional boundary and of the proposed North-South Freeway extended from the committed terminus of the Lake Freeway at W. Layton Avenue south through Racine and Kenosha counties to the state line would be adequate to carry the anticipated traffic loads. The capacities of the proposed new USH 12 and STH 15 would be adequate to carry the anticipated traffic loads for their entire lengths within the Region.

A summary of the volume-to-capacity relationships for all arterial streets and highways within the Region under the system proposed to serve the Controlled Existing Trend Plan is provided in Table 44. For the Region as a whole, 1.7 percent of the total arterial street and highway system mileage would be expected to operate over design capacity by 1990 if the proposed network is constructed.

Description of Transit Network and Assignment of Future Passenger Loads

An important element of the regional transportation system is the network of public transit facilities. The existing transit network within the Region consists almost entirely of a system of local transit bus routes operating over standard arterial streets and highways and centered on the three largest urban areas of the Region—Milwaukee, Racine, and Kenosha. Two modified rapid transit lines (Freeway Flyer) were instituted during the course of the regional land use-transportation study within

Table 44

VOLUME-TO-CAPACITY RATIOS[a] FOR PROPOSED HIGHWAY NETWORK BY COUNTY: 1990 CONTROLLED EXISTING TREND PLAN

County	Miles of Arterial Streets and Highways by Volume-to-Capacity Ratio Range							
	Total	Percent of Regional Total	0.00 - 0.90	Percent of County Total	0.91 - 1.10	Percent of County Total	Above 1.10	Percent of County Total
Kenosha	313.8	8.5	262.8	83.7	43.6	13.9	7.4	2.4
Milwaukee	934.2	25.4	818.8	87.6	85.6	9.2	29.8	3.2
Ozaukee	303.1	8.3	280.6	92.6	20.5	6.8	2.0	0.6
Racine	410.8	11.2	334.6	81.4	70.9	17.3	5.3	1.3
Walworth	477.5	13.0	450.9	94.4	25.4	5.3	1.2	0.3
Washington	418.3	11.4	389.7	93.2	24.4	5.8	4.2	1.0
Waukesha	813.1	22.2	696.7	85.7	102.2	12.6	14.2	1.7
Regional Total	3,670.8	100.0	3,234.1	88.1	372.6	10.2	64.1	1.7

[a] *The significance of the volume-to-capacity ratio ranges used is:*

0.00 - 0.90; Under design capacity, fully adequate and safest operational level.

0.91 - 1.10; At design capacity but still adequate.

Above 1.10; Over design capacity, congested at times.

Source: SEWRPC.

Milwaukee County, providing service over completed segments of the Milwaukee County freeway system between the Mayfair and Bay Shore Shopping Centers and the central business district of Milwaukee. Service is provided only during peak demand periods of the day.[11]

Because of the highly dispersed pattern of low-density residential development which has occurred within the Region since 1950, the lack of any significant concentrations of transit trip origins and destinations within the Region, except in the central business district of Milwaukee, and because of the long-term historic decline of transit utilization within the Region, the design of a future transit network for the Region presented a difficult task. The success of the recently instituted modified rapid transit service within the Region initially focused attention on an expanded network of such modified rapid transit routes as a point of departure for the design of future high-speed transit facilities. The modified rapid transit routes appeared to possess several attractive features for such a point of departure. First, such routes can provide relatively high-speed transit service without the necessity of large capital outlays for right-of-way and fixed structures. Second, the utilization of buses as the modified rapid transit vehicle allows a wide choice in the selection of routes, especially in Milwaukee County, where the proposed freeway network would provide excellent geographic coverage in terms of freeway access. Third, the utilization of buses as the modified rapid transit vehicle allows great flexibility in systems operation, since the same vehicles can be used for both the local collector and line-haul portions of the transit trip without a change of vehicles, thereby providing a "one-seat ride" from origin to destination. Fourth, and probably most significant, such modified rapid transit service has proven, on the basis of experience with the recently initiated lines, to be a financially sound method for providing relatively high-speed intra-urban transit service. Finally, the utilization of buses as the modified rapid transit vehicle provides an advantage similar to that provided by the staged construction of highway facilities in that both the system capacity and service level can be increased on an evolutionary basis as required to true rapid transit service. Moreover, the potential exists within present technology, through the application of electronic guidance and control systems and through new vehicle designs, to provide a very high-capacity bus rapid transit system when and if the demand for such service increases beyond the anticipated 1990 demand.

In light of these considerations, an all-day modified rapid transit network was proposed over all existing plus committed freeways within Milwau-

[11] *See Volume 1 of this report for a detailed description of the 1963 existing transit network.*

kee County. Terminal areas located outside the central business district of Milwaukee were assumed to be provided with adequate off-street parking space to serve all automobiles which might be used to make a combined mode "park and ride" trip. For some of the selected terminal points, such parking facilities presently exist, whereas for other points the parking facilities would have to be constructed or expanded. In addition, local transit service was proposed to be extended into the rapidly urbanizing areas peripheral to the existing transit service area in Milwaukee, Racine, and Kenosha counties.

The transit trips generated by the future land use pattern proposed in the Controlled Existing Trend plan were then assigned to the complete transit network consisting of local, intercity, and modified rapid transit (Freeway Flyer) routes. The results are displayed in summary form in Map 12 for the intercity and modified rapid transit routes only. The highest future demand for transit service within the Region may be anticipated in a corridor paralleling the East-West Freeway (IH 94) where the modified rapid transit routes from the Zoo, East-West, and Stadium Freeway converge. This demand may be expected to range from 39,000 revenue passengers per average weekday at a point just east of the Zoo Freeway to 56,000 revenue passengers at a point just west of the Central Interchange. A demand of 10,000 revenue passengers per average weekday may be anticipated along STH 145 and the Stadium Freeway from the Milwaukee-Waukesha County line to the Park Freeway and south into the central business district of Milwaukee. The future revenue passenger demand on all of the routes tested was found to be sufficiently high to justify their retention in the proposed modified rapid transit network.

Furthermore, the future revenue passenger demand along the East-West Freeway was found to be high enough to justify either preemption for exclusive use of an existing freeway lane or the construction of a 2-lane, fully grade separated roadway over private right-of-way for true rapid transit service.[12] Due to the anticipated traffic congestion on the East-West Freeway, the diversion of any additional traffic from this freeway to a rapid transit line would be highly desirable. Even if such a diversion were accomplished, however, the full capacity of the existing freeway would still be required to meet the future traffic demand. The alternative proposal of a separate bus rapid transit roadway and right-of-way was, therefore, considered to be a more satisfactory means of meeting the future transit demand in this corridor. It is anticipated that the buses would operate inbound in modified rapid transit service over the freeway network to the point where these freeways meet the separate transit roadway. From this point the buses would continue in rapid transit service over the transit roadway into the Milwaukee central business district.

[12] *See transit threshold service warrants, Table 2, Chapter 2, and Appendix Figures A-1 and A-2.*

Based on the assignments of future traffic to modified rapid transit routes over the existing plus committed freeways within the Milwaukee urbanizing area, it was further proposed that modified rapid transit service be instituted to Mequon, Menomonee Falls, Butler, Waukesha, New Berlin, Hales Corners, Greendale, and Oak Creek. In addition, the extension of such service was proposed to the University of Wisconsin-Milwaukee Campus over the proposed northerly extension of the Lake Freeway. Map 13 shows the location and terminal points of these routes near selected freeway interchanges and the grade separated rapid transit roadway.

CORRIDOR PLAN DESCRIPTION—LAND USE

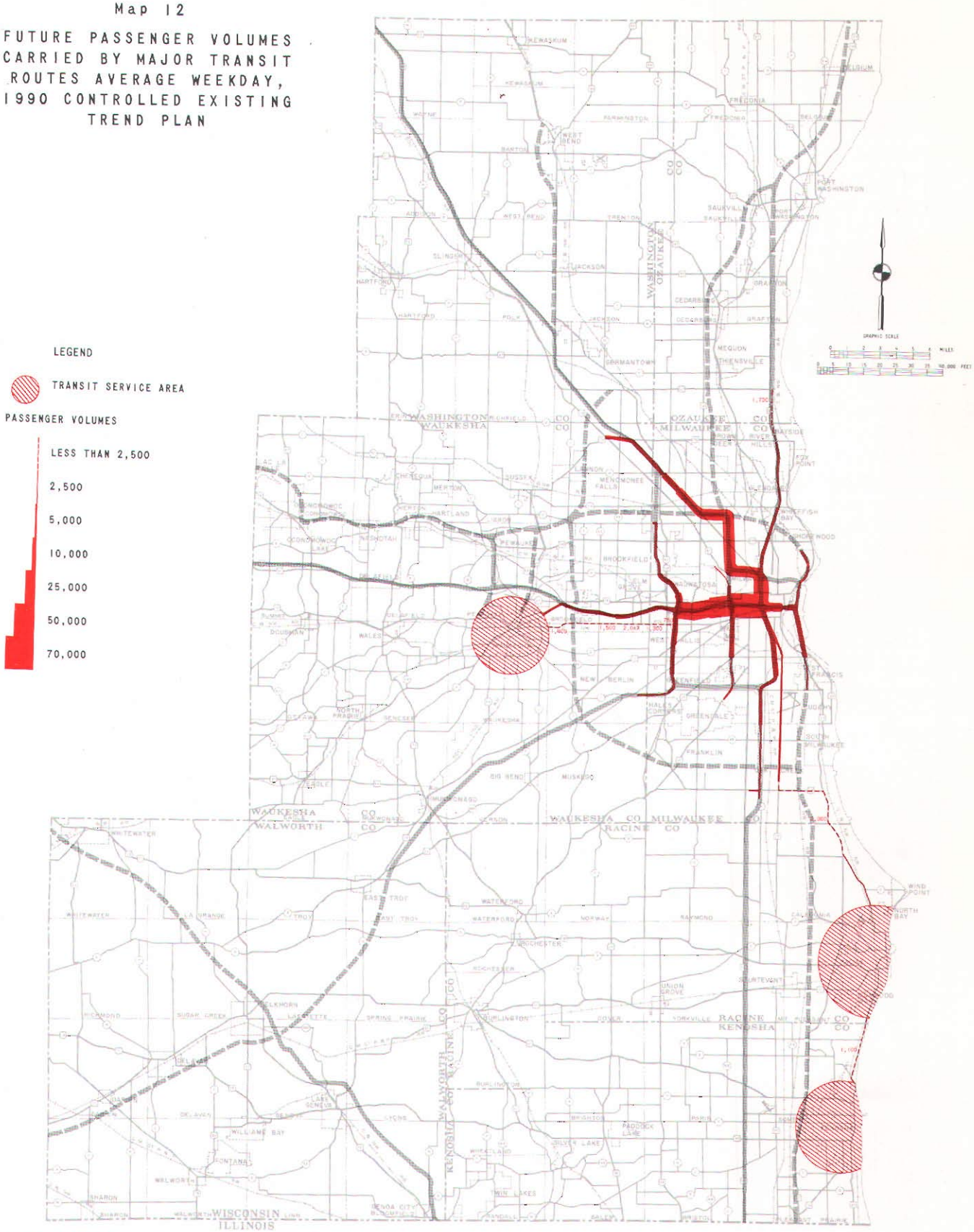
Introduction

The second alternative regional land use plan to be considered was one which examines the ramifications of concentrating future urban development within the Region along corridors radiating from the largest urban center within the Region. The corridors are centered on major transportation routes; and this alternative plan would thus place heavy emphasis on the effect of these transportation facilities in determining the location, intensity, and character of future urban development within the Region. The radial pattern would permit efficient access to employment opportunities and social interchange, both in the central city and along the radial corridors. The areas lying between the corridors of urban development would form significant areas of open space, penetrating the older urban areas as wedges, readily accessible to the population residing in the corridors, yet removed from the path of urban development in order to ensure their preservation.

Under this plan historic growth trends within the Region would have to be altered in order to emphasize the concentration of new urban development along the radial transportation corridors,

Map 12

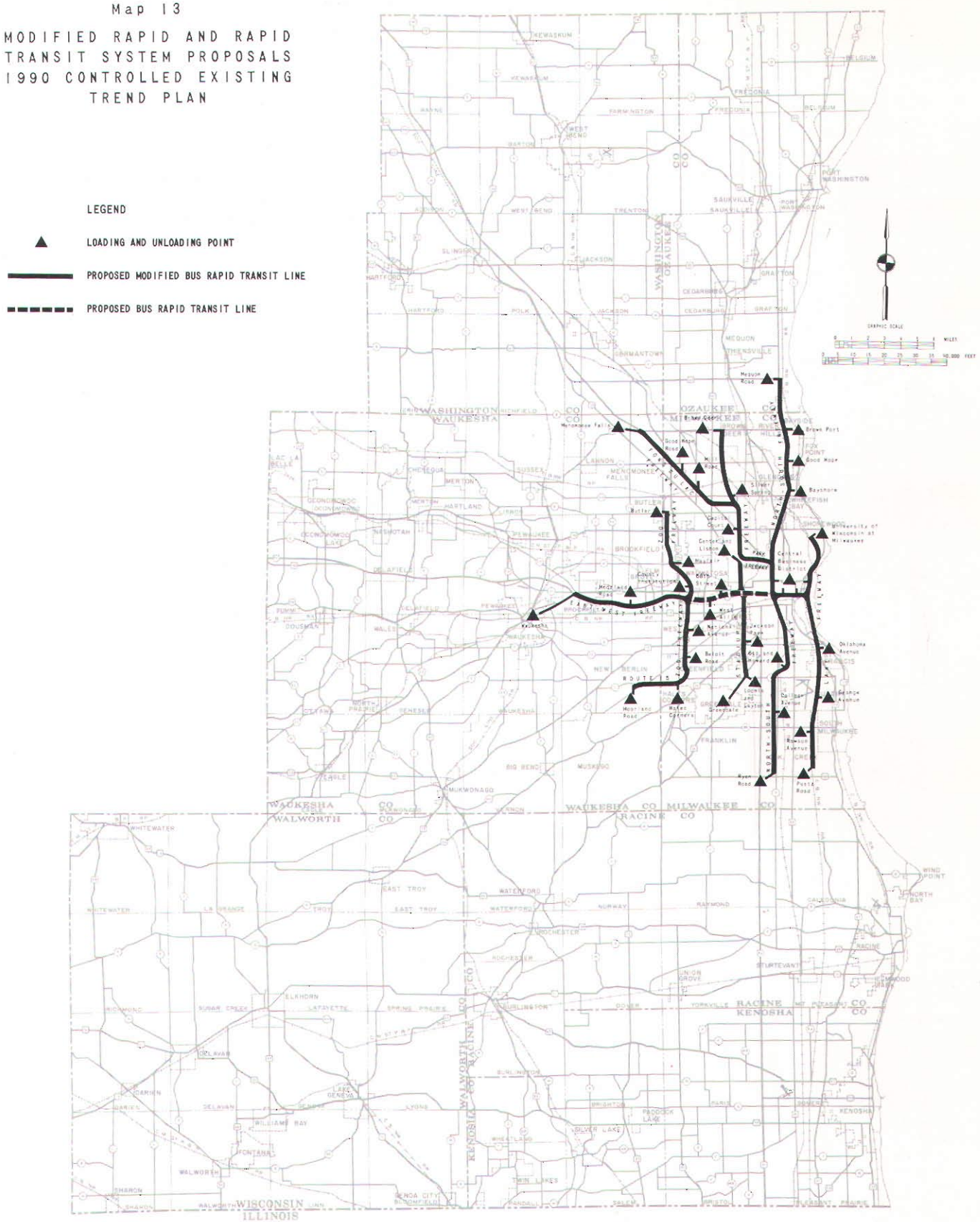
FUTURE PASSENGER VOLUMES CARRIED BY MAJOR TRANSIT ROUTES AVERAGE WEEKDAY, 1990 CONTROLLED EXISTING TREND PLAN



Future passenger volumes on major transit routes proposed to serve the Controlled Existing Trend Plan are shown on this flow map. Volumes in a corridor along the East-West Freeway would be sufficient to justify the provision of a bus rapid transit line. Branching flow bands along other freeways indicate future passenger volumes which would be carried by buses operating on freeways in mixed traffic, thereby providing modified rapid transit service. The only major non-freeway transit routes shown are those providing inter-city service between Milwaukee, Racine and Kenosha, and between Milwaukee and Waukesha.

Map 13

MODIFIED RAPID AND RAPID TRANSIT SYSTEM PROPOSALS 1990 CONTROLLED EXISTING TREND PLAN



The extension of modified bus rapid transit service ("Freeway Flyer") is proposed from the Milwaukee Central Business District outward along all freeways in Milwaukee County and beyond to Thiensville, Menomomee Falls, Waukesha, New Berlin, Greendale, and Oak Creek. An exclusive grade separated bus rapid transit roadway is proposed along the East-West Freeway Corridor.

and somewhat higher residential densities would have to be encouraged in order to take full advantage of this concentration along the transportation routes. The allocation of future land use within each county of the Region would be such as to modify the forecast population levels within each county, while meeting the level forecast for the Region as a whole. The planned future land use proposals would depart significantly in some areas of the Region from those contained in existing community development plans and zoning documents. The most basic regional development objectives would be achieved by protecting from development the floodways and flood plains of the perennial streams; by protecting from urban development the best remaining woodlands and wetlands; and by developing an integrated system of park and open-space areas centered on the primary environmental corridors, which, where possible, would form portions of the open-space wedges separating the corridors of urban development. The plan would be more difficult to adjust to the existing, planned, and possible future gravity drainage sanitary sewer service areas within the Region. An understanding of the regional growth pattern proposed by this alternative can be obtained from review of the graphic presentation of the plan shown on Map 14 and of the statistical presentation set forth in Tables 45 through 53.

Residential Development

The Corridor Plan would accommodate the expected regional population increase of one million persons by 1990 primarily through conscious efforts to concentrate new urban development along radial corridors emanating outward from the large urban complexes of the Region, while discouraging development in the wedges between these corridors. The plan would seek to encourage high- and medium-density residential development within the radial corridors by providing maximum accessibility to a transportation system centered in these corridors. Under this plan about 68 percent of all new urban residential development within the Region would be located within 20 miles of the central business district of Milwaukee. Future residential development would occur primarily at medium densities, with net lot sizes ranging from 6,300 to 19,800 square feet per dwelling unit. High-density development would occur on lots ranging in net size from 3,630 to 6,300 square feet per dwelling unit. The plan would require the development of only a very small amount of new residential land at low densities. The new urban residential development would consist primarily of single-family housing and low-rise multi-family housing located in planned residential development units.

As indicated in Table 45, more than 60,000 acres of residential development would be added to the existing stock of residential land within the Region; and more than half of this increment would be developed in Milwaukee and Waukesha counties. Over 82 percent, or more than 50,000 acres of the additional 60,000 acres, would be developed at medium densities; and about 11 percent, or 6,700 acres, would be developed at high densities. Only 3,700 acres of low-density residential development would be added under the Corridor Plan, and nearly all of this additional low-density development would be located in Ozaukee and Waukesha counties.

Population Distribution

Under the Corridor Plan, future population levels within several of the counties would vary from the forecast levels. As indicated in Table 46, Kenosha,

Table 45

EXISTING AND PROPOSED RESIDENTIAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN

County	Residential Land Use											
	High-Density			Medium-Density			Low-Density			Total		
	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres
Kenosha. .	2,511	391	2,902	2,673	5,421	8,094	6,729	--	6,729	11,913	5,812	17,725
Milwaukee.	21,080	3,714	24,794	8,697	14,764	23,461	12,207	739	12,946	41,984	19,217	61,201
Ozaukee. .	471	332	803	1,324	3,289	4,613	7,542	1,625	9,167	9,337	5,246	14,583
Racine . .	4,069	593	4,662	2,752	7,207	9,959	6,550	--	6,550	13,371	7,800	21,171
Walworth .	1,701	374	2,075	2,871	2,468	5,339	7,284	--	7,284	11,856	2,842	14,698
Washington	1,752	398	2,150	1,673	2,458	4,131	4,004	--	4,004	7,429	2,856	10,285
Waukesha .	2,879	912	3,791	4,758	14,492	19,250	25,831	1,344	27,175	33,468	16,748	50,216
Regional Total	34,463	6,714	41,177	24,748	50,099	74,847	70,147	3,708	73,855	129,358	60,521	189,879

Source: SEWRPC.

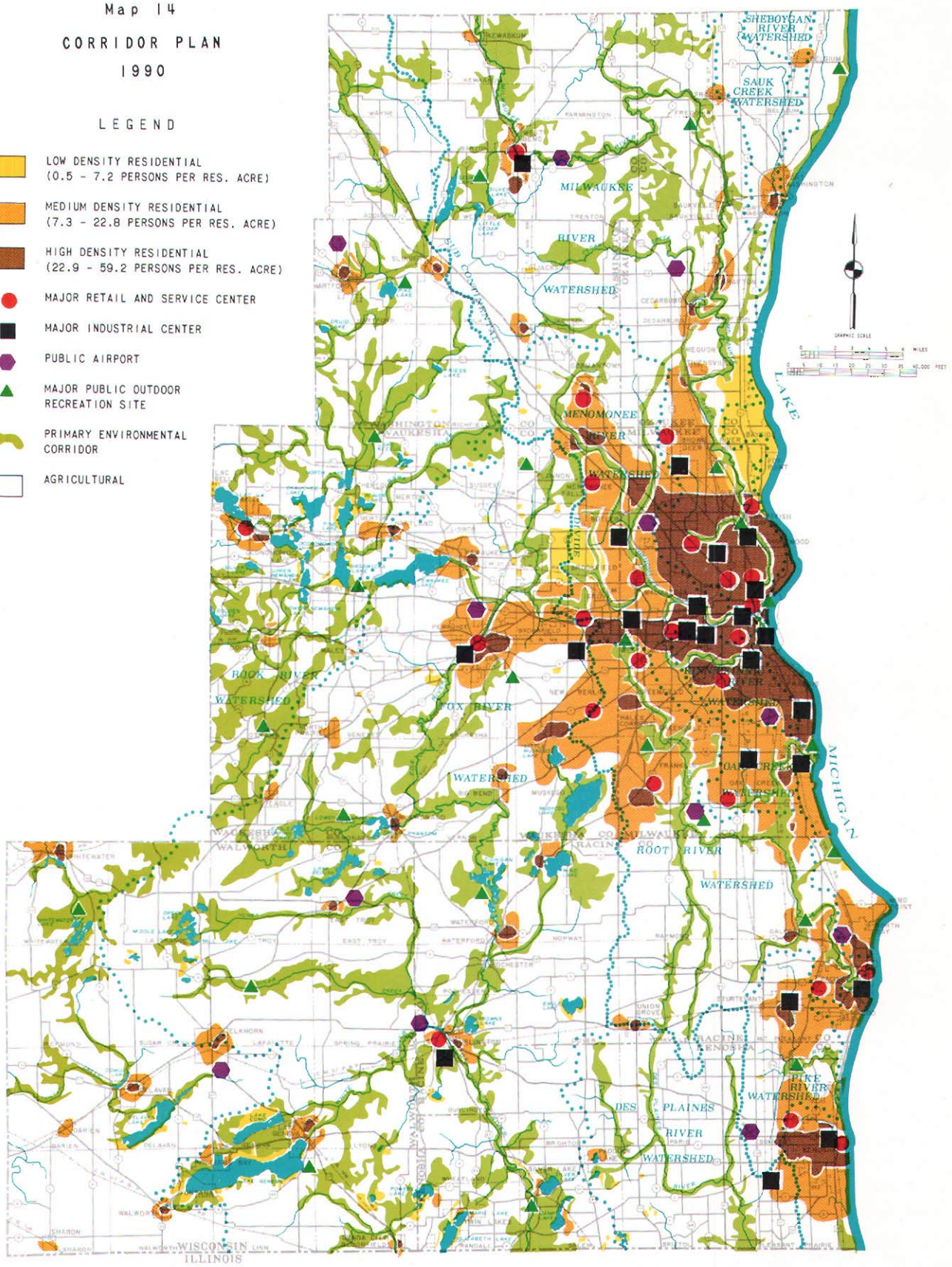
Map 14

CORRIDOR PLAN

1990

LEGEND

- LOW DENSITY RESIDENTIAL (0.5 - 7.2 PERSONS PER RES. ACRE)
- MEDIUM DENSITY RESIDENTIAL (7.3 - 22.8 PERSONS PER RES. ACRE)
- HIGH DENSITY RESIDENTIAL (22.9 - 59.2 PERSONS PER RES. ACRE)
- MAJOR RETAIL AND SERVICE CENTER
- MAJOR INDUSTRIAL CENTER
- PUBLIC AIRPORT
- MAJOR PUBLIC OUTDOOR RECREATION SITE
- PRIMARY ENVIRONMENTAL CORRIDOR
- AGRICULTURAL



The Corridor Plan represents an effort to concentrate new urban development within the Region in relatively narrow linear patterns along major transportation routes, separated by wedges of permanent agricultural and other open space uses. This plan would place primary emphasis upon the effect of transportation facilities upon urban development and such development would be strongly limited to the commercial and industrial activities of the larger central cities.

Table 46

EXISTING AND PROPOSED POPULATION DISTRIBUTION IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN
(Population in Thousands)

County	1963 Population	Forecast Increment 1963 - 1990		Planned Increment 1963 - 1990		1990 Population	
		Number	Percent Change	Number	Percent Change	Forecast	Planned
Kenosha	106.7	95.3	89.3	96.3	90.2	202.0	203.0
Milwaukee	1,086.3	359.7	33.1	350.3	32.2	1,446.0	1,436.6
Ozaukee	41.6	64.4	154.8	69.2	166.3	106.0	110.8
Racine	150.6	132.4	87.9	125.5	83.3	283.0	276.1
Walworth	55.5	31.5	56.7	54.2	97.6	87.0	109.7
Washington	49.5	46.5	93.9	51.2	103.4	96.0	100.7
Waukesha	184.2	273.8	148.6	256.9	139.4	458.0	441.1
Regional Total	1,674.4	1,003.6	59.9	1,003.6	59.9	2,678.0	2,678.0

Source: SEWRPC.

Ozaukee, Walworth, and Washington counties would each show a greater population increase under this alternative plan than that indicated by the demographic forecast. The greatest numerical increase over the demographic forecast would take place in Walworth County where more than 22,000 persons would be added over the forecast future level of 87,000 persons. The greatest percentage increase would take place in Ozaukee County, where a 166 percent increase would occur under this alternative plan. Milwaukee, Racine, and Waukesha counties would show lesser population increases under this alternative than indicated by the demographic forecast. These variations from the forecast population levels would be the results of a conscious effort to direct new residential and other urban development into the areas encompassed by the radial corridors and at the same time restrict development in the wedges between the corridors of development.

Sewer and Water Service

As indicated in Table 47, about 496 square miles, or 92 percent, of the developed area of the Region and about 2,511,000 persons, or 94 percent, of the population of the Region would be served by public sanitary sewer and water supply facilities by 1990. Of the new development, 188 square miles, or 95.2 percent, would be served by public sanitary sewer facilities tributary to existing or locally proposed systems. Such service to the remainder of the new development would require the construction of new systems.

Commercial and Industrial Development

Under the Corridor Plan, six new planned major industrial areas and ten new planned major commercial centers are proposed, which would employ a total of 35,000 and 15,000 persons, respectively. The major industrial and commercial centers proposed under this alternative would be located in the same general areas as those proposed under the Controlled Existing Trend Plan. Because of the nature of the specific locational requirements of these uses and the land use pattern inherent in this alternative, these new planned industrial and commercial centers would be located in the same general areas under the Corridor Plan as under the controlled existing trend plan alternative.

Table 48 indicates the changes proposed in commercial and industrial land use under the Corridor Plan. Over 4,800 acres of land are proposed for new commercial uses, and more than 4,900 acres of land are proposed for new industrial uses. These proposals would amount to an increase of nearly 73 percent in commercial land use and an increase of nearly 51 percent in industrial land use within the Region. Milwaukee County would account for the largest increases in both categories. In the commercial land use category, the greatest percentage increase would occur in Waukesha County, where an increase of more than 111 percent, or 1,248 acres, is proposed. In the industrial land use category, the greatest percentage increase would occur in Racine County, where an increase of more than 118 percent, or 1,049 acres, is proposed.

Employment Distribution

Table 49 indicates the estimated total number of jobs existing within each county in the Region in 1963 and the incremental growth to 1990 that would occur under the Corridor Plan. The largest in-

Table 47

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN

County	Total Area in Square Miles	Existing (1963)									Proposed (1990)[a]				
		Developed Area in Square Miles	Public Sewer Service				Public Water Supply				Developed Area in Square Miles	Public Sewer Service and Public Water Supply[b]			
			Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served	Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served		Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served
Kenosha . . .	278.3	27.6	14.0	50.7	79,160	74.2	13.6	49.2	78,670	73.7	39.9	36.0	90.2	193,900	95.5
Milwaukee . .	242.2	152.5	142.3	93.3	1,075,000	98.9	129.1	84.6	1,029,800	94.7	220.8	220.8	100.0	1,436,600	100.0
Ozaukee . . .	234.5	15.9	6.2	38.9	20,340	48.8	5.5	34.5	19,512	46.8	29.4	28.7	97.6	98,500	88.8
Racine. . . .	339.9	37.8	19.1	50.5	112,600	74.7	18.3	48.4	120,590	80.0	56.5	52.0	92.0	246,100	89.1
Walworth. . .	578.1	24.0	8.6	35.8	28,925	52.1	11.5	47.9	31,270	56.3	31.2	19.5	62.5	92,400	84.2
Washington. .	435.5	11.8	6.1	51.7	23,050	46.5	5.8	49.1	23,150	46.7	23.1	19.2	83.1	78,100	77.5
Waukesha. . .	580.6	70.1	20.7	29.5	79,950	43.3	16.2	23.1	69,490	37.6	136.5	119.9	87.8	365,200	82.7
Regional Total	2,689.1	339.7	217.0	63.9	1,419,025	84.7	200.0	58.8	1,372,482	81.9	537.4	496.1	92.3	2,510,800	93.7

[a] *All sanitary sewer facilities required to serve the 1963 to 1990 urban development are tributary to existing systems, except for those tributary to the systems proposed to serve the cities of Muskego and Delafield and the Town of Waukesha in Waukesha County; the City of Hartland, the Village of Germantown, and the Town of Jackson in Washington County; and the towns of Caledonia and Mount Pleasant in Racine County.*

[b] *It was assumed that public water supply facilities would be extended within all public sanitary sewer service areas.*

Source: SEWRPC.

Table 48

EXISTING AND PROPOSED COMMERCIAL AND INDUSTRIAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN

County	Commercial Land Use				Industrial Land Use			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	532	472	1,004	88.7	809	776	1,585	95.9
Milwaukee	3,035	1,782	4,817	58.7	5,234	1,752	6,986	33.4
Ozaukee	361	299	660	82.8	370	184	554	49.7
Racine	753	580	1,333	77.0	885	1,049	1,934	118.5
Walworth	615	207	822	33.6	862	132	994	15.3
Washington	287	280	567	97.5	455	133	588	29.2
Waukesha	1,123	1,248	2,371	111.1	1,131	934	2,065	82.5
Regional Total	6,706	4,868	11,574	72.5	9,746	4,960	14,706	50.8

Source: SEWRPC.

Table 49

EXISTING AND PROPOSED EMPLOYMENT IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN

County	1963 Employment		Planned Employment Increment 1963 - 1990		1990 Planned Employment Distribution	
	Number	Percent of Region	Number	Percent Change	Number	Percent of Region
Kenosha	41,900	6.6	36,300	86.6	78,200	8.0
Milwaukee	471,700	74.3	154,300	32.1	626,000	63.6
Ozaukee	10,800	1.7	16,100	149.0	26,900	2.7
Racine	52,100	8.2	46,400	89.0	98,500	10.1
Walworth	12,700	2.0	14,300	112.5	27,000	2.8
Washington	12,100	1.9	14,700	121.4	26,800	2.7
Waukesha	33,600	5.3	67,000	199.4	100,600	10.2
Regional Total	634,900	100.0	349,100	54.9	984,000	100.0

Source: Wisconsin Industrial Commission; SEWRPC.

crease in employment by 1990 would occur in Milwaukee County, where an increase of 32 percent, or 154,300 job opportunities, is proposed. Waukesha County would gain 67,000 employment opportunities, an increase of nearly 200 percent over the 1963 level. With the exception of Milwaukee County, each county is expected to increase its proportionate share of total regional employment by 1990, the largest gain being proposed in Waukesha County where the 1963 share of 5.3 percent of total regional employment is shown to increase to 10.2 percent.

Governmental and Transportation Land Use

As indicated in Table 50, the Corridor Plan would add nearly 5,800 acres of governmental land uses and over 25,000 acres of transportation land uses to the existing stock of land in these categories. This amounts to a 39 percent and a 26 percent increase, respectively. The greatest increase in these uses would occur in Milwaukee County, where 1,900 acres of governmental land uses and 8,100 acres of transportation land uses are proposed. These increases amount to nearly 28 percent and 27 percent, respectively. The greatest percentage increases in both categories would occur in Waukesha County, where 1,500 acres of governmental land uses and nearly 6,800 acres of transportation land uses are proposed. These increases amount to 60 percent and 37 percent, respectively.

Open Space—Recreational Land Use

As indicated in Table 51, the Corridor Plan would add about 7,700 acres of public recreation land to the existing stock of public and private recreation land, including the 11 new major parks proposed under the controlled existing trend plan alternative. This amounts to an increase of 23 percent over the 1963 acreage. The greatest acreage in-

Table 50

EXISTING AND PROPOSED GOVERNMENTAL[a] AND TRANSPORTATION[b] LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN

County	Governmental Land Use				Transportation Land Use			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	1,059	556	1,615	52.5	8,492	2,444	10,936	28.7
Milwaukee	6,995	1,943	8,938	27.7	30,442	8,131	38,573	26.7
Ozaukee	796	430	1,226	54.0	7,010	1,920	8,930	27.3
Racine	1,499	748	2,247	49.8	11,163	3,278	14,441	29.3
Walworth	1,090	286	1,376	26.2	10,552	1,225	11,777	11.6
Washington	762	291	1,053	38.1	10,344	1,237	11,581	11.9
Waukesha	2,521	1,528	4,049	60.0	18,114	6,784	24,898	37.4
Regional Total	14,722	5,782	20,504	39.2	96,117	25,019	121,136	26.0

[a] *Includes institutional uses and on-site parking.*

[b] *Includes communications and utilities uses.*

Source: SEWRPC.

Table 51

EXISTING AND PROPOSED RECREATIONAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN

County	Recreational Land Use			
	Existing[a] (1963) Acres	Planned[b] Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	3,118	550	3,668	17.6
Milwaukee	12,080	1,258	13,338	10.4
Ozaukee	1,614	1,129	2,743	69.9
Racine	2,316	864	3,180	37.3
Walworth	6,017	1,448	7,465	24.0
Washington	2,041	998	3,039	48.8
Waukesha	6,076	1,454	7,530	23.9
Regional Total	33,262	7,701	40,963	23.1

[a] *Includes the entire site area of public and nonpublic recreational uses.*

[b] *Includes only that increment which is for public recreational uses.*

Source: SEWRPC.

crease would occur in Waukesha County, where an additional 1,400 acres are proposed, an increase of nearly 24 percent. The greatest percentage increase would occur in Ozaukee County, where an increase of 1,100 acres of public recreation land, or an increase of nearly 70 percent, is proposed.

Open Space—Agricultural and Other Open Land Uses

As indicated in Table 52, the Corridor Plan would require the conversion of more than 108,000 acres of rural land to urban use by 1990. This would be equivalent to an average annual rate of conversion of about 4,000 acres, or 6.3 square miles. Most of this rural land, about 86,000 acres, would be withdrawn from the agricultural land use category. This would amount to nearly an 8 percent reduction in the existing stock of farmland. The existing stock of open lands would be decreased by almost 23,000 acres, or more than 6 percent, mostly in the form of woodlots and other woodland cover. The greatest decrease in agricultural land use would occur in Waukesha County, where more than 25,000 acres of farmland, or just over 11 percent of the existing stock, would be converted to urban uses. The greatest percentage decrease would occur in Milwaukee County, where a decrease of 59 percent, or nearly 21,000 acres, of the existing agricultural land would be converted to urban uses.

Table 52

EXISTING AND PROPOSED AGRICULTURAL AND OTHER OPEN LAND[a] USES IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN

County	Agricultural Land Use				Other Open Lands			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	116,391	- 9,405	106,986	- 8.0	35,781	- 1,205	34,576	- 3.3
Milwaukee	35,121	-20,756	14,365	-59.0	20,103	-13,327	6,776	-66.2
Ozaukee	105,199	- 8,254	96,945	- 7.8	25,326	- 954	24,372	- 3.7
Racine	153,636	-12,833	140,803	- 8.3	33,923	- 1,486	32,437	- 4.3
Walworth	266,251	- 4,725	261,526	- 1.7	72,737	- 1,415	71,322	- 1.9
Washington	192,271	- 4,868	187,403	- 2.5	65,143	- 927	64,216	- 1.4
Waukesha	216,275	-25,187	191,088	-11.6	92,938	- 3,509	89,429	- 3.7
Regional Total	1,085,144	-86,028	999,116	- 7.9	345,951	-22,823	323,128	- 6.5

[a] *Includes woodlands, water, wetlands, and quarries.*

Source: SEWRPC.

As indicated earlier, certain areas of the Region were determined to be particularly well suited for highly productive agricultural use. As urban development expands into the rural areas of the Region, some of these prime agricultural areas would be converted to urban uses unless efforts are made to protect these lands from development. Table 53 indicates the prime agricultural areas which would be converted to urban uses by 1990 under the corridor land use plan alternative. More than 16,000 acres, or nearly 4 percent of the existing acreage in this category, would be withdrawn from agricultural use. The greatest acreage reduction would occur in Racine County, where 4,200 acres, or nearly 6 percent, of the existing prime agricultural land area would be converted to urban uses. The greatest percentage decrease would occur in Milwaukee County, where a reduction of nearly 3,700 acres, or 46 percent, is proposed.

Open Space—Environmental Corridors

Under the Corridor Plan, the primary environmental corridors, which contain the highest quality elements of the natural resource base, would be preserved and protected from development. The acreage concentration and distribution by county under the Corridor Plan would be the same as that proposed under the controlled existing trend land use plan alternative described earlier.

Table 53

EXISTING AND PROPOSED PRIME AGRICULTURAL LANDS[a] IN THE REGION BY COUNTY: 1963 AND 1990 CORRIDOR PLAN

County	Prime Agricultural Lands			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	72,870	- 3,799	69,071	- 5.2
Milwaukee	7,959	- 3,668	4,291	-46.0
Ozaukee	41,455	- 426	41,029	- 1.0
Racine	74,321	- 4,205	70,116	- 5.6
Walworth	121,919	- 1,491	120,428	- 1.2
Washington	53,916	- 1,118	52,798	- 2.0
Waukesha	71,512	- 1,560	69,952	- 2.1
Regional Total	443,952	-16,267	427,685	- 3.6

[a] *Prime agricultural lands are defined as those areas which 1) contain soils rated in the regional detailed operational soil survey as very good or good for agriculture, and 2) occur in concentrated areas over five square miles in extent which have been designated as exceptionally good for agricultural production by agricultural specialists.*

Source: SEWRPC.

CORRIDOR PLAN DESCRIPTION—TRAVEL DEMAND AND TRANSPORTATION FACILITIES

Quantity of Future Travel Demand

It is estimated that, if fully developed, the land use pattern proposed by the Corridor Plan would generate a total of 5,966,000 internal person trips within the Region on an average weekday in 1990. This represents an increase of 68.4 percent over the 3,543,000 internal person trips generated within the Region on an average weekday in 1963. Present (1963 survey) and future internal person trip production within the Region by trip purpose is indicated in Table 54. This percentage increase in internal person trip production contrasts with an increase in population within the Region of about 60 percent and in automobile availability of about 90 percent over the same period of time.[13] The largest proportion of internal person trip increase is expected to occur in the home-based shopping, home-based other and non-home-based categories, which together are estimated to increase by about 86 percent. Home-based work trips are estimated to increase by about 45 percent over the 27-year period from 1963 to 1990.

The average number of internal person trips generated per capita is estimated to increase from 2.12 in 1963 to 2.23 by 1990, while the average number of internal person trips per household is expected to increase from 7.34 to 7.50. Average lengths of internal auto driver trips within the Region expressed in minutes of travel time are expected to decrease slightly by 1990 for the work trip purpose category, but increase for all other trip purpose categories under the Corridor Plan, as indicated in Table 55. Average trip lengths of transit person trips are expected to increase overall by 8 percent, as shown in Table 56.

Mode of Travel

It is estimated that, under the Corridor Plan,

[13] *The maximum difference in automobile availability among alternative land use plans is about 5 percent. This difference is considered to be negligible for regional planning purposes.*

Table 54

TOTAL INTERNAL PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 CORRIDOR PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey[a]	Percent of Total	1990 Corridor Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	1,008,000	28.5	1,458,000	24.4	44.6
Home-Based Shopping .	516,000	14.6	1,032,000	17.3	100.0
Home-Based Other. . .	1,131,000	31.9	2,147,000	36.0	89.8
Home-Based School . .	249,000	7.0	252,000	4.2	1.2
Non-Home-Based. . . .	639,000	18.0	1,077,000	18.1	68.5
Total	3,543,000	100.0	5,966,000	100.0	68.4

[a] *All 1963 origin and destination home interview survey data were factored by 117 percent to meet observed traffic volumes crossing selected screen lines. See "Screen Line Adjustment of Trip Data," SEWRPC Technical Record, Vol. 2 - No. 5.*

Source: SEWRPC.

Table 55

AVERAGE TRIP LENGTHS FOR INTERNAL AUTO DRIVER TRIPS IN THE REGION: 1963 AND 1990 CORRIDOR PLAN

Trip Purpose Category	Average Trip Length in Minutes		
	Modified 1963 Survey	1990 Corridor Plan	Percent Change 1963 - 1990
Home-Based Work	17.87	17.40	-2.6
Home-Based Shopping . . .	9.20	9.62	4.6
Home-Based Other.	12.38	12.70	2.6
Non-Home-Based.	12.55	12.70	1.2
Weighted Average	13.74	13.47	-2.0

Source: SEWRPC.

transit trip production within the Region on an average weekday would increase about 16.0 percent from the 324,000 level in 1963 to 376,000 by 1990. A smaller proportion of the total internal travel generated within the Region by 1990 would be made on transit facilities, decreasing from approximately 9.3 percent in 1963 to approximately 6.3 percent by 1990, including all trips formerly made by school bus within the transit service areas. The relative utilization of transit and private automobiles under the land use pattern proposed by the Corridor Plan is indicated by trip purpose categories in Tables 57 and 58. The largest increase in transit trip production, 105 percent, is estimated to occur in the home-based school trip purpose category; and the largest decrease, 36 percent, is estimated to occur in the non-home based trip purpose category. Home-based work

Table 56

AVERAGE TRIP LENGTHS FOR INTERNAL TRANSIT TRIPS IN THE REGION: 1963 AND 1990 CORRIDOR PLAN

Trip Purpose Category	Average Trip Length in Minutes		
	Modified 1963 Survey	1990 Corridor Plan	Percent Change 1963 - 1990
Home-Based Work	35.89	39.25	9.4
Home-Based Shopping	28.50	26.98	- 5.3
Home-Based Other[a]	32.51	34.65	6.6
Non-Home-Based	28.37	31.71	11.8
Weighted Average	33.63	36.32	8.0

[a] *Home-based school trips are not included.*

Source: SEWRPC.

Table 57

INTERNAL TRANSIT PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 CORRIDOR PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Corridor Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work	154,000	47.5	161,000	42.8	4.5
Home-Based Shopping	30,000	9.3	35,000	9.3	16.7
Home-Based Other	55,000	17.0	41,000	10.9	-25.5
Home-Based School	60,000	18.5	123,000	32.7	105.0
Non-Home-Based	25,000	7.7	16,000	4.3	-36.0
Total	324,000	100.0	376,000	100.0	16.0

Source: SEWRPC.

Table 58

INTERNAL AUTO DRIVER TRIP GENERATION IN THE REGION: 1963 AND 1990 CORRIDOR PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Corridor Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work	699,000	32.3	1,062,000	27.0	51.9
Home-Based Shopping	317,000	14.6	648,000	16.5	104.4
Home-Based Other	675,000	31.2	1,386,000	35.2	105.3
Home-Based School	24,000	1.1	24,000	0.6	0.0
Non-Home-Based	451,000	20.8	814,000	20.7	80.5
Total	2,166,000	100.0	3,934,000	100.0	81.6

Source: SEWRPC.

and home-based shopping transit trips are estimated to increase by 5 and 17 percent, respectively, while home-based other transit trips are estimated to decrease by 25 percent.

A total of 3,934,000 internal auto driver trips would be generated within the Region by 1990 under the Corridor Plan. This represents an increase of about 82 percent over the 1963 level of 2,166,000 internal auto driver trips. This increase in internal auto driver trips is slightly greater than the anticipated 77 percent increase in internal automobile person trips (auto driver and auto passenger trips) due to an estimated decrease in average automobile occupancy. The anticipated increases in internal auto driver trips by trip purpose categories are indicated in Table 58, while the anticipated increase in internal automobile person trips by 1990 under the Corridor Plan is indicated in Table 59.

Total vehicle trip production on an average weekday under this plan is estimated to increase by 80 percent from 2,568,000 vehicle trips in 1963 to 4,627,000 in 1990, as shown in Table 60. As under the controlled existing trend plan alternative, the largest increases in trip production under this plan are anticipated to occur in internal automobile and internal truck trips, while the largest percentage increases in trip production are anticipated to occur in external automobile and external truck trips. The proportion of trips by vehicle class would not change significantly from 1963 to 1990 under this plan.

Pattern of Future Vehicle Trips

The increased future vehicular travel demand generated by the Corridor Plan would continue to be centered in and around the three largest urbanizing areas of the Region: Milwaukee, Racine, and Kenosha.

Table 59

INTERNAL AUTOMOBILE PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 CORRIDOR PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Corridor Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	854,000	27.0	1,297,000	23.2	51.9
Home-Based Shopping .	486,000	15.4	997,000	17.8	105.1
Home-Based Other. . .	1,076,000	34.1	2,106,000	37.7	95.7
Home-Based School . .	129,000	4.1	129,000	2.3	0.0
Non-Home-Based. . . .	614,000	19.4	1,061,000	19.0	72.8
Total	3,159,000	100.0	5,590,000	100.0	77.0

Source: SEWRPC.

Table 60

TOTAL VEHICLE TRIP GENERATION IN THE REGION: 1963 AND 1990 CORRIDOR PLAN

Trip Class	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Corridor Plan	Percent of Total	Percent Change 1963 - 1990
Internal Automobile .	2,166,000	84.3	3,934,000	85.0	81.6
External Automobile[a].	86,000	3.4	202,000	4.4	134.9
Internal Truck[b] . . .	300,000	11.7	460,000	9.9	53.3
External Truck. . . .	16,000	0.6	31,000	0.7	93.8
Total	2,568,000	100.0	4,627,000	100.0	80.0

[a] *Through trips counted only once.*

[b] *Includes taxis.*

Source: SEWRPC.

The largest increase in vehicular travel from 1963 to 1990 under the Corridor Plan is anticipated to occur in the outlying areas surrounding the existing urban complexes of the Region and along the proposed radial corridors of urban development (see Map 15). The urbanizing areas in southern Milwaukee County and eastern Waukesha County are anticipated to experience the largest increase in travel demand over 1963. Racine and Kenosha counties would also show large increases in travel demand, predominantly in the eastern portions of these counties. The 1963 pattern of relatively minor interaction between the smaller cities within the Region would continue, although the cities of Waukesha, Racine, and Kenosha would be expected to increase their interaction with Milwaukee.

Description of Existing Plus Committed Highway Network

The network of existing plus committed highway facilities remains unchanged for all three land use plan alternatives, and this network represents the focal point for initial analysis under the Corridor Plan as it did under the controlled existing trend land use plan alternative.

Traffic Assignment to the Existing Plus Committed Highway Network

The anticipated travel demand generated by the Corridor Plan was assigned to the existing plus committed arterial street and highway network to determine its ability to carry the travel demand and to isolate future capacity deficiencies. The anticipated future traffic volumes are shown on Map 16 for the major regional transportation facilities, together with the capacity of these facilities. Also indicated are those portions of the system for which the anticipated future traffic loads exceed the design capacity.

The largest capacity deficiencies on the network would occur on the East-West and North-South freeways. Traffic loads on the East-West Freeway would exceed capacity from Moorland Road in Waukesha County to the Central Interchange, with the most severe congestion occurring just west of the Stadium Interchange. Traffic loads on the North-South Freeway would exceed capacity from W. Hampton Avenue south to W. Rawson Avenue, with the most severe congestion occurring just north of the Hillside Interchange.

In Racine and Kenosha counties, the volume-to-capacity ratios on the North-South Freeway would range from 0.7 at the state line to 1.1 between STH 20 and the Milwaukee County line. In Milwaukee County traffic loads on the Zoo, Stadium, and Airport freeways would be close to or over capacity for most of their lengths. On the Zoo Freeway, the volume-to-capacity ratios would range from 0.6 just north of W. Silver Spring Drive to 1.3 just south of the Zoo Interchange. The volume-to-capacity ratios on the Stadium Freeway are expected to range from 0.7 north of W. Silver Spring Drive to 1.5 just north of the interchange with the Park Freeway. The volume-to-capacity ratios on the Airport Freeway are expected to range from 0.9 just east of the Stadium Freeway to 1.2 just east of the North-South Freeway. Capacities of the Lake and Park Freeways would be adequate for their entire lengths.

Description of the Proposed Highway Network

Based on analyses of the future traffic assignment to the existing plus committed highway network, a planned regional arterial street and highway network was developed to serve the proposed land use pattern by carrying the anticipated travel demand at a level of service specified in the transportation objectives and standards and alleviating the capacity deficiencies inherent in the existing plus committed network. It was found that the planned highway network evolved for the Corridor Plan did not differ from that evolved for the controlled existing trend plan alternative with respect to major facilities. The regional freeway and expressway facilities comprising the basic framework of the planned network are described in detail under the discussion of the controlled existing trend plan alternative and are displayed in Map 10.

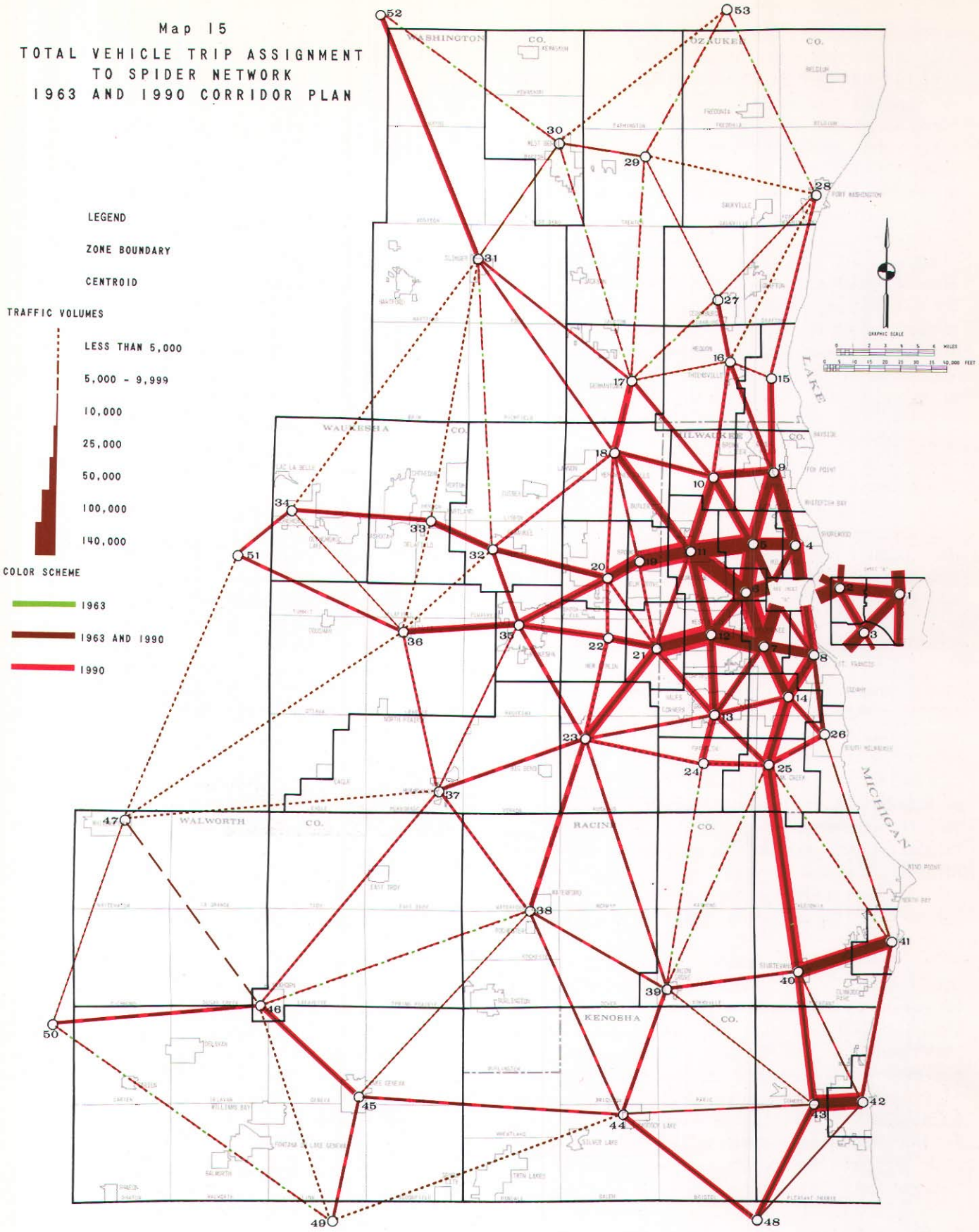
Although the same freeway and expressway network is proposed to serve both the corridor and controlled existing trend land use plan alternatives, differences would exist in the capacities of some arterial streets and highways. These differences, although not shown in this report because of map scale limitations, are, nevertheless, an integral part of the highway network proposed to serve the Corridor Plan. The total mileage of proposed new and improved street and highway facilities proposed to serve the Corridor Plan is summarized by functional type and costs in Table 61.

Traffic Assignment to the Proposed Highway Network

The anticipated 1990 travel demand generated by the Corridor Plan was assigned to the proposed highway network, and the results of this assignment are summarized on Map 17 for the major

Map 15

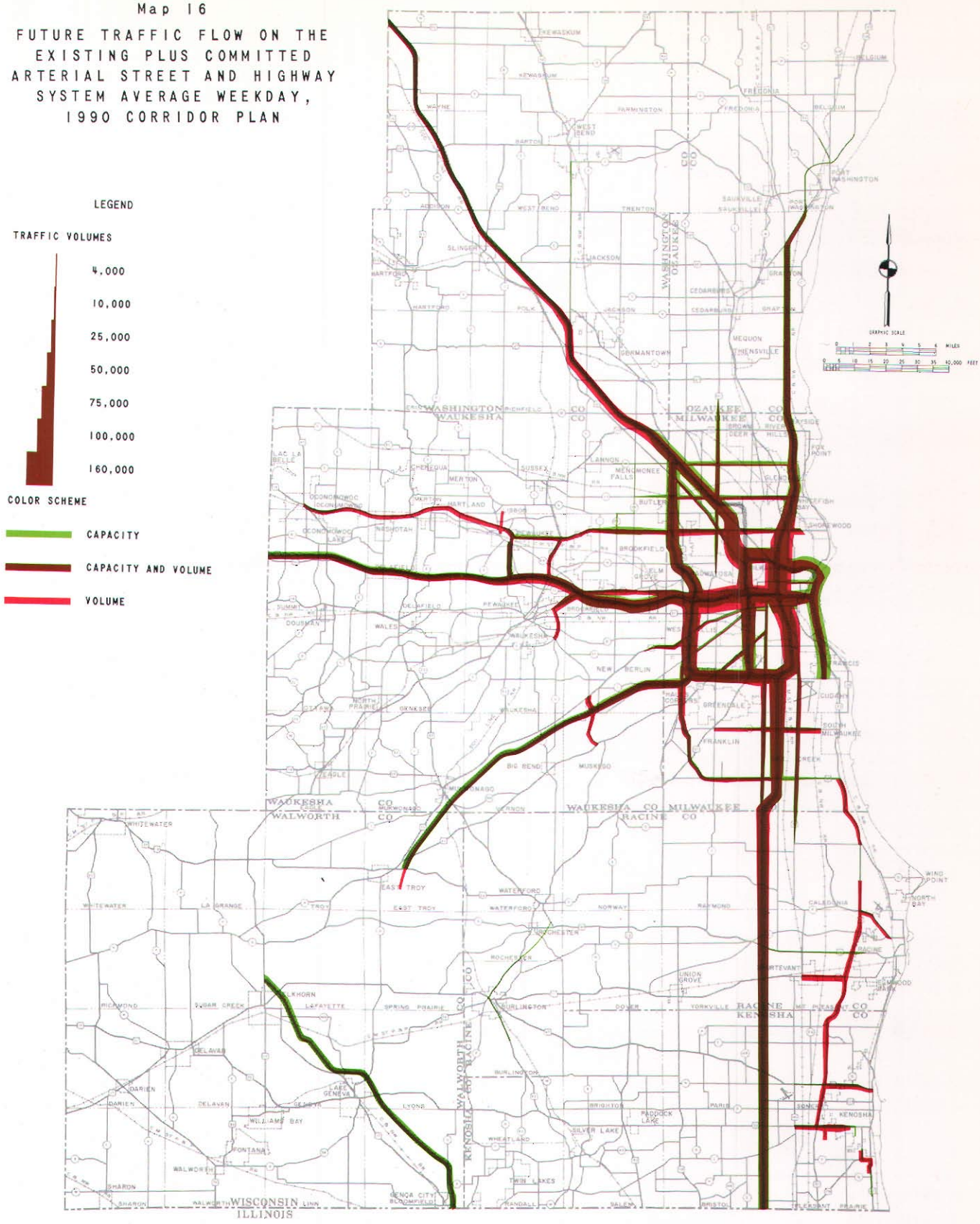
TOTAL VEHICLE TRIP ASSIGNMENT
TO SPIDER NETWORK
1963 AND 1990 CORRIDOR PLAN



The pattern of vehicular travel on a hypothetical transportation network connecting traffic analysis areas in the Region is shown on this diagram for existing development and for the corridor plan alternative. Development of major future traffic movements may be expected to be confined to the proposed radial corridors of urban development with only minor radial movements occuring outside these corridors in the newly urbanizing areas of the Region.

Map 16

FUTURE TRAFFIC FLOW ON THE EXISTING PLUS COMMITTED ARTERIAL STREET AND HIGHWAY SYSTEM AVERAGE WEEKDAY, 1990 CORRIDOR PLAN



Severe traffic congestion would occur on the regional arterial system if no further transportation system improvements were made. Particularly severe congestion would occur on much of the Milwaukee County Freeway System.

Table 61

MILES AND CONSTRUCTION COSTS OF PROPOSED NEW AND IMPROVED ARTERIAL STREET AND HIGHWAY FACILITIES IN THE REGION - CORRIDOR PLAN
(Costs in Millions of 1966 Dollars)

Functional Facility Type	New Facilities[a]		Improved Facilities		Total	
	Miles	Construction Cost	Miles	Construction Cost	Miles	Construction Cost
Standard Arterial:						
2-lane	91.5	$ 19.117	105.8	$ 23.258	197.3	$ 42.375
4-lane	26.6	13.873	341.7	189.651	368.3	203.524
6-lane	2.2	2.183	142.3	148.047	144.5	150.230
Subtotal	*120.3*	*35.173*	*589.8*	*360.956*	*710.1*	*396.129*
Expressway:						
4-lane	3.5	6.060	6.5	3.502	10.0	9.562
6-lane	--	--	--	--	--	--
Subtotal	*3.5*	*6.060*	*6.5*	*3.502*	*10.0*	*9.562*
Freeway:						
4-lane	180.1	237.313	32.8	22.304	212.9	259.617
6-lane	69.0	208.558	41.5	31.244	110.5	239.802
8-lane	6.6	25.876	--	--	6.6	25.876
Subtotal	*255.7*	*471.747*	*74.3*	*53.548*	*330.0*	*525.295*
Total	379.5	$512.980	670.6	$418.006	1,050.1	$930.986

[a] *Includes committed facilities which had not been programmed through calendar year 1966.*

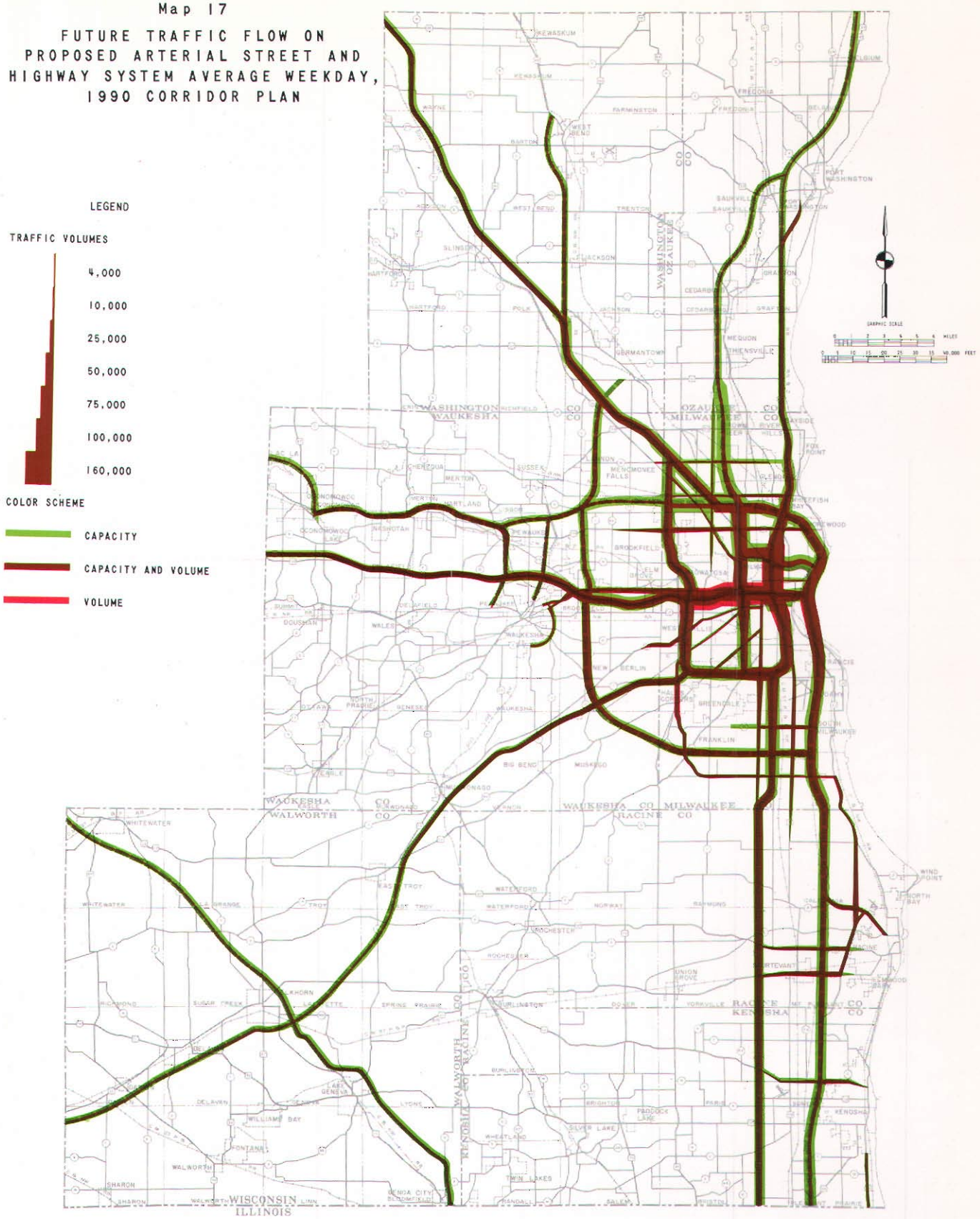
Source: SEWRPC.

highway facilities within the Region. The assignment indicates that the proposed network would be generally adequate to serve the future traffic demand generated by the Corridor Plan, with some overloads occurring at central points on the proposed system. The capacity of the East-West Freeway would be adequate to carry the anticipated future traffic volumes from the westerly boundary of the Region easterly to the Zoo Interchange at the level of service provided in the transportation system development objectives and standards. From this interchange to the Central Interchange, the traffic loads on this freeway would exceed the capacity, with the most severe congestion occurring just west of the Stadium Interchange. The capacity of the East-West Freeway from the Central Interchange east to the Lake Freeway would be adequate to meet the anticipated demand. The capacity of the North-South Freeway from the state line north to W. Greenfield Avenue in Milwaukee County would be adequate to carry the anticipated traffic volumes. From this point north to W. Capitol Drive, the highest volume-to-capacity ratio anticipated would be 1.2 just north of the Central Interchange. The capacity of the remainder of the North-South Freeway and the extension into Ozaukee County would be adequate to the Ozaukee-Sheboygan County line.

In Milwaukee County the capacity of the Zoo, Airport, Park, and Lake freeways for their entire lengths, and the new East-West Freeway in the vicinity of W. Hampton Avenue to its terminus at the Lake Freeway to the east, would all be adequate to carry the anticipated traffic loads. The Stadium Freeway and its northerly extension to its terminus at USH 141 would also be adequate to carry the anticipated traffic loads for its entire length. The capacity of the freeway portion of USH 41 from its northerly terminus at the Washington-Dodge County line to its southerly terminus at the proposed freeway in the vicinity of W. Hampton Avenue would be adequate to meet the anticipated traffic loads. The capacity of the north-south freeway in eastern Waukesha County and its east-west section in southern Milwaukee County would be adequate for its entire length to carry the anticipated traffic loads. The capacities of the new USH 16 Freeway extended westerly from the proposed freeway in the vicinity of W. Hampton Avenue to the regional boundary and the new North-South Freeway extended from the committed ter-

Map 17

FUTURE TRAFFIC FLOW ON PROPOSED ARTERIAL STREET AND HIGHWAY SYSTEM AVERAGE WEEKDAY, 1990 CORRIDOR PLAN



Future traffic volumes on all major arterial streets and highways in the proposed system would be below design flow rates except for some short segments of certain freeways in Milwaukee County.

minus of the Lake Freeway at W. Layton Avenue south to the state line would both be adequate to carry the anticipated traffic loads. The capacities of USH 12 and STH 15 would be adequate to carry the anticipated traffic volumes for their entire lengths within the Region.

A summary of the volume-to-capacity relationships for all arterial streets and highways within the Region under the system proposed to serve the Corridor Plan is provided in Table 62. For the Region as a whole, 1.4 percent of the total arterial street and highway system mileage would be expected to operate over design capacity by 1990 if the proposed network is constructed.

Description of Transit Network and Assignment of Future Passenger Loads

Since the Corridor Plan would concentrate medium- and high-density residential development along linear corridors radiating from Milwaukee, this plan appeared to offer the best opportunity to develop a high corridor transit demand. Consequently, a more extensive modified rapid transit network was developed for the Corridor Plan than for the other two land use plan alternatives; and modified rapid transit service was extended to areas within the Region that could not be served economically under the other two plan alternatives. Operating speeds on these transit routes were held essentially the same as prevailing freeway operating speeds.

The transit demand generated by the Corridor Plan was initially assigned to the existing plus modified rapid transit network, including extension along the urban corridors. This provided a point of departure from which high transit demand corridors could be identified and the feasibility of upgrading individual modified rapid transit routes to full rapid transit service analyzed. The results of this assignment are shown on Map 18. The corridor along the East-West Freeway developed the highest future transit demand. The future transit demand in this corridor is anticipated to range from 68,000 revenue passengers per day just west of the Central Interchange through 39,000 revenue passengers per day just east of the Zoo Interchange to 8,000 revenue passengers per day at STH 18 in Waukesha County.

The second highest demand is anticipated to occur in the corridor along the Fond du Lac Avenue and Stadium freeways to the Park Freeway and then over this freeway into the central business district of Milwaukee. The future transit demand on this route is expected to range from 11,000 revenue passengers per day at the Milwaukee-Waukesha County line to 36,000 revenue passengers per day just west of the Hillside Interchange. In a corridor

Table 62

VOLUME-TO-CAPACITY RATIOS[a] FOR PROPOSED HIGHWAY NETWORK BY COUNTY: 1990 CORRIDOR PLAN

County	Miles of Arterial Streets and Highways by Volume-to-Capacity Ratio Range							
	Total	Percent of Regional Total	0.00 - 0.90	Percent of County Total	0.91 - 1.10	Percent of County Total	Above 1.10	Percent of County Total
Kenosha	313.8	8.5	270.4	86.2	37.2	11.8	6.2	2.0
Milwaukee	934.2	25.4	825.5	88.4	84.5	9.0	24.2	2.6
Ozaukee	303.1	8.3	283.5	93.5	18.1	6.0	1.5	0.5
Racine	410.8	11.2	325.9	79.4	80.2	19.5	4.7	1.1
Walworth	477.5	13.0	425.7	89.1	50.5	10.6	1.3	0.3
Washington	418.3	11.4	389.5	93.1	24.6	5.9	4.2	1.0
Waukesha	813.1	22.2	699.1	86.0	104.6	12.9	9.4	1.1
Regional Total	3,670.8	100.0	3,219.6	87.7	399.7	10.9	51.5	1.4

[a] *The significance of the volume-to-capacity ratio ranges used is:*

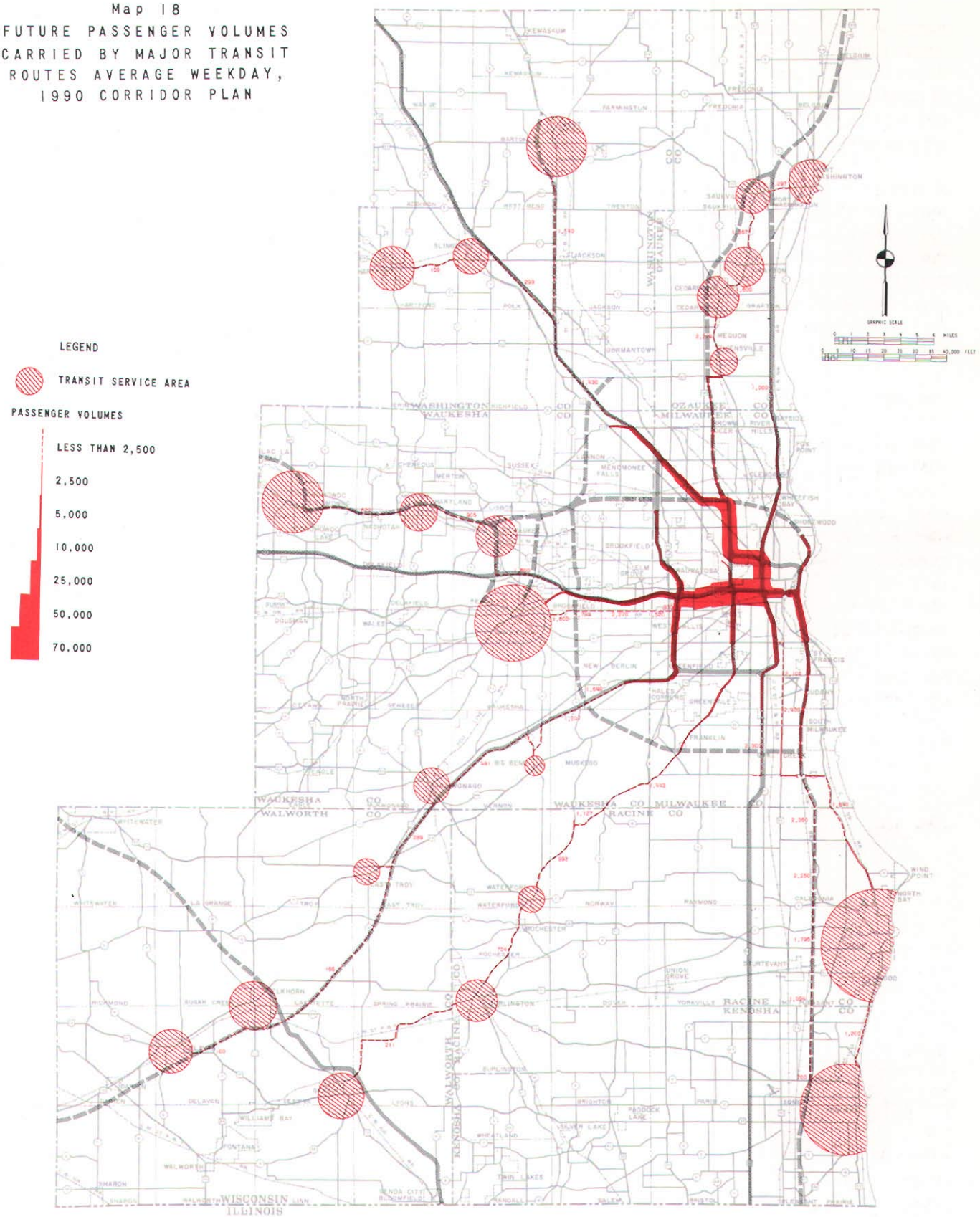
0.00 - 0.90; Under design capacity, fully adequate and safest operational level.

0.91 - 1.10; At design capacity but still adequate.

Above 1.10; Over design capacity, congested at times.

Source: SEWRPC.

Map 18
FUTURE PASSENGER VOLUMES CARRIED BY MAJOR TRANSIT ROUTES AVERAGE WEEKDAY, 1990 CORRIDOR PLAN



Future passenger volumes in two corridors, one along the East-West Freeway and one along the Park and Stadium Freeways, would be sufficient to justify the provision of bus rapid transit lines. Branching flow bands along other freeways indicate future passenger volumes which would be carried by buses operating on freeways in mixed traffic. Volumes along extensions, into outlying areas of the Region, of the routes centered in the proposed urban corridors would be insufficient to economically justify service throughout the day.

along the Lake Freeway entering the Milwaukee central business district from the south, a transit demand of 19,000 revenue passengers per day would be expected. Transit demands in excess of 10,000 revenue passengers per day are also anticipated in corridors along the north and south sections of the Zoo Freeway and the south sections of the Stadium and North-South freeways at their interchanges with the East-West Freeway.

Based on this initial assignment, full rapid transit service was proposed along the east-west corridor from the Zoo Interchange to the Milwaukee central business district. Although this corridor is anticipated to have a heavy transit demand, it is not high enough to meet practically the threshold service warrants for a rail rapid transit facility, considering operating and transfer problems; and the rapid transit service would be provided by buses operating on exclusive fully grade separated rights-of-way. The transit demand in the Stadium-Park Freeway corridor, in addition, was found to be sufficiently high to justify full bus rapid transit service over a similar separate transit roadway of about five miles in length. All other modified rapid transit lines within Milwaukee County were found to meet threshold service warrants. In addition, the provision of modified rapid transit service would also be justified to Big Bend, Pewaukee, West Bend; and an additional route would be justified to Thiensville. These service extensions would be in addition to those proposed to serve the controlled existing trend land use plan (see Map 19).

SATELLITE CITY PLAN DESCRIPTION—LAND USE

Introduction

The third alternative regional land use plan to be considered is one which examines the ramifications of concentrating future urban development in relatively compact and self-contained outlying communities, thereby de-emphasizing the continued outward growth of the largest urban areas within the Region. The outlying communities around which the new growth would be centered consist of existing communities selected for their strategic location on existing transportation routes, which presently provide a full range of urban facilities and services, including public utility, commercial, educational, recreational, governmental, and cultural facilities and services. These communities are the cities of Port Washington in Ozaukee County, West Bend in Washington County, Whitewater in Walworth County, Burlington in Racine County, and Oconomowoc in Waukesha County. The new cities so formed would be about eight miles in diameter, would each contain a population of about 50,000, and are envisioned as being physically cohesive communities with employment opportunities broad enough to attract a varied population and minimize work-related travel.

Under this plan the historic growth trends within the Region would have to be severely altered, restricting new urban development around the three largest urban centers within the Region while encouraging the expansion of certain outlying communities. The pattern of protection afforded the floodways and flood plains of the perennial streams and the best remaining woodlands and wetlands and the provision of an integrated system of park and open-space areas would be similar to that provided in the other plan alternatives. The plan could be adjusted to existing, planned, and possible future gravity drainage sanitary sewer service areas. The allocation of future land use within each county of the Region would be such as to significantly alter the forecast population levels within each county, while meeting the level forecast for the Region as a whole. The planned future land use proposals would depart significantly in most areas of the Region from those contained in existing community development plans and zoning documents.

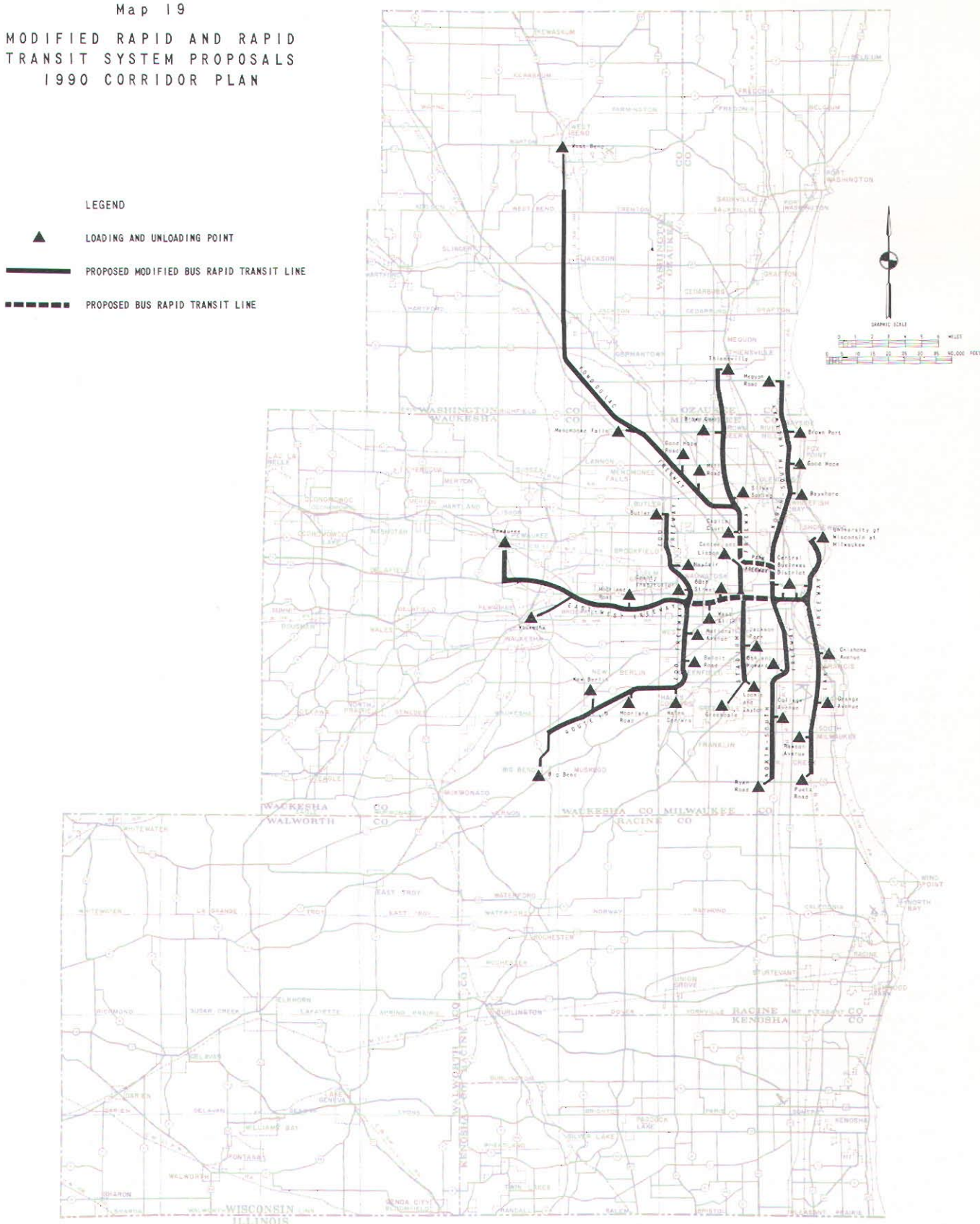
An understanding of the regional growth pattern proposed by this alternative can be obtained from review of the graphic presentation of the plan shown on Map 20 and of the statistical presentation set forth in Tables 63 through 71.

Residential Development

The Satellite City Plan would accommodate the expected regional population increase of one million persons by 1990 primarily through conscious efforts to restrict new urban development around the three largest urban centers of the Region and to encourage new urban development around certain existing outlying communities which are strategically located on existing transportation routes and which presently provide a full range of urban services, such as public utilities, commercial, recreational, educational, and governmental facilities. The Satellite City Plan would seek to discourage development in the sizable open areas between the large urban centers and the satellite cities. This plan would seek to encourage high- and medium-density development in the satellite cities, pri-

Map 19

MODIFIED RAPID AND RAPID TRANSIT SYSTEM PROPOSALS 1990 CORRIDOR PLAN

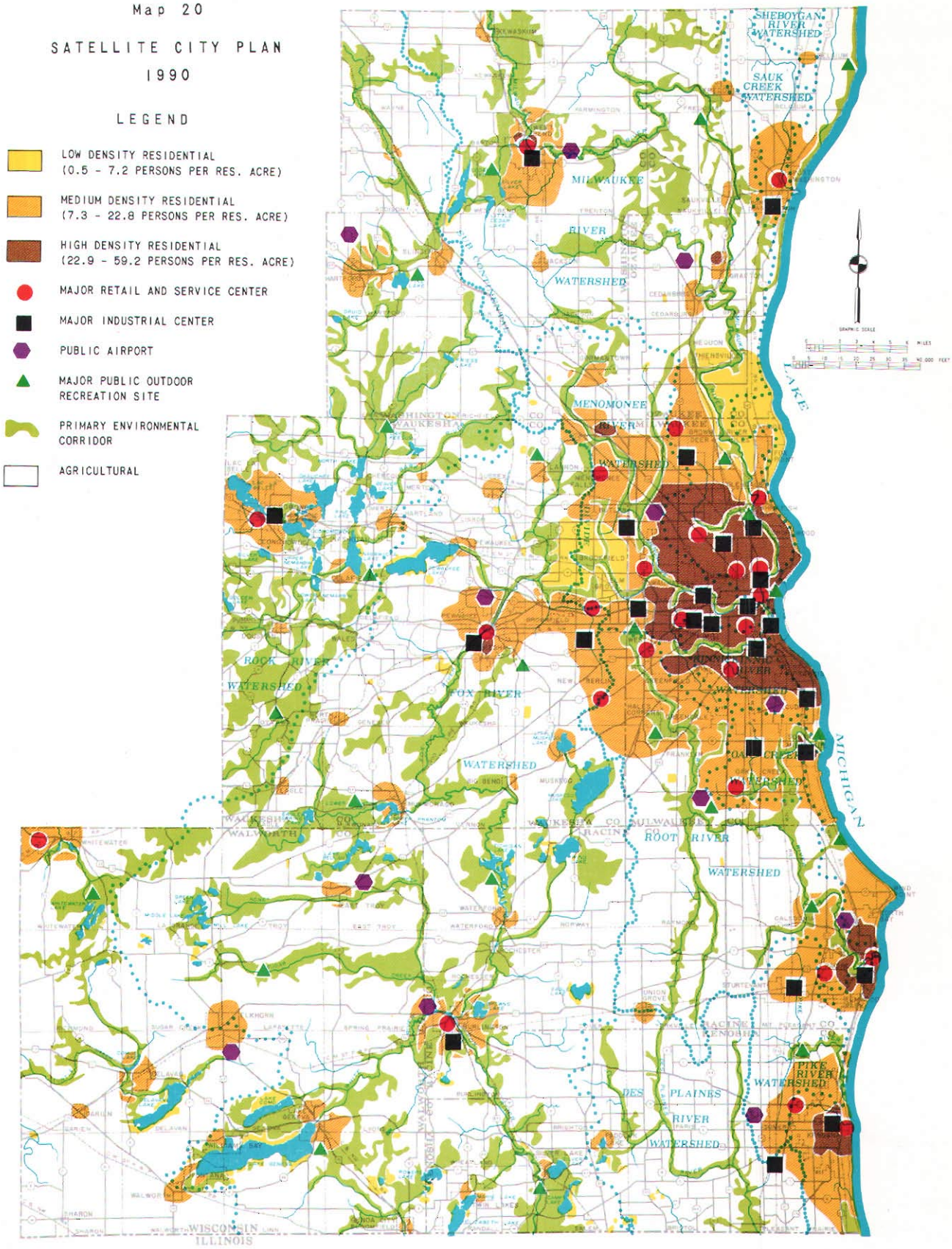


In addition to the transit service proposed for the other two land use plans, the extension of modified bus rapid transit service ("Freeway Flyer") is proposed to serve the Corridor Plan from the Milwaukee Central Business District along the corridors of urban development as far as Thiensville-Mequon, West Bend, Pewaukee, Big Bend, Greendale, and Oak Creek. Further extensions along corridors were tested but volumes were sufficient to justify only less frequent inter-city bus service. Two exclusive grade separated bus rapid transit roadways are further proposed along the East-West and Park-Stadium Freeway Corridors.

Map 20

SATELLITE CITY PLAN

1990



The Satellite City Plan represents an effort to concentrate new urban development in outlying communities of the Region, thus decentralizing new urban growth and deemphasizing the development of the three largest existing urban areas of the Region. New urban development would be relatively independent of the commercial and industrial activities of the larger central cities and separated from the larger urban centers by large areas of agricultural land and other open space uses.

marily in planned residential development units. The development pattern proposed under this plan would place only 54 percent of the new urban development within 20 miles of the central business district of Milwaukee.

As indicated in Table 63, more than 69,000 acres, or nearly 109 square miles, of residential land would be added to the existing stock of such land within the Region. This amounts to an increase of nearly 54 percent over the 1963 level. About one-half of this new development would occur in Milwaukee and Waukesha counties. Nearly 88 percent of this new development, or more than 60,000 acres, would be developed at medium density. About 6,000 acres of new residential development would be in the low-density classification, most of it in Ozaukee and Waukesha counties, while about 2,500 acres of new residential development would be in the high-density classification, most of it in Milwaukee County.

Population Distribution

Under the Satellite City Plan, the greatest increase in population would still occur in Milwaukee County, where an increase of more than 314,000 persons, or nearly 29 percent, is proposed (see Table 64). The greatest percentage gain would occur in Ozaukee County, where an increase of more than 241 percent, or 100,300 persons, is proposed. Variations from the forecast future county population levels would be the result of a conscious effort to direct new residential and other urban development into the satellite cities while, at the same time, restricting new growth in the three largest urban communities and in the open spaces between the satellite cities and the larger urban centers. Kenosha, Ozaukee, Walworth, and Wash-

Table 63

EXISTING AND PROPOSED RESIDENTIAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN

County	Residential Land Use											
	High-Density			Medium-Density			Low-Density			Total		
	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres	Existing (1963) Acres	Planned Increment Acres	Total 1990 Acres
Kenosha. .	2,511	59	2,570	2,673	7,238	9,911	6,729	--	6,729	11,913	7,297	19,210
Milwaukee.	21,080	2,214	23,294	8,697	16,289	24,986	12,207	707	12,914	41,984	19,210	61,194
Ozaukee. .	471	61	532	1,324	5,835	7,159	7,542	3,285	10,827	9,337	9,181	18,518
Racine . .	4,069	97	4,166	2,752	6,786	9,538	6,550	--	6,550	13,371	6,883	20,254
Walworth .	1,701	--	1,701	2,871	5,706	8,577	7,284	--	7,284	11,856	5,706	17,562
Washington	1,752	34	1,786	1,673	5,693	7,366	4,004	--	4,004	7,429	5,727	13,156
Waukesha .	2,879	91	2,970	4,758	13,384	18,142	25,831	2,047	27,878	33,468	15,522	48,990
Regional Total	34,463	2,556	37,019	24,748	60,931	85,679	70,147	6,039	76,186	129,358	69,526	198,884

Source: SEWRPC.

Table 64

EXISTING AND PROPOSED POPULATION DISTRIBUTION IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN
(Population in Thousands)

County	1963 Population	Forecast Increment 1963 - 1990		Planned Increment 1963 - 1990		1990 Population	
		Number	Percent Change	Number	Percent Change	Forecast	Planned
Kenosha	106.7	95.3	89.3	108.4	101.5	202.0	215.1
Milwaukee	1,086.3	359.7	33.1	314.1	28.9	1,446.0	1,400.4
Ozaukee	41.6	64.4	154.8	100.3	241.1	106.0	141.9
Racine.	150.6	132.4	87.9	101.4	67.3	283.0	252.0
Walworth.	55.5	31.5	56.7	84.3	151.8	87.0	139.8
Washington. . . .	49.5	46.5	93.9	81.3	164.2	96.0	130.8
Waukesha.	184.2	273.8	148.6	213.8	116.0	458.0	398.0
Regional Total	1,674.4	1,003.6	59.9	1,003.6	59.9	2,678.0	2,678.0

Source: SEWRPC.

ington counties would each show a greater population increase under this plan alternative than indicated by the demographic forecast.

Sewer and Water Service

As indicated in Table 65, about 547 square miles, or 93 percent, of the developed area of the Region and about 2,519,200 persons, or 94 percent of the population of the Region, would be served by public sanitary sewer and water supply facilities by 1990. Of the new development 218 square miles, or 87.3 percent, would be served by public sanitary sewer facilities tributary to existing or locally proposed systems. Such service to the remainder of the new development would require the construction of new systems.

Commercial and Industrial Development

Under the Satellite City Plan, eight new planned major industrial areas and ten new planned major commercial centers are proposed, which would employ approximately 40,000 and 15,000 persons, respectively. The eight new planned industrial areas are proposed to be located in the cities of Burlington, Kenosha, Milwaukee, New Berlin, Oak Creek, Oconomowoc, Port Washington, and Racine. The ten planned major commercial areas are proposed to be located in the cities of Brookfield, Kenosha, Menomonee Falls, Milwaukee, New Berlin, Oak Creek, Port Washington, Racine, West Allis, and Whitewater.

As indicated in Table 66, the Satellite City Plan would increase the existing stock of land in commercial use by more than 5,200 acres, or nearly 78 percent, and the existing stock of land in industrial use by 5,600 acres, or nearly 58 percent. Milwaukee County would account for the largest acreage increase in both categories, as more than 1,500 acres of new commercial land and nearly 1,700 acres of new industrial land would be added to the existing stock of such land under this plan alternative. The greatest percentage increase in both the commercial land use and the industrial land use categories would occur in Ozaukee County. The proposed 550 acres of commercial land use in that county would result in a 152 percent increase, and the proposed 524 acres of industrial land use would result in a 142 percent increase over the existing amount.

Employment Distribution

As indicated in Table 67, the estimated number of new employment opportunities within the Region between 1963 and 1990 would be about 349,000. While this regional total remains the same under each alternative plan, the distribution of these employment opportunities would vary among the counties in each plan. Even though the Satellite City Plan implies a conscious effort to restrict growth in the largest urban centers of the Region, Milwaukee County would still account for the greatest numerical increase in job opportunities between 1963 and 1990, largely as the result of additional employment opportunities becoming available through expansion of existing enterprises. As indicated, employment opportunities in Milwaukee County would increase by about 30 percent, or 142,000 jobs, between 1963 and 1990. The greatest percentage increase would occur in Ozaukee County, where an increase of 262 percent, or more than 28,000 employment opportunities, is proposed.

Governmental and Transportation Land Use

As indicated in Table 68, the Satellite City Plan would propose to add nearly 6,200 acres of governmental land use and 28,000 acres of transportation land use to the existing stock of land in these categories. This amounts to a 42 percent and a 29 percent increase, respectively. The greatest increases in both categories would occur in Milwaukee County, where governmental land use increases of 1,800 acres, or 26 percent, and transportation land use increases of 7,900 acres, or nearly 26 percent, are proposed. The greatest percentage increase in both categories would occur in Ozaukee County, where increases in governmental land use of 695 acres, or 87 percent, and in transportation land use of 3,200 acres, or nearly 46 percent, are proposed.

Open Space-Recreational Land Use

As indicated in Table 69, the Satellite City Plan would add about 7,900 acres of public recreational land to the existing stock of public and private recreational land, including the 11 new major parks proposed under the controlled existing trend plan alternative. This amounts to an increase of nearly 24 percent over the 1963 acreage. The greatest numerical increase would occur in Walworth County, where an increase of more than 1,500 acres, or nearly 26 percent, is proposed. The greatest percentage increase would occur in Ozaukee County, where an increase of 1,200 acres, or more than 77 percent, is proposed.

Open Space-Agricultural and Other Open Land Use

As indicated in Table 70, the Satellite City Plan would require the conversion of more than 122,000

Table 65

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN

County	Total Area in Square Miles	Existing (1963)									Proposed (1990)[a]				
		Developed Area in Square Miles	Public Sewer Service				Public Water Supply				Developed Area in Square Miles	Public Sewer Service and Public Water Supply[b]			
			Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served	Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served		Developed Area Served in Square Miles	Percent of Developed Area Served	Population Served	Percent of Total Population Served
Kenosha . . .	278.3	27.6	14.0	50.7	79,160	74.2	13.6	49.2	78,670	73.7	48.3	44.4	92.0	202,200	94.0
Milwaukee . .	242.2	152.5	142.3	93.3	1,075,000	98.9	129.1	84.6	1,029,800	94.7	216.0	216.0	100.0	1,400,400	100.0
Ozaukee . . .	234.5	15.9	6.2	38.9	20,340	48.8	5.5	34.5	19,512	46.8	45.9	45.2	98.4	132,800	93.5
Racine. . . .	339.9	37.8	19.1	50.5	112,600	74.7	18.3	48.4	120,590	80.0	60.3	55.8	92.5	228,600	90.7
Walworth. . .	578.1	24.0	8.6	35.8	28,925	52.1	11.5	47.9	31,270	56.3	45.3	33.6	74.1	106,500	76.1
Washington. .	435.5	11.8	6.1	51.7	23,050	46.5	5.8	49.1	23,150	46.7	38.3	34.3	89.5	93,500	71.4
Waukesha. . .	580.6	70.1	20.7	29.5	79,950	43.3	16.2	23.1	69,490	37.6	134.8	118.1	87.6	355,200	89.2
Regional Total	2,689.1	339.7	217.0	63.9	1,419,025	84.7	200.0	58.8	1,372,482	81.9	588.9	547.4	92.9	2,519,200	94.0

[a] *All sanitary sewer facilities required to serve the 1963 to 1990 urban development are tributary to existing systems, except for those tributary to the systems proposed to serve the cities of Delafield and Oconomowoc in Waukesha County, Port Washington in Ozaukee County, Elkhorn and Delavan in Walworth County, the Village of Union Grove in Racine County, and the town of Somers in Kenosha County.*

[b] *It was assumed that public water supply facilities would be extended within all public sanitary sewer service areas.*

Source: SEWRPC.

Table 66

EXISTING AND PROPOSED COMMERCIAL AND INDUSTRIAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN

County	Commercial Land Use				Industrial Land Use			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha.	532	553	1,085	103.9	809	825	1,634	101.9
Milwaukee. . . .	3,035	1,562	4,597	51.4	5,234	1,695	6,929	32.3
Ozaukee.	361	550	911	152.3	370	524	894	141.6
Racine	753	493	1,246	65.4	885	992	1,877	112.0
Walworth	615	445	1,060	72.3	862	235	1,097	27.2
Washington . . .	287	384	671	133.7	455	240	695	52.7
Waukesha	1,123	1,238	2,361	110.2	1,131	1,113	2,244	98.4
Regional Total	6,706	5,225	11,931	77.9	9,746	5,624	15,370	57.7

Source: SEWRPC.

Table 67

EXISTING AND PROPOSED EMPLOYMENT IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN

County	1963 Employment		Planned Employment Increment 1963 - 1990		1990 Planned Employment Distribution	
	Number	Percent of Region	Number	Percent Change	Number	Percent of Region
Kenosha.	41,900	6.6	38,100	90.9	80,000	8.1
Milwaukee. . . .	471,700	74.3	142,100	30.1	613,800	62.4
Ozaukee.	10,800	1.7	28,300	262.0	39,100	4.0
Racine	52,100	8.2	39,400	75.6	91,500	9.3
Walworth	12,700	2.0	21,300	167.7	34,000	3.5
Washington . . .	12,100	1.9	19,900	164.4	32,000	3.2
Waukesha	33,600	5.3	60,000	178.5	93,600	9.5
Regional Total	634,900	100.0	349,100	54.9	984,000	100.0

Source: Wisconsin Industrial Commission; SEWRPC.

Table 68

EXISTING AND PROPOSED GOVERNMENTAL[a] AND TRANSPORTATION[b] LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN

County	Governmental Land Use				Transportation Land Use			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha.	1,059	664	1,723	62.7	8,492	3,009	11,501	35.4
Milwaukee. . . .	6,995	1,826	8,821	26.1	30,442	7,916	38,358	26.0
Ozaukee.	796	695	1,491	87.3	7,010	3,212	10,222	45.8
Racine	1,499	627	2,126	41.8	11,163	2,830	13,993	25.3
Walworth	1,090	516	1,606	47.3	10,552	2,348	12,900	22.2
Washington . . .	762	529	1,291	69.4	10,344	2,397	12,741	23.1
Waukesha	2,521	1,323	3,844	52.4	18,114	6,039	24,153	33.3
Regional Total	14,722	6,180	20,902	41.9	96,117	27,751	123,868	28.8

[a] *Includes institutional uses and on-site parking.*

[b] *Includes communications and utilities uses.*

Source: SEWRPC.

Table 69

EXISTING AND PROPOSED RECREATIONAL LAND USE IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN

County	Recreational Land Use			
	Existing[a] (1963) Acres	Planned[b] Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	3,118	602	3,720	19.3
Milwaukee	12,080	1,216	13,296	10.0
Ozaukee	1,614	1,249	2,863	77.3
Racine	2,316	813	3,129	35.1
Walworth	6,017	1,555	7,572	25.8
Washington	2,041	1,109	3,150	54.3
Waukesha	6,076	1,366	7,442	22.4
Regional Total	33,262	7,910	41,172	23.7

[a] *Includes the entire site area of public and nonpublic recreational uses.*

[b] *Includes only that increment which is for public recreational use.*

Source: SEWRPC.

Table 70

EXISTING AND PROPOSED AGRICULTURAL AND OTHER OPEN LAND[a] USES IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN

County	Agricultural Land Use				Other Open Lands			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	116,391	-11,577	104,814	- 9.9	35,781	- 1,373	34,408	- 3.8
Milwaukee	35,121	-20,143	14,978	-57.3	20,103	-13,282	6,821	-66.0
Ozaukee	105,199	-14,025	91,174	-13.3	25,326	- 1,386	23,940	- 5.4
Racine	153,636	-11,410	142,226	- 7.4	33,923	- 1,228	32,695	- 3.6
Walworth	266,251	- 8,982	257,269	- 3.3	72,737	- 1,823	70,914	- 2.5
Washington	192,271	- 9,346	182,925	- 4.8	65,143	- 1,040	64,103	- 1.5
Waukesha	216,275	-22,778	193,497	-10.5	92,938	- 3,823	89,115	- 4.1
Regional Total	1,085,144	-98,261	986,883	- 9.0	345,951	-23,955	321,996	- 6.9

[a] *Includes woodlands, water, wetlands, and quarries.*

Source: SEWRPC.

acres of rural land to urban land use by 1990. This would be equivalent to an average annual conversion rate of about 4,500 acres, or 7.1 square miles. Most of this rural land, about 98,000 acres, would be withdrawn from the agricultural land use category. This would amount to a 9 percent reduction from the existing stock of agricultural land. The existing stock of open lands would be decreased by nearly 24,000 acres, or about 7 percent. As indicated earlier, most of these open lands subject to conversion are presently in woodland use.

The greatest decrease in agricultural land would occur in Waukesha County, where a reduction of about 23,000 acres, or more than 10 percent, of the existing agricultural land area is proposed. The greatest percentage decrease would occur in Milwaukee County, where 57 percent, or about 20,000 acres, of the existing stock of agricultural land would be converted to urban uses.

As indicated in Table 71, the Satellite City Plan would propose to convert about 20,000 acres of prime agricultural areas to urban uses by 1990. The greatest acreage reduction under this plan would occur in Kenosha County, where more than 4,800 acres, or nearly 7 percent, of the existing prime agricultural land area would be converted to urban uses. The greatest percentage decrease would occur in Milwaukee County, where nearly 32 percent, or about 2,500 acres, of existing prime agricultural land would be converted to urban uses.

Table 71

EXISTING AND PROPOSED PRIME AGRICULTURAL LANDS[a] IN THE REGION BY COUNTY: 1963 AND 1990 SATELLITE CITY PLAN

County	Prime Agricultural Lands			
	Existing (1963) Acres	Planned Increment Acres	1990 Acres	Percent Change 1963 - 1990
Kenosha	72,870	- 4,821	68,049	- 6.6
Milwaukee	7,959	- 2,536	5,423	-31.8
Ozaukee	41,455	- 3,063	38,392	- 7.3
Racine	74,321	- 3,562	70,759	- 4.7
Walworth	121,919	- 2,865	119,054	- 2.3
Washington	53,916	- 784	53,132	- 1.4
Waukesha	71,512	- 1,937	69,575	- 2.7
Regional Total	443,952	-19,568	424,384	- 4.4

[a] *Prime agricultural lands are defined as those areas which 1) contain soils rated in the regional detailed operational soil survey as very good or good for agriculture, and 2) occur in concentrated areas over five square miles in extent, which have been designated as exceptionally good for agricultural production by agricultural specialists.*

Source: SEWRPC.

Open Space—Environmental Corridors

The 285,000 acres of the Region which comprise the primary environmental corridor lands proposed to be set aside and preserved from development under the Controlled Existing Trend Plan and under the Corridor Plan would also be set aside and preserved from development under the Satellite City Plan.

SATELLITE CITY PLAN DESCRIPTION—TRAFFIC DEMAND AND TRANSPORTATION FACILITIES

Quality of Future Travel Demand

It is estimated that, if fully developed, the land use pattern proposed by the Satellite City Plan would generate a total of 6,093,000 internal person trips within the Region on an average weekday in 1990. This represents an increase of 72.0 percent over the 3,543,000 internal person trips generated within the Region on an average weekday in 1963. Present (1963 survey) and future internal person trip production within the Region by trip purpose is indicated in Table 72. This percentage increase in internal person trip production contrasts with an increase in population within the Region of about 60 percent and in automobile availability of about 100 percent. The largest proportion of the internal person trip increase is expected to occur in the home-based shopping, home-based other and non-home-based tripmaking categories, which together are estimated to increase by 91 percent. Home-based work trips are estimated to increase by about 47 percent over the 27-year period from 1963 to 1990.

The average number of internal person trips generated per capita would increase from 2.12 in 1963 to 2.28 in 1990, while the average number of internal person trips generated per household would increase from 7.34 to 7.69. Average lengths of auto driver trips within the Region expressed in minutes of travel time are expected to decrease slightly by 1990 for the work and non-home-based trip purpose categories, but increase for shopping and other trip purpose categories under the Satellite City Plan, as indicated in Table 73. Average trip lengths of transit person trips within the Region expressed in minutes of travel time are expected to increase slightly by 1990, as shown in Table 74.

Mode of Travel

It is estimated that, under the Satellite City Plan transit trip production within the Region on an average weekday would increase 4.6 percent from 324,000 in 1963 to 339,000 trips by 1990. A smaller proportion of the total travel generated within the Region would be made on transit facilities than in 1963, decreasing from approximately 9.3 percent in 1963 to approximately 5.6 percent by 1990, including all trips within the transit service areas formerly made by school bus. The relative utilization of transit and private automobiles under the land use pattern proposed by the Satellite City Plan is indicated by trip purpose categories in Tables 75 and 76. The large increase anticipated in home-based school transit trip production, 105 percent, is primarily responsible for the total increase in transit trip production. The transit

Table 72

TOTAL INTERNAL PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 SATELLITE CITY PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey[a]	Percent of Total	1990 Satellite City Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	1,008,000	28.5	1,482,000	24.3	47.0
Home-Based Shopping .	516,000	14.6	1,067,000	17.5	106.8
Home-Based Other. . .	1,131,000	31.9	2,206,000	36.2	95.0
Home-Based School . .	249,000	7.0	252,000	4.1	1.2
Non-Home-Based. . . .	639,000	18.0	1,086,000	17.9	70.0
Total	3,543,000	100.0	6,093,000	100.0	72.0

[a] *All 1963 origin and destination home interview survey data were factored by 117 percent to meet observed traffic volumes crossing selected screen lines. See "Screen Line Adjustment of Trip Data," SEWRPC Technical Record, Vol. 2 - No. 5.*

Source: SEWRPC.

Table 73

AVERAGE TRIP LENGTHS FOR INTERNAL AUTO DRIVER TRIPS IN THE REGION: 1963 AND 1990 SATELLITE CITY PLAN

Trip Purpose Category	Average Trip Length in Minutes		
	Modified 1963 Survey	1990 Satellite City Plan	Percent Change 1963 - 1990
Home-Based Work	17.87	17.24	-3.5
Home-Based Shopping . . .	9.20	9.54	3.7
Home-Based Other.	12.38	12.63	2.0
Non-Home-Based.	12.55	12.52	-0.2
Weighted Average	13.74	13.29	-3.3

Source: SEWRPC.

Table 74

AVERAGE TRIP LENGTHS FOR INTERNAL TRANSIT TRIPS IN THE REGION: 1963 AND 1990 SATELLITE CITY PLAN

Trip Purpose Category	Average Trip Length in Minutes		
	Modified 1963 Survey	1990 Satellite City Plan	Percent Change 1963 - 1990
Home-Based Work	35.89	37.00	3.1
Home-Based Shopping . . .	28.50	28.74	0.8
Home-Based Other[a]	32.51	32.60	0.3
Non-Home-Based.	28.37	31.67	11.7
Weighted Average	33.63	35.03	4.2

[a] *Home-based school trips are not included.*

Source: SEWRPC.

trip production for all other trip purpose categories is anticipated to decrease. The largest decrease, 36 percent, is estimated to occur in the non-home-based trip purpose category, with the home-based trip purpose category, with the home-based work, shopping, and other transit trip purpose categories estimated to decline 8, 30, and 31 percent, respectively.

A total of 4,023,000 internal auto driver trips would be generated within the Region on an average weekday in 1990 under the Satellite City Plan. This represents an increase of about 86 percent over the 1963 level of 2,166,000 internal auto driver trips. This increase in internal auto driver trips is slightly greater than the anticipated 82 percent increase in internal automobile person trips

(auto driver plus auto passenger trips) due to an estimated decrease in average automobile occupancy. The anticipated increases in internal auto driver trips by trip purpose categories are indicated in Table 76, while the anticipated increase in total internal vehicle trips by 1990 under the Satellite City Plan is indicated in Table 77.

Total vehicle trip production on an average weekday under this plan is estimated to increase by 84 percent from 2,568,000 vehicle trips in 1963 to 4,716,000 in 1990 as shown in Table 78. As under the other alternative plans, the largest increases in trip production under this plan are anticipated to occur in internal automobile and internal truck

Table 75

INTERNAL TRANSIT PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 SATELLITE CITY PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Satellite City Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	154,000	47.5	141,000	41.6	- 8.4
Home-Based Shopping .	30,000	9.3	21,000	6.2	- 30.0
Home-Based Other. . .	55,000	17.0	38,000	11.2	- 30.9
Home-Based School . .	60,000	18.5	123,000	36.3	105.0
Non-Home-Based. . . .	25,000	7.7	16,000	4.7	- 36.0
Total	324,000	100.0	339,000	100.0	4.6

Source: SEWRPC.

Table 76

INTERNAL AUTO DRIVER TRIP GENERATION IN THE REGION: 1963 AND 1990 SATELLITE CITY PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Satellite City Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	699,000	32.3	1,055,000	26.2	50.9
Home-Based Shopping .	317,000	14.6	683,000	17.0	115.5
Home-Based Other. . .	675,000	31.2	1,435,000	35.7	112.6
Home-Based School . .	24,000	1.1	24,000	0.6	0.0
Non-Home-Based. . . .	451,000	20.8	826,000	20.5	83.1
Total	2,166,000	100.0	4,023,000	100.0	85.7

Source: SEWRPC.

Table 77

INTERNAL AUTOMOBILE PERSON TRIP GENERATION IN THE REGION: 1963 AND 1990 SATELLITE CITY PLAN

Trip Purpose Category	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Satellite City Plan	Percent of Total	Percent Change 1963 - 1990
Home-Based Work . . .	854,000	27.0	1,341,000	23.3	57.0
Home-Based Shopping .	486,000	15.4	1,046,000	18.2	115.2
Home-Based Other. . .	1,076,000	34.1	2,168,000	37.7	101.5
Home-Based School . .	129,000	4.1	129,000	2.2	0.0
Non-Home-Based. . . .	614,000	19.4	1,070,000	18.6	74.3
Total	3,159,000	100.0	5,754,000	100.0	82.1

Source: SEWRPC.

trips, while the largest percentage increases in trip production are anticipated to occur in external automobile and external truck trips. The proportion of trips by vehicle class would not change significantly from 1963 to 1990 under this plan.

Pattern of Future Vehicle Trips

The increased future vehicular travel demand generated by the Satellite City Plan is anticipated to continue to center around the Region's three largest urban areas of Milwaukee, Racine, and Kenosha. The traffic pattern would remain predominantly radial, the heaviest movements centering on the City of Milwaukee and radiating to the west and south (see Map 21). Of all three land use plan alternatives, the future traffic movements would be expected to be the heaviest in the outlying areas of the Region under the Satellite City Plan. The highest travel desire line densities, however, are still anticipated to occur in Milwaukee County and eastern Waukesha, Racine, and Kenosha counties, with large increases also expected in the areas surrounding the proposed satellite cities of Burlington, Oconomowoc, Port Washington, West Bend, and Whitewater. This is in contrast to conditions in 1963, when travel desire line densities of similar magnitude were confined to the central area of Milwaukee County (see Map 6). The largest increase in vehicular travel from 1963 to 1990 under the Satellite City Plan is anticipated to occur in the outlying areas surrounding existing urban complexes and the proposed satellite cities (see Map 22). The growth in travel in the areas surrounding the proposed satellite cities would increase the interaction between these cities and the existing major cities within the Region.

Description of Existing Plus Committed Highway Network

As already noted, the network of existing plus committed highway facilities remains unchanged for all three land use plan alternatives and represents the focal point for initial analysis under the Satellite City Plan as under the other two land use plan alternatives.

Traffic Assignment to the Existing Plus Committed Highway Network

The anticipated travel demand generated by the Satellite City Plan was assigned to the existing plus committed arterial street and highway network to determine its ability to carry the travel demand at the levels of service specified in the transportation system development objectives and standards and to isolate future capacity deficiencies. The anticipated future traffic volumes are shown on Map 23 for the major regional transportation facilities, together with the capacity of these facilities. Also indicated are those portions of the system for which the future traffic loads are anticipated to exceed the design capacity.

The largest capacity deficiencies on the network would occur on the East-West and North-South freeways in Milwaukee County. Traffic loads on the East-West Freeway would exceed capacity from the Zoo Interchange to the Central Interchange, with the most severe congestion occurring just west of the Stadium Interchange. Traffic loads on the North-South Freeway would exceed capacity from W. Hampton Avenue south to W. Rawson Avenue, with the most severe congestion occurring just north of the Hillside Interchange. Traffic loads on the Zoo, Stadium, and Airport freeways are ex-

Table 78

TOTAL VEHICLE TRIP GENERATION IN THE REGION: 1963 AND 1990 SATELLITE CITY PLAN

Trip Class	Number of Trips Generated on An Average Weekday				
	Modified 1963 Survey	Percent of Total	1990 Satellite City Plan	Percent of Total	Percent Change 1963 - 1990
Internal Automobile	2,166,000	84.3	4,023,000	85.3	85.7
External Automobile[a]	86,000	3.4	202,000	4.3	134.9
Internal Truck[b]	300,000	11.7	460,000	9.8	53.3
External Truck	16,000	0.6	31,000	0.6	93.8
Total	2,568,000	100.0	4,716,000	100.0	83.6

[a] *Through trips counted once.*

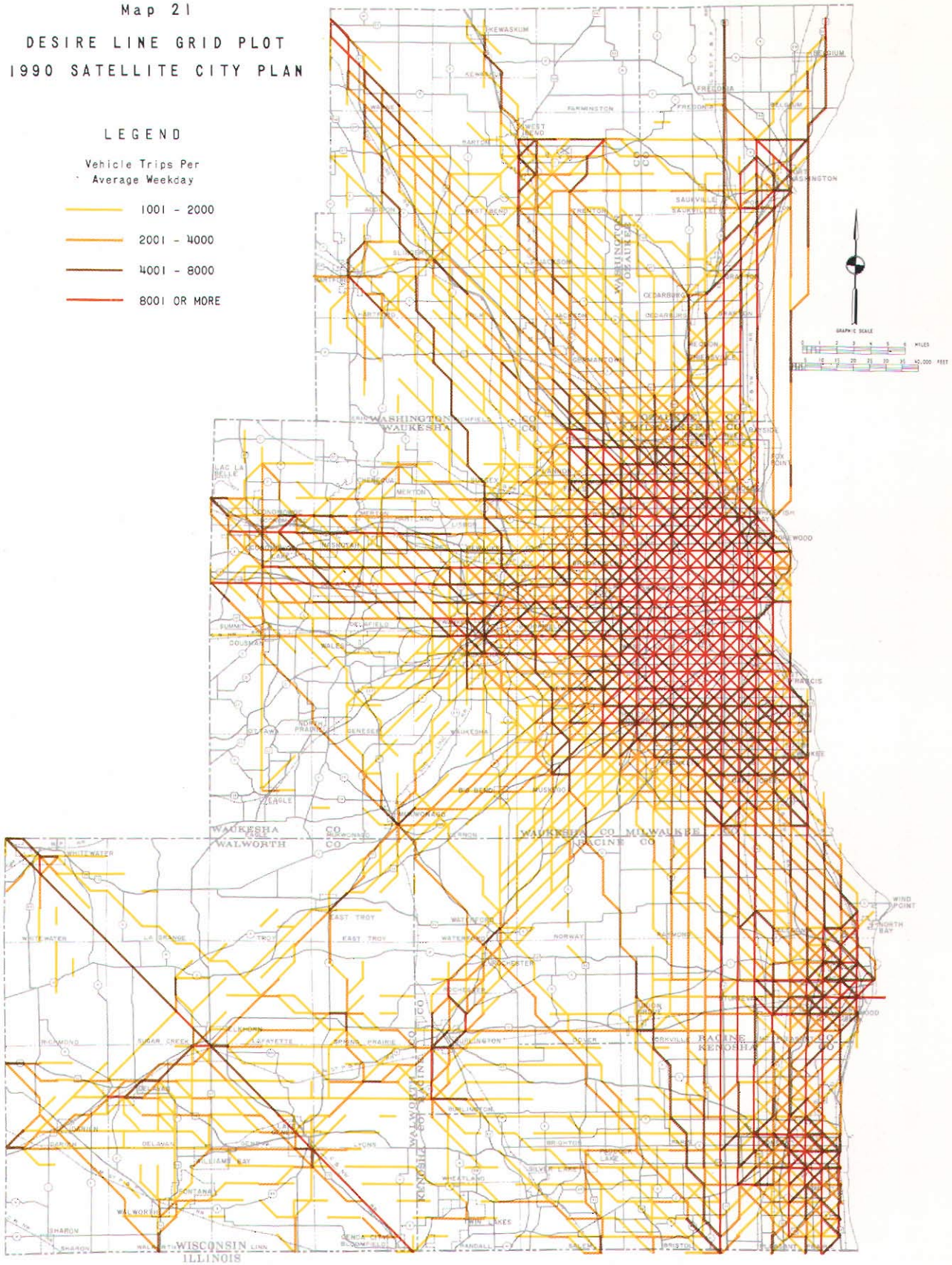
[b] *Includes taxis.*

Source: SEWRPC.

Map 21

DESIRE LINE GRID PLOT

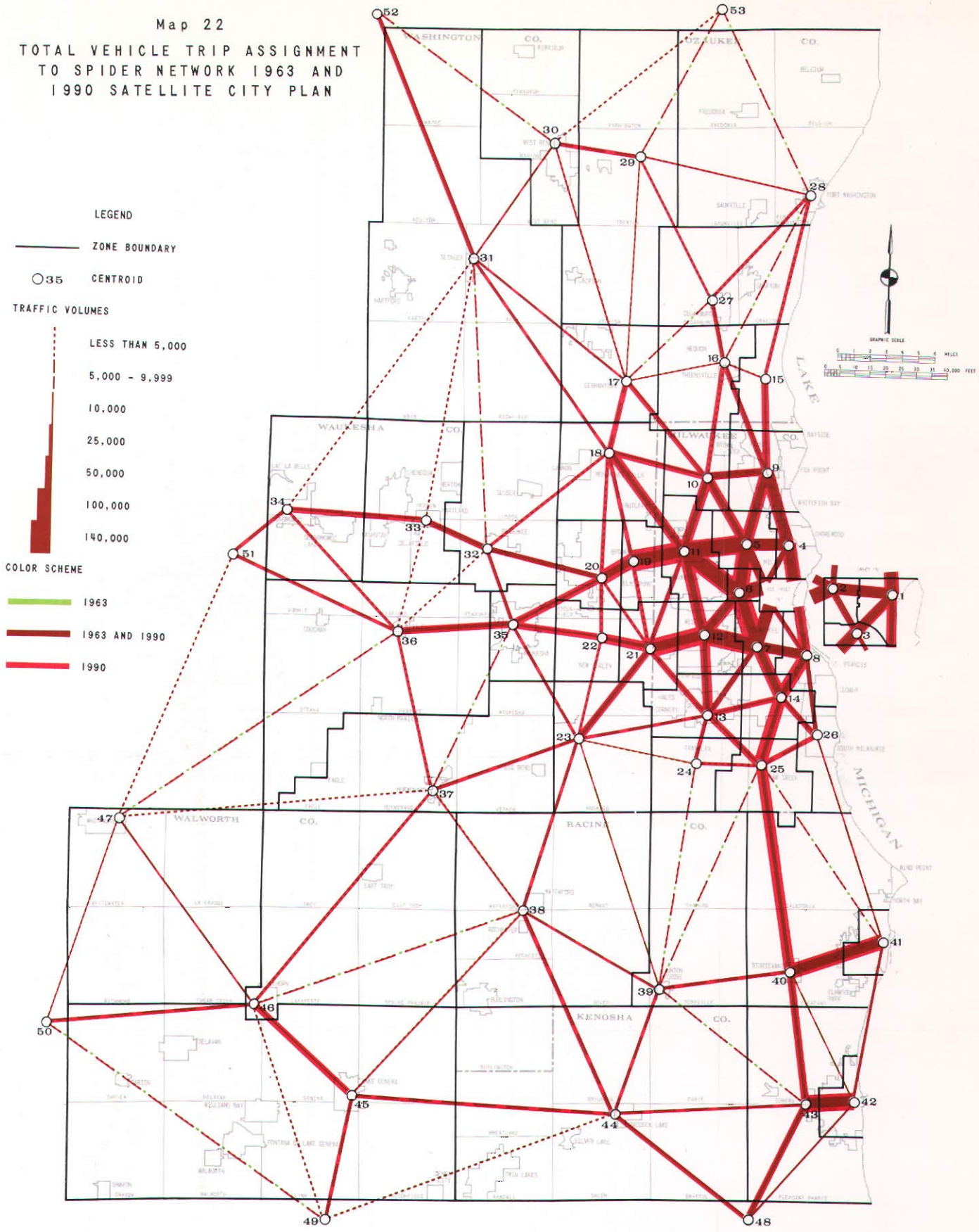
1990 SATELLITE CITY PLAN



The future regional traffic pattern is anticipated to remain predominantly radial, centering on the City of Milwaukee with the heaviest movements occurring to the west and south. Under the satellite city plan alternative, the future traffic movements would be expected to be the heaviest of all three land use plans in the outlying areas of the Region.

Map 22

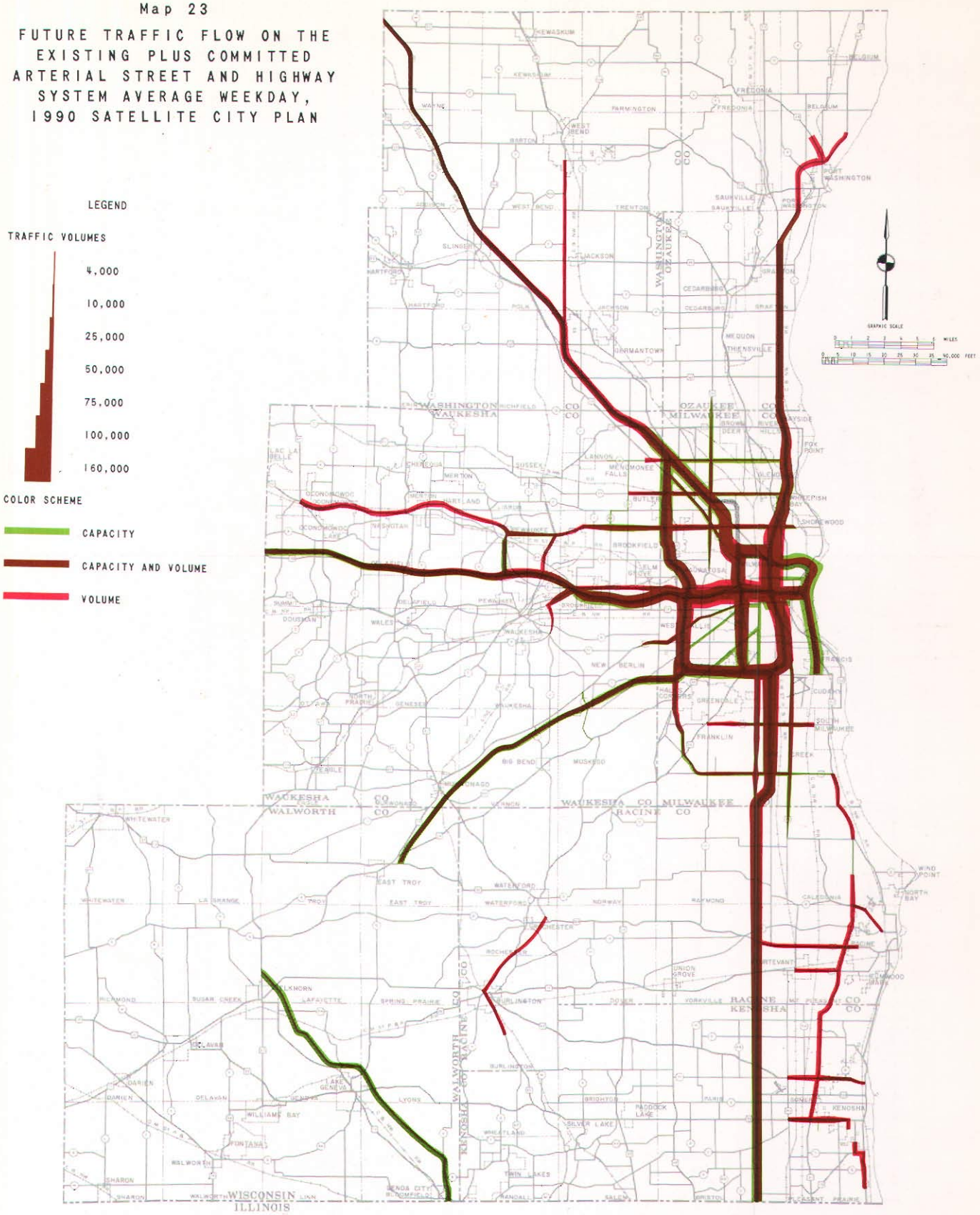
TOTAL VEHICLE TRIP ASSIGNMENT TO SPIDER NETWORK 1963 AND 1990 SATELLITE CITY PLAN



The pattern of vehicular travel on a hypothetical transportation network connecting traffic analysis areas in the Region is shown on this diagram for existing development and for the satellite city plan alternative. The largest growth in vehicular travel is expected to occur in the outlying areas surrounding the existing urban complexes and proposed satellite cities within the Region.

Map 23

FUTURE TRAFFIC FLOW ON THE EXISTING PLUS COMMITTED ARTERIAL STREET AND HIGHWAY SYSTEM AVERAGE WEEKDAY, 1990 SATELLITE CITY PLAN



Severe traffic congestion would occur on the regional arterial system if no further transportation system improvements were made. Particularly severe congestion would occur on much of the Milwaukee County Freeway System.

pected to be close to or over capacity for most of their lengths. On the Zoo Freeway, the volume-to-capacity ratios would range from 0.6 north of W. Silver Spring Drive to 1.2 just south of the Zoo Interchange. The volume-to-capacity ratios on the Stadium Freeway are expected to range from 0.7 north of W. Silver Spring Drive to 1.5 just north of the interchange with the Park Freeway. The volume-to-capacity ratios on the Airport Freeway would be expected to range from 0.8 just east of the Stadium Freeway to 1.1 just west of the North-South Freeway. Capacities of the Lake and Park freeways would be adequate for their entire lengths. In Racine and Kenosha counties, the volume-to-capacity ratios on the North-South Freeway would range from 0.7 at the state line to 1.2 at the Milwaukee County line.

Description of the Proposed Highway Network

Based on analyses of the future traffic assignment to the existing plus committed highway network, a planned regional arterial street and highway network was developed to serve the proposed land use pattern by carrying the anticipated travel demand at a level of service specified in the transportation objectives and standards and alleviating the capacity deficiencies inherent in the existing plus committed network. It was found that the planned highway network evolved for the Satellite City Plan did not differ from that evolved for the controlled existing trend or corridor plan alternatives with respect to major facilities. The regional freeway and expressway facilities comprising the basic framework of the planned network are described in detail under the discussion of the controlled existing trend land use plan alternative and are displayed on Map 10.

Although the same freeway and expressway network is proposed to serve all three land use plan alternatives, differences exist in the capacities of some arterial streets and highways. These differences, although not shown in this report because of map scale limitations, are, nevertheless, an integral part of the highway network proposed to serve the Satellite City Plan. The total mileage of proposed new and improved street and highway facilities proposed to serve the Satellite City Plan is summarized by functional type and costs in Table 79.

Traffic Assignment to the Proposed Highway Network

The anticipated 1990 travel demand generated by the Satellite City Plan was assigned to the proposed

Table 79

MILES AND CONSTRUCTION COSTS OF PROPOSED NEW AND IMPROVED ARTERIAL STREET AND HIGHWAY FACILITIES IN THE REGION - SATELLITE CITY PLAN
(Costs in Millions of 1966 Dollars)

Functional Facility Type	New Facilities[a]		Improved Facilities		Total	
	Miles	Construction Cost	Miles	Construction Cost	Miles	Construction Cost
Standard Arterial:						
2-lane	91.5	$ 19.117	185.1	$ 40.393	276.6	$ 59.510
4-lane	26.6	13.873	375.4	206.164	402.0	220.037
6-lane	2.2	2.183	140.0	145.619	142.2	147.802
Subtotal	*120.3*	*35.173*	*700.5*	*392.176*	*820.8*	*427.349*
Expressway:						
4-lane	3.5	6.060	6.5	3.502	10.0	9.562
6-lane	--	--	--	--	--	--
Subtotal	*3.5*	*6.060*	*6.5*	*3.502*	*10.0*	*9.562*
Freeway:						
4-lane	180.1	237.313	32.8	22.304	212.9	259.617
6-lane	69.0	208.558	41.5	31.244	110.5	239.802
8-lane	6.6	25.876	--	--	6.6	25.876
Subtotal	*255.7*	*471.747*	*74.3*	*53.548*	*330.0*	*525.295*
Total	379.5	$512.980	781.3	$449.226	1,160.8	$962.206

[a] *Includes committed facilities which had not been programmed through calendar year 1966.*

Source: SEWRPC.

highway network, and the results of this assignment are summarized on Map 24 for the major highway facilities within the Region. The assignment indicates that the proposed network would be generally adequate to serve the future land use pattern under the Satellite City Plan, with some overloads occurring at certain points in the proposed system. The capacity of the East-West Freeway would be adequate to carry the anticipated future traffic volumes from the westerly boundary of the Region east to the Zoo Interchange. From this interchange to the Central Interchange, the traffic loads on this freeway would exceed the capacity, with the most severe congestion occurring just west of the Stadium Interchange. The capacity of the East-West Freeway from the Central Interchange east to the Lake Freeway would be adequate to meet the anticipated demand. The capacity of the North-South Freeway from the state line to W. Greenfield Avenue in Milwaukee County would also be adequate to carry the anticipated traffic volumes. From this point north to just south of W. Capitol Drive, the anticipated traffic volumes would exceed the capacity, with the highest volume-to-capacity ratio anticipated to be 1.1 just north of the Central Interchange. The capacity of the remainder of the North-South Freeway and the extension into Ozaukee County would be adequate to its northerly terminus at the Ozaukee-Sheboygan County line.

In Milwaukee County the capacity of the Zoo, Airport, Park, and Lake freeways for their entire lengths, and the new East-West Freeway in the vicinity of W. Hampton Avenue to its terminus at the Lake Freeway to the east, would all be adequate to carry the anticipated traffic loads. The Stadium Freeway and its northerly extension to its terminus at USH 141 would have a volume-to-capacity ratio of 1.0 or less for its entire length.

The capacity of the freeway portion of USH 41 from its northerly terminus at the Washington-Dodge County line to its southerly terminus at the proposed freeway in the vicinity of W. Hampton Avenue would be adequate to meet the anticipated traffic loads. The capacity of the proposed North-South Freeway in eastern Waukesha County and its east-west connection in southern Milwaukee County would be adequate for its entire length to carry the anticipated traffic loads. The capacities of the new USH 16 Freeway extended westerly from the proposed freeway in the vicinity of W. Hampton Avenue to the regional boundary and the proposed North-South Freeway extended from the committed terminus of the Lake Freeway at W. Layton Avenue south to the state line would both be adequate to carry the anticipated traffic loads. The capacities of USH 12 and STH 15 would be adequate to carry the anticipated traffic volumes for their entire lengths within the Region.

Table 80

VOLUME-TO-CAPACITY RATIOS[a] FOR PROPOSED HIGHWAY NETWORK BY COUNTY: 1990 SATELLITE CITY PLAN

County	Miles of Arterial Streets and Highways by Volume-to-Capacity Ratio Range							
	Total	Percent of Regional Total	0.00 - 0.90	Percent of County Total	0.91 - 1.10	Percent of County Total	Above 1.10	Percent of County Total
Kenosha	313.8	8.5	268.0	85.4	40.2	12.8	5.6	1.8
Milwaukee	934.2	25.4	843.1	90.3	70.4	7.5	20.7	2.2
Ozaukee	303.1	8.3	272.7	90.0	27.0	8.9	3.4	1.1
Racine	410.8	11.2	360.2	87.7	45.9	11.2	4.7	1.1
Walworth	477.5	13.0	432.8	90.6	42.9	9.0	1.8	0.4
Washington	418.3	11.4	386.9	92.5	30.3	7.2	1.1	0.3
Waukesha	813.1	22.2	729.8	89.8	65.0	8.0	18.3	2.2
Regional Total	3,670.8	100.0	3,293.5	89.7	321.7	8.8	55.6	1.5

[a] *The significance of the volume-to-capacity ratio ranges used is:*

0.00 - 0.90; Under design capacity, fully adequate and safest operational level.

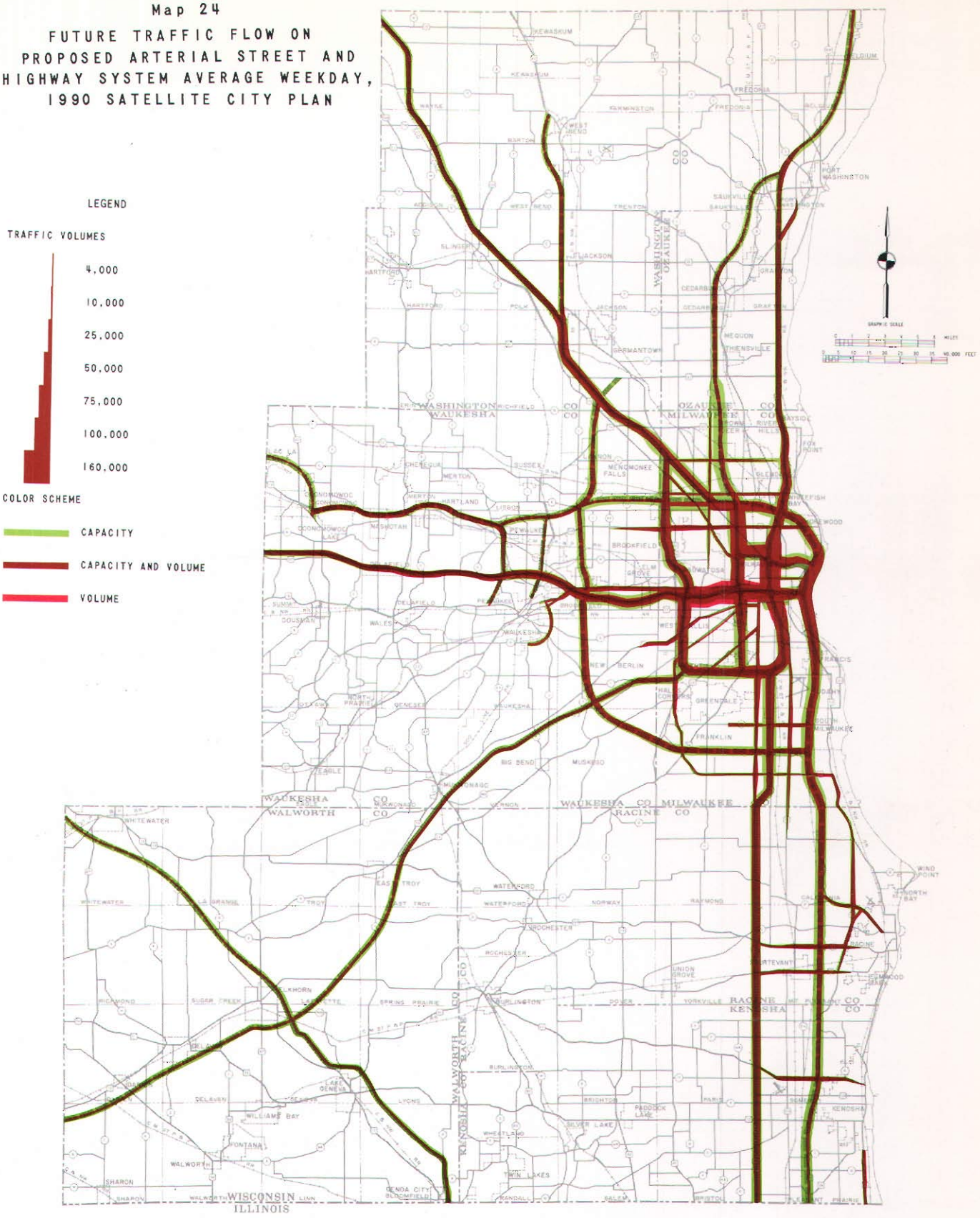
0.91 - 1.10; At design capacity but still adequate.

Above 1.10; Over design capacity, congested at times.

Source: SEWRPC.

Map 24

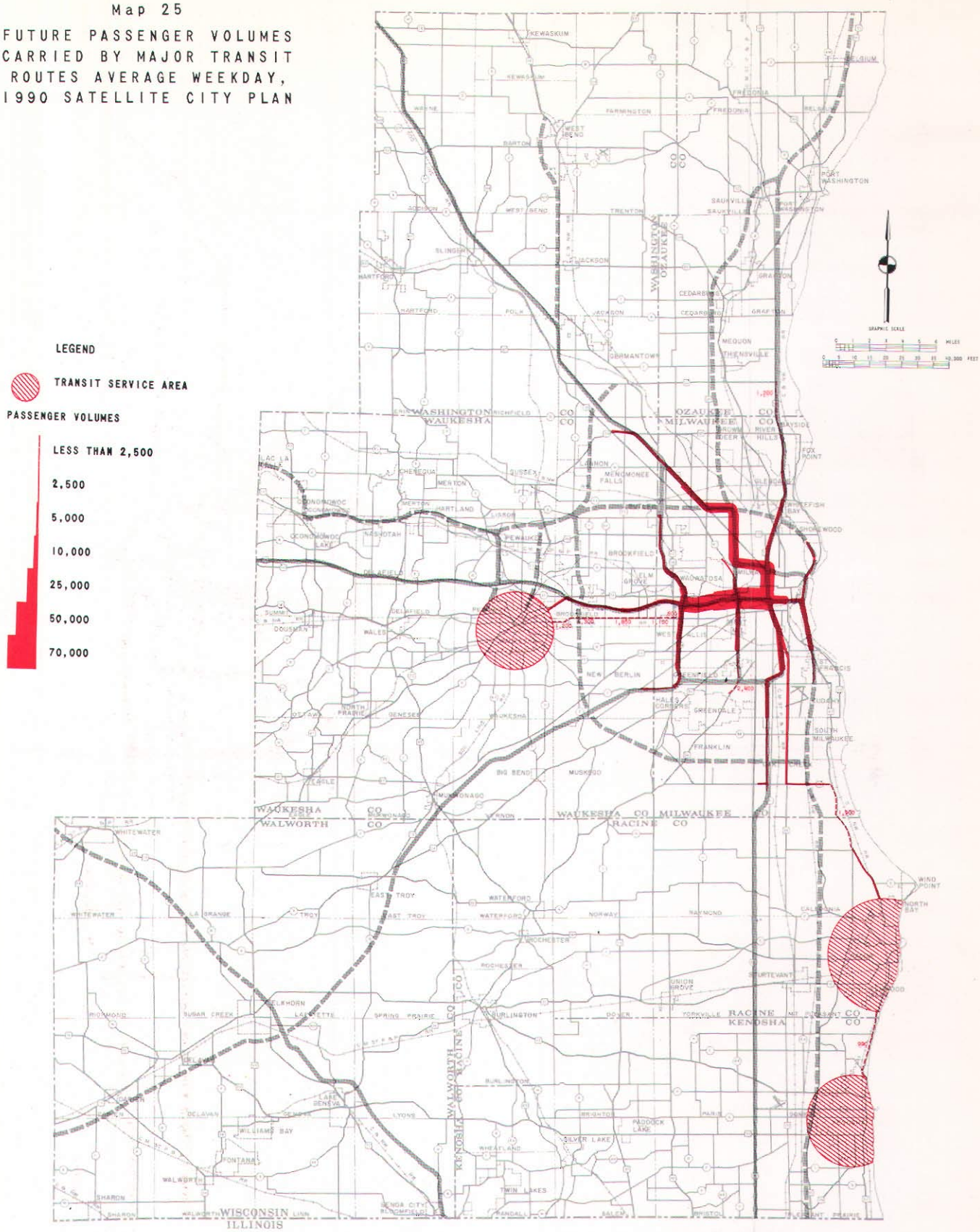
FUTURE TRAFFIC FLOW ON PROPOSED ARTERIAL STREET AND HIGHWAY SYSTEM AVERAGE WEEKDAY, 1990 SATELLITE CITY PLAN



Future traffic volumes on all major arterial streets and highways in the proposed system would be below design flow rates except for some short segments of certain freeways in Milwaukee County.

Map 25

FUTURE PASSENGER VOLUMES CARRIED BY MAJOR TRANSIT ROUTES AVERAGE WEEKDAY, 1990 SATELLITE CITY PLAN



As for the other land use plans, future passenger volumes in a corridor along the East-West Freeway are expected to be sufficient to justify the provision of a bus rapid transit line. Volumes on connecting "Freeway Flyer" routes are shown along with volumes on non-freeway intercity routes between Milwaukee, Racine and Kenosha and between Milwaukee and Waukesha. Future passenger volumes are less than those for the Controlled Existing Trend Plan but quite similar in overall pattern.

A summary of volume-to-capacity relationships for all arterial streets and highways within the Region under the system proposed to serve the Satellite City Plan is provided in Table 80. For the Region as a whole, 1.5 percent of the total arterial street and highway system mileage would be expected to operate over design capacity by 1990 if the proposed network is constructed.

Description of Transit Network and Assignment of Future Passenger Loads

The preliminary future transit network evolved for the Satellite City Plan did not differ from that evolved for the controlled existing trend plan alternative with respect to major facilities. The network consists of all-day modified rapid transit service on all existing plus committed freeways within Milwaukee County and extensions of local transit service into the rapidly urbanizing areas peripheral to the existing transit service area in Milwaukee, Racine, and Kenosha counties.

The transit demand generated by the Satellite City Plan was assigned to this existing plus modified rapid transit network as a point of departure from which the high demand corridors could be identified and the feasibility of upgrading individual routes to full rapid transit service analyzed. The results of this assignment are shown on Map 25. The corridor along the East-West Freeway developed the highest future transit demand. The transit demand in this corridor is anticipated to range from 52,000 revenue passengers per day, just west of the Central Interchange, to 36,000 revenue passengers per day just east of the Zoo Interchange. The second highest transit demand is anticipated to occur on the route along the Stadium Freeway to the Park Freeway and into the central business district of Milwaukee. The transit demand on this route is expected to range from 6,000 revenue passengers per day at the Milwaukee-Waukesha county line to 23,000 revenue passengers per day just west of the Hillside Interchange.

Based on this assignment, a separate transit roadway is proposed for the east-west corridor from the Zoo Freeway to the Milwaukee central business district. All other modified rapid transit lines within Milwaukee County would meet threshold service warrants established in the transportation system development objectives and standards. The system of modified rapid transit routes proposed to serve the satellite city land use plan would be the same as the system proposed to serve the controlled existing trend land use plan (see Map 13).

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Chapter VI

ALTERNATIVE PLAN COMPARISON AND EVALUATION

INTRODUCTION

After alternative plans have been designed, these plans must be evaluated in order to determine the degree to which they meet the established regional development objectives and standards formulated to serve as the criteria for plan selection. Presently, the techniques available for transportation system plan evaluation are more highly developed than those available for land use plan evaluation. Not only have traffic simulation models been developed for the quantitative test of the engineering feasibility of transportation plans, but also the transportation system development objectives and standards are more readily quantifiable than are the land use development objectives and standards. Moreover, the benefit–cost analysis method of evaluating investment in public works is more readily applicable to the evaluation of transportation facility plans than to land use plans.

Although a benefit-cost approach may be theoretically applicable to land use plan evaluation, the method loses much of its effectiveness in such application because of the following limitations:

1. It is impractical to assign a monetary value to the many intangible benefits and costs that relate to the most important land use development objectives, and it is extremely difficult to assign monetary values to even the direct benefits and costs associated with a given land use plan.

2. Because of the relatively greater uncertainty associated with land use plan implementation than with transportation system plan implementation, there can be no assurance that the potential benefits will ever be realized, even though many of the costs associated with the development of a given land use plan may, nevertheless, be incurred through public facility and utility construction.

3. Finally, a complete benefit-cost analysis of a land use plan would require the development of benefits and costs associated with the construction of the complete public facility and utility systems associated with the given land use plan, a task beyond the budgetary limitations and capabilities of public planning operations today.

To provide an alternative to the overriding criteria of system integration and benefit-cost analyses applied in the evaluation of the transportation system plan, as well as to provide a method for quantitatively evaluating the ability of both the land use and transportation system plans to achieve stated development objectives, the alternative plans were scaled against the standards supporting each regional development objective, and the results evaluated by the Technical Coordinating and Advisory and the Intergovernmental Coordinating Committees on Regional Land Use-Transportation Planning and by the Regional Planning Commission itself. In addition, the foregoing plan evaluation through Committee and Commission review was supplemented by application of a method of plan evaluation which seeks to assign a value to each alternative plan. The method chosen overcomes, to a considerable extent, the difficulties inherent in the application of system integration and benefit-cost analyses to land use plan evaluation and is an adaptation of the rank–based expected value method[1] used in corporate and military decision-making. This method avoids the difficulty associated with the assignment of monetary values to the benefits and costs associated with alternative land use plans by limiting the plan evaluation problem to one of rank ordering each alternative under each of the stated development objectives, since it is usually much easier to quantitatively rank the effectiveness of a given plan in achieving a given development objective than it is to attempt to assign a monetary value to the benefits accruing to the attainment of the same objective.

The difficult problems associated with uncertainty of plan implementation are also recognized in the rank-based expected value method of plan evaluation through the medium of probability estimation. Some alternative plans, while theoretically more desirable, may have a low probability of imple-

[1] *See H. Igor Ansoff, Corporate Strategy, McGraw-Hill, New York, N.Y., 1965.*

mentation; and, in the application of the method, such plans are assigned a lower value for probability of implementation. Other plans, while theoretically less desirable on the basis of their ability to attain development objectives, may have a higher actual value because of a greater likelihood of implementation. This concept of considering the uncertainty of plan implementation in plan evaluation is particularly important in relation to regional land use plans prepared as a basis for the planning and design of public works. Construction of the latter may require a high investment of public funds, and such an investment cannot be made on the sole basis of a land use plan which cannot be practically implemented.

In plan evaluation, then, the application of the rank-based expected value method involves the following sequence of activities:

1. All specific development objectives, n in number, are ranked in order of importance to the general development objectives and assigned values of n, n minus 1, n minus 2... to n minus (n-1) in descending rank order.
2. The alternative plans, m in number, are ranked under each of the specific land use development objectives and assigned a value of m, m minus 1, m minus 2 ... to m minus (m-1) in descending rank order.
3. A probability, p, of implementation is assigned to each of the plans being ranked.
4. The value, V, of each alternative plan is then determined by summing the products of n times m times p for each of the specific development objectives.

$$V = p \geq (n_1 m_1 + n_2 m_2 + \cdots + n_n m_n)$$

The matrix table shown below illustrates a simple theoretical application of the method for three specific development objectives.

In the hypothetical plan evaluation shown in the table, Plan No. 3 would be selected as that plan which best meets the development objectives.

In Chapter II of this volume, specific regional land use and transportation system development objectives were expanded into a set of supporting standards which could be used to evaluate the ability of an alternative plan to achieve a given specific development objective. Any ranking of an alternative plan for a given specific development objective must, therefore, be consistent with the ability of the plan to achieve the standards formulated for that objective. To achieve this consistency, it is first necessary to compute a value for each of the alternative plans according to the standards formulated for each specific development objective before arriving at an overall value for each plan in relation to the development objectives. This subsidiary evaluation can utilize a series of matrix tables similar to that given in the preceding example, except that the development standards replace the development objectives in the matrix table and that it is usually not necessary to assign a probability estimate for the standard evaluation.

Plan / Specified Development Objective		Balanced Allocation of Land	Natural Resource Conservation	Facility Costs	Plan Value, V
		Rank Order Value of Objective n = 2	Rank Order Value of Objective n = 3	Rank Order Value of Objective n = 1	$V = p \geq (n_1 m_1 + n_2 m_2 + n_3 m_3)$
		Rank Order Value of Plan, m	Rank Order Value of Plan, m	Rank Order Value of Plan, m	
1	Probability of Implementation p = 0.6	3	1	3	$0.6\left[(2 \times 3) + (3 \times 1) + (1 \times 3)\right] = 7.2$
2	Probability of Implementation p = 0.5	2	2	1	$0.5\left[(2 \times 2) + (3 \times 2) + (1 \times 1)\right] = 5.5$
3	Probability of Implementation p = 0.9	1	3	2	$0.9\left[(2 \times 1) + (3 \times 3) + (1 \times 2)\right] = 11.7$

HIERARCHICAL STRUCTURE OF OBJECTIVES AND STANDARDS

In plan evaluation it is important to recognize that the development objectives and standards formulated possess an implicit hierarchy; that is, a multi-level structure relating to differing stages and levels of detail in the land use-transportation planning process, as well as to differing levels of implementation. An example of an objective with its related standards that ranks at the highest level of the hierarchical structure is regional land use development objective No. 1, which calls for the provision of a supply of land for each use corresponding to the anticipated demand for that use. Such a design requirement can be complied with only at the regional level of plan design since it is only at this level that total land use allocation is ever known.

Other objectives and standards stand lower in the hierarchy and may directly affect plan design only at the neighborhood unit level. Examples of these kinds of standards occur under regional land use development objective No. 5, which specifies design standards for residential areas. Most of the standards supporting this objective can be finally met only through the detailed design of neighborhood unit development plans, even though a regional plan might provide the framework for such detailed design. In this connection it should be noted that the existence of a hierarchy of development objectives and standards should not create the false impression that higher levels in the hierarchy do not affect lower levels. It is quite possible that a feature of a regional plan could prevent or seriously interfere with the attainment of a neighborhood level development objective. For example, the standard requiring a diversity of housing types, designs, and costs could be defeated by the concentration of a certain class of housing in a few areas at the regional level. The hierarchical structure of the regional land use and transportation system development objectives is illustrated in Figures 19 and 20.

Since regional planning is primarily concerned with land use activities and public works facilities of the kind that have areawide implications, it is apparent that the regional land use-transportation plan may not directly affect the attainment of all of the development objectives and standards. Lower level objectives and standards not directly influenced by the regional plan are, nevertheless, required to provide guidelines for planning at the community and neighborhood levels. Regionally, it is important only that compliance with lower level standards not be in conflict with the regional plan.

The following section presents in summary form a comparison of the three alternative regional land use and transportation system plans and an evaluation of these alternatives in terms of the recommended regional development objectives and standards.

Figure 19

HEIRARCHY OF LAND USE PLANNING OBJECTIVES AND STANDARDS FOR THE REGION

	OBJECTIVE 1	OBJECTIVE 2	OBJECTIVE 3	OBJECTIVE 4	OBJECTIVE 5	OBJECTIVE 6	OBJECTIVE 7	OBJECTIVE 8
REGIONAL LEVEL	STANDARDS 1, 2a, 3, 4, 5a	STANDARDS 2, 3	STANDARDS A-1, A-2, A-3, B-1, B-2, B-3, B-5, B-6, C-1, D-1, D-3, E-1	STANDARDS 2, 5, 6, 7		STANDARDS 1, 3	STANDARD 2	STANDARDS 1, 2
COMMUNITY LEVEL	STANDARDS 2b, 5b	STANDARD 1	STANDARDS B-4, D-2	STANDARDS 1, 3, 4	STANDARD 1	STANDARD 2	STANDARD 1	
NEIGHBORHOOD LEVEL					STANDARDS 2, 3			

NOTE: Objective and standard numbers are the same as those assigned in Chapter III, Table 1.

Figure 20

HEIRARCHY OF TRANSPORTATION PLANNING OBJECTIVES AND STANDARDS FOR THE REGION

	OBJECTIVE 1	OBJECTIVE 2	OBJECTIVE 3	OBJECTIVE 4	OBJECTIVE 5	OBJECTIVE 6	OBJECTIVE 7
REGIONAL LEVEL	STANDARDS 1,2	STANDARDS 1,7,8, 9,10,11	STANDARDS 1,2,3	STANDARDS 1,2	STANDARDS 1,2,3	STANDARDS 1,2,3, 4,5,6, 7	STANDARDS 1,2
COMMUNITY LEVEL		STANDARDS 2,3,4, 5,6,12, 13					
NEIGHBORHOOD LEVEL							

NOTE: Objective and standard numbers are the same as those assigned in Chapter II, Table 2.

ALTERNATIVE PLAN COMPARISON—LAND USE

A comparison of the land use changes proposed within the Region under each of the alternative regional land use plans previously described in this report is provided in Table 81. As indicated, the Controlled Existing Trend Plan would propose the addition of 128,600 acres to the existing stock of urban land; the Satellite City Plan would add 122,200 acres; and the Corridor Plan would add 108,900 acres, or nearly 20,000 acres less than the controlled existing trend plan alternative.

Residential Land Use

The greatest increase in residential land within the Region would occur under the Controlled Existing Trend Plan, which proposes an increase of 75,400 acres, or 58 percent. The Corridor Plan proposes the smallest increase in residential land, with an increase of 60,500 acres, or 47 percent. Under each of the alternatives, the majority of new residential development would be in the medium-density range. The Satellite City Plan proposes the greatest increase in medium-density development, 60,900 acres, or 246 percent. The Corridor Plan proposes the greatest increase in high-density residential development, 6,700 acres, or 19 percent. The Controlled Existing Trend Plan proposes the greatest increase in low-density residential development, 15,000 acres, or 21 percent.

Commercial Land Use

The greatest increase in commercial land within the Region would occur under the Satellite City Plan, which proposes to increase the existing stock of commercial land by 5,200 acres, or 78 percent. The Corridor Plan proposes the smallest increase in commercial land within the Region, 4,900 acres, or 73 percent. All of the plans propose ten new major commercial centers. Under the Controlled Existing Trend Plan and the Corridor Plan, these centers would be located as follows: one in Kenosha County, four in Milwaukee County, one in Racine County, one in Washington County, and three in Waukesha County. Under the Satellite City Plan, these centers would be located as follows: one in Kenosha County, three in Milwaukee County, one in Ozaukee County, one in Racine County, one in Walworth County, and three in Waukesha County. (See Maps 4, 14, and 20 in Chapter V.)

Industrial Land Use

The greatest increase in industrial land within the Region would occur under the Satellite City Plan, which proposes an increase of about 5,600 acres, or 58 percent, over the existing stock of such land. The Corridor Plan proposes the smallest increase in industrial land, about 5,000 acres, or 51 percent. All of the plans propose six new major industrial areas located as follows: one in Kenosha County, two in Milwaukee County, two in Racine County, and one in Waukesha County. In addition, the Satellite City Plan proposes one new major industrial area in Ozaukee County and an additional one in Waukesha County.

Table 81

COMPARISON OF PROPOSED LAND USE CHANGES IN THE REGION: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN, CORRIDOR PLAN, AND SATELLITE CITY PLAN

Land Use Category	Existing (1963)		Alternative Plan Increments						Alternative 1990 Land Use Totals					
			Controlled Trend		Corridor		Satellite City		Controlled Trend		Corridor		Satellite City	
	Acres	Percent of Region	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent of Region	Acres	Percent of Region	Acres	Percent of Region
Residential														
High-Density	34,463	2.0	2,900	8.4	6,714	19.4	2,556	7.4	37,363	2.2	41,177	2.4	37,019	2.2
Medium-Density	24,748	1.5	57,451	232.1	50,099	202.4	60,931	246.2	82,199	4.8	74,847	4.3	85,679	5.0
Low-Density	70,147	4.0	15,058	21.4	3,708	5.2	6,039	8.6	85,205	4.9	73,855	4.3	76,186	4.4
Subtotal	*129,358*	*7.5*	*75,409*	*58.2*	*60,521*	*46.7*	*69,526*	*53.7*	*204,767*	*11.9*	*189,879*	*11.0*	*198,884*	*11.6*
Commercial[a]	6,706	0.4	5,132	76.5	4,868	72.5	5,225	77.9	11,838	0.7	11,574	0.7	11,931	0.7
Industrial[a]	9,746	0.6	5,064	51.9	4,960	50.8	5,624	57.7	14,810	0.8	14,706	0.8	15,370	0.9
Governmental[b]	14,722	0.9	6,258	42.5	5,782	39.2	6,180	41.9	20,980	1.2	20,504	1.2	20,902	1.2
Transportation[c]	96,117	5.6	28,841	30.0	25,019	26.0	27,751	28.8	124,958	7.3	121,136	7.0	123,868	7.2
Recreation[d]	33,262	1.9	7,930	23.8	7,701	23.1	7,910	23.7	41,192	2.4	40,963	2.4	41,172	2.4
Agriculture														
Prime Agriculture	443,952	25.8	- 22,679	- 5.1	- 16,267	- 3.6	- 19,568	- 4.4	421,273	24.5	427,685	24.9	424,384	24.7
Other Agriculture	641,192	37.2	- 81,415	- 12.7	- 67,761	- 10.6	- 78,693	- 12.3	559,777	32.5	571,431	33.2	562,499	32.6
Subtotal	*1,085,144*	*63.0*	*- 104,094*	*- 9.5*	*- 86,028*	*- 7.9*	*- 98,261*	*- 9.0*	*981,050*	*57.0*	*999,116*	*58.1*	*986,883*	*57.3*
Open Lands[e]	345,951	20.1	- 24,540	- 7.0	- 22,823	- 6.5	- 23,955	- 6.9	321,411	18.7	323,128	18.8	321,996	18.7
Converted Land	--	--	*(128,634)*[f]	--	*(108,851)*[f]	--	*(122,216)*[f]	--	--	--	--	--	--	--
Total	1,721,006	100.0	--	--	--	--	--	--	1,721,006	100.0	1,721,006	100.0	1,721,006	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Existing area includes public and nonpublic recreational sites; planned area includes only public recreational areas.*

[e] *Includes woodlands, water, wetlands, quarries, and other open lands.*

[f] *Acres of rural land converted to urban use under this alternative.*

Source: SEWRPC.

Governmental and Institutional Land Use

The greatest increase in this land use category would occur under the Controlled Existing Trend Plan, which proposes an increase of 6,300 acres, or 43 percent, over the existing stock of such land. The Corridor Plan proposes the smallest increase in governmental and institutional land, 5,800 acres, or 39 percent. All of the plans provide for the additional land requirements of certain known major future uses, such as the new University of Wisconsin centers in Kenosha and Waukesha counties.

Transportation, Communication, and Utility Land Uses

The greatest increase in this land use category would occur under the Controlled Existing Trend Plan, which proposes an increase of about 28,800 acres, or 30 percent, over the existing stock of such land. The Corridor Plan proposes the smallest increase in this use category, about 25,000 acres, or 26 percent. It should be noted that the need for additional land for streets, highways, and utility facilities is directly related to increases in the other urban land uses. Consequently, this category is estimated to increase in direct proportion to increases in such other major urban land use categories as residential, commercial, and industrial.

Recreation Land Use

The greatest increase in public recreation land would occur under the Controlled Existing Trend Plan, which proposes an increase of about 7,900 acres, or 24 percent, over the existing stock of recreation land. The Corridor Plan proposes the smallest increase in this use category, 7,700 acres, or 23 percent. All of the plans provide for 11 new major regional park facilities located as follows: one in Milwaukee County, two in Ozaukee County, one in Racine County, two in Walworth County, two in Washington County, and three in Waukesha County.

Agricultural Land Use

The greatest decrease in agricultural land use would occur under the Controlled Existing Trend Plan, which proposes a reduction of more than 104,000 acres, or nearly 10 percent, of the existing stock of such land. The smallest amount of agricultural land would be converted to urban uses under the Corridor Plan, which would reduce the existing stock of agricultural land by 86,000 acres, or 8 percent.

It is important to note that the amount of prime agricultural land proposed to be converted to urban uses is greatest under the Controlled Existing Trend Plan because the remaining prime agricultural land within the Region, much of which lies along the periphery of the 1963 developed urban area, is more subject to conversion to urban uses if current development trends are continued to 1990. Nearly 22,700 acres of such prime agricultural land, or more than 5 percent of the existing stock of such use, would be converted under the Controlled Existing Trend Plan; 19,600 acres, or just over 4 percent, under the Satellite City Plan; and 16,300 acres, or about 4 percent, under the Corridor Plan.

Other Open Lands

The greatest decrease in this land use category would occur under the Controlled Existing Trend Plan, which proposes a reduction of about 24,500 acres, or 7 percent, of the existing stock of such land. The Corridor Plan, which proposes to convert the least amount of rural land to urban use, would reduce this category by about 22,800 acres, or slightly less than 7 percent. The water, wetland, woodland, and other open land areas contained in this category also comprise the principal land areas in the primary environmental corridors. It should be noted that the principal land areas subject to development within this category are the woodlands, but that reductions in this land use category under all three plan alternatives would occur in areas of the Region outside the environmental corridors and that the corridor areas would remain unchanged for each of the alternative plans.

Public Water Supply and Sanitary Sewer Service

As indicated in Table 82, the Controlled Existing Trend Plan proposes to increase the developed land area within the Region to about 590 square miles from the 1963 total of about 340 square miles. In 1963, 64 percent of the developed land area and 85 percent of the population within the Region were served by sanitary sewer facilities; and 59 percent of the developed land area and 82 percent of the population were served by public water supply facilities. By 1990 the Controlled Existing Trend Plan proposes to serve 93 percent of the developed area and 95 percent of the population with sanitary sewer and public water supply facilities. The Satellite City Plan proposes to increase the developed area to about 589 square miles and would serve 93 percent of this developed area and 94 percent of the total population with sanitary sewer and public water supply facilities. The Corridor Plan proposes to increase the developed area of the Region to about 537 square miles and would serve 92 percent of this developed area

and 94 percent of the total population with sanitary sewer and public water supply facilities.

Population and Employment

As indicated earlier, the regional demographic and economic forecasts described in Chapter III of this report would remain unchanged under each alternative plan; that is, the regional population is forecast to increase by 1,003,600 persons to 2,678,000 persons by 1990, and the number of employment opportunities is forecast to increase by 349,100 to 984,000 by 1990. It is important to note, however, that, while the regional population and employment levels remain unchanged, the levels within each county would vary from the county forecasts under the different land use arrangements proposed.

KENOSHA COUNTY

A comparison of the changes proposed within Kenosha County under each of the alternative regional land use plans is provided in Table 83. As indicated, the Satellite City Plan proposes the largest addition to the existing stock of urban land; and the Corridor Plan proposes the smallest addition. To provide for the new urban development, the alternative plans propose to convert between 8.0 and 9.9 percent of the existing stock of agricultural land and between 3.3 percent and 3.8 percent of the existing stock of other open lands, which consist primarily of woodland cover. More prime agricultural land would be converted to urban uses under the Controlled Existing Trend Plan than under the other two alternatives. The Satellite City Plan proposes the largest addition to the existing stock of residential land, and neither this plan nor the Corridor Plan would provide any new low-density residential development.

Each of the plans proposes a new major commercial center and a new major industrial center west of the City of Kenosha. Each of the plans would also provide for the new University of Wisconsin Center and for the expansion of two major regional parks: the Fox River Park in the Town of Salem and the Petrifying Springs Park in the Town of Somers.

Public Water Supply and Sanitary Sewer Service

As indicated in Table 84, the Satellite City Plan would propose to increase the developed land area within Kenosha County to about 48 square miles from the 1963 total of about 28 square miles. In 1963 about 50 percent of the developed land area and 74 percent of the population within the county were served by sanitary sewer and public water supply facilities. By 1990 the Satellite City Plan would propose to serve 92 percent of the developed area and 94 percent of the population with sanitary sewer and public water supply facilities. The

Table 82

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN THE REGION: 1963 AND 1990

Facility	Extent of Service	Existing (1963)	Proposed Plan - 1990		
			Controlled Trend	Corridor	Satellite City
Public Sewer Service	Developed Area				
	Total Square Miles	339.7	590.0	537.4	588.9
	Square Miles Served	217.0	548.7	496.1	547.4
	Percent Served	63.9	93.0	92.3	92.9
	Population				
	Total Number	1,674,400	2,678,000	2,678,000	2,678,000
	Number Served	1,419,025	2,546,670	2,510,800	2,519,200
	Percent Served	84.7	95.0	93.7	94.0
Public Water Supply	Developed Area				
	Total Square Miles	339.7	590.0	537.4	588.9
	Square Miles Served	200.0	548.7	496.1	547.4
	Percent Served	58.8	93.0	92.3	92.9
	Population				
	Total Number	1,674,400	2,678,000	2,678,000	2,678,000
	Number Served	1,372,480	2,546,670	2,510,800	2,519,200
	Percent Served	81.9	95.0	93.7	94.0

Source: SEWRPC.

Table 83

COMPARISON OF PROPOSED LAND USE CHANGES IN KENOSHA COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN, CORRIDOR PLAN, AND SATELLITE CITY PLAN

Land Use Category	Existing (1963)		Alternative Plan Increments						Alternative 1990 Land Use Totals					
			Controlled Trend		Corridor		Satellite City		Controlled Trend		Corridor		Satellite City	
	Acres	Percent of County	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent of County	Acres	Percent of County	Acres	Percent of County
Residential														
High-Density	2,511	1.4	135	5.3	391	15.5	59	2.3	2,646	1.5	2,902	1.6	2,570	1.4
Medium-Density	2,673	1.5	6,038	225.8	5,421	202.8	7,238	270.7	8,711	4.9	8,094	4.5	9,911	5.6
Low-Density	6,729	3.8	1,014	15.0	--	--	--	--	7,743	4.3	6,729	3.8	6,729	3.8
Subtotal	*11,913*	*6.7*	*7,187*	*60.3*	*5,812*	*48.7*	*7,297*	*61.2*	*19,100*	*10.7*	*17,725*	*9.9*	*19,210*	*10.8*
Commercial[a]	532	0.3	509	95.6	472	88.7	553	103.9	1,041	0.6	1,004	0.6	1,085	0.6
Industrial[a]	809	0.5	795	98.2	776	95.9	825	101.9	1,604	0.9	1,585	0.9	1,634	0.9
Governmental[b]	1,059	0.6	616	58.1	556	52.5	664	62.7	1,675	1.0	1,615	0.9	1,723	1.0
Transportation[c]	8,492	4.8	2,793	32.8	2,444	28.7	3,009	35.4	11,285	6.3	10,936	6.1	11,501	6.5
Recreation[d]	3,118	1.7	578	18.5	550	17.6	602	19.3	3,696	2.1	3,668	2.1	3,720	2.1
Agriculture														
Prime Agriculture	72,870	40.9	- 5,979	- 8.2	- 3,799	- 5.2	- 4,821	- 6.6	66,891	37.5	69,071	38.8	68,049	38.2
Other Agriculture	43,521	24.4	- 5,107	- 11.7	- 5,606	- 12.9	- 6,756	- 15.5	38,414	21.6	37,915	21.3	36,765	20.6
Subtotal	*116,391*	*65.3*	*- 11,086*	*- 9.5*	*- 9,405*	*- 8.0*	*- 11,577*	*- 9.9*	*105,305*	*59.1*	*106,986*	*60.1*	*104,814*	*58.8*
Open Lands[e]	35,781	20.1	- 1,392	- 3.8	- 1,205	- 3.3	- 1,373	- 3.8	34,389	19.3	34,576	19.4	34,408	19.3
Converted Land	--	--	*(12,478)*[f]	--	*(10,610)*[f]	--	*(12,950)*[f]	--	--	--	--	--	--	--
Total	178,095	100.0	--	--	--	--	--	--	178,095	100.0	178,095	100.0	178,095	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Existing area includes public and nonpublic recreational sites; planned area includes only public recreational areas.*

[e] *Includes woodlands, water, wetlands, quarries, and other open lands.*

[f] *Acres of rural land converted to urban use under this alternative.*

Source: SEWRPC.

Table 84

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN KENOSHA COUNTY: 1963 AND 1990

Facility	Extent of Service	Existing (1963)	Proposed Plan - 1990		
			Controlled Trend	Corridor	Satellite City
Public Sewer Service	Developed Area				
	Total Square Miles	27.6	46.8	39.9	48.3
	Square Miles Served	14.0	43.0	36.0	44.4
	Percent Served	50.7	91.9	90.2	92.0
	Population				
	Total Number	106,700	206,200	203,000	215,100
	Number Served	79,160	197,350	193,900	202,200
	Percent Served	74.2	95.7	95.5	94.0
Public Water Supply	Developed Area				
	Total Square Miles	27.6	46.8	39.9	48.3
	Square Miles Served	13.6	43.0	36.0	44.4
	Percent Served	49.2	91.9	90.2	92.0
	Population				
	Total Number	106,700	206,200	203,000	215,100
	Number Served	78,670	197,350	193,900	202,200
	Percent Served	73.7	95.7	95.5	94.0

Source: SEWRPC.

Table 85

EXISTING, FORECAST, AND PROPOSED POPULATION CHANGES FOR KENOSHA COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Population
		Number	Percent	
Demographic Forecast	106,700	95,300	89.3	202,000
Controlled Trend Plan.	106,700	99,500	93.2	206,200
Corridor Plan.	106,700	96,300	90.2	203,000
Satellite City Plan.	106,700	108,400	101.5	215,100

Source: SEWRPC.

Controlled Existing Trend Plan would propose to increase the developed area to about 47 square miles and would serve 92 percent of this developed area and 96 percent of the total population with sanitary sewer and public water supply facilities. The Corridor Plan would propose to increase the developed area of the county to 40 square miles and would serve 90 percent of this developed area and 96 percent of the total population with sanitary sewer and public water supply facilities.

Population

According to the demographic forecasts and as indicated in Table 85, the 1963 population level within Kenosha County would increase by 95,300 to 202,000 persons by 1990. Each of the alternative plans tends to vary from this forecast under the different land use arrangements proposed. The greatest population increase would occur under the Satellite City Plan, which proposes an increase of 108,400 persons, or 102 percent, over the 1963 level. The smallest increase would occur under the Corridor Plan, which proposes an increase of 96,300 persons, or 90 percent. The Controlled Existing Trend Plan proposes an increase of 99,500 persons, or 93 percent.

Employment

As a result of the differing land use arrangements and allocations, county employment levels would vary from the employment forecasts under two of the alternative land use plans. As indicated in Table 86, the greatest employment increase within the county would occur under the Controlled Existing Trend Plan, which proposes an increase of 38,800 employment opportunities, or 93 percent, over the 1963 level. The smallest increase would occur under the Corridor Plan, which proposes an

Table 86

EXISTING, FORECAST, AND PROPOSED EMPLOYMENT CHANGES FOR KENOSHA COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Employment
		Number	Percent	
Employment Forecast	41,900	38,800	92.6	80,700
Controlled Trend Plan	41,900	38,800	92.6	80,700
Corridor Plan	41,900	36,300	86.6	78,200
Satellite City Plan	41,900	38,100	90.9	80,000

Source: SEWRPC.

increase of 36,300 employment opportunities, or 87 percent. The Satellite City Plan proposes an increase of 38,100 employment opportunities, or 91 percent.

MILWAUKEE COUNTY

A comparison of the changes proposed within Milwaukee County under each of the alternative regional land use plans is provided in Table 87. As indicated, the Controlled Existing Trend Plan proposes the largest addition to the existing stock of urban land; and the Satellite City Plan proposes the smallest addition. To provide for the new urban development, the alternative plans propose to convert between 57.3 and 77.1 percent of the existing stock of agricultural land and between 66.0 and 68.2 percent of the existing stock of other open lands, which consist primarily of woodland cover. More prime agricultural land would be converted to urban uses under the Controlled Existing Trend Plan than under the other two alternatives. The Controlled Existing Trend Plan also proposes the largest addition to the existing stock of residential land.

Each of the plans proposes two new major industrial areas, three new major commercial centers, and one new major regional park within the county. The industrial areas are proposed for the northwestern part of the City of Milwaukee and along IH 94 in the City of Oak Creek. The new major regional park is proposed in the southern part of the City of Franklin along the Root River. The new major commercial centers are proposed for the cities of Milwaukee, Oak Creek, and West Allis. In addition, the Controlled Existing Trend Plan and the Corridor Plan propose a new major commercial center in the City of Franklin.

Public Water Supply and Sanitary Sewer Service

As indicated in Table 88, the Controlled Existing Trend Plan proposes to increase the developed land area within Milwaukee County to about 233 square miles from the 1963 total of 153 square miles. In 1963, 93 percent of the developed land area and 99 percent of the population within the county were served by sanitary sewer facilities; and 85 percent of the developed land area and 95 percent of the population were served by public water supply facilities. By 1990 each of the alternative plans proposes to serve all of the developed area and all of the population with sanitary sewer and public water supply facilities. The Corridor Plan proposes to increase the developed area to about 221 square miles, and the Satellite City Plan proposes to increase the developed area of the county to 216 square miles.

Population

According to the demographic forecasts and as indicated in Table 89, the 1963 population level within Milwaukee County would increase by 359,700 persons to 1,446,000 persons by 1990. Each of the alternative plans tends to vary from this forecast under the different land use arrangements proposed. The greatest population increase would occur under the Controlled Existing Trend Plan, which proposes an increase of 354,500 persons, or about 33 percent, over the 1963 level. The smallest increase would occur under the Satellite City Plan, which proposes an increase of 314,100 persons, or nearly 29 percent. The Corridor Plan proposes an increase of 350,300 persons, or 32 percent.

Employment

As a result of the differing land use arrangements and allocations, county employment levels would vary from the employment forecasts under two of the alternative land use plans. As indicated in Table 90, the greatest employment increase within Milwaukee County would occur under the Controlled Existing Trend Plan, which proposes an increase of 157,100 employment opportunities, or 33 percent, over the 1963 level. The smallest increase would occur under the Satellite City Plan, which proposes an increase of 142,100 employment opportunities, or 30 percent. The Corridor Plan proposes an increase of 154,300 employment opportunities, or 32 percent.

Table 87

COMPARISON OF PROPOSED LAND USE CHANGES IN MILWAUKEE COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN, CORRIDOR PLAN, AND SATELLITE CITY PLAN

Land Use Category	Existing (1963)		Alternative Plan Increments						Alternative 1990 Land Use Totals					
			Controlled Trend		Corridor		Satellite City		Controlled Trend		Corridor		Satellite City	
	Acres	Percent of County	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent of County	Acres	Percent of County	Acres	Percent of County
Residential														
High-Density	21,080	13.6	2,512	11.9	3,714	17.6	2,214	10.5	23,592	15.2	24,794	16.0	23,294	15.0
Medium-Density	8,697	5.6	18,583	213.6	14,764	169.7	16,289	187.2	27,280	17.6	23,461	15.1	24,986	16.1
Low-Density	12,207	7.9	2,797	22.9	739	6.0	707	5.7	15,004	9.7	12,946	8.4	12,914	8.4
Subtotal	*41,984*	*27.1*	*23,892*	*56.9*	*19,217*	*45.7*	*19,210*	*45.7*	*65,876*	*42.5*	*61,201*	*39.5*	*61,194*	*39.5*
Commercial[a]	3,035	1.9	1,913	63.0	1,782	58.7	1,562	51.4	4,948	3.2	4,817	3.1	4,597	3.0
Industrial[a]	5,234	3.4	1,820	34.7	1,752	33.4	1,695	32.3	7,054	4.5	6,986	4.5	6,929	4.5
Governmental[b]	6,995	4.5	2,147	30.6	1,943	27.7	1,826	26.1	9,142	5.9	8,938	5.7	8,821	5.7
Transportation[c]	30,442	19.6	9,676	31.7	8,131	26.7	7,916	26.0	40,118	25.9	38,573	24.9	38,358	24.7
Recreation[d]	12,080	7.8	1,356	11.2	1,258	10.4	1,216	10.0	13,436	8.7	13,338	8.6	13,296	8.6
Agriculture														
Prime Agriculture	7,959	5.1	- 5,905	- 74.1	- 3,668	- 46.0	- 2,536	- 31.8	2,054	1.3	4,291	2.8	5,423	3.5
Other Agriculture	27,162	17.6	- 21,180	- 78.0	- 17,088	- 62.9	- 17,607	- 64.8	5,982	3.9	10,074	6.5	9,555	6.1
Subtotal	*35,121*	*22.7*	*- 27,085*	*- 77.1*	*- 20,756*	*- 59.0*	*- 20,143*	*- 57.3*	*8,036*	*5.2*	*14,365*	*9.3*	*14,978*	*9.6*
Open Lands[e]	20,103	13.0	- 13,719	- 68.2	- 13,327	- 66.2	- 13,282	- 66.0	6,384	4.1	6,776	4.4	6,821	4.4
Converted Land	--	--	*(40,804)*[f]	--	*(34,083)*[f]	--	*(33,425)*[f]	--	--	--	--	--	--	--
Total	154,994	100.0	--	--	--	--	--	--	154,994	100.0	154,994	100.0	154,994	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Existing area includes public and nonpublic recreational sites; planned area includes only public recreational areas.*

[e] *Includes woodlands, water, wetlands, quarries, and other open lands.*

[f] *Acres of rural land converted to urban use under this alternative.*

Source: SEWRPC.

Table 88

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN MILWAUKEE COUNTY: 1963 AND 1990

Facility	Extent of Service	Existing (1963)	Proposed Plan - 1990		
			Controlled Trend	Corridor	Satellite City
Public Sewer Service	Developed Area				
	Total Square Miles	152.5	232.9	220.8	216.0
	Square Miles Served	142.3	232.9	220.8	216.0
	Percent Served	93.3	100.0	100.0	100.0
	Population				
	Total Number	1,086,300	1,446,000	1,446,000	1,446,000
	Number Served	1,075,000	1,446,000	1,446,000	1,446,000
	Percent Served	98.9	100.0	100.0	100.0
Public Water Supply	Developed Area				
	Total Square Miles	152.5	232.9	220.8	216.0
	Square Miles Served	129.1	232.9	220.8	216.0
	Percent Served	84.6	100.0	100.0	100.0
	Population				
	Total Number	1,086,300	1,446,000	1,446,000	1,446,000
	Number Served	1,029,800	1,446,000	1,446,000	1,446,000
	Percent Served	94.7	100.0	100.0	100.0

Source: SEWRPC.

Table 89

EXISTING, FORECAST, AND PROPOSED POPULATION CHANGES FOR MILWAUKEE COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Population
		Number	Percent	
Demographic Forecast	1,086,300	359,700	33.1	1,446,000
Controlled Trend Plan.	1,086,300	354,500	32.6	1,440,800
Corridor Plan.	1,086,300	350,300	32.2	1,436,600
Satellite City Plan.	1,086,300	314,100	28.9	1,400,400

Source: SEWRPC.

Table 90

EXISTING, FORECAST, AND PROPOSED EMPLOYMENT CHANGES FOR MILWAUKEE COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Employment
		Number	Percent	
Employment Forecast.	471,700	157,100	33.3	628,800
Controlled Trend Plan.	471,700	157,100	33.3	628,800
Corridor Plan.	471,700	154,300	32.1	626,000
Satellite City Plan.	471,700	142,100	30.1	613,800

Source: SEWRPC.

Table 91

COMPARISON OF PROPOSED LAND USE CHANGES IN OZAUKEE COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN, CORRIDOR PLAN, AND SATELLITE CITY PLAN

Land Use Category	Existing (1963)		Alternative Plan Increments						Alternative 1990 Land Use Totals					
			Controlled Trend		Corridor		Satellite City		Controlled Trend		Corridor		Satellite City	
	Acres	Percent of County	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent of County	Acres	Percent of County	Acres	Percent of County
Residential														
High-Density	471	0.3	--	--	332	70.4	61	12.9	471	0.3	803	0.5	532	0.3
Medium-Density	1,324	0.9	3,326	251.2	3,289	248.4	5,835	440.7	4,650	3.1	4,613	3.1	7,159	4.8
Low-Density	7,542	5.0	3,049	40.4	1,625	21.5	3,285	43.5	10,591	7.1	9,167	6.1	10,827	7.2
Subtotal	*9,337*	*6.2*	*6,375*	*68.2*	*5,246*	*56.1*	*9,181*	*98.3*	*15,712*	*10.5*	*14,583*	*9.7*	*18,518*	*12.3*
Commercial[a]	361	0.2	299	82.8	299	82.8	550	152.3	660	0.4	660	0.4	911	0.6
Industrial[a]	370	0.3	177	47.8	184	49.7	524	141.6	547	0.4	554	0.4	894	0.6
Governmental[b]	796	0.5	443	55.6	430	54.0	695	87.3	1,239	0.8	1,226	0.8	1,491	1.0
Transportation[c]	7,010	4.7	2,077	29.6	1,920	27.3	3,212	45.8	9,087	6.1	8,930	6.0	10,222	6.8
Recreation[d]	1,614	1.1	1,135	70.3	1,129	69.9	1,249	77.3	2,749	1.8	2,743	1.8	2,863	1.9
Agriculture														
Prime Agriculture	41,455	27.6	- 890	- 2.1	- 426	- 1.0	- 3,063	- 7.3	40,565	27.0	41,029	27.3	38,392	25.6
Other Agriculture	63,744	42.5	- 8,526	- 13.4	- 7,828	- 12.3	- 10,962	- 17.2	55,218	36.8	55,916	37.3	52,782	35.0
Subtotal	*105,199*	*70.1*	*- 9,416*	*- 8.9*	*- 8,254*	*- 7.8*	*- 14,025*	*- 13.3*	*95,783*	*63.8*	*96,945*	*64.6*	*91,174*	*60.8*
Open Lands[e]	25,326	16.9	- 1,090	- 4.3	- 954	- 3.7	- 1,386	- 5.4	24,236	16.2	24,372	16.3	23,940	16.0
Converted Land	--	--	*(10,506)*[f]	--	*(9,208)*[f]	--	*(15,411)*[f]	--	--	--	--	--	--	--
Total	150,013	100.0	--	--	--	--	--	--	150,013	100.0	150,013	100.0	150,013	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Existing area includes public and nonpublic recreational sites; planned area includes only public recreational areas.*

[e] *Includes woodlands, water, wetlands, quarries, and other open lands.*

[f] *Acres of rural land converted to urban use under this alternative.*

Source: SEWRPC.

OZAUKEE COUNTY

A comparison of the changes proposed within Ozaukee County under each of the alternative regional land use plans is provided in Table 91. As indicated, the Satellite City Plan proposes the largest addition to the existing stock of urban land; and the Corridor Plan proposes the smallest addition. To provide for the new urban development, the alternative plans propose to convert between 7.8 and 13.3 percent of the existing stock of agricultural land and between 3.7 and 5.4 percent of the existing stock of other open lands, which consist primarily of woodland cover. More prime agricultural land would be converted to urban uses under the Satellite City Plan than under the other two alternatives. The Satellite City Plan also proposes the largest addition to the existing stock of residential land, and the Controlled Existing Trend Plan does not provide any new low-density development.

Each of the plans proposes two new major regional parks: one located on the Lake Michigan shore east of Lake Church and one located on the Milwaukee River southwest of Fredonia. The Satellite City Plan proposes a new major commercial center and a new major industrial center in the vicinity of the City of Port Washington.

Public Water Supply and Sanitary Sewer Service

As indicated in Table 92, the Satellite City Plan proposes to increase the developed land area within Ozaukee County to about 46 square miles from the 1963 total of about 16 square miles. In 1963, 39 percent of the developed land area and 49 percent of the population within the county were served by sanitary sewer facilities; and 35 percent of the developed land area and 47 percent of the population were served by public water supply facilities. By 1990 the Satellite City Plan proposes to serve 98 percent of the developed area and about 94 percent of the population with sanitary sewer and public water supply facilities. The Controlled Existing Trend Plan proposes to increase the developed area to 35 square miles and serve 98 percent of this developed area and 88 percent of the total population with sanitary sewer and public water supply facilities. The Corridor Plan proposes to increase the developed area of the county to about 29 square miles and serve 98 percent of this developed area and 89 percent of the total population with sanitary sewer and public water supply facilities.

Population

According to the demographic forecasts and as indicated in Table 93, the 1963 population level within Ozaukee County would increase by 64,400

Table 92

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN OZAUKEE COUNTY: 1963 AND 1990

Facility	Extent of Service	Existing (1963)	Proposed Plan - 1990		
			Controlled Trend	Corridor	Satellite City
Public Sewer Service	Developed Area				
	Total Square Miles	15.9	35.1	29.4	45.9
	Square Miles Served	6.2	34.4	28.7	45.2
	Percent Served	38.9	98.0	97.6	98.4
	Population				
	Total Number	41,600	107,100	110,800	141,900
	Number Served	20,340	93,870	98,500	132,800
	Percent Served	48.8	87.7	88.8	93.5
Public Water Supply	Developed Area				
	Total Square Miles	15.9	35.1	29.4	45.9
	Square Miles Served	5.5	34.4	28.7	45.2
	Percent Served	34.5	98.0	97.6	98.4
	Population				
	Total Number	41,600	107,100	110,800	141,900
	Number Served	19,510	93,870	98,500	132,800
	Percent Served	46.8	87.7	88.8	93.5

Source: SEWRPC.

Table 93

EXISTING, FORECAST, AND PROPOSED POPULATION CHANGES FOR OZAUKEE COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Population
		Number	Percent	
Demographic Forecast	41,600	64,400	154.8	106,000
Controlled Trend Plan	41,600	65,500	157.4	107,100
Corridor Plan	41,600	69,200	166.3	110,800
Satellite City Plan	41,600	100,300	241.1	141,900

Source: SEWRPC.

persons to 106,000 persons by 1990. Each of the alternative plans tends to vary from this forecast under the different land use arrangements proposed. The greatest population increase would occur under the Satellite City Plan which proposes an increase of 100,300 persons, or 241 percent, over the 1963 level. The smallest increase would occur under the Controlled Existing Trend Plan, which proposes an increase of 65,500 persons, or 157 percent. The Corridor Plan proposes an increase of 69,200 persons, or 166 percent.

Employment

As a result of the differing land use arrangements and allocations, county employment levels would vary from the employment forecasts under two of the alternative land use plans. As indicated in Table 94, the greatest employment increase within Ozaukee County would occur under the Satellite City Plan, which proposes an increase of 28,300 employment opportunities, or 262 percent, over the 1963 level. The smallest increase would occur under the Controlled Existing Trend Plan, which proposes an increase of 15,700 employment opportunities, or 145 percent. The Corridor Plan proposes an increase of 16,100 employment opportunities, or 149 percent.

RACINE COUNTY

A comparison of the changes proposed within Racine County under each of the alternative regional land use plans is provided in Table 95. As indicated, the Controlled Existing Trend Plan proposes the largest addition to the existing stock of urban land; and the Satellite City Plan proposes the smallest addition. To provide for the new urban development, the alternative plans propose to convert between 7.4 and 10.7 percent of the existing stock of agricultural land and between 3.6 and 4.3 percent of the existing stock of other open lands, which consist primarily of woodland cover. More prime agricultural land would be converted to urban uses under the Controlled Existing Trend Plan than under the other two alternatives. The Controlled Existing Trend Plan also proposes the largest addition to the existing stock of residential land, and neither the Corridor Plan nor the Satellite City Plan would provide any new low-density development.

Each of the alternative plans proposes a new major commercial center west of the City of Racine; two new major industrial areas, one in the City of Burlington and one in the City of Racine; and one new major regional park along the Lake Michigan shore in the Town of Caledonia.

Public Water Supply and Sanitary Sewer Service

As indicated in Table 96, the Controlled Existing Trend Plan proposes to increase the developed land area within Racine County to about 71 square miles from the 1963 total of about 38 square miles. In 1963 about 51 percent of the developed land area and 75 percent of the population within the county were served by sanitary sewer facilities, and about 48 percent of the developed land area and

Table 94

EXISTING, FORECAST, AND PROPOSED EMPLOYMENT CHANGES FOR OZAUKEE COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Employment
		Number	Percent	
Employment Forecast	10,800	15,700	145.3	26,500
Controlled Trend Plan	10,800	15,700	145.3	26,500
Corridor Plan	10,800	16,100	149.0	26,900
Satellite City Plan	10,800	28,300	262.0	39,100

Source: SEWRPC.

Table 95

COMPARISON OF PROPOSED LAND USE CHANGES IN RACINE COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN, CORRIDOR PLAN, AND SATELLITE CITY PLAN

Land Use Category	Existing (1963)		Alternative Plan Increments						Alternative 1990 Land Use Totals					
			Controlled Trend		Corridor		Satellite City		Controlled Trend		Corridor		Satellite City	
	Acres	Percent of County	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent of County	Acres	Percent of County	Acres	Percent of County
Residential														
High-Density	4,069	1.9	200	4.9	593	14.5	97	2.3	4,269	1.9	4,662	2.1	4,166	1.9
Medium-Density	2,752	1.2	6,953	252.6	7,207	261.8	6,786	246.5	9,705	4.5	9,959	4.6	9,538	4.4
Low-Density	6,550	3.0	3,637	55.5	--	--	--	--	10,187	4.7	6,550	3.0	6,550	3.0
Subtotal	*13,371*	*6.1*	*10,790*	*80.6*	*7,800*	*58.3*	*6,883*	*51.4*	*24,161*	*17.1*	*21,171*	*9.7*	*20,254*	*9.3*
Commercial[a]	753	0.4	604	80.2	580	77.0	493	65.4	1,357	0.6	1,333	0.6	1,246	0.6
Industrial[a]	885	0.4	1,049	118.5	1,049	118.5	992	112.0	1,934	0.9	1,934	0.9	1,877	0.9
Governmental[b]	1,499	0.7	818	54.5	748	49.8	627	41.8	2,317	1.1	2,247	1.0	2,126	1.0
Transportation[c]	11,163	5.1	3,766	33.7	3,278	29.3	2,830	25.3	14,929	6.9	14,441	6.7	13,993	6.4
Recreation[d]	2,316	1.1	895	38.6	864	37.3	813	35.1	3,211	1.5	3,180	1.5	3,129	1.4
Agriculture														
Prime Agriculture	74,321	34.2	- 6,330	- 8.5	- 4,205	- 5.6	- 3,562	- 4.7	67,991	31.2	70,116	32.2	70,759	32.5
Other Agriculture	79,315	36.4	- 10,164	- 12.8	- 8,628	- 10.9	- 7,848	- 9.9	69,151	31.8	70,687	32.5	71,467	32.9
Subtotal	*153,636*	*70.6*	*- 16,494*	*- 10.7*	*- 12,833*	*- 8.3*	*- 11,410*	*- 7.4*	*137,142*	*63.0*	*140,803*	*64.7*	*142,226*	*65.4*
Open Lands[e]	33,923	15.6	- 1,428	- 4.2	- 1,486	- 4.3	- 1,228	- 3.6	32,495	14.9	32,437	14.9	32,695	15.0
Converted Land	--	--	*(17,922)*[f]	--	*(14,319)*[f]	--	*(12,638)*[f]	--	--	--	--	--	--	--
Total	217,546	100.0	--	--	--	--	--	--	217,546	100.0	217,546	100.0	217,546	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Existing area includes public and nonpublic recreational sites; planned area includes only public recreational areas.*

[e] *Includes woodlands, water, wetlands, quarries, and other open lands.*

[f] *Acres of rural land converted to urban use under this alternative.*

Source: SEWRPC.

Table 96

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN RACINE COUNTY: 1963 AND 1990

Facility	Extent of Service	Existing (1963)	Proposed Plan - 1990		
			Controlled Trend	Corridor	Satellite City
Public Sewer Service	Developed Area				
	Total Square Miles	37.8	70.7	56.5	60.3
	Square Miles Served	19.1	66.2	52.0	55.8
	Percent Served	50.5	93.6	92.0	92.5
	Population				
	Total Number	150,600	273,200	276,100	252,000
	Number Served	112,600	244,100	246,100	228,600
	Percent Served	74.7	89.3	89.1	90.7
Public Water Supply	Developed Area				
	Total Square Miles	37.8	70.7	56.5	60.3
	Square Miles Served	18.3	66.2	52.0	55.8
	Percent Served	48.4	93.6	92.0	92.5
	Population				
	Total Number	150,600	273,200	276,100	252,000
	Number Served	120,590	244,000	246,100	228,600
	Percent Served	80.0	89.3	89.1	90.7

Source: SEWRPC.

80 percent of the population were served by public water supply facilities. By 1990 the Controlled Existing Trend Plan proposes to serve about 94 percent of the developed area and 89 percent of the population with sanitary sewer and public water supply facilities. The Satellite City Plan proposes to increase the developed area to about 60 square miles and serve almost 93 percent of this developed area and about 91 percent of the total population with sanitary sewer and public water supply facilities. The Corridor Plan proposes to increase the developed area of the county to about 57 square miles and serve 92 percent of this developed area and 89 percent of the total population with sanitary sewer and public water supply facilities.

Population

According to the demographic forecasts and as indicated in Table 97, the 1963 population level within Racine County would increase by 132,400 persons to 283,000 persons by 1990. Each of the alternative plans tends to vary from this forecast under the different land use arrangements proposed. The greatest population increase would occur under the Corridor Plan, which proposes an increase of 125,500 persons, or about 83 percent, over the 1963 level. The smallest increase would occur under the Satellite City Plan, which proposes an increase of 101,400 persons, or 67 percent. The Controlled Existing Trend Plan proposes an increase of 122,600 persons, or about 81 percent.

Employment

As a result of the differing land use arrangements and allocations, county employment levels would vary from the employment forecasts under two

Table 97

EXISTING, FORECAST, AND PROPOSED POPULATION CHANGES FOR RACINE COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Population
		Number	Percent	
Demographic Forecast	150,600	132,400	87.9	283,000
Controlled Trend Plan.	150,600	122,600	81.4	273,200
Corridor Plan.	150,600	125,500	83.3	276,100
Satellite City Plan.	150,600	101,400	67.3	252,000

Source: SEWRPC.

of the alternative land use plans. As indicated in Table 98, the greatest employment increase within Racine County would occur under the Corridor Plan, which proposes an increase of 46,400 employment opportunities, or 89 percent, over the 1963 level. The smallest increase would occur under the Satellite City Plan, which proposes an increase of 39,400 employment opportunities, or about 76 percent. The Controlled Existing Trend Plan proposes an increase of 45,400 employment opportunities, or 87 percent.

WALWORTH COUNTY

A comparison of the changes proposed within Walworth County under each of the alternative regional land use plans is provoded in Table 99. As indicated, the Satellite City Plan proposes the largest addition to the existing stock of urban land; and the Controlled Existing Trend Plan proposes the smallest addition. To provided for the new urban development, the alternative plans propose to convert between 1.3 and 3.3 percent of the existing stock of agricultural land and between 1.9 and 2.5 percent of the existing stock of other open lands, which consist primarily of woodland cover. More prime agricultural land would be converted to urban uses under the Satellite City Plan than under the other two alternatives. The Satellite City Plan also proposes the largest addition to the existing stock of residential land, and none of the plans propose any new low-density residential development. Also, neither the Controlled Existing Trend Plan nor the Satellite City Plan would provide any new high-density residential development.

Each of the plans proposes two new major regional parks: one on Rice Lake southeast of the City of Whitewater and one on Sugar Creek in the Town of LaFayette. In addition, the Satellite City Plan proposes a new major commercial center in the City of Whitewater.

Public Water Supply and Sanitary Sewer Service

As indicated in Table 100, the Satellite City Plan proposes to increase the developed land area within Walworth County to about 45 square miles from the 1963 total of 24 square miles. In 1963 about 36 percent of the developed land area and 52 percent of the population within the county were served by sanitary sewer facilities, and about 48 percent of the developed land area and 56 percent of the population were served by public water supply facilities. By 1990 the Satellite City Plan proposes to serve 74 percent of the developed area and 76 percent of the population with sanitary sewer and public water supply facilities. The Corridor Plan proposes to increase the developed area to about 31 square miles and serve about 63 percent of this developed area and 84 percent of the total population with sanitary sewer and public water supply facilities. The Controlled Existing Trend Plan proposes to increase the developed area of the county to about 31 square miles and serve 62 percent of this developed area and 70 percent of the total population with sanitary sewer and public water supply facilities.

Population

According to the demographic forecasts and as indicated in Table 101, the 1963 population level within Walworth County would increase by 31,500 persons to 87,000 persons by 1990. Each of the alternative plans tends to vary from this forecast under the different land use arrangements proposed. The greatest population increase would occur under the Satellite City Plan, which proposes an increase of 84,300 persons, or 152 percent, over the 1963 level. The smallest increase would occur under the Controlled Existing Trend Plan, which proposes an increase of 35,500 persons, or 64 percent. The Corridor Plan proposes an increase of 54,200 persons, or 98 percent.

Employment

As a result of the differing land use arrangements and allocations, county employment levels would

Table 98

EXISTING, FORECAST, AND PROPOSED EMPLOYMENT CHANGES FOR RACINE COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Employment
		Number	Percent	
Employment Forecast.	52,100	45,400	87.1	97,500
Controlled Trend Plan.	52,100	45,400	87.1	97,500
Corridor Plan.	52,100	46,400	89.0	98,500
Satellite City Plan.	52,100	39,400	75.6	91,500

Source: SEWRPC.

Table 99

COMPARISON OF PROPOSED LAND USE CHANGES IN WALWORTH COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN, CORRIDOR PLAN, AND SATELLITE CITY PLAN

Land Use Category	Existing (1963)		Alternative Plan Increments						Alternative 1990 Land Use Totals					
			Controlled Trend		Corridor		Satellite City		Controlled Trend		Corridor		Satellite City	
	Acres	Percent of County	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent of County	Acres	Percent of County	Acres	Percent of County
Residential														
High-Density	1,701	0.4	--	--	374	21.9	--	--	1,701	0.4	2,075	0.6	1,701	0.5
Medium-Density	2,871	0.8	2,173	75.6	2,468	85.9	5,706	198.7	5,044	1.4	5,339	1.4	8,577	2.3
Low-Density	7,284	2.0	--	--	--	--	--	--	7,284	2.0	7,284	2.0	7,284	2.0
Subtotal	*11,856*	*3.2*	*2,173*	*18.3*	*2,842*	*23.9*	*5,706*	*48.1*	*14,029*	*3.8*	*14,698*	*4.0*	*17,562*	*4.8*
Commercial[a]	615	0.2	140	22.7	207	33.6	445	72.3	755	0.2	822	0.2	1,060	0.3
Industrial[a]	862	0.2	88	10.2	132	15.3	235	27.2	950	0.3	994	0.2	1,097	0.3
Governmental[b]	1,090	0.3	193	17.7	286	26.2	516	47.3	1,283	0.3	1,376	0.4	1,606	0.4
Transportation[c]	10,552	2.8	1,150	10.8	1,225	11.6	2,348	22.2	11,702	3.2	11,777	3.2	12,900	3.5
Recreation[d]	6,017	1.6	1,408	23.4	1,448	24.0	1,555	25.8	7,425	2.0	7,465	2.0	7,572	2.0
Agriculture														
Prime Agriculture	121,919	32.9	- 585	- 0.4	- 1,491	- 1.2	- 2,865	- 2.3	121,334	32.8	120,428	32.5	119,054	32.1
Other Agriculture	144,332	39.1	- 2,955	- 2.1	- 3,234	- 2.4	- 6,117	- 4.2	141,377	38.2	141,098	38.2	138,215	37.4
Subtotal	*266,251*	*72.0*	*- 3,540*	*- 1.3*	*- 4,725*	*- 1.7*	*- 8,982*	*- 3.3*	*262,711*	*71.0*	*261,526*	*70.7*	*257,269*	*69.5*
Open Lands[e]	72,737	19.7	- 1,612	- 2.2	- 1,415	- 1.9	- 1,823	- 2.5	71,125	19.2	71,322	19.3	70,914	19.2
Converted Land	--	--	*(5,152)*[f]	--	*(6,140)*[f]	--	*(10,805)*[f]	--	--	--	--	--	--	--
Total	369,980	100.0	--	--	--	--	--	--	369,980	100.0	369,980	100.0	369,980	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Existing area includes public and nonpublic recreational sites; planned area includes only public recreational areas.*

[e] *Includes woodlands, water, wetlands, quarries, and other open lands.*

[f] *Acres of rural land converted to urban use under this alternative.*

Source: SEWRPC.

Table 100

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN WALWORTH COUNTY: 1963 AND 1990

Facility	Extent of Service	Existing (1963)	Proposed Plan - 1990		
			Controlled Trend	Corridor	Satellite City
Public Sewer Service	Developed Area				
	Total Square Miles	24.0	30.9	31.2	45.3
	Square Miles Served	8.6	19.2	19.5	33.6
	Percent Served	35.8	62.1	62.5	74.1
	Population				
	Total Number	55,500	91,000	109,700	139,800
	Number Served	28,925	64,000	92,400	106,500
	Percent Served	52.1	70.3	84.2	76.1
Public Water Supply	Developed Area				
	Total Square Miles	24.0	30.9	31.2	45.3
	Square Miles Served	11.5	19.2	19.5	33.6
	Percent Served	47.9	62.1	62.5	74.1
	Population				
	Total Number	55,500	91,000	109,700	139,800
	Number Served	31,270	64,000	92,400	106,500
	Percent Served	56.3	70.3	84.2	76.1

Source: SEWRPC.

Table 101

EXISTING, FORECAST, AND PROPOSED POPULATION CHANGES FOR WALWORTH COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Population
		Number	Percent	
Demographic Forecast	55,500	31,500	56.7	87,000
Controlled Trend Plan.	55,500	35,500	63.9	91,000
Corridor Plan.	55,500	54,200	97.6	109,700
Satellite City Plan.	55,500	84,300	151.8	139,800

Source: SEWRPC.

vary from the employment forecasts under two of the alternative land use plans. As indicated in Table 102, the greatest employment increase within Walworth County would occur under the Satellite City Plan, which proposes an increase of 21,300 employment opportunities, or 168 percent, over the 1963 level. The smallest increase would occur under the Controlled Existing Trend Plan, which proposes an increase of 10,100 employment opportunities, or 80 percent. The Corridor Plan proposes an increase of 14,300 employment opportunities, or 113 percent.

WASHINGTON COUNTY

A comparison of the changes proposed within Washington County under each of the alternative regional land use plans is provided in Table 103. As indicated, the Satellite City Plan proposes the largest addition to the existing stock of urban land; and the Corridor Plan proposes the smallest addition. To provide for the new urban development, the alternative plans propose to convert between 2.5 and 4.8 percent of the existing stock of agricultural land and between 1.4 and 1.5 percent of the existing stock of other open lands, which consist primarily of woodland cover. More prime agricultural land would be converted to urban uses under the Controlled Existing Trend Plan than under the other two alternatives. The Satellite City Plan proposes the largest addition to the existing stock of residential land, and neither this plan nor the Corridor Plan would provide any new low-density residential development.

Table 102
EXISTING, FORECAST, AND PROPOSED EMPLOYMENT CHANGES FOR WALWORTH COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Employment
		Number	Percent	
Employment Forecast.	12,700	10,100	79.5	22,800
Controlled Trend Plan.	12,700	10,100	79.5	22,800
Corridor Plan.	12,700	14,300	112.5	27,000
Satellite City Plan.	12,700	21,300	167.7	34,000

Source: SEWRPC.

Each of the plans proposes two new major regional parks; one on Pike Lake between Hartford and Slinger and one on Lucas Lake southwest of the City of West Bend. In addition, the Controlled Existing Trend Plan and the Corridor Plan propose a new major commercial center in the Village of Germantown.

Public Water Supply and Sanitary Sewer Service

As indicated in Table 104, the Satellite City Plan proposes to increase the developed land area within Washington County to about 38 square miles from the 1963 total of about 12 square miles. In 1963 about 52 percent of the developed land area and 47 percent of the population within the county were served by sanitary sewer facilities, and 49 percent of the developed land area and 47 percent of the population were served by public water supply facilities. By 1990 the Satellite City Plan proposes to serve about 90 percent of the developed area and 71 percent of the population with sanitary sewer and public water supply facilities. The Controlled Existing Trend Plan proposes to increase the developed area to about 24 square miles and serve 84 percent of this developed area and 79 percent of the total population with sanitary sewer and public water supply facilities. The Corridor Plan proposes to increase the developed area of the county to 23 square miles and serve 83 percent of this developed area and 78 percent of the total population with sanitary sewer and public water supply facilities.

Population

According to the demographic forecasts and as indicated in Table 105, the 1963 population level within Washington County would increase by 46,500 to 96,000 persons by 1990. Each of the alternative plans tends to vary from this forecast under the different land use arrangements proposed. The greatest population increase would occur under the Satellite City Plan, which proposes an increase of 81,300 persons, or 164 percent, over the 1963 level. The smallest increase would occur under the Corridor Plan, which proposes an increase of 51,200 persons, or 103 percent. The Controlled Existing Trend Plan proposes an increase of 54,900 persons, or 111 percent.

Employment

As a result of the differing land use arrangements and allocations, county employment levels would vary from the employment forecasts under two of the alternative land use plans. As indicated in Table 106, the greatest employment increase within Washington County would occur under the Satellite City Plan, which proposes an increase of 19,900 employment opportunities, or about 164 percent, over the 1963 level. The smallest increase would occur under the Controlled Existing Trend Plan, which proposes an increase of 14,300 employment opportunities, or 118 percent. The Corridor Plan proposes an increase of 14,700 employment opportunities, or 121 percent.

WAUKESHA COUNTY

A comparison of the changes proposed within Waukesha County under each of the alternative regional land use plans is provided in Table 107. As indicated, the Controlled Existing Trend Plan proposes the largest addition to the existing stock of urban land; and the Satellite City Plan proposes the smallest addition. To provide for the new urban development, the alternative plans propose to convert between 10.5 and 13.9 percent of the existing stock of agricultural land and between 3.7 and 4.6 percent of the existing stock of other open lands, which consist primarily of woodland cover. More prime agricultural land would be converted to urban uses under the Satellite City Plan than under the other two alternatives. The Controlled Existing Trend Plan proposes the largest addition to the existing stock of residential land.

Table 103

COMPARISON OF PROPOSED LAND USE CHANGES IN WASHINGTON COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN, CORRIDOR PLAN, AND SATELLITE CITY PLAN

Land Use Category	Existing (1963)		Alternative Plan Increments						Alternative 1990 Land Use Totals					
			Controlled Trend		Corridor		Satellite City		Controlled Trend		Corridor		Satellite City	
	Acres	Percent of County	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent of County	Acres	Percent of County	Acres	Percent of County
Residential														
High-Density	1,752	0.6	39	2.2	398	22.7	34	1.9	1,791	0.6	2,150	0.8	1,786	0.6
Medium-Density	1,673	0.6	3,602	215.3	2,458	146.9	5,693	340.2	5,275	1.9	4,131	1.5	7,366	2.7
Low-Density	4,004	1.5	325	8.1	--	--	--	--	4,329	1.6	4,004	1.4	4,004	1.4
Subtotal	*7,429*	*2.7*	*3,966*	*53.3*	*2,856*	*38.4*	*5,727*	*77.0*	*11,395*	*4.1*	*10,285*	*3.7*	*13,156*	*4.7*
Commercial[a]	287	0.1	303	105.5	280	97.5	384	133.7	590	0.2	567	0.2	671	0.2
Industrial[a]	455	0.1	143	31.4	133	29.2	240	52.7	598	0.2	588	0.2	695	0.3
Governmental[b]	762	0.3	328	43.0	291	38.1	529	69.4	1,090	0.4	1,053	0.4	1,291	0.5
Transportation[c]	10,344	3.7	1,501	14.5	1,237	11.9	2,397	23.1	11,845	4.3	11,581	4.2	12,741	4.6
Recreation[d]	2,041	0.7	1,017	49.8	998	48.8	1,109	54.3	3,058	1.1	3,039	1.1	3,150	1.1
Agriculture														
Prime Agriculture	53,916	19.3	- 1,712	- 3.1	- 1,118	- 2.0	- 784	- 1.4	52,204	18.7	52,798	18.9	53,132	19.1
Other Agriculture	138,355	49.7	- 4,526	- 3.3	- 3,750	- 2.7	- 8,562	- 6.2	133,829	48.0	134,605	48.3	129,793	46.5
Subtotal	*192,271*	*69.0*	*- 6,238*	*- 3.2*	*- 4,868*	*- 2.5*	*- 9,346*	*- 4.8*	*186,033*	*66.7*	*187,403*	*67.2*	*182,925*	*65.6*
Open Lands[e]	65,143	23.4	- 1,020	- 1.5	- 927	- 1.4	- 1,040	- 1.5	64,123	23.0	64,216	23.0	64,103	23.0
Converted Land	--	--	*(7,258)*[f]	--	*(5,795)*[f]	--	*(10,386)*[f]	--	--	--	--	--	--	--
Total	278,732	100.0	--	--	--	--	--	--	278,732	100.0	278,732	100.0	278,732	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Existing area includes public and nonpublic recreational sites; planned area includes only public recreational areas.*

[e] *Includes woodlands, water, wetlands, quarries, and other open lands.*

[f] *Acres of rural land converted to urban use under this alternative.*

Source: SEWRPC.

Table 104

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN WASHINGTON COUNTY: 1963 AND 1990

Facility	Extent of Service	Existing (1963)	Proposed Plan - 1990		
			Controlled Trend	Corridor	Satellite City
Public Sewer Service	Developed Area				
	Total Square Miles	11.8	23.9	23.1	38.3
	Square Miles Served	6.1	20.0	19.2	34.3
	Percent Served	51.7	83.7	83.1	89.5
	Population				
	Total Number	49,500	104,400	100,700	130,800
	Number Served	23,050	82,950	78,100	93,500
	Percent Served	46.5	79.5	77.5	71.4
Public Water Supply	Developed Area				
	Total Square Miles	11.8	23.9	23.1	38.3
	Square Miles Served	5.8	20.0	19.2	34.3
	Percent Served	49.1	83.7	83.1	89.5
	Population				
	Total Number	49,500	104,400	100,700	130,800
	Number Served	23,150	82,950	78,100	93,500
	Percent Served	46.7	79.5	77.5	71.4

Source: SEWRPC.

Table 105

EXISTING, FORECAST, AND PROPOSED POPULATION CHANGES FOR WASHINGTON COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Population
		Number	Percent	
Demographic Forecast	49,500	46,500	93.9	96,000
Controlled Trend Plan.	49,500	54,900	110.9	104,400
Corridor Plan.	49,500	51,200	103.4	100,700
Satellite City Plan.	49,500	81,300	164.2	130,800

Source: SEWRPC.

Table 106

EXISTING, FORECAST, AND PROPOSED EMPLOYMENT CHANGES FOR WASHINGTON COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Employment
		Number	Percent	
Employment Forecast.	12,100	14,300	118.1	26,400
Controlled Trend Plan.	12,100	14,300	118.1	26,400
Corridor Plan.	12,100	14,700	121.4	26,800
Satellite City Plan.	12,100	19,900	164.4	32,000

Source: SEWRPC.

Table 107

COMPARISON OF PROPOSED LAND USE CHANGES IN WAUKESHA COUNTY: 1963 AND 1990 CONTROLLED EXISTING TREND PLAN, CORRIDOR PLAN, AND SATELLITE CITY PLAN

Land Use Category	Existing (1963)		Alternative Plan Increments						Alternative 1990 Land Use Totals					
			Controlled Trend		Corridor		Satellite City		Controlled Trend		Corridor		Satellite City	
	Acres	Percent of County	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent Change 1963 - 1990	Acres	Percent of County	Acres	Percent of County	Acres	Percent of County
Residential														
High-Density	2,879	0.8	14	0.4	912	31.6	91	3.1	2,893	0.8	3,791	1.0	2,970	0.8
Medium-Density	4,758	1.3	16,776	352.5	14,492	304.5	13,384	281.2	21,534	5.8	19,250	5.2	18,142	4.9
Low-Density	25,831	6.9	4,236	16.3	1,344	5.2	2,047	7.9	30,067	8.1	27,175	7.3	27,878	7.5
Subtotal	*33,468*	*9.0*	*21,026*	*62.8*	*16,748*	*50.0*	*15,522*	*46.3*	*54,494*	*14.7*	*50,216*	*13.5*	*48,990*	*13.2*
Commercial[a]	1,123	0.3	1,364	121.4	1,248	111.1	1,238	110.2	2,487	0.7	2,371	0.6	2,361	0.6
Industrial[a]	1,131	0.3	992	87.7	934	82.5	1,113	98.4	2,123	0.6	2,065	0.6	2,244	0.6
Governmental[b]	2,521	0.7	1,713	67.9	1,528	60.0	1,323	52.4	4,234	1.1	4,049	1.1	3,844	1.0
Transportation[c]	18,114	4.9	7,878	43.4	6,784	37.4	6,039	33.3	25,992	7.0	24,898	6.7	24,153	6.5
Recreation[d]	6,076	1.6	1,541	25.3	1,454	23.9	1,366	22.4	7,617	2.0	7,530	2.0	7,442	2.0
Agriculture														
Prime Agriculture	71,512	19.2	- 1,278	- 1.7	- 1,560	- 2.1	- 1,937	- 2.7	70,234	19.0	69,952	18.8	69,575	18.7
Other Agriculture	144,763	39.0	- 28,957	- 20.0	- 23,627	- 16.3	- 20,841	- 14.4	115,806	31.1	121,136	32.6	123,922	33.4
Subtotal	*216,275*	*58.2*	*- 30,235*	*- 13.9*	*- 25,187*	*- 11.6*	*- 22,778*	*- 10.5*	*186,040*	*50.1*	*191.088*	*51.4*	*193,497*	*52.1*
Open Lands[e]	92,938	25.0	- 4,279	- 4.6	- 3,509	- 3.7	- 3,823	- 4.1	88,659	23.8	89,429	24.1	89,115	24.0
Converted Land	--	--	*(34,514)*[f]	--	*(28,696)*[f]	--	*(26,601)*[f]	--	--	--	--	--	--	--
Total	371,646	100.0	--	--	--	--	--	--	371,646	100.0	371,646	100.0	371,646	100.0

[a] *Includes on-site parking.*

[b] *Includes institutional uses and on-site parking.*

[c] *Includes communications and utilities uses.*

[d] *Existing area includes public and nonpublic recreational sites; planned area includes only public recreational areas.*

[e] *Includes woodlands, water, wetlands, quarries, and other open lands.*

[f] *Acres of rural land converted to urban use under this alternative.*

Source: SEWRPC.

Each of the plans proposes three new major commercial centers, one new major industrial center, three new major regional parks, and a new University of Wisconsin Center. The commercial areas are proposed for the cities of Brookfield and New Berlin and the Village of Menomonee Falls. The industrial center is proposed for the City of New Berlin, and under the Satellite City Plan an additional industrial center is proposed for the City of Oconomowoc. The regional parks are proposed for the northern part of the Town of Merton on the Oconomowoc River, on Ottawa Lake in the Town of Ottawa, and one southeast of the City of Waukesha. The University of Wisconsin Center is proposed for the City of Waukesha.

Public Water Supply and Sanitary Sewer Service

As indicated in Table 108, the Controlled Existing Trend Plan proposes to increase the developed land area within Waukesha County to about 150 square miles from the 1963 total of 70 square miles. In 1963 about 30 percent of the developed land area and 43 percent of the population within the county were served by sanitary sewer facilities, and 23 percent of the developed land area and 38 percent of the population were served by public water supply facilities. By 1990 the Controlled Existing Trend Plan proposes to serve about 89 percent of the developed area and 92 percent of the population with sanitary sewer and public water supply facilities. The Corridor Plan proposes to increase the developed area to 137 square miles and serve about 88 percent of this developed area and 83 percent of the total population with sanitary sewer and public water supply facilities. The Satellite City Plan proposes to increase the developed area of the county to about 135 square miles and serve 88 percent of this developed area and 89 percent of the total population with sanitary sewer and public water supply facilities.

Population

According to the demographic forecasts and as indicated in Table 109, the 1963 population level within Waukesha County would increase by 273,800 persons to 458,000 persons by 1990. Each of the alternative plans tends to vary from this forecast under the different land use arrangements proposed. The greatest population increase would occur under the Controlled Existing Trend Plan, which proposes an increase of 271,100 persons, or 147 percent, over the 1963 level. The smallest increase would occur under the Satellite City Plan, which proposes an increase of 213,800 persons, or 116 percent. The Corridor Plan proposes an increase of 256,900 persons, or 139 percent.

Table 108

EXISTING AND PROPOSED DEVELOPED AREA AND POPULATION SERVED BY PUBLIC SANITARY SEWER AND PUBLIC WATER SUPPLY IN WAUKESHA COUNTY: 1963 AND 1990

Facility	Extent of Service	Existing (1963)	Proposed Plan - 1990		
			Controlled Trend	Corridor	Satellite City
Public Sewer Service	Developed Area				
	Total Square Miles	70.1	149.7	136.5	134.8
	Square Miles Served	20.7	133.0	119.9	118.1
	Percent Served	29.5	88.8	87.8	87.6
	Population				
	Total Number	184,200	455,300	441,100	398,000
	Number Served	79,950	418,500	365,200	355,200
	Percent Served	43.3	91.9	82.7	89.2
Public Water Supply	Developed Area				
	Total Square Miles	70.1	149.7	136.5	134.8
	Square Miles Served	16.2	133.0	119.9	118.1
	Percent Served	23.1	88.8	87.1	87.6
	Population				
	Total Number	184,200	455,300	441,100	398,000
	Number Served	64,490	418,500	365,200	355,200
	Percent Served	37.6	91.9	82.7	89.2

Source: SEWRPC.

Table 109

EXISTING, FORECAST, AND PROPOSED POPULATION CHANGES FOR WAUKESHA COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Population
		Number	Percent	
Demographic Forecast	184,200	273,800	148.6	458,000
Controlled Trend Plan	184,200	271,100	147.1	455,300
Corridor Plan	184,200	256,900	139.4	441,100
Satellite City Plan	184,200	213,800	116.0	398,000

Source: SEWRPC.

Table 110

EXISTING, FORECAST, AND PROPOSED EMPLOYMENT CHANGES FOR WAUKESHA COUNTY: 1963 - 1990

Source Classification	Existing (1963)	1963 - 1990 Change		1990 Employment
		Number	Percent	
Employment Forecast	33,600	67,700	201.4	101,300
Controlled Trend Plan	33,600	67,700	201.4	101,300
Corridor Plan	33,600	67,000	199.4	100,600
Satellite City Plan	33,600	60,000	178.5	93,600

Source: SEWRPC.

Employment

As a result of the differing land use arrangements and allocations, county employment levels would vary from the employment forecasts under two of the alternative land use plans. As indicated in Table 110, the greatest employment increase within Waukesha County would occur under the Controlled Existing Trend Plan, which proposes an increase of 67,700 employment opportunities, or 201 percent, over the 1963 level. The smallest increase would occur under the Satellite City Plan, which proposes an increase of 60,000 employment opportunities, or 179 percent. The Corridor Plan proposes an increase of 67,000 employment opportunities, or 199 percent.

ALTERNATIVE PLAN COMPARISON—TRANSPORTATION

The more important transportation implications of the three alternative land use plans previously described in this report are summarized in this section. Table 111 indicates the total number of internal person trips that would be generated by each of the three land use plan alternatives. The largest difference in total internal tripmaking between any two plan alternatives would be 127,000 person trips per average weekday between the Corridor and Satellite City plans. This difference represents about 2 percent of the 1990 trips generated by the corridor plan alternative. A difference of this magnitude is considered very small and not significant for regional planning purposes.

A more significant difference, however, would occur among the three alternative land use plans in the spatial distribution of trip productions and attractions. The spatial distribution of trip productions and attractions would roughly coincide with the spatial distribution of population and employment, respectively, as proposed in each plan alternative. In the satellite city plan alternative, for example, a large increase in the trip end density could be expected in the immediate vicinity of the proposed satellite cities of Burlington, Oconomowoc, Port Washington, West Bend, and Whitewater.

Table 112 indicates the average trip lengths in minutes of the internal auto-driver trips that would be generated by the three land use plan alternatives. The range of these trip lengths is expected to be very small, both among plan alternatives and with respect to changes from 1963 to the 1990 plan estimates. The average trip lengths in minutes of transit person trips are compared in Table 113. Differences in average trip lengths among plans are expected to be larger for transit person trips than for auto-driver trips. It should be noted that for both transit and auto-driver trips the average trip length would be longest under the corridor plan alternative.

Table 111

COMPARISON OF TOTAL INTERNAL PERSON TRIP GENERATION IN THE REGION ALTERNATIVE LAND USE PLANS 1963 - 1990

Trip Purpose Category	Number of Trips Modified 1963 Survey	Controlled Existing Trend Plan		Corridor Plan		Satellite City Plan	
		Number of Trips	Percent Change	Number of Trips	Percent Change	Number of Trips	Percent Change
Home-Based Work. . . .	1,008,000	1,466,000	45.4	1,458,000	44.6	1,482,000	47.0
Home-Based Shopping. .	516,000	1,054,000	104.3	1,032,000	100.0	1,067,000	106.8
Home-Based Other . . .	1,131,000	2,185,000	93.2	2,147,000	89.8	2,206,000	95.0
Home-Based School. . .	249,000	252,000	1.2	252,000	1.2	252,000	1.2
Non-Home-Based	639,000	1,058,000	65.6	1,077,000	68.5	1,086,000	70.0
Total	3,543,000	6,015,000	69.8	5,966,000	68.4	6,093,000	72.0

Source: SEWRPC.

Table 112

COMPARISON OF AVERAGE TRIP LENGTHS FOR INTERNAL AUTO-DRIVER TRIPS IN THE REGION: 1963 - 1990

Trip Purpose Category	Average Trip Length in Minutes Modified 1963 Survey	Controlled Existing Trend Plan		Corridor Plan		Satellite City Plan	
		Average Trip Length in Minutes	Percent Change	Average Trip Length in Minutes	Percent Change	Average Trip Length in Minutes	Percent Change
Home-Based Work. . . .	17.87	17.31	-3.2	17.40	-2.7	17.24	-3.6
Home-Based Shopping. .	9.20	9.58	4.1	9.62	4.5	9.54	3.7
Home-Based Other . . .	12.38	12.77	3.1	12.70	2.6	12.63	2.0
Non-Home-Based	12.55	12.75	1.5	12.70	1.1	12.52	-0.3
Weighted Average	13.74	13.43	-2.3	13.47	-2.0	13.29	-3.3

Source: SEWRPC.

Table 113

COMPARISON OF AVERAGE TRIP LENGTHS FOR INTERNAL TRANSIT TRIPS IN THE REGION: 1963 - 1990

Trip Purpose Category	Average Trip Length in Minutes Modified 1963 Survey	Controlled Existing Trend Plan		Corridor Plan		Satellite City Plan	
		Average Trip Length in Minutes	Percent Change	Average Trip Length in Minutes	Percent Change	Average Trip Length in Minutes	Percent Change
Home-Based Work. . . .	35.89	37.88	5.5	39.25	9.4	37.00	3.1
Home-Based Shopping. .	28.50	25.33	-11.1	26.98	- 5.3	28.74	0.8
Home-Based Other . . .	32.51	32.67	0.5	34.65	6.6	32.60	0.3
Non-Home-Based	28.37	32.31	13.9	31.71	11.8	31.67	11.7
Weighted Average	33.63	34.88	3.7	36.32	8.0	35.03	4.1

Source: SEWRPC.

While the average vehicle trip length on the arterial highway network measured in terms of time is not expected to change significantly between 1963 and 1990 under any of the alternative plans, the average vehicle trip length on the arterial highway network measured in terms of distance is, however, expected to change substantially over this period. In 1963, the average vehicle trip length on the arterial highway network was 5.7 miles; in 1990, the average vehicle trip length on the arterial highway network under the Controlled Existing Trend Plan is expected to increase to 7.7 miles, under the Corridor Plan to 7.8 miles, and under the Satellite City Plan, to 7.7 miles.

The level of transit utilization within the Region is expected to vary from 339,000 transit person trips per average weekday for the Satellite City Plan to 376,000 transit person trips per average weekday for the Corridor Plan. The difference of 37,000 transit person trips represents 11 percent of the transit person trips generated under the satellite city plan alternative. For all three land use plan alternatives, the percent of transit utilization could be expected to decrease from 9 percent of the total person trips generated on an average weekday in 1963 to about 6 percent by 1990. Transit person trip generation for the three plans is compared in Table 114.

Comparative auto-driver trip generation within the Region is indicated in Table 115. The largest variation in internal auto-driver trip generation between any two land use plan alternatives would be 118,000 trips per average weekday between the Controlled Existing Trend and Satellite City plans. This difference represents about 3 percent of the approximately four million auto-driver trips expected to be generated within the Region on an average weekday in 1990.

No significant difference in the number of external automobile and internal and external truck trips would be expected among the three land use plan alternatives. A total of 693,000 such trips would be expected on an average weekday by 1990, which represents an increase of 75 percent over the 396,000 such trips in 1963.

The large increase expected to occur in vehicle travel on the regional arterial street and highway system from 1963 to 1990 is evident from a comparison of the 1963 traffic flow map (Map 27) with the 1990 traffic flow map for the existing plus committed and proposed highway systems (Map 28). This expected increase in vehicle travel from 1963 to 1990 would not be a new phenomenon within the Region. Since the end of World War II, vehicle travel within the Region has been increasing at an extremely rapid rate. Map 26 shows the traffic flow on the regional arterial street and highway system in 1942. Although vehicle travel in this year was somewhat lower than normal prewar years, due to wartime rationing of gasoline and tires, a compari-

Table 114

COMPARISON OF INTERNAL TRANSIT PERSON TRIP GENERATION IN THE REGION: 1963 - 1990

Trip Purpose Category	Number of Trips Modified 1963 Survey	Controlled Existing Trend Plan		Corridor Plan		Satellite City Plan	
		Number of Trips	Percent Change	Number of Trips	Percent Change	Number of Trips	Percent Change
Home-Based Work. . . .	154,000	146,000	- 5.1	161,000	4.5	141,000	- 8.4
Home-Based Shopping. .	30,000	33,000	10.1	35,000	16.7	21,000	- 30.0
Home-Based Other . . .	55,000	38,000	- 30.9	41,000	- 25.5	38,000	- 30.9
Home-Based School. . .	60,000	123,000	105.0	123,000	105.0	123,000	105.0
Non-Home-Based	25,000	16,000	- 36.0	16,000	- 36.0	16,000	- 36.0
Total	324,000	356,000	9.8	376,000	16.0	339,000	4.6

Source: SEWRPC.

Table 115

COMPARISON OF INTERNAL AUTO-DRIVER TRIP GENERATION IN THE REGION: 1963 - 1990

Trip Purpose Category	Number of Trips Modified 1963 Survey	Controlled Existing Trend Plan		Corridor Plan		Satellite City Plan	
		Number of Trips	Percent Change	Number of Trips	Percent Change	Number of Trips	Percent Change
Home-Based Work. . . .	699,000	1,030,000	47.4	1,062,000	51.9	1,055,000	50.1
Home-Based Shopping. .	317,000	657,000	107.3	648,000	104.4	683,000	115.5
Home-Based Other . . .	675,000	1,398,000	107.1	1,386,000	105.3	1,435,000	112.6
Home-Based School. . .	24,000	24,000	0.0	24,000	0.0	24,000	0.0
Non-Home-Based	451,000	796,000	76.5	814,000	80.5	826,000	83.1
Total	2,166,000	3,905,000	80.0	3,934,000	81.6	4,023,000	85.7

Source: SEWRPC.

son of this flow map with the 1963 flow map illustrates the nature of the travel increase. As a result of this rapid increase, and in consideration of the social and economic value and importance of an efficient transportation system, the Region presently is committed to a major highway construction program to provide the highway transportation facilities needed to carry this increased travel demand. Moreover, if such a commitment is not continued into the next 27-year period (1963-1990), the additional rapid increase in traffic will result in severe and widespread traffic congestion.

Therefore, an expanded and integrated system of streets and highways and local, modified bus rapid and bus rapid transit facilities is proposed to carry the 1990 travel demand generated by each land use plan alternative. The proposed major regional highway system would be essentially the same for all three land use plan alternatives, whereas the proposed arterial street and highway system would vary. The total mileage of proposed new and improved street and highway facilities required to serve the alternative land use plans is summarized by functional type in Table 116.

The proposed system of modified bus rapid transit routes would be essentially the same for the controlled existing trend and satellite city plan alternatives and would be confined primarily to Milwaukee County. The proposed system of such facilities would be more extensive for the corridor plan alternative, with service extensions provided to several communities outside Milwaukee County that would not be served under the other land use plan alternatives. The bus rapid transit line proposed to parallel the East-West Freeway from the Zoo Interchange into the Milwaukee central business district is warranted for all three land use plan alternatives. An additional bus rapid transit line would be warranted along the Park Freeway corridor to serve the Corridor Plan.

The 1990 traffic assignments to both the existing plus committed and proposed freeway systems would not change substantially among plans. The volume-to-capacity ratios would not vary appreciably among plans, and the highest volume-to-capacity ratios would occur in similar locations for all three plan alternatives. Differences expected would occur primarily in the newly developing areas of the Region outside the Milwaukee urban complex. Volume-to-capacity ratios by county are displayed in Table 117 for each of the three land use plan alternatives.

Table 116

MILES AND CONSTRUCTION COSTS OF PROPOSED NEW AND IMPROVED ARTERIAL STREET AND HIGHWAY FACILITIES IN THE REGION - CONTROLLED EXISTING TREND, CORRIDOR, AND SATELLITE CITY PLANS
(Costs in Millions of 1966 Dollars)

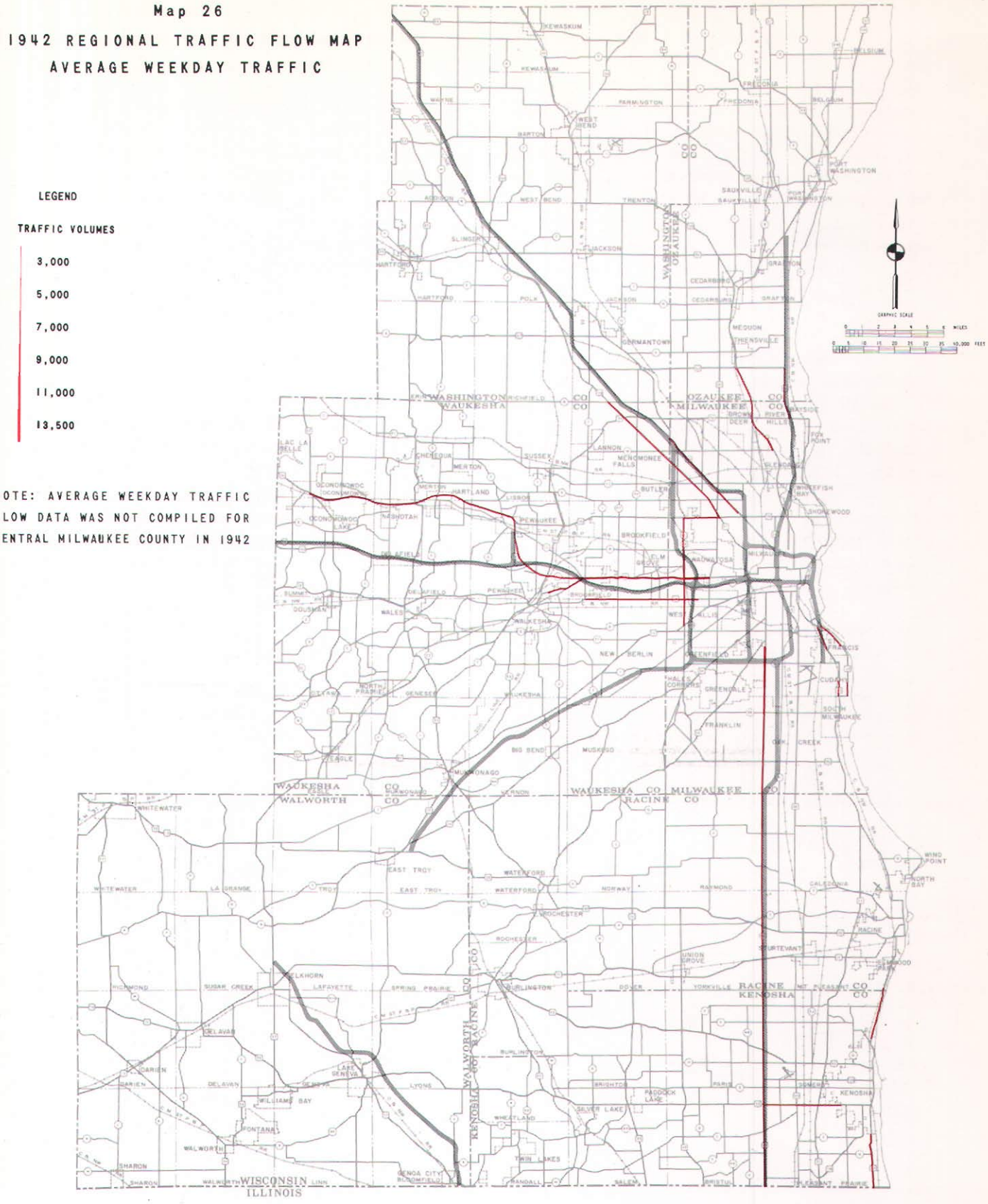
Functional Facility Type	New Facilities[a]		Controlled Existing Trend Plan				Corridor Plan				Satellite City Plan			
			Improved Facilities		Total[a]		Improved Facilities		Total[a]		Improved Facilities		Total[a]	
	Miles	Construction Cost	Miles	Construction Cost	Miles	Construction Cost	Miles	Construction Cost	Miles	Construction Cost	Miles	Construction Cost	Miles	Construction Cost
Standard Arterial:														
2-lane	91.5	$ 19.117	101.8	$ 22.755	193.3	$ 41.872	105.8	$ 23.258	197.3	$ 42.375	185.1	$ 40.393	276.6	$ 59.510
4-lane	26.6	13.873	335.2	189.836	361.8	203.709	341.7	189.651	368.3	203.524	375.4	206.164	402.0	220.037
6-lane	2.2	2.183	142.8	148.926	145.0	151.109	142.3	148.047	144.5	150.230	140.0	145.619	142.2	147.802
Subtotal	*120.3*	*35.173*	*579.8*	*361.517*	*700.1*	*396.690*	*589.8*	*360.956*	*710.1*	*396.129*	*700.5*	*392.176*	*820.8*	*427.349*
Expressway:														
4-lane	3.5	6.060	6.5	3.502	10.0	9.562	6.5	3.502	10.0	9.562	6.5	3.502	10.0	9.562
6-lane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Subtotal	*3.5*	*6.060*	*6.5*	*3.502*	*10.0*	*9.562*	*6.5*	*3.502*	*10.0*	*9.562*	*6.5*	*3.502*	*10.0*	*9.562*
Freeway:														
4-lane	180.1	237.313	32.8	22.304	212.9	259.617	32.8	22.304	212.9	259.617	32.8	22.304	212.9	259.617
6-lane	69.0	208.558	41.5	31.244	110.5	239.802	41.5	31.244	110.5	239.802	41.5	31.244	110.5	239.802
8-lane	6.6	25.876	--	--	6.6	25.876	--	--	6.6	25.876	--	--	6.6	25.876
Subtotal	*255.7*	*471.747*	*74.3*	*53.548*	*330.0*	*525.295*	*74.3*	*53.548*	*330.0*	*525.295*	*74.3*	*53.548*	*330.0*	*525.295*
Total	379.5	$512.980	660.6	$418.567	1,040.1	$931.547	670.6	$418.006	1,050.1	$930.986	781.3	$449.226	1,160.8	$962.206

[a] *Includes committed facilities for the Controlled Existing Trend, Corridor, and Satellite City plans which had not been programmed through calendar year 1966.*

Source: SEWRPC.

Map 26

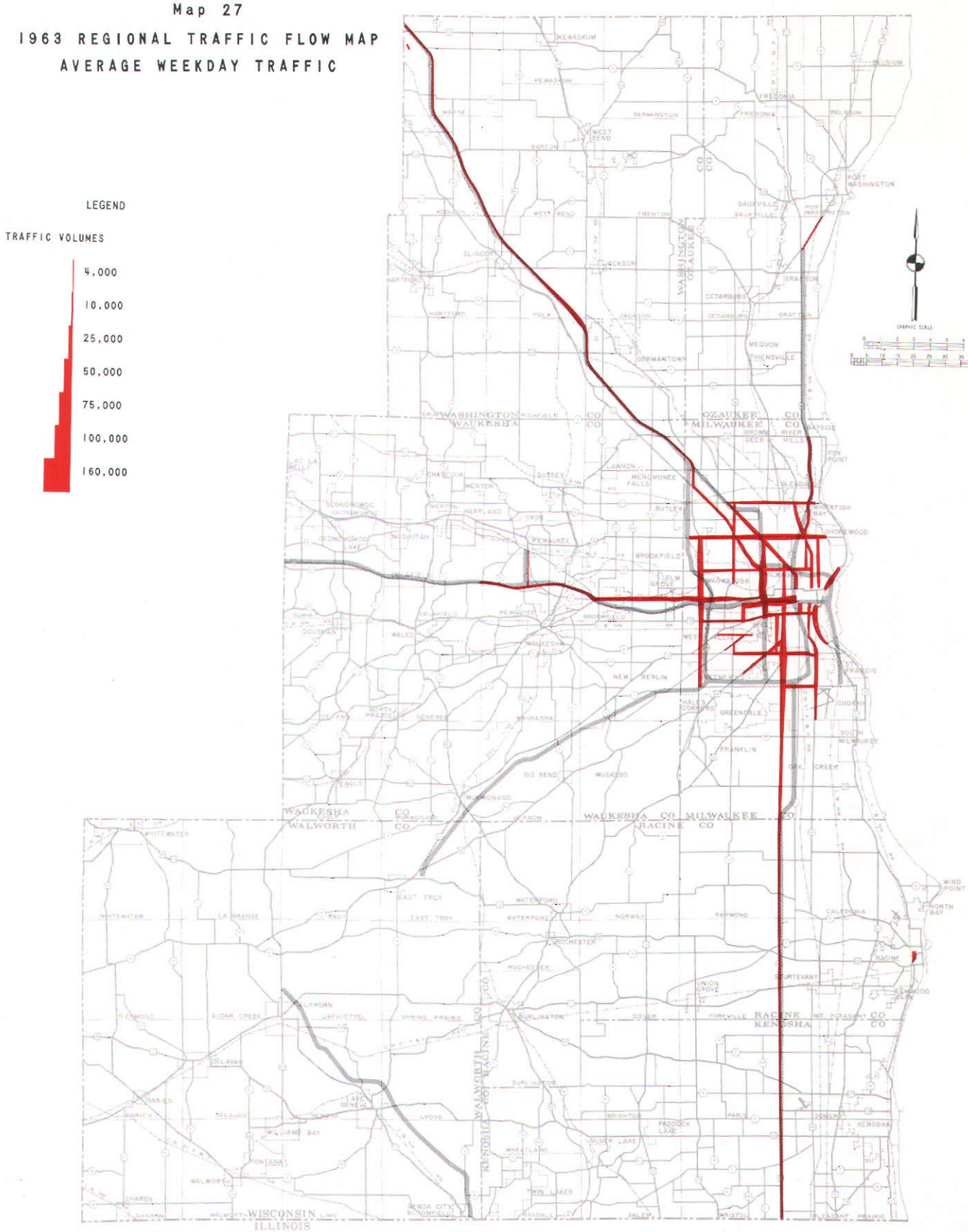
1942 REGIONAL TRAFFIC FLOW MAP
AVERAGE WEEKDAY TRAFFIC



This 1942 traffic flow map, when compared with the 1963 traffic flow map, illustrates the very rapid increase in street and highway traffic which has been experienced within the Region in the two decades preceeding this study. Even allowing for the effects of the war, the highest traffic volumes counted within the Region in 1942 seem very small indeed when compared to existing and probable future volumes.

Map 27

1963 REGIONAL TRAFFIC FLOW MAP
AVERAGE WEEKDAY TRAFFIC



By 1963 street and highway traffic within the Region had increased greatly on an areawide basis and the automobile was, by an overwhelming proportion, the predominant form of transportation for the movement of people within the Region. Heavy traffic flows were being carried on facilities, which in 1942 had volumes too light to be plotted on the flow map, and traffic congestion was a severe problem.

Table 117

VOLUME-TO-CAPACITY RATIOS[a] FOR PROPOSED HIGHWAY NETWORK BY COUNTY: 1990 CONTROLLED EXISTING TREND, CORRIDOR, AND SATELLITE CITY PLANS

County	Mileage	Controlled Existing Trend Plan						Corridor Plan						Satellite City Plan					
		0.00 - 0.90		0.91 - 1.10		Above 1.10		0.00 - 0.90		0.91 - 1.10		Above 1.10		0.00 - 0.90		0.91 - 1.10		Above 1.10	
		Mileage	Percent of County Total	Mileage	Percent of County Total	Mileage	Percent of County Total	Mileage	Percent of County Total	Mileage	Percent of County Total	Mileage	Percent of County Total	Mileage	Percent of County Total	Mileage	Percent of County Total	Mileage	Percent of County Total
Kenosha	313.8	262.8	83.7	43.6	13.9	7.4	2.4	270.4	86.2	37.2	11.8	6.2	2.0	268.0	85.4	40.2	12.8	5.6	1.8
Milwaukee	934.2	818.8	87.6	85.6	9.2	29.8	3.2	825.5	88.4	84.5	9.0	24.2	2.6	843.1	90.3	70.4	7.5	20.7	2.2
Ozaukee	303.1	280.6	92.6	20.5	6.8	2.0	0.6	283.5	93.5	18.1	6.0	1.5	0.5	272.7	90.0	27.0	8.9	3.4	1.1
Racine	410.8	334.6	81.4	70.9	17.3	5.3	1.3	325.9	79.4	80.2	19.5	4.7	1.1	360.2	87.7	45.9	11.2	4.7	1.1
Walworth	477.5	450.9	94.4	25.4	5.3	1.2	0.3	425.7	89.1	50.5	10.6	1.3	0.3	432.8	90.6	42.9	9.0	1.8	0.4
Washington	418.3	389.7	93.2	24.4	5.8	4.2	1.0	389.5	93.1	24.6	5.9	4.2	1.0	386.9	92.5	30.3	7.2	1.1	0.3
Waukesha	813.1	696.7	85.7	102.2	12.6	14.2	1.7	699.1	86.0	104.6	12.9	9.4	1.1	729.8	89.8	65.0	8.0	18.3	2.2
Regional Total	3,670.8	3,234.1	88.1	372.6	10.2	64.1	1.7	3,219.6	87.7	399.7	10.9	51.5	1.4	3,293.5	89.7	321.7	8.8	55.6	1.5

[a] *The significance of the volume-to-capacity ratio ranges used is:*

0.00 - 0.90; Under design capacity, fully adequate and safest operational level.

0.91 - 1.10; At design capacity but still adequate.

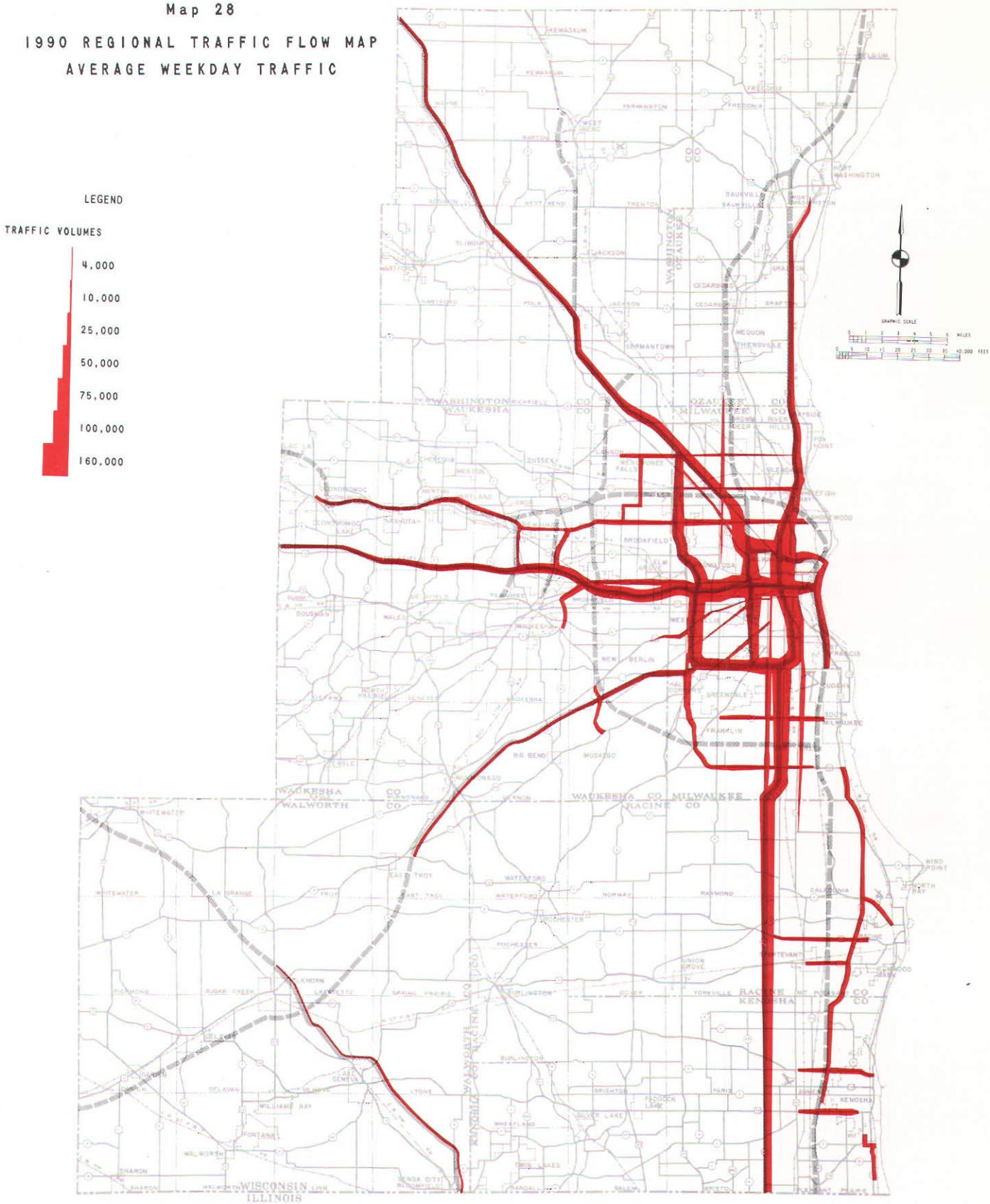
Above 1.10; Over design capacity, congested at times.

Source: SEWRPC.

Map 28

1990 REGIONAL TRAFFIC FLOW MAP

AVERAGE WEEKDAY TRAFFIC



A comparison of the 1990 traffic flow map with the 1942 and 1963 traffic flow maps indicates that the very rapid increase in street and highway traffic experienced from 1942 to 1963 may be expected to continue to 1990. Unless a major highway construction program is undertaken to provide the highway transportation facilities needed to carry this increased travel demand, severe and widespread congestion will result.

Traffic assignment volumes on the existing plus modified rapid transit system would be very similar for the controlled existing trend and satellite city plan alternatives, while for the corridor plan alternative these assignment volumes would be somewhat higher.

In summary, the three land use plan alternatives are strikingly similar with respect to their trip-generating characteristics and the major transportation facilities which would be required to serve them. In general, the loadings on the proposed transportation systems would be similar, with traffic assignment volumes to major elements of the system in the same locations showing close agreement for all three plans. Assignment volumes to the transit system differ more widely than for the highway system; but these, too, are quite similar.

Plan Evaluation—Satisfaction of Standards

The specific land use and transportation system development objectives to be met by the regional land use and transportation plans, together with the standards which relate these objectives to physical development proposals and facilitate evaluation of the ability of the alternative land use plans to meet the chosen objectives, have been described earlier in this report. In order to determine the ability of the land use and transportation plans to meet the development objectives, the alternative land use and transportation plans were scaled against the standards supporting each development objective. The following section presents the results of this procedure.

Land Use Standards

Table 118 indicates the extent to which each alternative land use plan meets each land use standard. Determination of the adequacy of the plan proposals to meet the standards was based upon evaluation of the incremental land use development proposals and not upon evaluation of the total future land use pattern. While many of the entries in the table are self-explanatory, some additional explanations and comments, with respect to certain standards, are appropriate.

Objective 1, Standard 2

The land use plan design methodology provides approximately 6 acres of governmental and institutional land for each additional 1,000 persons under each plan. Because of the unique locational requirements for such institutional uses as colleges, hospitals, and cemeteries and for presently unforeseen large county, state, or federal governmental uses, and in the absence of a regional community facilities plan, the standard can only be partially met under each alternative plan through the allocation of land area for the known or anticipated local and regional uses.

Objective 1, Standard 3(a)

The local park and recreation standard is only partially met under each of the alternative land use plans in that only that area requirement for neighborhood parks has been provided in each of the alternative plans. Land area was not allocated for such park or recreational facilities as playfields, community and county parks, and special use areas, such as golf courses, since the spatial location of these community parks should be determined through more detailed local planning efforts. It should be noted, however, that the necessary land for these community parks is readily available within the primary environmental corridors.

Objective 1, Standard 4

The allocation of land uses for commercial and service uses does not meet the standard under any of the alternative land use plans because, in the preparation of the plans, a portion of the total anticipated growth in commercial and service employment was assigned to existing commercial areas which, although fully developed physically, possess a potential for increased development. This resulted in an overall intensification of employment on land in commercial use. The standard is met, however, for all new commercial and service land use development.

Objective 1, Standard 5

The allocation of land area for industrial uses does not meet the standard under two of the alternative land use plans because, as in the case of commercial and service employment, the existing industrial areas within the Region were assigned additional employment under each of the alternative plans. The demonstrated ability of the existing regional industrial centers to absorb additional employees without a corresponding increase in physical plant capacity is the primary reason for this employment allocation procedure. It should be noted that under the Satellite City Plan more industrial land was set aside in the outlying communities than under the other two plans, and under this plan the standard was consequently met.

Objective 3, Standard 2(a)

There are 99 lakes within the Region which have

Table 118

COMPARISON OF RELATIVE ABILITY OF THE PROPOSED ALTERNATIVE LAND USE PLANS TO MEET LAND USE DEVELOPMENT STANDARDS

Objective	Controlled Existing Trend Plan	Corridor Plan	Satellite City Plan
Objective No. 1			
Standard			
1. Residential Land Allocation			
a. Low-density - 250 acres/1,000 persons[a]	Met	Met	Met
b. Medium-density - 70 acres/1,000 persons[a]	Met	Met	Met
c. High-density - 25 acres/1,000 persons[a]	Met	Met	Met
2. Governmental and Institutional Land Allocation[b]			
a. Local - 6 acres/1,000 added population	Partially met	Partially met	Partially met
b. Regional - 3 acres/1,000 added population	Partially met	Partially met	Partially met
3. Park and Recreation Land Allocation			
a. Local - 10 acres/1,000 added population[b]	2.80 ac./1,000	2.57 ac./1,000	2.78 ac./1,000
b. Regional - 4 acres/1,000 added population	5.10 ac./1,000	5.10 ac./1,000	5.10 ac./1,000
4. Commercial Land Allocation[b]			
a. 5 acres/100 added employees	3.37 ac./100	3.20 ac./100	3.43 ac./100
5. Industrial Land Allocation[b]			
a. 7 acres/100 added employees	6.34 ac./100	6.21 ac./100	7.04 ac./100
Objective No. 2			
Standard			
1. Residential Planning Units[c]	Could be met	Could be met	Could be met
2. Regional Commercial Land Location[a]	Met	Met	Met
3. Major Industrial Land Location[a]	Met	Met	Met
Objective No. 3			
Standard			
1. Soils			
a. Urban uses[a]	Met	Met	Met
b. Rural uses[a]	Met	Met	Met
c. Sanitary sewer service areas[a]	Met	Met	Met
2. Inland Lakes and Streams			
a. Large inland lakes - over 50 acres			
1) 25 percent of shore in natural state	Met for 55 of 99 lakes	Met for 55 of 99 lakes	Met for 55 of 99 lakes
2) 10 percent of shore in public use	Met for 17 of 99 lakes	Met for 17 of 99 lakes	Met for 17 of 99 lakes
3) 50 percent of shore in nonurban uses	Met for 62 of 99 lakes	Met for 62 of 99 lakes	Met for 62 of 99 lakes
b. Small inland lakes - under 50 acres			
1) 25 percent of shore in natural state[c]	Could be met	Could be met	Could be met
c. Perennial streams			
1) 25 percent of shore in natural state[b]	Met for 121 of 129 streams	Met for 121 of 129 streams	Met for 121 of 129 streams
2) 50 percent of shore in nonurban uses[b]	Met for 121 of 129 streams	Met for 121 of 129 streams	Met for 121 of 129 streams
3) Restrict urban uses in flood plains[a]	Met	Met	Met
4) Restrict development in channels and floodways[a]	Met	Met	Met
3. Wetlands			
a. Protect wetlands over 50 acres and those with high resource value[a]	Met	Met	Met

Table 118 (continued)

Objective	Controlled Existing Trend Plan	Corridor Plan	Satellite City Plan
4. Woodlands			
a. 10 percent of watershed[b]	Partially met	Partially met	Partially met
b. 40 acres each of 4 forest types[c]	Could be met	Could be met	Could be met
c. 5 acres/1,000 population[d]	23 ac./1,000	23 ac./1,000	23 ac./1,000
5. Wildlife[b]			
a. Maintain a wholesome habitat	Met	Met	Met
Objective No. 4			
Standard			
1. Major Transportation Routes Penetrating Residential Planning Units[b]	Could be met	Could be met	Could be met
2. Major Transportation Routes Penetrating Resource Areas[b]	Partially met	Partially met	Partially met
3. Transportation Service to Appropriate Areas[c]	Could be met	Could be met	Could be met
4. Transportation Terminal Areas[c]	Could be met	Could be met	Could be met
5. Sewer Service to Residential Areas	100 percent served	95 percent served	87 percent served
6. Water Supply to Residential Areas	100 percent served	95 percent served	87 percent served
7. Maximize Use of Existing Transportation and Utility Facilities[a]	Met	Met	Met
Objective No. 5			
Standard			
1. Physical Self-Containment of Residential Planning Units[c]	Could be met	Could be met	Could be met
2. Appropriate Land Uses Within Residential Planning Units[c]	Could be met	Could be met	Could be met
3. Variety of Housing Within Residential Planning Units[c]	Could be met	Could be met	Could be met
Objective No. 6			
Standard			
1. Major Industrial Site Requirements[a]	Met	Met	Met
2. Local Commercial Site Requirements[c]	Could be met	Could be met	Could be met
3. Major Commercial Site Requirements[a]	Met	Met	Met
Objective No. 7			
Standard			
1. Local Park Spatial Location[c]	Could be met	Could be met	Could be met
2. Regional Park Spatial Location[a]	Met	Met	Met
Objective No. 8			
Standard			
1. Preserve Prime Agricultural Areas	95 percent preserved	96 percent preserved	97 percent preserved
2. Preserve Other Appropriate Agricultural Areas	35,000 acres lost	18,000 acres lost	25,000 acres lost

[a] *This standard has been met under each of the alternative land use plans because it served as an input to the plan design process.*

[b] *This standard is explained briefly in the accompanying text.*

[c] *This standard could be met only by local community action.*

[d] *Only that woodland cover contained within the primary environmental corridors was assumed to be preserved.*

Source: SEWRPC.

a surface area in excess of 50 acres. Fifty-five lakes, or 56 percent of the total, presently have 25 percent or more of their shoreline mileage in a natural state. Seventeen lakes, or 17 percent of the total, presently have 10 percent or more of their shoreline frontage devoted to public recreational uses. Sixty-two lakes, or 63 percent of the total, presently have 50 percent or more of their shoreline mileage devoted to urban uses other than public recreation.

Objective 3, Standard 2(c) (1) and (2)

There are 129 perennial streams within the Region; all but 8 of these streams, or about 94 percent, meet this standard.

Objective 3, Standard 4(a)

This standard is not met under any of the alternative land use plans because none of the 11 major watersheds within the Region presently contain enough woodland cover to constitute the required 10 percent of the total watershed area. It should be noted, however, that the two largest watersheds within the Region, the Fox River watershed and the Rock River watershed each contain woodland cover totaling over 9 percent of the watershed land area. If this standard were to be fully met within the Region, a reforestation program would be required in each of the 11 watersheds.

Objective 3, Standard 5

This standard is met under each of the alternative land use plans because all of the primary environmental corridors are proposed to be preserved. These corridors contain 168,000 acres, or about 88 percent, of the remaining high- and medium-value wildlife habitat areas within the Region.

Objective 4, Standard 1

The effective evaluation of this standard can only be made once the final right-of-way and specific alignment for proposed transportation facilities are established. These determinations are more feasible at a later stage of the planning process. This standard could, however, be met through proper design under each of the alternative plans.

Objective 4, Standard 2

Because the prime natural resource areas are located in the environmental corridors, which are generally of a linear configuration, it is unlikely that all proposed new major transportation routes could be located so as to avoid any penetration of these areas. Consequently, the ability of any plan to satisfy this objective can best be measured by how little this standard is violated. It should be noted, however, that new major transportation route locations are not specified as such in the alternative plans. They are instead identified as transportation corridors which would generate enough traffic to warrant high service level type facilities. An analysis of the relationship between the proposed major highway corridors and the environmental corridors reveals that about 1,700 acres, or 0.5 percent, of the area of the environmental corridors might be required for proposed major transportation facilities.

Transportation Standards

Table 119 indicates the extent to which the transportation standards are met under each alternative land use-transportation plan. Unlike the procedure followed for the land use plan, determination of the adequacy of the transportation plan proposals to meet the standards under each land use plan alternative was based primarily upon the evaluation of the total future transportation system. While most of the entries in the table are self-explanatory, some additional explanations and comments, with respect to certain standards, are appropriate.

Objective 1, Standard 1

In order to determine the relative accessibility of the various subareas within the Region under the proposed transportation system, three combined accessibility indices [2] were computed for all zones within the Region, one for each land use plan. The combined accessibility index measures the ease with which activity [3] can be reached anywhere within the Region, the higher the index, the greater the accessibility. The combined index for any zone was calculated by summing eight indices computed for the zone, one for each of four trip purposes by both highway and transit modes. These combined indices were plotted as iso-accessibility lines for each of the three land use plans and are shown on Maps 29, 30, and 31.

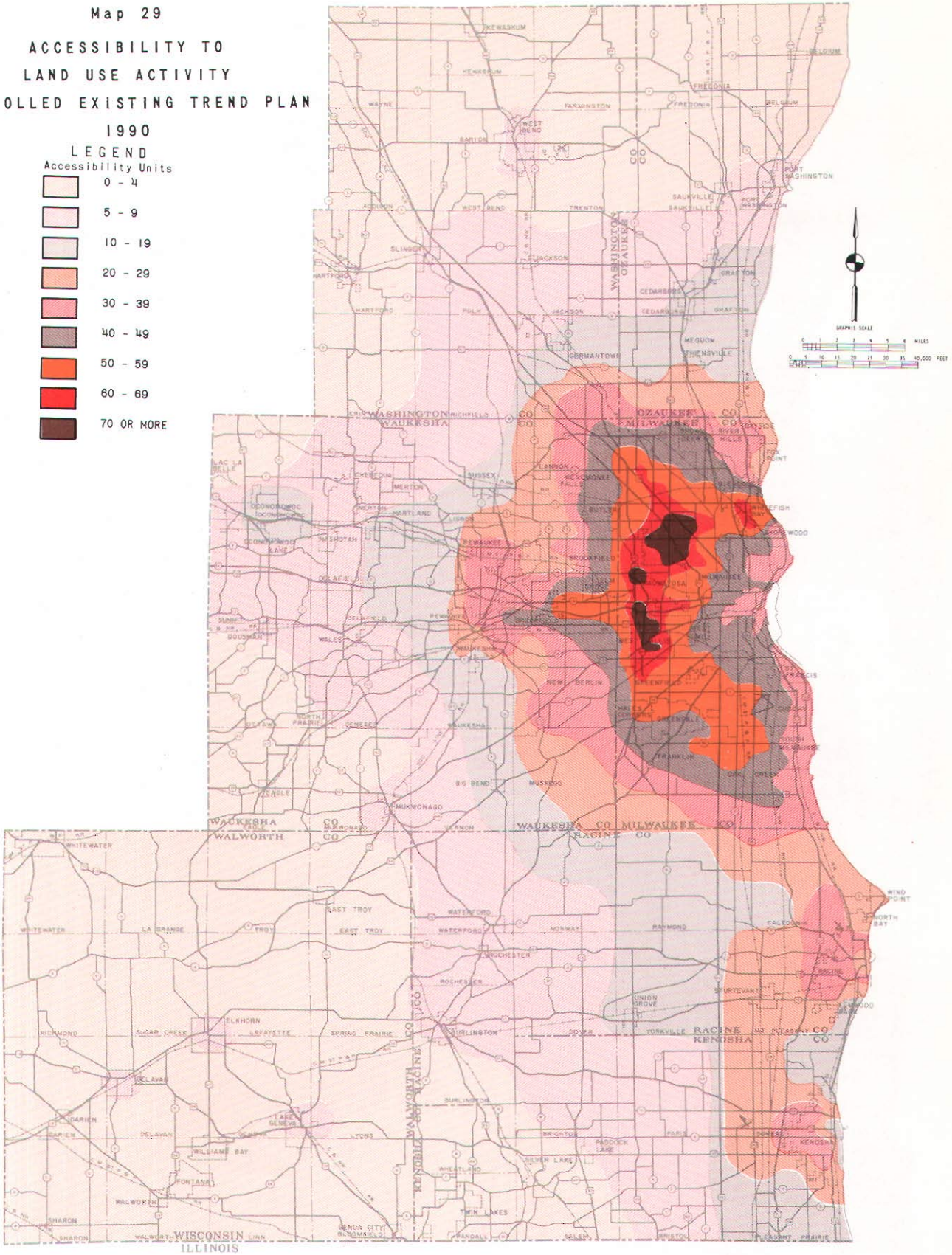
A comparison of the three iso-accessibility maps indicates that: the areas of the highest accessibility within the Region are located at relatively short distances from the central portion of Milwaukee County, the areas containing the two highest value iso-accessibility lines would be located

[2] *For a mathematical statement of the accessibility index, see Footnote 6, Chapter IV, on page 61 of this volume.*

[3] *Activity is defined as a location where a trip destination can be satisfied for all trip purposes except school.*

Map 29

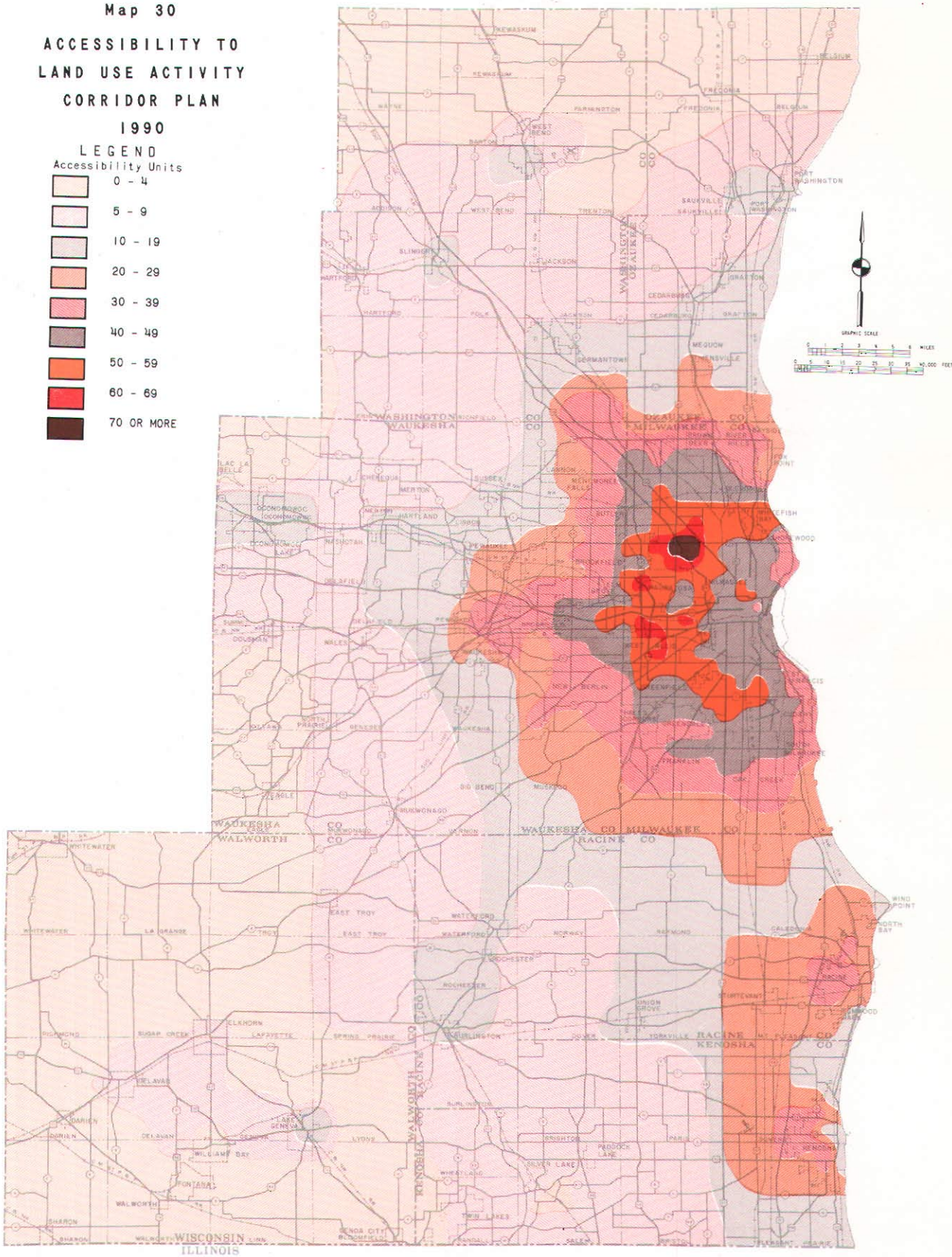
ACCESSIBILITY TO
LAND USE ACTIVITY
CONTROLLED EXISTING TREND PLAN
1990



The areas of highest accessibility to all land use activity within the Region may, by 1990, be expected to be located in western Milwaukee County under the Controlled Existing Trend Plan, with lesser "peaks" apparent in eastern Racine and Kenosha counties and with a "ridge" extending into eastern Milwaukee County.

Map 30

ACCESSIBILITY TO LAND USE ACTIVITY CORRIDOR PLAN 1990



As under the Controlled Existing Trend Plan the areas of highest accessibility within the Region may, by 1990, be expected to be located in western Milwaukee County under the Corridor Plan. The "peaks", however, are somewhat higher and smaller in areal extent, and several outlying areas of the Region exhibit higher accessibility.

Table 119

COMPARISON OF RELATIVE ABILITY OF THE PROPOSED TRANSPORTATION SYSTEM TO MEET THE TRANSPORTATION SYSTEM DEVELOPMENT STANDARDS UNDER EACH LAND USE PLAN ALTERNATIVE

Objective	Controlled Existing Trend Plan	Corridor Plan	Satellite City Plan
Objective No. 1			
Standard			
1. Adequate Accessibility[a]	Met	Met	Met
2. Volume-to-Capacity Ratio Equal To or Less Than 1.0[a]	93.1 percent of arterial streets and highways; 100 percent of transit route mileage	93.1 percent of arterial streets and highways; 100 percent of transit route mileage	94.0 percent of arterial streets and highways; 100 percent of transit route mileage
Objective No. 2			
Standard			
1. Transit Warrants[b]	Met	Met	Met
2. Local Transit Service[c]	Could be met	Could be met	Could be met
3. Transit Headways[c]	Could be met	Could be met	Could be met
4. Transit Stop Spacing[c]	Could be met	Could be met	Could be met
5. Transit Loading Factors[c]	Could be met	Could be met	Could be met
6. Transit Route Alignment[c]	Could be met	Could be met	Could be met
7. Percent Transit to CBD[a]			
Milwaukee	22.8 percent	24.0 percent	21.8 percent
Racine	4.3 percent	4.1 percent	3.8 percent
Kenosha	3.6 percent	3.5 percent	3.6 percent
8. Provision of Transit Peak Hours[b]	Met	Met	Met
9. Parking at Park-and-Ride Stations[c]	Could be met	Could be met	Could be met
10. Freeway Warrants[b]	Met	Met	Met
11. Arterial Warrants[b]	Met	Met	Met
12. Walking Distance for Short-Term Parkers[c]	Could be met	Could be met	Could be met
13. Parking Spaces in CBD's[c]	Could be met	Could be met	Could be met
Objective No. 3			
Standard			
1. Minimize Vehicle Hours of Travel	928,000 hours per day	930,000 hours per day	931,000 hours per day
2. Overall Speeds			
Freeways	42 miles per hour	42 miles per hour	42 miles per hour
Standard Arterials	30 miles per hour	30 miles per hour	31 miles per hour
3. Maximize Proportion of Vehicle Miles on Freeways	42.6 percent	42.9 percent	42.4 percent
Maximize Percent Rapid and Modified Rapid Transit Utilization	38.2 percent	42.5 percent	37.6 percent
Objective No. 4			
Standard			
1. Volume-to-Capacity Equal To or Less Than 0.9	88.0 percent of arterial streets and highways	87.7 percent of arterial streets and highways	89.6 percent of arterial streets and highways
2. Maximize Proportion of Vehicle Miles on Freeways	42.6 percent	42.9 percent	42.4 percent
Maximize Percent Transit Utilization	5.9 percent	6.3 percent	5.6 percent

Table 119 (continued)

Objective	Controlled Existing Trend Plan	Corridor Plan	Satellite City Plan
Objective No. 5			
Standard			
1. Minimize Operating Costs[d]	$22.06 billion	$22.11 billion	$22.21 billion
Minimize Capital Investment[e]	$ 2.06 billion	$ 2.05 billion	$ 2.09 billion
Minimize Total Costs	$24.12 billion[f]	$24.16 billion[f]	$24.30 billion[f]
2. Minimize Vehicle Miles of Travel	31,822,000 miles per day	31,912,000 miles per day	32,331,000 miles per day
3. Use of Existing and Committed Transportation System[b]	Met	Met	Met
Objective No. 6			
Standard			
1. Minimize Penetration of Neighborhoods[c]	Could be met	Could be met	Could be met
2. Minimize Dislocation[c]	Could be met	Could be met	Could be met
3. Minimize Penetration of Environmental Corridors[c]	Could be met	Could be met	Could be met
4. Advance Reservation of Right-of-Way[a]	Partially met	Partially met	Partially met
5. Minimize Destruction of Cultural Sites[c]	Could be met	Could be met	Could be met
6. Minimize Use of Land for Transportation System	65.99 square miles	61.25 square miles	66.34 square miles
Objective No. 7			
Standard			
1. Minimize Disruption of Visual Axes[c]	Could be met	Could be met	Could be met
2. Design Standards[c]	Could be met	Could be met	Could be met

[a] *This standard is explained briefly in the accompanying text.*

[b] *This standard has been met under each of the alternative land use plans because it served as an input to the plan design process.*

[c] *This standard could be met only by local community or private action.*

[d] *Only includes travel on SEWRPC net (interzonal travel only).*

[e] *Includes maintenance (includes off-net facilities).*

[f] *Does not include cost of rapid transit proposals estimated at $20,575,000 under the Controlled Existing Trend and Satellite City plans, or $36,145,000 under the Corridor Plan.*

Source: SEWRPC.

in western Milwaukee County, and the values of these lines would be highest under the Controlled Existing Trend Plan. These phenomena reflect the higher concentration of activity that would exist in western Milwaukee and eastern Waukesha counties under this land use plan and, consequently, the greater accessibility to urban activity for the residents of these areas. The accessibility of southern Milwaukee County would also be highest under the Controlled Existing Trend Plan, thereby reflecting the increased activity in this area and the accessibility to it. Under the other two land use alternatives, development would be curtailed to various degrees in the newly urbanizing areas surrounding the Milwaukee, Racine, and Kenosha urban complexes. Areas in the vicinity of the freeway corridors, particularly in the vicinity of the corridors occupied by IH 94 and USH 45, 41, and 141, would have significantly higher accessibilities than the areas between these corridors, although the levels of accessibility would vary under the three land use plans.

The immediate environs of the cities of Burlington, Oconomowoc, Port Washington, West Bend, and Whitewater would have the highest accessibility under the Satellite City Plan, demonstrating the greater concentration of activity and the subsequent higher accessibility of these areas under this plan. The areas between these satellite cities

and the Milwaukee urban complex have their highest accessibility under the Satellite City Plan instead of under the Corridor Plan, as might be expected, apparently due to the greater opportunities provided to reach activity under the Satellite City Plan. The iso-accessibility lines further indicate that a pronounced pattern of high accessibility would develop under the Satellite City Plan in certain short corridors within the Region. These accessibility corridors would not be as pronounced under the other two land use plans.

Although the transportation system does provide the required relative accessibility for all three land use plans, it serves the Controlled Existing Trend Plan most effectively and the Corridor Plan least effectively. It is important to note that the proposed transportation system would provide generally lower accessibility to those areas of the Region lying within the primary environmental corridors. Under the Controlled Existing Trend Plan, the largest proportion of the environmental corridors would be in the lower two categories of accessibility, while under the Satellite City Plan the smallest proportion of those corridors would be in the lowest two categories of accessibility.

Objective 1, Standard 2

Table 119 lists for this standard the percentage of highway and transit route mileage which would have capacities adequate to carry the anticipated traffic loads generated by the three land use plan alternatives. Implicit in the ability of the proposed facilities to meet the traffic demand is the fact that these facilities were located and designed consistent with the trip generating and trip interacting characteristics of the various land uses delineated in the land use plan alternatives. The methodology by which this standard has been met was described in Chapter IV of this volume. Since the same transportation system design methodology has been applied to all three land use plan alternatives, this standard has been met equally well for all three land use plans.

Objective 2, Standard 7

In 1963 transit trips to the central business districts of Milwaukee, Racine, and Kenosha comprised 34, 8, and 7 percent, respectively, of the internal person trips made to these districts on an average weekday. By 1990 it is expected that these proportions will be reduced to 23, 4, and 4 percent, respectively, under the Controlled Existing Trend Plan; 24, 4, and 4 percent, respectively, under the Corridor Plan; and 22, 4, and 4 percent, respectively, under the Satellite City Plan. Although the standard stating that the existing proportion of transit utilization to the major central business districts of the Region be maintained is thus not met, it should be noted that the total number of transit trips to these districts are expected to show only slight declines. In 1963 transit trips to the central business districts of Milwaukee, Racine, and Kenosha totaled approximately 51,200, 2,000, and 1,900, respectively. By 1990 it is expected that these totals will be approximately 41,000, 1,400, and 1,200, respectively, under the Controlled Existing Trend Plan; 42,900, 1,400, and 1,100, respectively, under the Corridor Plan; and 39,200, 1,400, and 1,200, respectively, under the Satellite City Plan.

Objective 6, Standard 4

As part of the initial SEWRPC land use-transportation study, 28.5 miles of major transportation corridor will be surveyed for the purpose of facility centerline and right-of-way delineation so that the necessary right-of-way could be protected from urban development through official mapping.[4] An additional 45.2 miles have been aerially photographed in preparation for detailed mapping, and the continuing land use-transportation study provides for the future completion of this additional mapping. Therefore, this standard would be met at least for important segments of the major transportation facilities.

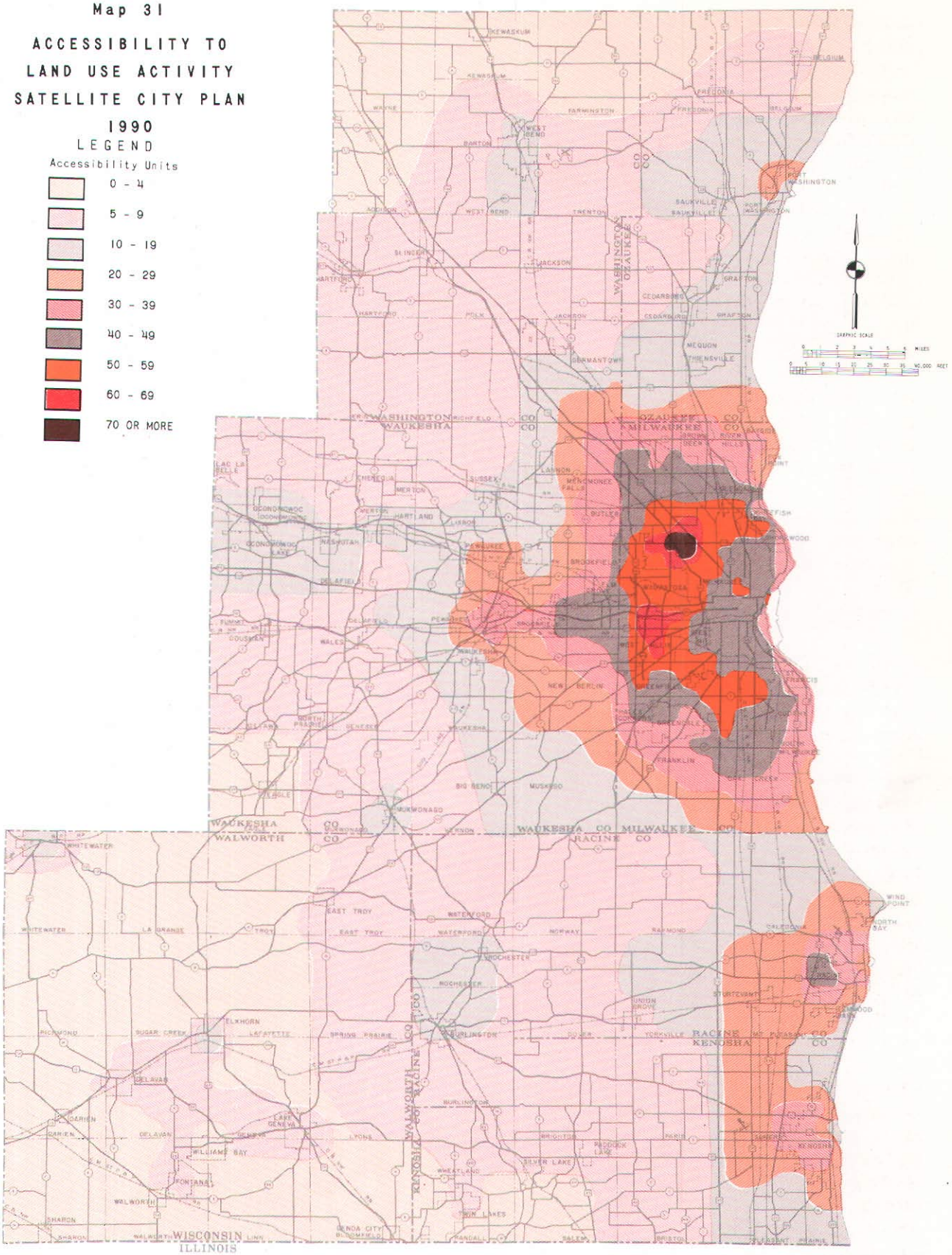
Plan Evaluation—Satisfaction of Objectives

The tabulations of the relative ability of the alternative land use and transportation plans to meet the development standards were carefully evaluated by the Technical Coordinating and Advisory and the Intergovernmental Coordinating Committees on Regional Land Use-Transportation Planning and by the Regional Planning Commission itself. Through these committee and Commission evaluations, it was concluded that the degree to which the alternative plans met the development standards, and therefore the development objectives, did not vary sufficiently to justify recommending a radical departure from historic development trends, thereby disregarding the heavy commitment of capital to public utilities and facilities by certain units and agencies of government within the Region in anticipation of development. This conclusion was substantiated by an independent staff evaluation of the alternative plans utilizing

[4] *See SEWRPC Planning Guide No. 2, Official Mapping Guide, February 1964.*

Map 31

ACCESSIBILITY TO LAND USE ACTIVITY SATELLITE CITY PLAN 1990



The effect of the proposed satellite cities on accessibility within the Region is evident in their immediate vicinity although areas of highest accessibility would still occur in northwestern Milwaukee County.

the rank-based expected value method. Application of this method permitted determination of the extent to which each land use and transportation plan met each specific regional land use and transportation system development objective. Application of this method required the following steps:

1. The land use and transportation standards were ranked under each objective in order of importance. (See Appendix Tables A-27 and A-28.)

2. Each standard was assigned a numerical value based upon the extent to which it was met under each alternative land use and transportation plan. A numerical value of 3, 2, or 1 was assigned to each standard in one of two ways: if the standard was expressed in numerical terms, the three values were assigned to the three alternative plans on the basis of the rank order of the quantified criteria; if each alternative plan met the standard to the same degree, as determined by numerical criteria, or if the standard was expressed in qualitative terms, a value was assigned on the basis of whether the standard was fully met (3), partially met (2), or could be met (1) through community, neighborhood, or private planning efforts.

Once each plan had been assigned a value under each standard, a plan value was computed for each specific regional development objective by multiplying the value of the plan under each supporting standard by the rank order of the standard under each objective, and summing these products for each plan. The resulting plan values were then assigned rank order values on the basis of the results of the procedure. The computations are shown in matrix form in Appendix Tables A—29 and A—30, and the results were summarized for Tables 120 and 121.

Plan Evaluation—Plan Selection

The final selection of a recommended land use and transportation plan from among the alternatives, as indicated earlier, is predicated on the total ability of each of the alternative plans to meet the specific land use and transportation system development objectives. Since some of the objectives pertain to similar functional areas and since the satisfaction of the various objectives have varying importance, the land use and transportation system development objectives were each grouped into three major categories in order to facilitate total plan evaluation. These groups were then, in accordance with the first steps of the rank based expected value method, ranked in order of importance. It should be noted, however, that this ranking of the grouped objectives is necessarily conditioned by present environmental conditions within the Region and the present state of planning at the regional level. As time passes and certain areawide development objectives are fulfilled, others may grow in relative importance. Thus, plan evaluation must also be a part of the continuing land use-transportation planning process. The grouped objectives are shown in Appendix Table A-31 and Appendix Table A-32.

Table 120

COMPARISON OF RELATIVE ABILITY OF THE ALTERNATIVE LAND USE PLANS TO MEET THE SPECIFIC DEVELOPMENT OBJECTIVES

Objective	Plan Value Under Land Use Plan (V)		
	Controlled Existing Trend Plan	Corridor Plan	Satellite City Plan
1	2	1	3
2	2	2	2
3	2	2	2
4	3	2	1
5	1	1	1
6	2	2	2
7	2	2	2
8	1	2	3

Source: SEWRPC.

The next step in the rank based expected value method of plan evaluation and selection requires that each alternative plan be assigned a value

Table 121

COMPARISON OF RELATIVE ABILITY OF THE PLANNED TRANSPORTATION SYSTEM TO MEET THE TRANSPORTATION OBJECTIVES UNDER THE ALTERNATIVE LAND USE PLANS

Objective	Plan Value Under Land Use Plan (V)		
	Controlled Existing Trend Plan	Corridor Plan	Satellite City Plan
1	2	1	3
2	3	2	1
3	3	2	1
4	2	3	1
5	3	2	1
6	2	3	1
7	1	1	1

Source: SEWRPC.

under each group of ranked development objectives in descending rank order. A plan implementation probability value is then selected for each alternative plan, and the value of each alternative plan computed.

Plan implementation probability values of 0.6, 0.3, and 0.1 were assigned to the controlled existing trend, corridor, and satellite city plan alternatives, respectively. The Controlled Existing Trend Plan was assigned the highest probability of implementation because of its heavy reliance on the continued effect of the urban land market in determining the location, intensity, and character of future development within the Region and its conformance to logical utility service areas and local development plans. Thus, historic development trends would be altered only slightly under the Controlled Existing Trend Plan, as required to meet regional development objectives. The Corridor Plan was assigned an intermediate probability of implementation value because, while it represents a more radical departure from historic development trends, it does recognize the continued effect of major transportation routes upon the location, intensity, and character of future development. Historic development trends would have to be more severely altered than under the Controlled Existing Trend Plan and development restricted in certain areas already committed to development through utility service extensions. The Satellite City Plan was assigned the lowest probability of implementation value because it represents the most radical departure from historic development trends. It not only ignores local development plans to a considerable extent but would require severe development restrictions to be imposed on areas presently committed to development.

The final results of the plan evaluation and selection procedure are shown in matrix form for the alternative land use plans in Table 122 and for the alternative land use-transportation system plan combinations in Table 123. These results indicate that the Controlled Existing Trend Plan best meets the regional land use and transportation system development objectives.

OVERRIDING CONSIDERATIONS

Earlier in this report, it was emphasized that full evaluation of the alternative plans could not be achieved through application of the development objectives and standards alone but that five overriding considerations would have to be recognized in the full plan evaluation process.

First, it was indicated that each proposed transportation plan must constitute an integrated system. Each alternative land use and transportation plan proposed herein meets this requirement since the plan design methodology applied dealt with the

Table 122

LAND USE PLAN SELECTION CRITERIA

Plan / Major Group Objective		Provide for A Balanced Allocation of Land[a]	Provide for An Appropriate Spatial Distribution of Land Uses[a]	Meet the Design Requirements of the Major Land Uses[a]	Plan Value
		Rank Order of Group Objective = 3	Rank Order of Group Objective = 2	Rank Order of Group Objective = 1	
		Rank Order Value of Plan[b]	Rank Order Value of Plan[b]	Rank Order Value of Plan[b]	
Controlled Existing Trend	Probability of Implementation = 0.6	2	3	1	7.8
Corridor	Probability of Implementation = 0.3	1	2	2	2.7
Satellite City	Probability of Implementation = 0.1	3	1	3	1.4

[a] *Includes the objectives listed under this group in Appendix Table A-31.*

[b] *Based on the rank order value as shown in Appendix Table A-29.*

Source: SEWRPC.

Table 123

TRANSPORTATION PLAN SELECTION CRITERIA

Plan \ Major Group Objective		Serve Land Use Pattern and Meet Travel Demand[a]	Provide Appropriate Transportation at An Adequate Service Level[a]	Provide for An Economical Transportation System[a]	Plan Value
		Rank Order of Group Objective = 3	Rank Order of Group Objective = 2	Rank Order of Group Objective = 1	
		Rank Order Value of Plan[b]	Rank Order Value of Plan[b]	Rank Order Value of Plan[b]	
Controlled Existing Trend	Probability of Implementation = 0.6	2	3	3	9.0
Corridor	Probability of Implementation = 0.3	3	2	2	4.5
Satellite City	Probability of Implementation = 0.1	3	1	1	1.2

[a] *Includes the objectives listed under this group in Appendix Table A-32.*

[b] *Based on the rank order value as shown in Appendix Table A-30.*

Source: SEWRPC.

transportation elements solely as an integrated system and incorporated the application of traffic simulation models for quantitative plan test.

Second, it was indicated that, in addition to application of the development standards, an evaluation of each transportation system plan must be made on the basis of cost. Total construction and maintenance cost estimates were, therefore, prepared for the transportation element of each alternative land use and transportation plan; and these are summarized in a following section of this report.

Third, it was indicated that it was unlikely that any one plan proposal would meet all of the development standards completely and that the extent to which each standard was met, exceeded, or violated must serve as a measure of the ability of each alternative plan proposal to achieve the specific objectives which the given standard complements. An evaluation procedure was developed to accommodate this consideration and thereby facilitate the plan evaluation and selection process. This procedure consists of an adaptation of the rank-based expected value method of evaluation applied in corporate decision-making, and the results were described in the preceding section of this report.

Fourth, it was indicated that certain objectives and standards may be in conflict and require resolution through compromise and that meaningful plan evaluation can take place only through a comprehensive assessment of each of the alternative plans against all of the objectives and standards.

Application of the rank—based expected value method of plan evaluation utilized herein assists in achieving the necessary comprehensive assessment, and any compromises necessary to resolve conflicts are accommodated in the ranking of development standards and objectives.

Finally, it was indicated that the standards must be very judiciously applied to areas or facilities which are already partially or fully developed, since strict application might indicate the requirement of extensive renewal or reconstruction programs. Accommodation of this consideration was achieved for the land use plans through evaluation of the plans against the development standards on the basis of the incremental land use proposals rather than on the basis of the ultimate land use pattern proposed. For the transportation system plans, however, the evaluation was based upon the full ultimate system; and careful consideration was given to the need for facility reconstruction.

TRANSPORTATION SYSTEM COST ANALYSIS

In order to facilitate full plan evaluation, estimates of the overall cost of implementing the proposed transportation plan under each of the alternative land use plans were prepared. These estimates were prepared by applying unit improve-

ment costs to the estimated mileage of proposed future improvements, including construction of new facilities and reconstruction of certain existing facilities, which would be required to provide adequate arterial street and highway system capacity by 1990; by applying unit improvement costs to the estimated mileage of new collector and local or minor streets necessary to serve new urban development; and by preparing special estimates of the cost of constructing the proposed bus rapid transit facilities. In addition, the costs of maintaining the proposed and existing arterial street and highway systems and the proposed and existing collector and minor street systems were separately estimated.

Unit cost data for the construction and maintenance of facilities required to provide and maintain adequate system traffic capacity were obtained primarily from the local units of government and the District Offices of the State Highway Commission of Wisconsin and reflect recent experience in southeastern Wisconsin. These unit costs were summarized on a per mile basis for right-of-way acquisition, construction, engineering, and resurfacing by three subareas of the Region: Milwaukee and eastern Waukesha counties, Racine and Kenosha counties east of IH 94, and the remainder of the Region and are set forth in Appendix Table A—33. The mileage of existing and proposed arterial facilities for each improvement and maintenance category was taken directly from the arterial network maps representing the existing and proposed systems.

Unit cost data for collector and minor street construction and maintenance were developed from information provided by the local units of government and the State Highway Commission of Wisconsin. These unit costs were expressed separately for collector and for minor streets as a lump sum per mile for construction and for maintenance. The mileage of new collector and minor street facilities was calculated by applying an appropriate factor, representing the proportion of land normally devoted to streets and highways in urban areas under good subdivision design practices, to the land area to be converted from rural to urban use over the plan design period. Construction and maintenance costs were estimated for these facilities and added to the costs of constructing and maintaining the arterial street and highway system to obtain total highway construction and maintenance costs over the plan design period. Maintenance costs for proposed facilities were assumed to accrue for one-half of the 1967 to 1990 plan implementation period, based upon the assumption that the proposed facilities would be constructed at a uniform rate throughout this period.

The resulting total cost estimates, based on 1966 unit prices, for the highway portion of the proposed transportation systems are set forth in Table 124. As indicated, the Corridor Plan would result in the lowest total cost for arterial highway construction necessary to provide increased traffic capacity estimated at $931 million, while the Satellite City Plan would result in the highest cost, estimated at $962 million over the 25-year plan

Table 124

ESTIMATED COSTS FOR CONSTRUCTION AND MAINTENANCE OF STREETS AND HIGHWAYS IN THE REGION: 1967 - 1990
(In Thousands of 1966 Dollars)

Alternative Plan	Construction Costs				Maintenance Costs					Total Costs
	New and Upgraded Arterials[a]	New Collector and Minor Streets[b]	Repave or Reconstruct Specific Arterials	Total	New and Upgraded Arterials	New Collector and Minor Streets	All Other Arterials	All Other Collector and Minor Streets	Total	
Controlled Existing Trend	$931,547	$61,356	$153,367	$1,146,270	$111,792	$45,984	$248,736	$506,980	$913,492	$2,059,762
Corridor	$930,986	$58,281	$153,323	$1,142,590	$111,768	$40,154	$248,640	$506,980	$907,542	$2,050,132
Satellite City	$962,206	$61,099	$149,049	$1,172,354	$120,144	$44,426	$241,800	$506,980	$913,350	$2,085,704

[a] *These costs would be incurred in the construction of the proposed arterial street and highway system required to provide adequate capacity to meet future traffic loads.*

[b] *These costs would be incurred in order to serve new land use development with adequate transportation facilities.*

Source: SEWRPC.

implementation period. The total cost for arterial highway construction necessary to provide increased traffic capacity under the Controlled Existing Trend Plan is estimated at $932 million. Arterial repaving and reconstruction costs necessary, not to provide additional traffic capacity, but to replace worn pavements and structures and improve safety characteristics, are estimated to total about $153 million for both the Controlled Existing Trend and Corridor plans and $149 million for the Satellite City Plan, bringing the total arterial highway system construction costs to $1.084 billion for the Corridor Plan, $1.111 billion for the Satellite City Plan, and $1.085 billion for the Controlled Existing Trend Plan. It should be noted that the proposed arterial street and highway systems necessary to serve the three alternative land use plans differ only in the location, length, and degree of improvement required for the standard arterial streets and highways to provide adequate capacity to meet the future traffic loads, since the proposed major freeway system is the same for all three alternative land use plans.

It is estimated that the public cost of constructing new collector and minor streets to serve anticipated land use development within the Region would cost an additional $58.3 million under the Corridor Plan, $61.1 million under the Satellite City Plan, and $61.4 million under the Controlled Existing Trend Plan. Total highway system construction costs would thus approximate $1.143 billion under the Corridor Plan, $1.172 billion under the Satellite City Plan, and $1.146 billion under the Controlled Existing Trend Plan, based upon 1966 unit prices. Appreciating these costs at the rate of 4.0 percent per year to 1990 in order to provide for rising land, labor, and material costs, results in total estimated construction costs of $1.903 billion, $1.953 billion, and $1.907 billion, respectively, under the three alternative plans. The public financial resource studies indicate that $2.12 billion should become available for new highway construction over the plan implementation period. Thus, the costs of implementing the highway transportation elements of each of the three alternative plans would appear to be reasonably within the financial capabilities of the Region.

In order to further explore the financial feasibility of the alternative regional highway transportation system plans, the estimated arterial street and highway system construction and maintenance costs were compared to the results of the "1965 National Comprehensive Needs Study." The latter statewide highway needs determination study was coordinated nationally by the U.S. Bureau of Public Roads and in Wisconsin was prepared by the State Highway Commission of Wisconsin in cooperation with county and municipal highway and public works officials. It estimated total street and highway costs anticipated to be incurred over the 20-year period extending from 1965 to 1985. The estimated costs, however, were not based upon any definitive and long-range transportation system plan designed to meet forecast traffic demand at an adequate level of service, but rather were based upon the concept of maintaining a tolerable level of service on the existing street and highway system. Assumptions were, however, made in the study based upon committed and anticipated construction programs and professional knowledge of present and anticipated inadequacies of the existing system.

Table 125 indicates that the total arterial street and highway system needs within the Region were, based upon 1965 unit prices, estimated at $899 million over the 20-year period from 1965 to 1985. Extrapolation of this estimate to the year 1990 provides a total estimated arterial street and highway system need of $1.124 billion. This estimate closely approximates the comparable total cost estimates of $1.084 billion for the Corridor Plan, $1.111 billion for the Satellite City Plan, and $1.085 billion for the Controlled Existing Trend Plan.[5]

The total regional highway needs, excluding maintenance, for all other street and highway facilities within the Region not on the arterial system were estimated in the needs determination study as $293.1 million over the 20-year period extending from 1965 to 1985. Extrapolation of this estimate to the year 1990 provides a total estimated cost of $366.4 million for collector and local street improvements, not including cost of streets necessary to serve new land use development. Using an average value of $60.3 million for construction of new collector and minor streets necessary to serve anticipated land use development, total street and highway system needs within the Region, excluding maintenance costs, would approximate $1.551 billion over the plan implementation period, based upon 1965 unit prices, or $2.415 billion appreciated to 1990. Maintenance costs are estimated to approximate $912 million for the entire street and highway system, over the plan imple-

[5] *Excluding arterial system maintenance costs, but including arterial costs for replacement of worn pavements and structures and for safety improvements.*

Table 125

ESTIMATED HIGHWAY NEEDS[a] FOR THE REGION: 1965 - 1985
(Costs in Thousands of 1965 Dollars)

County	Arterial Street and Highway System								Collector and Minor Streets[c]		Totals	
	State Trunk Highways and Connecting Streets		Interstate Highways[b] and Proposed Freeways		Major Primary and Primary Highways		Total					
	Miles	Cost[d]	Miles	Cost[d]	Miles	Cost[d]	Miles	Cost[d]	Miles	Cost[d]	Miles	Cost[d]
Kenosha . .	87	$ 32,177	27	$ 18,010	124	$ 5,611	238	$ 55,798	411	$ 11,404	649	$ 67,202
Milwaukee .	89	47,000	79	297,200	318	98,994	486	443,194	1,048	156,271	1,534	599,465
Ozaukee . .	52	16,763	10	10,000	197	13,975	259	40,738	270	8,722	529	49,460
Racine. . .	117	40,347	38	23,400	186	7,692	341	71,439	528	13,670	869	85,109
Walworth. .	184	55,632	55	44,000	257	7,718	496	107,350	748	21,316	1,244	128,666
Washington.	113	24,308	19	16,000	263	6,520	395	46,828	526	8,674	921	55,502
Waukesha. .	148	32,986	79	49,845	412	50,796	639	133,627	915	73,049	1,554	206,676
Region	790	$249,213	307	$458,455	1,757	191,306	2,854	$898,974	4,446	$293,106	7,300	$1,192,080

[a] *Estimated by state, county, and municipal highway and public works officials as a part of the "1965 National Comprehensive Needs Study."*

[b] *Includes only those interstate highway costs anticipated after 1972.*

[c] *Includes secondary, local, and marginal streets.*

[d] *Cost estimates do not include maintenance expenditures.*

Source: SEWRPC.

mentation period, based upon 1966 unit prices, or $1.520 billion appreciated to 1990. Thus total construction and maintenance costs are estimated at approximately $3.935 billion. The public financial resource studies indicate that $5.695 billion should become available over the plan implementation period. Deducting the estimated $3.935 billion construction and maintenance costs from this total leaves $1.760 billion for all other street and highway purposes over the plan implementation period, including lighting, signing, signalling, traffic control, landscaping, and beautification.

The costs of implementing the recommended rapid transit portions of the proposed transportation system plans were also estimated. Since the fixed way and structure costs of the recommended rapid transit systems consist entirely of the right-of-way acquisition, construction, engineering, and maintenance costs of exclusive, grade separated, bus roadways, the cost estimates could be prepared using recent highway construction experience within the Region. These estimates, set forth in Table 126, indicate that the total right-of-way acquisition and construction costs, based upon 1966 unit prices, of the recommended rapid transit system for the Region would be $20,575,000 under the controlled existing trend and satellite city land use plans and $36,145,000 under the corridor land use plan, excluding rolling stock.[6] In addition, annual maintenance costs estimated at $21,000 and $36,900, respectively, would be incurred. Since implementation of the rapid transit portions of the transportation plan would either have to be accomplished through private investment or through the establishment of an entirely new category of public expenditures within the Region, no estimates of public financial resources available for the implementation of this portion of the plan were prepared.

[6] *Rolling stock is estimated to cost $1,387,500 for the Controlled Existing Trend and Satellite City plans and $2,381,250 for the Corridor Plan.*

Benefit-Cost Analysis

The total cost estimates prepared above were supplemented by benefit-cost analyses in order to demonstrate the economic value of the transportation system plan proposals. Benefit-cost analyses strictly applied to public works planning require evaluation of alternative projects which would accomplish the same development objectives. In applying systems analysis techniques to the design of a highway transportation system for southeastern Wisconsin, however, it was found that there was no practical alternative highway transportation system for the Region insofar as the provision of service to the major traffic corridors was concerned. Theoretical alternatives might have been proposed for the sake of the benefit-cost analyses, but the investment of staff time and costs in the exploration of alternatives which either did not meet the overriding criteria of system continuity and integration or which could not be practically implemented seemed unwarranted. This is not to say, however, that practical alternatives are not available with respect to detailed route location within the major traffic corridors; and further benefit-cost analyses will be required at the project planning and design levels of planning and plan implementation.

Table 126

ESTIMATED COSTS FOR CONSTRUCTION AND MAINTENANCE OF A PROPOSED RAPID TRANSIT SYSTEM IN THE REGION (In 1966 Dollars)

Alternative Plan	Right-of-Way	Construction Costs Construction[a]	Total	Annual Maintenance Cost
Controlled Existing Trend[b]	$15,750,000	$4,825,000	$20,575,000	$21,000
Corridor[c]	$27,675,000	$8,470,000	$36,145,000	$36,900
Satellite City[b]	$15,750,000	$4,825,000	$20,575,000	$21,000

[a] *Includes line construction, yards, shops, and all engineering costs.*

[b] *Costs relate to a 7.0 mile bus rapid transit line.*

[c] *Costs relate to a 7.0 and a 5.3 bus rapid transit line.*

Source: SEWRPC.

Even though several practical alternatives were not available for consideration in the system benefit-cost analyses, such analyses of the proposed system, nevertheless, served a useful purpose in demonstrating that the benefits derived from the construction of the proposed transportation system exceeded the costs of that system. Table 127 indicates that the present worth of the estimated highway user benefits for the analysis period greatly exceeds the present worth of the estimated highway construction and maintenance costs for each alternative land use plan.

Using the assignment of future traffic demand to the existing plus committed network as the basis for comparison, the highway user benefits were calculated as the savings in such direct road user costs as vehicle operating costs, travel time, and accident costs[7] accruing through provision of the proposed highway facilities. The incremental construction costs were calculated as the total cost of: 1) upgrading the traffic-carrying characteristics

[7] *See Appendix Table A-34 for a summary of accident rates and Appendix Table A-35 for a summary of vehicle operating travel time and accident costs used in the calculation of road user benefits.*

Table 127

BENEFIT / COST RATIOS FOR THE PROPOSED HIGHWAY SYSTEM[a] FOR THE REGION UNDER THE ALTERNATIVE LAND USE PLANS

Alternative Plan	Road User Benefits[b] Received 1970 - 2015	Construction and Maintenance Costs[b] Incurred 1970 - 2015	Ratio
Controlled Existing Trend	$816,071,000	$560,653,000	1.455
Corridor	$947,081,000	$559,703,000	1.692
Satellite City	$797,974,000	$578,816,000	1.378

[a] *The proposed highway system comprises all those facilities necessary to provide adequate traffic capacity to meet future needs. These proposed facilities are in addition to all existing and committed major highway facilities.*

[b] *Present worth in 1970.*

Source: SEWRPC.

of those arterials within the Region for which the traffic assignment process indicated a capacity deficiency, and 2) providing new facilities where the traffic assignment process indicated that future traffic congestion could not be readily relieved by the upgrading of existing facilities.

The benefit–cost ratios, as shown in Table 127, range from a low of 1.4 to a high of 1.7 and demonstrate that the expenditures required to implement the proposed highway system plans would constitute a sound investment of public funds under each of the three alternative regional land use plans. It should be noted that the benefits and costs were calculated as accruing over the period extending from 1970 to 2015, in order to bring the salvage value of each staged facility recommended in the plans to zero.

It should also be noted that the benefit-cost ratios set forth in Table 127 apply to the aggregation of system improvements proposed in the regional transportation plans and do not imply that each individual project within this aggregation will have a uniformly high ratio of benefits to costs. Moreover, these benefit-cost ratios do not in any way indicate which land use alternative will lend itself to the provision of the most economical transportation system; that is, the system which minimizes the sum of capital investment and operating costs. The determination of the most economical transportation system is best arrived at through a second benefit-cost analysis, which compares the incremental costs of each plan with the incremental benefits derived from each plan using one of the plans as a basis of comparison. The highway user benefits shown, however, do provide a measure of the difference in road user costs over the 1970 to 2015 period, based upon a comparison for each land use plan of traffic assignments to the existing plus committed highway system and to the proposed highway system.

While the corridor land use plan exhibits the highest first benefit-cost ratio, the second benefit-cost ratio analysis,[8] using the corridor land use plan alternative as a basis for comparison, indicates that the adoption of the Controlled Existing Trend Plan would result in the most economical transportation system (see Table 128). This is due to the fact that total road user costs between 1970 and 2015 are estimated to be $29 million less for the Controlled Existing Trend Plan, that is, an additional investment of $950,000 over the amount necessary to construct the highway system under the corridor land use plan would be necessary to construct instead the highway system proposed for the controlled existing trend land use plan. This additional investment would in turn produce additional benefits valued at more than $29 million. In a similar manner, comparison of the satellite city plan alternative with the corridor plan alternative would indicate a negative second benefit-cost ratio favoring the corridor plan alternative.

[8] *The second benefit-cost ratio is computed as the present worth in 1970 of the difference in the total road user costs divided by the present worth in 1970 of the difference in the total construction and maintenance costs.*

Table 128

SECOND BENEFIT / COST RATIOS FOR THE PROPOSED HIGHWAY SYSTEM USING THE CORRIDOR PLAN AS A BASE

Alternative Plan	Road User Costs[a] 1970 - 2015	Construction and Maintenance Costs[b] 1970 - 2015	Incremental Benefits[c]	Incremental Costs	Second Benefit/Cost Ratio
Corridor	$8,923,800,000	$559,703,000	----	----	----
Controlled Existing Trend	$8,894,600,000	$560,653,000	$ 29,200,000	$ 950,000	30.736
Satellite City	$9,334,900,000	$578,816,000	-$411,100,000	$19,113,000	Negative

[a] *Present worth in 1970 of total road user costs incurred between 1970 and 2015 under proposed highway system alternatives.*

[b] *Present worth in 1970.*

[c] *Defined as the difference between the present worth of road user costs of the base plan and the alternative being considered.*

Source: SEWRPC.

SUMMARY

This and the preceding chapter have presented a description, comparison, and evaluation of three alternative land use and transportation plans designed to meet anticipated growth and change within the Region while attaining stated regional development objectives. The most important elements of these two chapters are summarized below.

1. Three alternative regional development plans were prepared and evaluated under the regional land use-transportation study: a Controlled Existing Trend, a Corridor, and a Satellite City Plan. Each represents an attempt to meet the regional development objectives with a basically different land use arrangement.

   While many variations of these three basic development patterns are possible, it is believed that the three patterns selected represent the basic choices with respect to future development patterns practically available to the Region.

2. The Controlled Existing Trend Plan represents a conscious continuation of historic development trends with urban development occurring in concentric rings along the full periphery of, and outward from, the existing major urban centers within the Region. This plan places heavy reliance on the effect of the urban land market in determining the location, intensity, and character of future development. It does, however, propose to regulate in the public interest the effect of this market on development in order to provide for a more orderly and economic regional development pattern and avoid intensification of areawide development and environmental problems. Under this plan the historic growth trends would be altered by guiding intensive urban development into those areas of the Region having both soils suitable for such development and gravity drainage sanitary sewer service readily available. In addition, the floodways and flood plains; the best remaining woodlands, wetlands, and fish and game habitat areas; and the best remaining potential park and related open-space sites would be protected from urban development and would form the basic framework for an integrated system of park and open-space areas within the Region. The allocation of future land use within each county of the Region under this plan would be such as to approximate the forecast population levels within each county and, to the extent possible, the proposals contained in existing community development plans and zoning documents. The plan would add approximately 200 square miles of new urban development within the Region by 1990.

3. The Corridor Plan represents an attempt to concentrate new urban development within the Region in radial corridors centered on major transportation routes emanating from the existing major urban centers within the Region. Higher densities of development than under the Controlled Existing Trend Plan would be emphasized, and the radial corridors of urban development would be alternated with wedges of agricultural and other open-space uses. The plan would add approximately 170 square miles of new urban development within the Region by 1990.

4. The Satellite City Plan represents an attempt to concentrate new urban development within the Region in five outlying communities of the Region, relatively independent of commercial and industrial development in the larger central cities and separated from these cities by large areas of open space. The plan would add 180 square miles of new urban development within the Region by 1990.

5. The Controlled Existing Trend Plan would convert more prime agricultural land from rural to urban use than the other two alternatives and proposes the greatest increase in low-density residential development. The Satellite City Plan proposes the greatest increase in medium-density residential development. The Corridor Plan proposes the greatest increase in high-density residential development and would convert the least amount of prime agricultural land from rural to urban use.

6. The Satellite City Plan proposes eight new major industrial areas, while each of the other two alternatives propose only six new major industrial areas within the Region by 1990. Each of the alternative plans proposes 10 new major commercial areas, but

under the Satellite City Plan two of these areas would be located in outlying communities instead of in the vicinity of the older central cities within the Region.

7. The Controlled Existing Trend Plan would permit the highest proportion of the urbanized area and the highest proportion of the population to be served by public sanitary sewer and water facilities.

8. The total future travel demand generated by the three alternative land use patterns would not be significantly different. Total person trips generated within the Region would be expected to increase from the 1963 level of 3.6 million person trips per average weekday to a 1990 level of 6.1 million under the Controlled Existing Trend Plan, 6.0 million under the Corridor Plan, and 6.1 million under the Satellite City Plan. Vehicle trips would similarly be expected to increase from the 1963 level of 2.9 million vehicle trips per average weekday to a 1990 level of 5.1 million under the Controlled Existing Trend Plan, 4.9 million under the Corridor Plan, and 5.0 million under the Satellite City Plan.

9. Somewhat greater differences were found between the three alternative land use plans with respect to transit trip generation and utilization. The Region in 1963 generated a total of 384,000 transit trips per average weekday. This is expected to increase by 1990 to 488,000 under the Controlled Existing Trend Plan, to 508,000 under the Corridor Plan, and to 471,000 under the Satellite City Plan. Although the total number of transit trips within the Region is expected to increase during the period 1963 to 1990, a reversal of historic trends, the proportion of transit utilization is expected to decrease under each of the three alternative plans from about 9 percent of the total person trips per average weekday in 1963 to about 6 percent by 1990.

10. Total vehicle miles of travel within the Region are expected to remain essentially the same under each of the three alternative land use plans, increasing from the 1963 level of about 13.2 million vehicle miles per average weekday to 31.8 million vehicle miles by 1990 under the Controlled Existing Trend Plan, 31.9 million vehicle miles under the Corridor Plan, and 32.3 million vehicle miles under the Satellite City Plan.

11. Automobile availability within the Region is expected to be highest under the Satellite City Plan, increasing from the 1963 level of 527,000 automobiles to 1,056,000 by 1990. Automobile ownership would be expected to increase to 1,042,000 by 1990 under the Controlled Existing Trend Plan and to 1,002,000 under the Corridor Plan.

12. Essentially the same system of freeways would be required to serve the Region under each of the alternative plans, although the required capacity of the standard arterial street and highway system would differ, with the Satellite City Plan requiring the greatest investment for additional highway capacity by 1990. Eight new freeways proposed under each of the alternative plans total approximately 256 miles in length.

13. In addition to and complementing the proposed freeway system, an expanded modified rapid transit and rapid transit system is recommended, which would provide the most heavily urbanized portions of the Region with an efficient and economical as well as a high level of transit service. Under the Corridor Plan, the construction of two fully grade-separated bus rapid transit lines would be justified, totaling about 12 miles in length, while under the Controlled Existing Trend and Satellite City plans only one such bus rapid transit line, totaling about 7 miles in length, would be justified.

14. The total improvement costs involved in the implementation of the highway transportation plan elements would be about $932 million under the Controlled Existing Trend Plan, $931 million under the Corridor Plan, and $962 million under the Satellite City Plan. These costs would be incurred over the 1967-1990 plan implementation period and are well within the financial ability of the Region, as indicated

by public revenue forecasts for highway construction purposes. Benefit-cost analyses indicate, moreover, that the expenditure for highway improvements would represent a sound investment of public funds, with the benefit-cost ratio varying from 1.4 under the Satellite City Plan to 1.7 under the Corridor Plan. The cost of implementing the proposed rapid transit plan recommendations would be $36,145,000 under the Corridor Plan and $20,575,000 under the Controlled Existing Trend and Satellite City plans.

15. The controlled existing trend land use plan appears to satisfy more of the land use development standards than either of the other two alternatives. Plan evaluation, utilizing the rank-based expected value method, further indicates that the Controlled Existing Trend Plan best meets the stated regional development objectives.

Chapter VII

SUMMARY AND CONCLUSIONS

INTRODUCTION

This report is the second in a series of three volumes which together present the major findings and recommendations of the SEWRPC Regional Land Use-Transportation Study. The first volume, published in May 1965, set forth the basic principles and concepts underlying the study and presented in summary form the basic facts pertinent to long-range land use and transportation planning in southeastern Wisconsin, which facts, together, describe the existing state of the systems being planned.

This, the second volume, is concerned with the formulation of regional planning objectives, principles, and standards; the forecast of future growth and change in the Region; and the presentation and evaluation of alternative land use-transportation plans designed to meet the anticipated growth and change. This report is intended to provide the basis for the selection of a final regional land use-transportation plan from among the alternative development proposals.

The nature of the land use-transportation planning problem, the basic principles and concepts underlying the land use-transportation planning process, and the process itself were all described in the first volume of this series. It is important to note in review, however, that the generalized alternative land use-transportation plans presented in this volume have been developed through a seven-step planning process by which the Region and its principal functional relationships can be accurately described, both graphically and numerically; the complex movement of people and vehicles over highway and transit facilities simulated; and the effects of different courses of action with respect to regional land use and transportation system development evaluated. Plan implementation, although necessarily a step beyond the foregoing planning process, must be considered throughout the process if the plans are to be realized. In fact, one of the primary objectives of the critical plan test and evaluation step is to test plan proposals for feasibility of implementation. This volume describes and presents the results of four steps in the seven-step planning process: formulation of objectives and standards, analysis and forecasts, plan design, and plan test and evaluation.

OBJECTIVES, PRINCIPLES, AND STANDARDS

Planning is a rational process for formulating and meeting objectives, and plans to be meaningful must be designed to guide actions toward agreed-upon objectives. The Commission has identified two basic types of objectives: general development objectives, which are by their very nature either qualitative or difficult to relate directly to physical development plans, and specific development objectives, which can be directly related to physical development plans and at least crudely quantified.

The Commission, after careful review and recommendation by the Technical Coordinating and Advisory Committee and the Intergovernmental Coordinating Committee on Regional Land Use-Transportation Planning, adopted nine general regional development objectives:

1. Economic growth at a maximum rate, consistent with regional resources and with 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 in the urban areas of the Region; and prevention of slums and blight.

4. A broad range of choice among housing types, designs, 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.

These nine 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. With respect to these general development objectives, it will be deemed sufficient to arrive at a consensus among the various 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.

Within the framework established by the general development objectives, a secondary set of more specific objectives were postulated, which can be directly related to physical development plans and can be at least crudely quantified. The specific development objectives adopted by the Commission, after careful review and recommendation by the advisory committees, are herein listed separately for land use and transportation planning purposes. It should be emphasized, however, that land use and transportation are inextricably linked; and the separate listing is used only for convenience in organization and presentation.

Land Use Development Objectives

The Commission, after careful review and recommendation by the Technical Coordinating and Advisory Committee and the Intergovernmental Coordinating Committee on Regional Land Use and Transportation Planning, adopted eight specific objectives for land use development within the Region, which may be grouped in three major classes dealing with providing a balanced allocation of space to the various land uses (how much), providing an appropriate spatial distribution of the various land uses (where), and meeting the design requirements of the major land uses (in what way).

Provide Balanced Spatial Allocation:

1. A balanced allocation of space to the various land use categories which meets the social, physical, and economic needs of the regional population.

Provide Appropriate Spatial Distribution:

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.

Meet Design Requirements:

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 suitable industrial and commercial sites 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 bal-

anced year-round outdoor recreational program providing a full range of facilities for all age groups.

8. The preservation of land areas for agricultural uses in order 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 development objectives adopted by the Commission for regional transportation system development may be grouped into three major classifications dealing with serving the land use pattern and meeting the anticipated travel demand (provide capacity), providing appropriate transportation at an adequate service level (provide balanced system), and providing for an economical transportation system (minimize costs). The following specific transportation system development objectives have been adopted by the Commission after careful review and recommendation by the Technical Coordinating and Advisory Committee and the Intergovernmental Coordinating Committee on Regional Land Use-Transportation Planning:

Serve Land Use Pattern and Meet Travel Demand:

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. The minimization of disruption of desirable existing neighborhood and community development and of deterioration or destruction of the natural resource base.

3. A high aesthetic quality in the transportation system with proper visual relation of the major transportation facilities to the land and cityscape.

Provide Appropriate Transportation at an Adequate Service Level:

4. 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.

5. The alleviation of traffic congestion and the reduction of travel time between component parts of the Region.

6. The reduction of accident exposure and provision of increased travel safety.

Provide Economical System:

7. A transportation system which is both economical and efficient, meeting all other objectives at the lowest cost possible.

Principles and Standards

Complementing each of the foregoing specific land use and transportation development objectives is a planning principle and a set of planning standards. Each set of standards is directly relatable to a planning principle, as well as to the objective, and serves to facilitate quantitative application of the objectives in plan design, test, and evaluation. In the application of the planning standards and in preparation, test, and evaluation of the regional land use-transportation plans, however, several overriding considerations must be recognized. First, it must be recognized that each proposed transportation plan must constitute an integrated system. This requires the application of traffic simulation models to quantitatively test the proposed system, thereby permitting adjustment of the spatial distribution and capacities of the system to the existing and future travel demand as derived from the land use plan. Second, it must be recognized that an overall evaluation of each transportation plan must be made on the basis of cost. Such an analysis may show that certain standards cannot be met practically and must be either reduced or eliminated. Third, it must be recognized that it is unlikely that any one plan proposal will meet all of the standards completely; and the extent to which each standard is met, exceeded, or violated must serve as a measure of the ability of each alternative plan proposal to achieve the specific objectives which the given standard complements. Fourth, it must be recognized that certain objectives and standards may be in conflict and require resolution through compromise. Finally, it must be recognized that the standards must be very judiciously applied to areas or facilities which are partially or fully developed since such application may require extensive renewal or reconstruction programs.

ANTICIPATED REGIONAL GROWTH AND CHANGE

Change is one of the basic characteristics of the modern world, and urbanization is one of the most

important and far-reaching aspects of this change. No nation, no state, and no region which participates in modern life can escape this increasing urbanization; and no part of daily life can avoid being influenced in some way by forces rooted in this complex process. Since population growth and urbanization appear inevitable in the absence of some world-wide natural or man-made disaster, the question facing public officials and citizen leaders within the Region is not whether such growth and urbanization will occur but how much will occur and how well it will be shaped and guided in the public interest. One of the very important steps necessary to the formulation of regional development plans is, therefore, the preparation of forecasts. Forecasts are necessary because many facets of regional change cannot, within the structure of a free society, be planned but rather must be accommodated, at least to a considerable extent. These include population growth and change; economic growth and change; growth and change in the demand for automobiles and trucks; and growth and change in the demand for land to accommodate social, economic, and political activities.

The most important changes likely to take place in the Southeastern Wisconsin Region by 1990, as forecast by the Commission, may be summarized as follows:

1. The population of the Southeastern Wisconsin Region may be expected to increase by approximately 1,000,000 persons over the present population level of approximately 1,674,000 persons. A high proportion of the 1990 regional population of approximately 2,700,000 persons will be in the very old age groups, with approximately 9 percent of the regional population over 65 years of age in 1990, and an even higher proportion will be in the very young age groups, with approximately 41 percent of the future regional population under 20 years of age in 1990.

2. Employment in the Region by 1990 may be expected to reach nearly the one million level, an increase of 349,000 jobs over the present employment level of approximately 635,000. Many of these jobs will be in manufacturing activities; but a growing proportion will be in trade and service activities, both private and public.

3. Personal income is expected to increase at a rapid rate, so that by 1990 the average household will earn about $14,000 before taxes, an increase of $5,500 over present levels; and total personal income generated in the Region will exceed $10 billion.

4. The amount of money available to local units of government in the Region for providing the necessary public facilities and services by 1990 may be expected to increase from $512 million per year to approximately $2.2 billion per year. Monies available for highway, street, and related purposes alone between now and 1990, including state and federal monies, will increase from $153 million per year to approximately $228 million per year.

5. If recent historic development trends continue, approximately 296,100 acres, or over 462 square miles, of land will be required to meet the land use demand for the various new urban activities generated by growth in population and economic activity levels within the Region by 1990. Over 63 percent of this land would be used for new homes, apartments, and other living quarters; and an additional 23 percent would be used for streets and highways. Smaller proportions of land would be used for commercial, industrial, governmental, institutional, and recreational activities.

6. The number of automobiles within the Region may be expected to increase by approximately 87 percent over the present level of 545,900 to 1,022,800, while the number of motor trucks may be expected to increase by approximately 36 percent over the present level of 63,400 to 86,300.

It is evident from the forecasts summarized above that the Southeastern Wisconsin Region will in 1990 be very different from the Region of today. There will be many more people receiving greater incomes, driving more automobiles, and demanding more land and more transportation facilities.

ALTERNATIVE LAND USE—TRANSPORTATION PLANS

Three alternative regional land use plans, each with its supporting transportation system plan, were prepared to meet these anticipated changes and at the same time preserve and protect the

limited and irreplaceable natural resource base of the Region: a Controlled Existing Trend, a Corridor, and a Satellite City Plan. Each represents an attempt to meet the regional development objectives and the forecast needs through a basically different design. In addition, a fourth alternative was explored, that of continued existing trend development in the absence of any attempt to guide this development on an areawide basis in the public interest. This last alternative is not a plan, but a forecast of unplanned development; and it is intended to serve, not as a recommendation, but as a standard of comparison for the evaluation of the true land use plans directed toward the attainment of regional development objectives. The fourth alternative will be presented in the third and final volume of this report as a basis for comparison with the land use plan finally recommended for adoption.

Controlled Existing Trend Plan

The Controlled Existing Trend Plan represents a conscious continuation of historic development trends, with urban development continuing to occur in concentric rings along the full periphery of, and outward from, existing urban centers within the Region. This plan places heavy emphasis on the continued effect of the urban land market in determining the location, intensity, and character of future development. It does, however, propose to regulate in the public interest the effect of this market on development in order to provide for a more orderly and economic regional development pattern and to avoid intensification of areawide development and environmental problems.

Under this plan the historic growth trends would be altered by guiding intensive urban development into those areas of the Region having both soils suitable for such development and gravity drainage sanitary sewer service readily available. In addition, the floodways and flood plains and the best remaining woodlands, wetlands, fish and game habitat, and park and related open-space sites would be protected from development and would form the basic framework for an integrated system of park and open-space areas within the Region. The allocation of future land use within each county of the Region under this plan would be such as to approximate the forecast population levels within each county and, to the extent possible, the proposals contained in existing community development plans and zoning documents.

The plan would seek to place over 74 percent of all new urban residential development within the Region within 20 miles of the central business district of Milwaukee. Residential development would occur primarily at medium densities, with net lot sizes ranging from 6,300 to 19,800 square feet per dwelling unit. The new urban residential development would consist primarily of single-family housing located in planned residential development units interspersed with town houses and garden apartments. The plan would permit the ready provision of public sanitary sewer service and public water supply to 93 percent of the developed area of the Region and to 95 percent of the total regional population. The plan would add approximately 200 square miles of new urban development to the Region by 1990 and would provide for 23 major industrial centers, 6 being newly established, and for 25 major commercial areas, 10 being newly established. The plan would provide for 26 major regional park sites, 11 being newly established, and would, in addition, seek to protect the primary environmental corridors within the Region from incompatible urban development.

Corridor Plan

The Corridor Plan represents an attempt to concentrate new urban development within the Region in radial corridors centered on major transportation routes emanating from the existing major urban centers within the Region. Urban growth would, thus, still be outward from the major urban centers; but higher densities of development would be emphasized; and the radial corridors of urban development would alternate with wedges of agricultural and other open-space land uses. The plan would permit the ready provision of public sanitary sewer service and public water supply to 92 percent of the developed area of the Region and to 94 percent of the total regional population. This plan would seek to place 68 percent of all new urban residential development within 20 miles of the central business district of Milwaukee and would add approximately 170 square miles of new urban development by 1990. The location of the major industrial centers, major commercial centers, and major regional park sites would be the same as under the Controlled Existing Trend Plan.

Satellite City Plan

Finally, the Satellite City Plan represents an attempt to concentrate new urban development within the Region in outlying communities relatively independent of commercial and industrial development in the larger central cities and sepa-

rated from these cities by large areas of open space. The resulting development pattern would be discontinuous, both radially and circumferentially. The plan would permit the ready provision of public sanitary sewer service and public water supply to 93 percent of the developed area of the Region and to 94 percent of the total regional population. This plan would seek to place 54 percent of all new urban residential development within 20 miles of the central business district of Milwaukee and would add 180 square miles of new urban development by 1990.

The plan would provide for 24 major industrial centers, 8 being newly established, and for 25 major commercial areas, 10 being newly established. The plan would provide for 26 major regional park sites, 11 being newly established, and would, in common with the other two alternative plans, seek to protect the primary environmental corridors from incompatible urban development.

While many variations of the three basic regional development patterns presented in the alternative plans are possible, it is believed that the three patterns selected, together with that of continued uncontrolled development, represent the basic choices with respect to future development patterns practically available to the Region.

Transportation Analyses and Plans

When the transportation implications of the three alternative land use plans were analyzed, some rather surprising findings were revealed. First of all, contrary to what might be expected, the total travel demand generated by the three alternative land use patterns was not found to be significantly different. The Region in 1963 generated a total of 3.6 million person trips per average weekday. These are expected to increase to 6.1 million under the Controlled Existing Trend Plan, to 6.0 million under the Corridor Plan, and to 6.1 million under the Satellite City Plan. The Region in 1963 generated a total of 2.9 million vehicle trips per day. This is expected to increase to 5.1 million under the Controlled Existing Trend Plan, to 4.9 million under the Corridor Plan, and to 5.0 million under the Satellite City Plan. None of these differences in travel demand are significant for regional planning purposes.

Somewhat greater differences were found between the three alternative land use plans with respect to transit trip generation and utilization. The Region generated a total of 324,000 transit trips per average weekday in 1963. This is expected to increase to 356,000 transit trips under the Controlled Existing Trend Plan, to 376,000 transit trips under the Corridor Plan, and to 339,000 transit trips under the Satellite City Plan. Although the number of transit trips within the Region is expected to increase from 1963 to 1990, a reversal of historic trends, the proportion of transit utilization is expected to decrease under each of the three alternative plans from about 9 percent of the total person trips per average weekday in 1963 to about 6 percent by 1990.

Average vehicle trip length expressed in travel time is expected to decrease slightly from the 1963 value of 13.7 minutes to 13.4 minutes under the Corridor Plan, and to 13.3 under the Satellite City Plan. Total vehicle miles of travel within the Region are expected to be essentially the same under each of the three alternative land use plans, increasing from the 1963 level of about 13 million vehicle miles per average weekday to 31.8 million vehicle miles by 1990 under the Controlled Existing Trend Plan, to 31.9 million vehicle miles under the Corridor Plan, and to 32.3 million vehicle miles under the Satellite City Plan.

The existing plus committed arterial street and highway system within the Region became the point of departure for the planning of a future highway transportation system for the Region. Assignments of future traffic demand to the existing plus committed arterial street and highway network indicated that, if no further capital were invested in highway transportation facilities, traffic congestion within the Region would reach severe levels by 1990, with the areas of highest overloading occurring in the central portion of Milwaukee County. The existing plus committed freeway system would be heavily overloaded and, consequently, would not provide the desired and necessary level of service. Future traffic volumes on the existing plus committed arterial street and highway network would not differ significantly between the three alternative land use plans as effected upon facilities in the central portions of Milwaukee County and in the Racine and Kenosha urban areas. Such traffic volumes would, however, differ for outlying facilities.

A transportation system plan was prepared based upon analyses of the inability of the existing plus committed system to serve the future travel demand. This plan recommends the construction

of 120 miles of new arterial street and highway facilities and the reconstruction of 590 miles of existing facilities to provide the necessary traffic capacity. Included in the highway transportation plans are the following major freeway facilities:

1. A new freeway from the southerly end of the proposed high level bridge across the Milwaukee harbor southerly through southeastern Milwaukee and eastern Racine and Kenosha counties, connecting to a freeway proposed through Lake County by the State of Illinois.

2. Extension of the Stadium Freeway north through northwestern Milwaukee County and into Ozaukee County to the vicinity of the City of Port Washington.

3. A new East-West Freeway in the vicinity of Hampton Avenue from USH 141 west through northern Milwaukee and Waukesha counties to the vicinity of the City of Oconomowoc.

4. A new freeway in the vicinity of the Milwaukee River Valley, connecting the Juneau Interchange of the Lake Freeway to the proposed new East-West Freeway in the vicinity of Hampton Avenue.

5. A new Belt Freeway from the new North-South Freeway in southern Milwaukee County westerly through southern Milwaukee County and then northerly through eastern Waukesha County to USH 41 in southeastern Washington County.

6. A new freeway from USH 41 to the vicinity of the City of West Bend.

7. The completion of STH 15 southwesterly across Walworth County as a freeway.

8. The completion of USH 12 northwesterly across Walworth County as a freeway.

The total construction and reconstruction costs involved in the implementation of the highway transportation plan elements would be about $931.5 million under the Controlled Existing Trend Plan, $931.0 million under the Corridor Plan, and $962.2 million under the Satellite City Plan. These costs would be incurred over the 1967-1990 plan implementation period. Public financial resource projections indicate that about $2.0 billion should become available for highway construction within the Region over this same period. Implementation of the plan would, thus, leave about $1.1 billion available for the reconstruction of the existing streets and highways in order to maintain structural adequacy and for the construction of new local and collector streets. Not only is the proposed highway transportation plan well within the financial capability of the Region, but benefit-cost analyses indicate that the required public funds would be well invested, providing a benefit-cost ratio of over 1.5 for the Controlled Existing Trend Plan, 1.7 for the Corridor Plan, and 1.4 for the Satellite City Plan.

The plan recommends, in addition to and complementing the improved arterial street and highway system, an expanded modified rapid transit and rapid transit system which would provide the most heavily urbanized portions of the Region with an efficient and economical as well as a high level of transit service. Motor coaches operating in mixed traffic on the outlying portions of the expanded regional freeway system would provide high level service to such outlying suburban areas as Mequon, Thiensville, Menomonee Falls, Brookfield, New Berlin, Franklin, and Oak Creek. These modified rapid transit lines, consisting of two fully grade separated lanes for the exclusive operation of motor coaches, would under the Controlled Existing Trend and Satellite City plans feed a rapid transit line paralleling the East-West Freeway from the Milwaukee central business district west to about the Milwaukee County line. In the Corridor Plan, an additional rapid transit line paralleling the Park Freeway from the Milwaukee central business district to Capitol Court would be justified. Thus, the same transit vehicle would operate in collection and distribution service in the central business district in Milwaukee, in true rapid transit service on the trunk lines, in modified rapid transit service on outlying portions of the freeway system, and in its own collection and distribution service in the outlying areas served. The construction cost of the rapid transit line proposed to serve the Controlled Existing Trend and Satellite City plans, approximately seven miles in length, is estimated at $20,575,000. The construction cost of the two rapid transit lines proposed to serve the Corridor Plan, approximately seven and five miles in length, is estimated at $36,125,000.

If the plan recommendations are carried out, nearly 40 percent of the future traffic load would be carried on the freeway system, while transit

utilization in the Region would increase slightly in terms of total revenue passengers, a reversal of historic trends.

Plan evaluation indicated that implementation of the Controlled Existing Trend Plan would meet more of the regional development standards than the other two alternative land use-transportation plans. Moreover, application of the rank-based expected value method to plan evaluation indicated that implementation of the Controlled Existing Trend Plan would also best meet the regional land use-transportation development objectives.

Plan Selection and Adoption

The alternative regional land use-transportation plans presented herein are not to be regarded as final plans to be accepted or rejected but as working proposals on which the reactions of the federal, state, and local units and agencies of government concerned are solicited. The plans themselves, as presented herein, are presently being reviewed by the SEWRPC Technical Coordinating and Advisory and Intergovernmental Coordinating Committees, as well as by interested federal, state, and local units and agencies of government. Based upon this review, the Commission will select one of the alternate plans as the final plan, after which both the land use and transportation elements will be detailed and published for implementation.

The general approach contemplated for the selection of one plan from among these alternatives is to proceed through the use of the advisory committee structure and hearings to a final decision and plan adoption by the Commission in accordance with the provisions of the state enabling legislation. Since plan selection and adoption necessarily involve both technical and nontechnical policy determinations, they must be founded in the active involvement in the entire planning process of the various governmental bodies, technical agencies, and private interest groups concerned with regional development. Such involvement is particularly important in light of the advisory role of the Commission in shaping regional development. The use of advisory committees and both formal and informal hearings appear to be the most practical and effective procedures available for involving public officials, technicians, and citizens in the planning process and of openly arriving at agreement among the affected governmental bodies and agencies on objectives and on plans which can be jointly implemented.

The alternative regional land use-transportation plans will, therefore, be presented to the 146 municipalities and to the seven constituent county boards, as well as to the State Highway Commission of Wisconsin and to such plan implementation agencies as the Milwaukee County Expressway Commission and the Milwaukee County Park Commission, in a series of formal meetings and informal staff presentations over a period of approximately six months. Based on the reaction received to these alternative plan presentations, a final land use-transportation plan will be selected, refined, and recommended for adoption and implementation.

Appendix A

DETAILED TABLES AND FIGURES

Table A-1

POPULATION, DWELLING UNITS, AND ACREAGE RANGES FOR EACH RESIDENTIAL DENSITY CLASS UTILIZED IN PLAN PREPARATION[a]

Category	Low	Medium	High
Gross[b] Residential Development	640.0 Acres	640.0 Acres	640.0 Acres
Net[c] Residential Development	512.0 Acres	454.4 Acres	422.4 Acres
Population Range	350-3,499	3,500-9,999	10,000-25,000
Population	2,050	6,500	16,700
Dwelling Units[d]	621	1,970	5,061
Persons/Gross Acre (range)	0.5-5.5	5.6-15.6	15.7-39.1
Persons/Gross Acre (av.)	3.2	10.2	26.1
Persons/Net Residential Acre (range)	0.5-6.8 0.5-7.2 (Adj.)[e]	7.7-22.0 7.3-22.8 (Adj.)	23.7-59.2 22.9-59.2 (Adj.)
Persons/Net Residential Acre (av.)	4.0	14.3	39.5
Net Residential Acres/1,000 Population	249.8	69.9	25.3
Dwelling Units[d]/Gross Acre (range)	0.2-1.7	1.8-4.7	4.8-11.8
Dwelling Units/Gross Acre (av.)	1.0	3.1	7.9
Dwelling Units/Net Residential Acre (range)	0.2-2.1 0.2-2.2 (Adj.)	2.3-6.7 2.3-6.9 (Adj.)	7.1-17.9 7.0-17.9 (Adj.)
Dwelling Units/Net Residential Acre (av.)	1.2	4.3	12.0
Net Sq. Ft./Dwelling Unit (range)	209,090-20,910 209,090-19,820 (Adj.)	18,730-6,530 19,819-6,333 (Adj.)	6,135-2,430 6,332-2,430 (Adj.)
Net Sq. Ft./Dwelling Unit (av.)	35,700	10,000	3,630

[a] *Applies to new residential development only.*

[b] *Gross residential land use area is defined as the net area devoted to residential use plus the proportionate area devoted to all supporting land uses including streets, neighborhood parks and playgrounds, elementary schools, and neighborhood institutional and commercial uses.*

[c] *Net residential land use area is defined as the actual site area devoted to the residential use and consists of the ground floor site area occupied by any building plus the required yards and open spaces.*

[d] *Occupied by 3.3 persons.*

[e] *Adjusted to complete range.*

Table A-2

RESIDENTIAL PLANNING UNIT DEVELOPMENT STANDARDS FOR EACH RESIDENTIAL DENSITY CLASS UTILIZED IN PLAN PREPARATION

Low Density	Number	Acres	Percent	Acres	Percent
Gross Area				2,560.0	100.0
Public Elementary School (K-6) Area		12.8	0.5		
Number of Classrooms	25.0				
Total Number of Pupils	688.0[a]				
Public Park & Parkway Area		38.4	1.5		
Neighborhood Commercial Area		12.8	0.5		
Street Area		422.4	16.5		
Other Public & Quasi-Public Area		25.6	1.0		
Net Residential Area				2,048.0	80.0
Single-Family Area		2,048.0	80.0		
Population	8,200.0				
Residential Acres/1,000 Population	250.0				
Persons/Residential Acre	4.0				
Number of Dwelling Units	2,485.0				
Dwelling Units/Net Residential Acre	1.2				
Multi-Family Area		None			

[a] *Represents 8.4 percent of total population.*

Table A-2 (continued)

Medium Density	Number	Acres	Percent	Acres	Percent
Gross Area				640.0	100.0
Public Elementary School (K-6) Area		9.6	1.5		
Number of Classrooms	20.0				
Total Number of Pupils	546.0				
Public Park Area		16.0	2.5		
Neighborhood Commercial Area		6.4	1.0		
Street Area		147.2	23.0		
Other Public & Quasi-Public Area		6.4	1.0		
Net Residential Area				454.4	71.0
Single-Family Area		416.0	65.0		
Population	5,330.0				
Residential Acres/1,000 Population	76.0				
Persons/Residential Acre	12.8				
Number of Dwelling Units	1,615.0				
Dwelling Units/Residential Acre	3.9				
Multi-Family Area		38.4	6.0		
Population	1,170.0				
Residential Acres/1,000 Population	32.0				
Persons/Residential Acre	30.2				
Number of Dwelling Units	355.0				
Dwelling Units/Residential Acre	9.2				

Table A-2 (continued)

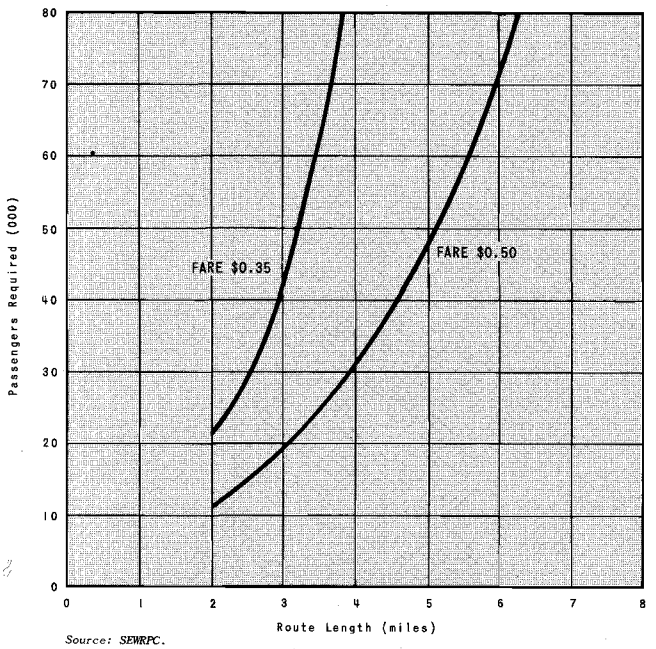
High Density	Number	Acres	Percent	Acres	Percent
Gross Area				160.0	100.0
Public Elementary School (K-6) Area		4.0	2.5		
Number of Classrooms	13.0				
Total Number of Pupils	350.0				
Public Park Area		5.6	3.5		
Neighborhood Commercial Area		2.4	1.5		
Street Area		40.0	25.0		
Other Public & Quasi-Public Area		2.4	1.5		
Net Residential Area				105.6	66.0
Single-Family Area		94.4	59.0		
Population	1,869.0				
Residential Acres/1,000 Population	49.7				
Persons/Residential Acre	19.8				
Number of Dwelling Units	566.0				
Dwelling Units/Residential Acre	5.9				
Multi-Family Area		11.2	7.0		
Population	2,305.0				
Residential Acres/1,000 Population	4.9				
Persons/Residential Acre	205.8				
Number of Dwelling Units	698.0				
Dwelling Units/Residential Acre	62.3				

THRESHOLD SERVICE WARRANT CURVES RAIL RAPID TRANSIT

Like the threshold service warrants for bus rapid transit facilities, threshold service warrants for rail rapid transit service were found to vary with the route length. This is due to the interaction of operating costs and capital investment costs for fixed way and structure. The curves necessary to express the threshold service warrant standards for rail rapid transit facilities were calculated from the following data:

1. Average Right-of-Way Acquisition Costs — $2,250,000.00 per mile
2. Construction (including earth work, track, electrification, signalization, structures, drainage, fencing, grading, utility relocation, engineering, and contingencies) — 2,240,000.00 per mile
3. Stations to Have 250 Lineal Feet of Platform, Total Cost of $2,200 per Lin. Ft. (minimum of six stations) — 550,000 per station
4. Yards and Shops — 8,000.00 per car
5. Cost of Rapid Transit Car — 80,000.00 each
6. Maintenance of Way (per two track mile) — 20,000.00 per mile
7. Turn around extension including two cross-overs and storage sidings — 50,000.00 each
8. Operating costs (not including depreciation of car) — 0.60 per car-mile
9. Car Size - 54 seats
   Average Car Occupancy - 28 passengers
10. K = 15 percent; D = 70/30; KD = 10.5 percent
11. i = 6 percent; n = 25 years for all investment costs

Figure A-1



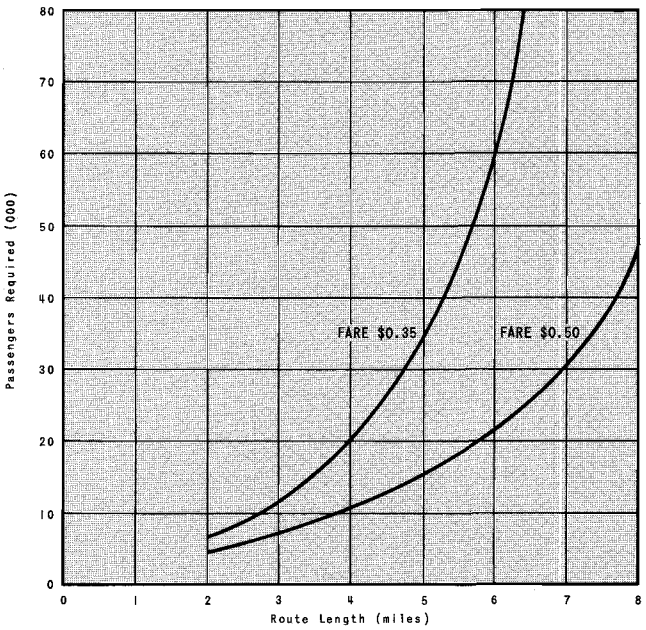
Source: SEWRPC.

THRESHOLD SERVICE WARRANT CURVES BUS RAPID TRANSIT

Unlike local and modified rapid transit service, threshold service warrants for bus and rail rapid service were found to vary with the route length. This is due to the interaction of operating costs and capital investment costs for fixed way and structures. The curves necessary to express the threshold service warrant standards for bus rapid transit facilities were calculated from the following data:

1. Average Right-of-Way Acquisition Costs — $2,250,000.00 per mile
2. Construction (including earth work, pavement, structures, drainage, fencing, grading, utility relocation, engineering, and contingencies. — 650,000.00 per mile
3. Maintenance of Way — 3,000.00 per mile per year
4. Cost of Bus — 30,000.00 each
5. Cost of Yards and Shops — 5,500.00 per bus
6. Operating Costs (including 9.4¢ depreciation on bus but not taxes) — 0.56 per bus-mile
7. Bus Size - 52 seats
   Average Bus Occupancy - 26 passengers
8. i = 6 percent; n = 25 years for fixed capital investment; n = 12 years for bus

Figure A-2



Source: SEWRPC.

Table A-3

ACCIDENT RATES AND COSTS BY FACILITY TYPE IN THE REGION

Facility Type	Number of Accidents per 100,000 Vehicle Miles			Costs of Accidents per 100,000 Vehicle Miles		
	Fatality	Injury Accidents	Property Damage Only Accidents	Fatal	Injury	Property Damage Only
A. Arterial Streets and Highways						
1. Milwaukee County	0.003	0.256	0.522	$111	$710	$162
2. Remainder of Region	0.009	0.102	0.162	310	283	50
B. Freeways						
1. Milwaukee County	0.002	0.066	0.127	78	218	21
2. Remainder of Region	0.002	0.048	0.067	80	160	39
	Number of Traffic and Passenger Accidents per 100,000 Vehicle Miles			Total Costs of Accidents per 100,000 Vehicle Miles		
C. Transit	9.150			$1,290		

Source: State Highway Commission; Safety Commission, City of Milwaukee; Milwaukee County Expressway Commission; Milwaukee and Suburban Transport Corporation; National Safety Council; and SEWRPC.

Table A-4

POPULATION PROJECTIONS FOR KENOSHA COUNTY BY AGE AND SEX: 1960 - 1990

Age Group	1960			1965			1970			1975			1980			1985			1990		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	6.2	5.9	12.1	5.7	5.6	11.3	6.6	6.5	13.1	7.8	7.8	15.6	9.3	9.1	18.4	10.5	10.4	20.9	12.2	11.9	24.1
5 - 9	5.6	5.3	10.9	5.5	5.3	10.8	5.8	5.7	11.5	6.8	6.7	13.5	8.1	8.1	16.2	9.4	9.3	18.7	10.9	10.5	21.4
10 - 14	4.8	4.6	9.4	5.1	4.8	9.9	5.8	5.5	11.3	6.0	5.9	11.9	7.0	6.9	13.9	8.2	8.2	16.4	9.9	9.6	19.5
15 - 19	3.7	3.5	7.2	4.6	4.5	9.1	5.4	5.2	10.6	6.1	5.8	11.9	6.3	6.3	12.6	7.4	7.4	14.8	9.0	8.9	17.9
20 - 24	3.2	2.9	6.1	3.9	3.7	7.6	5.1	4.9	10.0	5.9	5.8	11.7	6.5	6.4	12.9	6.8	6.9	13.7	8.1	8.1	16.2
25 - 29	3.0	2.9	5.9	3.8	3.6	7.4	4.1	3.9	8.0	5.5	5.3	10.8	6.4	6.3	12.7	7.2	7.1	14.3	7.6	7.7	15.3
30 - 34	3.3	3.3	6.6	3.3	3.4	6.7	4.2	4.0	8.2	4.2	4.1	8.3	5.8	5.7	11.5	6.7	6.6	13.3	7.6	7.6	15.2
35 - 39	3.5	3.5	7.0	3.4	3.4	6.8	3.2	3.3	6.5	4.2	3.9	8.1	4.2	4.1	8.3	5.8	5.5	11.3	6.8	6.7	13.5
40 - 44	3.3	3.2	6.5	3.4	3.7	7.1	3.4	3.6	7.0	3.1	3.3	6.4	4.2	4.0	8.2	4.2	4.0	8.2	5.8	5.7	11.5
45 - 49	2.9	3.0	5.9	3.5	3.6	7.1	3.7	4.1	7.8	3.6	3.9	7.5	3.3	3.6	6.9	4.4	4.1	8.5	4.5	4.4	8.9
50 - 54	2.5	2.6	5.1	2.9	2.8	5.7	3.3	3.2	6.5	3.4	3.4	6.8	3.4	3.3	6.7	3.1	3.2	6.3	4.1	3.6	7.7
55 - 59	2.2	2.3	4.5	2.8	2.9	5.7	3.1	3.2	6.3	3.5	3.6	7.1	3.4	3.9	7.3	3.7	3.9	7.6	3.4	3.4	6.8
60 - 64	2.1	2.1	4.2	2.3	2.4	4.7	2.4	2.6	5.0	2.6	2.9	5.5	3.1	3.3	6.4	3.1	3.8	6.9	3.1	3.4	6.5
65 - 69	1.9	1.8	3.7	2.0	2.1	4.1	2.1	2.3	4.4	2.2	2.5	4.7	2.4	2.8	5.2	2.6	3.2	5.8	2.7	3.4	6.1
70 - 74	1.3	1.4	2.7	1.7	1.8	3.5	1.6	1.9	3.5	1.6	2.0	3.6	1.7	2.2	3.9	1.9	2.6	4.5	2.0	2.7	4.7
75 - 79	0.8	0.9	1.7	1.1	1.4	2.5	1.3	1.5	2.8	1.2	1.6	2.8	1.1	1.7	2.8	1.1	1.7	2.8	1.3	2.0	3.3
80 +	0.5	0.6	1.1	1.0	1.0	2.0	1.1	1.4	2.5	1.2	1.6	2.8	1.4	1.7	3.1	1.2	1.8	3.0	1.4	2.0	3.4
Total	50.8	49.8	100.6	56.0	56.0	112.0	62.2	62.8	125.0	68.9	70.1	139.0	77.6	79.4	157.0	87.3	89.7	177.0	100.4	101.6	202.0

Source: SEWRPC.

Table A-5

POPULATION PROJECTIONS FOR MILWAUKEE COUNTY BY AGE AND SEX: 1960 - 1990

Age Group	1960			1965			1970			1975			1980			1985			1990		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	61.7	59.7	121.4	58.0	57.2	115.2	61.2	59.7	120.9	67.2	66.1	133.3	75.1	74.2	149.3	82.4	81.7	164.1	88.8	85.5	174.3
5 - 9	52.6	50.9	103.5	52.9	51.2	104.1	56.8	55.5	112.3	58.9	58.5	117.4	65.1	64.1	129.2	71.8	71.5	143.3	79.1	76.3	155.4
10 - 14	43.6	42.3	85.9	45.5	43.6	89.1	52.8	51.1	103.9	55.8	55.3	111.1	57.4	56.8	114.2	62.5	61.7	124.2	69.8	67.7	137.5
15 - 19	31.7	35.2	66.9	40.2	38.7	78.9	46.8	45.5	92.3	53.3	52.3	105.6	55.7	55.9	111.6	57.2	56.9	114.1	62.4	61.0	123.4
20 - 24	29.9	35.5	65.4	30.2	32.7	62.9	41.8	41.1	82.9	48.1	47.9	96.0	54.5	53.9	108.4	56.2	56.4	112.6	58.2	57.8	116.0
25 - 29	34.1	33.9	68.0	34.7	42.7	77.4	32.3	34.5	66.8	43.9	43.1	87.0	49.7	49.7	99.4	56.0	54.4	110.4	58.4	58.6	117.0
30 - 34	35.6	35.7	71.3	34.6	35.6	70.2	35.0	43.8	78.8	32.0	34.8	66.8	43.2	43.3	86.5	48.4	47.9	96.3	54.7	54.8	109.5
35 - 39	34.7	36.0	70.7	35.0	36.8	71.8	33.2	34.2	67.4	33.2	41.6	74.8	30.0	33.4	63.4	39.9	39.1	79.0	45.7	45.5	91.2
40 - 44	32.0	33.8	65.8	33.6	36.7	70.3	34.0	35.9	69.9	31.0	32.6	63.6	30.9	39.6	70.5	27.9	30.0	57.9	37.0	37.4	74.4
45 - 49	31.0	33.0	64.0	32.3	36.8	69.1	34.4	37.9	72.3	33.7	36.6	70.3	30.8	33.4	64.2	30.5	38.3	68.8	27.2	31.0	58.2
50 - 54	28.7	30.4	59.1	29.3	30.1	59.4	28.8	29.8	58.6	29.8	30.4	60.2	29.6	28.9	58.5	26.4	28.4	54.8	26.6	31.1	57.7
55 - 59	26.4	27.1	53.5	30.5	31.1	61.6	30.4	32.6	63.0	29.2	31.8	61.0	30.0	32.8	62.8	29.6	32.6	62.2	26.4	27.2	53.6
60 - 64	22.5	23.6	46.1	25.5	26.6	52.1	25.2	27.7	52.9	24.6	28.7	53.3	23.9	28.2	52.1	24.5	29.7	54.2	23.7	26.4	50.1
65 - 69	17.8	20.0	37.8	21.1	22.7	43.8	21.2	23.6	44.8	20.2	25.0	45.2	20.0	25.0	45.0	19.5	25.4	44.9	19.1	24.3	43.4
70 - 74	12.5	15.0	27.5	15.6	18.9	34.5	15.9	19.4	35.3	16.1	20.6	36.7	14.8	21.0	35.8	14.9	21.4	36.3	14.2	19.8	34.0
75 - 79	7.1	9.6	16.7	9.9	13.8	23.7	10.6	14.7	25.3	10.5	14.8	25.3	10.3	15.6	25.9	10.2	14.8	25.0	9.9	15.5	25.4
80 +	4.8	7.6	12.4	8.8	10.1	18.9	8.5	14.1	22.6	12.6	15.8	28.4	12.4	15.8	28.2	10.1	16.8	26.9	8.5	16.4	24.9
Total	506.7	529.3	1,036.0	537.7	565.3	1,103.0	568.9	601.1	1,170.0	600.1	635.9	1,236.0	633.4	671.6	1,305.0	668.0	707.0	1,375.0	709.7	736.3	1,446.0

Source: SEWRPC.

Table A-6

POPULATION PROJECTIONS FOR OZAUKEE COUNTY BY AGE AND SEX: 1960 - 1990

Age Group	1960			1965			1970			1975			1980			1985			1990		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	2.6	2.5	5.1	2.3	2.2	4.5	2.9	2.9	5.8	3.8	4.0	7.8	4.7	5.6	10.3	5.3	5.0	10.3	6.4	6.2	12.6
5 - 9	2.5	2.4	4.9	2.4	2.3	4.7	2.4	2.5	4.9	3.2	3.2	6.4	4.1	3.9	8.0	5.0	4.6	9.6	5.8	5.6	11.4
10 - 14	1.9	1.9	3.8	2.4	2.4	4.8	2.6	2.5	5.1	2.7	2.6	5.3	3.3	3.2	6.5	4.4	4.2	8.6	5.4	5.3	10.7
15 - 19	1.2	1.2	2.4	2.1	2.0	4.1	2.7	2.7	5.4	2.7	2.6	5.3	2.8	2.7	5.5	3.7	3.5	7.2	4.9	4.9	9.8
20 - 24	0.9	1.0	1.9	1.5	1.4	2.9	2.3	2.3	4.6	3.1	2.9	6.0	3.2	3.0	6.2	3.2	3.0	6.2	4.2	4.3	8.5
25 - 29	1.1	1.1	2.2	1.1	1.3	2.4	1.7	1.6	3.3	2.8	2.8	5.6	3.5	3.1	6.6	3.7	3.3	7.0	3.7	3.8	7.5
30 - 34	1.4	1.5	2.9	1.2	1.3	2.5	1.3	1.5	2.8	2.0	2.0	4.0	2.8	2.9	5.7	3.8	3.4	7.2	4.1	4.1	8.2
35 - 39	1.4	1.4	2.8	1.6	1.7	3.3	1.3	1.4	2.7	1.3	1.5	2.8	1.9	1.9	3.8	3.0	3.5	6.5	4.0	4.0	8.0
40 - 44	1.3	1.2	2.5	1.6	1.6	3.2	1.6	1.8	3.4	1.3	1.5	2.8	1.3	1.6	2.9	1.9	2.8	4.7	3.1	3.2	6.3
45 - 49	1.1	1.1	2.2	1.6	1.5	3.1	1.7	1.9	3.6	1.6	2.0	3.6	1.4	1.6	3.0	1.4	1.8	3.2	2.1	2.2	4.3
50 - 54	0.9	0.9	1.8	1.3	1.1	2.4	1.5	1.3	2.8	1.6	1.6	3.2	1.7	1.8	3.5	1.4	1.5	2.9	1.4	1.6	3.0
55 - 59	0.8	0.8	1.6	1.1	1.1	2.2	1.4	1.3	2.7	1.7	1.6	3.3	1.7	1.9	3.6	1.8	1.7	3.5	1.5	1.7	3.2
60 - 64	0.7	0.7	1.4	0.9	0.9	1.8	1.0	1.0	2.0	1.2	1.3	2.5	1.5	1.5	3.0	1.6	2.0	3.6	1.6	2.0	3.6
65 - 69	0.6	0.5	1.1	0.7	0.8	1.5	0.9	0.8	1.7	0.9	1.0	1.9	1.1	1.2	2.3	1.3	1.8	3.1	1.5	1.8	3.3
70 - 74	0.4	0.4	0.8	0.6	0.6	1.2	0.6	0.8	1.4	0.7	0.8	1.5	0.8	0.9	1.7	0.9	1.5	2.4	1.1	1.4	2.5
75 - 79	0.2	0.3	0.5	0.4	0.5	0.9	0.4	0.5	0.9	0.4	0.6	1.0	0.5	0.7	1.2	0.5	1.0	1.5	0.7	0.9	1.6
80 +	0.2	0.3	0.5	0.1	0.4	0.5	0.4	0.5	0.9	0.5	0.5	1.0	0.5	0.7	1.2	0.7	0.8	1.5	0.7	0.8	1.5
Total	19.2	19.2	38.4	22.9	23.1	46.0	26.7	27.3	54.0	31.5	32.5	64.0	36.8	38.2	75.0	43.6	45.4	89.0	52.2	53.8	106.0

Source: SEWRPC.

Table A-7

POPULATION PROJECTIONS FOR RACINE COUNTY BY AGE AND SEX: 1960 - 1990
(Population in Thousands)

Age Group	1960			1965			1970			1975			1980			1985			1990		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	9.0	8.9	17.9	8.0	7.9	15.9	9.2	9.2	18.4	11.2	11.2	22.4	13.2	13.1	26.3	14.9	13.6	28.5	17.3	16.8	34.1
5 - 9	8.2	7.9	16.1	7.8	7.6	15.4	8.2	8.1	16.3	9.6	9.5	19.1	11.4	11.3	22.7	13.5	12.3	25.8	15.5	15.1	30.6
10 - 14	6.9	6.6	13.5	7.4	7.1	14.5	8.1	7.9	16.0	8.4	8.4	16.8	9.7	9.8	19.5	11.8	10.8	22.6	14.1	13.8	27.9
15 - 19	4.5	4.8	9.3	6.8	6.3	13.1	8.0	7.7	15.7	8.4	8.4	16.8	8.8	8.8	17.6	10.4	11.2	21.6	12.8	12.7	25.5
20 - 24	3.6	4.3	7.9	4.7	4.9	9.6	7.3	6.9	14.2	8.5	8.4	16.9	9.1	9.3	18.4	9.5	10.0	19.5	11.4	11.5	22.9
25 - 29	4.3	4.4	8.7	4.4	5.3	9.7	5.2	5.4	10.6	7.9	7.6	15.5	9.3	9.2	18.5	10.0	9.4	19.4	10.6	10.7	21.3
30 - 34	4.9	4.8	9.7	4.5	4.8	9.3	4.6	5.6	10.2	5.3	5.7	11.0	8.3	8.0	16.3	9.8	9.4	19.2	10.6	10.9	21.5
35 - 39	4.8	5.1	9.9	5.0	5.1	10.1	4.4	4.8	9.2	4.4	5.6	10.0	5.2	5.6	10.8	8.1	8.5	16.6	9.7	9.8	19.5
40 - 44	4.4	4.4	8.8	4.8	5.3	10.1	5.0	5.2	10.2	4.4	4.8	9.2	4.4	5.6	10.0	5.2	7.0	12.2	8.2	8.1	16.3
45 - 49	4.1	4.1	8.2	4.6	5.0	9.6	5.1	5.5	10.6	5.2	5.6	10.8	4.6	5.1	9.7	4.7	5.4	10.1	5.6	6.2	11.8
50 - 54	3.5	3.5	7.0	4.1	3.9	8.0	4.3	4.2	8.5	4.7	4.8	9.5	4.7	4.6	9.3	4.3	5.0	9.3	4.4	5.1	9.5
55 - 59	3.1	3.2	6.3	3.8	3.8	7.6	4.3	4.3	8.6	4.6	4.7	9.3	4.9	5.4	10.3	5.1	4.9	10.0	4.7	4.8	9.5
60 - 64	2.7	2.9	5.6	3.1	3.2	6.3	3.2	3.5	6.7	3.6	3.9	7.5	3.8	4.3	8.1	4.3	4.8	9.1	4.5	4.8	9.3
65 - 69	2.4	2.6	5.0	2.6	3.0	5.6	2.7	3.0	5.7	2.8	3.2	6.0	3.1	3.6	6.7	3.4	4.9	8.3	3.8	4.6	8.4
70 - 74	1.8	2.0	3.8	2.2	2.6	4.8	2.1	2.7	4.8	2.1	2.6	4.7	2.2	2.8	5.0	2.4	3.9	6.3	2.6	3.7	6.3
75 - 79	1.1	1.3	2.4	1.6	1.9	3.5	1.5	2.1	3.6	1.5	2.1	3.6	1.5	2.2	3.7	1.6	3.1	4.7	1.8	2.7	4.5
80 +	0.7	1.0	1.7	1.3	1.6	2.9	1.6	2.1	3.7	1.7	2.2	3.9	1.8	2.3	4.1	1.6	2.2	3.8	1.5	2.6	4.1
Total	70.0	71.8	141.8	76.7	79.3	156.0	84.8	88.2	173.0	94.3	98.7	193.0	106.0	111.0	217.0	120.6	126.4	247.0	139.1	143.9	283.0

Source: SEWRPC.

Table A-8

POPULATIONS PROJECTIONS FOR WALWORTH COUNTY BY AGE AND SEX: 1960 - 1990
(Population in Thousands)

Age Group	1960			1965			1970			1975			1980			1985			1990		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	2.9	2.7	5.6	2.9	2.9	5.8	3.3	3.4	6.7	3.7	3.8	7.5	4.2	4.1	8.3	4.7	4.6	9.3	5.4	5.2	10.6
5 - 9	2.9	2.6	5.5	2.5	2.5	5.0	3.0	3.0	6.0	3.3	3.4	6.7	3.7	3.7	7.4	4.1	4.1	8.2	4.7	4.6	9.3
10 - 14	2.5	2.4	4.9	2.5	2.3	4.8	2.5	2.5	5.0	2.9	3.0	5.9	3.4	3.4	6.8	3.8	3.8	7.6	4.2	4.1	8.3
15 - 19	2.1	2.1	4.2	2.4	2.2	4.6	2.6	2.4	5.0	2.6	2.6	5.2	3.0	3.1	6.1	3.5	3.5	7.0	3.8	3.7	7.5
20 - 24	1.5	1.6	3.1	1.9	2.0	3.9	2.4	2.3	4.7	2.7	2.6	5.3	2.8	2.8	5.6	3.2	3.2	6.4	3.6	3.7	7.3
25 - 29	1.4	1.4	2.8	1.8	2.1	3.9	2.2	2.1	4.3	2.6	2.7	5.3	2.9	2.8	5.7	3.0	2.9	5.9	3.4	3.5	6.9
30 - 34	1.5	1.5	3.0	1.5	1.5	3.0	1.9	2.2	4.1	2.3	2.2	4.5	2.7	2.8	5.5	3.0	2.9	5.9	3.0	3.1	6.1
35 - 39	1.6	1.6	3.2	1.5	1.6	3.1	1.4	1.5	2.9	1.9	2.2	4.1	2.2	2.2	4.4	2.7	2.6	5.3	2.9	2.8	5.7
40 - 44	1.5	1.6	3.1	1.6	1.7	3.3	1.6	1.6	3.2	1.4	1.4	2.8	1.9	2.1	4.0	2.1	2.1	4.2	2.6	2.6	5.2
45 - 49	1.6	1.6	3.2	1.6	1.8	3.4	1.7	1.8	3.5	1.6	1.6	3.2	1.4	1.5	2.9	1.8	2.2	4.0	2.1	2.2	4.3
50 - 54	1.4	1.4	2.8	1.6	1.5	3.1	1.5	1.5	3.0	1.5	1.5	3.0	1.4	1.4	2.8	1.3	1.3	2.6	1.6	1.7	3.3
55 - 59	1.2	1.3	2.5	1.5	1.4	2.9	1.7	1.6	3.3	1.6	1.6	3.2	1.5	1.7	3.2	1.5	1.6	3.1	1.3	1.3	2.6
60 - 64	1.1	1.2	2.3	1.3	1.3	2.6	1.4	1.4	2.8	1.4	1.5	2.9	1.3	1.5	2.8	1.3	1.6	2.9	1.2	1.3	2.5
65 - 69	1.1	1.2	2.3	1.1	1.2	2.3	1.1	1.2	2.3	1.1	1.2	2.3	1.2	1.3	2.5	1.1	1.5	2.6	1.1	1.3	2.4
70 - 74	0.9	0.9	1.8	1.0	1.1	2.1	0.8	1.1	1.9	0.8	1.0	1.8	0.9	1.1	2.0	0.8	1.2	2.0	0.8	1.1	1.9
75 - 79	0.5	0.6	1.1	0.8	0.9	1.7	0.7	0.9	1.6	0.6	0.8	1.4	0.6	0.8	1.4	0.6	0.8	1.4	0.6	0.9	1.5
80 +	0.4	0.6	1.0	0.7	0.8	1.5	0.8	0.9	1.7	0.9	1.0	1.9	0.7	0.9	1.6	0.7	0.9	1.6	0.7	0.9	1.6
Total	26.1	26.3	52.4	28.2	28.8	57.0	30.6	31.4	62.0	32.9	34.1	67.0	35.8	37.2	73.0	39.2	40.8	80.0	43.0	44.0	87.0

Source: SEWRPC.

Table A-9

POPULATION PROJECTIONS FOR WASHINGTON COUNTY BY AGE AND SEX: 1960 - 1990
(Population in Thousands)

Age Group	1960			1965			1970			1975			1980			1985			1990		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	3.2	3.0	6.2	2.6	2.6	5.2	3.1	3.1	6.2	3.8	3.8	7.6	4.7	4.5	9.2	5.0	5.0	10.0	5.8	5.6	11.4
5 - 9	2.9	2.7	5.6	2.7	2.6	5.3	2.6	2.7	5.3	3.2	3.1	6.3	4.0	3.9	7.9	4.7	4.5	9.2	5.3	5.1	10.4
10 - 14	2.4	2.2	4.6	2.5	2.5	5.0	2.8	2.7	5.5	2.7	2.8	5.5	3.3	3.3	6.6	4.1	4.1	8.2	4.8	4.7	9.5
15 - 19	1.5	1.5	3.0	2.3	2.2	4.5	2.8	2.7	5.5	3.0	2.9	5.9	2.9	3.0	5.9	3.5	3.4	6.9	4.4	4.3	8.7
20 - 24	1.2	1.3	2.5	1.7	1.7	3.4	2.5	2.4	4.9	3.0	3.0	6.0	3.2	3.2	6.4	3.2	3.2	6.4	3.8	3.9	7.7
25 - 29	1.3	1.4	2.7	1.5	1.7	3.2	1.9	1.9	3.8	2.8	2.6	5.4	3.2	3.3	6.5	3.6	3.4	7.0	3.5	3.5	7.0
30 - 34	1.5	1.5	3.0	1.5	1.6	3.1	1.6	1.8	3.4	2.0	2.0	4.0	3.0	2.7	5.7	3.5	3.4	6.9	3.8	3.8	7.6
35 - 39	1.5	1.5	3.0	1.7	1.7	3.4	1.5	1.6	3.1	1.6	1.8	3.4	2.0	1.9	3.9	2.9	2.7	5.6	3.5	3.5	7.0
40 - 44	1.4	1.4	2.8	1.6	1.6	3.2	1.7	1.7	3.4	1.5	1.6	3.1	1.5	1.8	3.3	1.9	1.9	3.8	2.9	2.8	5.7
45 - 49	1.3	1.2	2.5	1.5	1.5	3.0	1.7	1.8	3.5	1.7	1.8	3.5	1.5	1.7	3.2	1.6	1.8	3.4	2.0	2.1	4.1
50 - 54	1.1	1.1	2.2	1.4	1.2	2.6	1.5	1.3	2.8	1.5	1.5	3.0	1.6	1.5	3.1	1.4	1.5	2.9	1.5	1.7	3.2
55 - 59	1.0	1.0	2.0	1.3	1.2	2.5	1.4	1.4	2.8	1.6	1.5	3.1	1.5	1.7	3.2	1.6	1.9	3.5	1.5	1.6	3.1
60 - 64	0.9	0.8	1.7	1.1	1.0	2.1	1.1	1.1	2.2	1.2	1.2	2.4	1.3	1.4	2.7	1.4	1.7	3.1	1.4	1.6	3.0
65 - 69	0.8	0.8	1.6	0.9	0.9	1.8	0.9	0.9	1.8	0.9	1.0	1.9	1.0	1.2	2.2	1.1	1.4	2.5	1.2	1.4	2.6
70 - 74	0.6	0.6	1.2	0.8	0.8	1.6	0.7	0.8	1.5	0.7	0.8	1.5	0.7	0.9	1.6	0.8	1.1	1.9	0.9	1.1	2.0
75 - 79	0.4	0.5	0.9	0.5	0.6	1.1	0.5	0.6	1.1	0.5	0.6	1.1	0.5	0.7	1.2	0.5	0.7	1.2	0.6	0.8	1.4
80 +	0.3	0.3	0.6	0.5	0.5	1.0	0.6	0.6	1.2	0.6	0.7	1.3	0.7	0.7	1.4	0.6	0.9	1.5	0.7	0.9	1.6
Total	23.3	22.8	46.1	26.1	25.9	52.0	28.9	29.1	58.0	32.3	32.7	65.0	36.6	37.4	74.0	41.4	42.6	84.0	47.6	48.4	96.0

Source: SEWRPC.

Table A-10

POPULATION PROJECTIONS FOR WAUKESHA COUNTY BY AGE AND SEX: 1960 - 1990
(Population in Thousands)

Age Group	1960			1965			1970			1975			1980			1985			1990		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	10.8	10.2	21.0	9.7	9.6	19.3	12.3	12.2	24.5	16.1	16.0	32.1	19.8	19.7	39.5	22.8	22.7	45.5	27.3	26.9	54.2
5 - 9	10.3	9.7	20.0	10.2	9.6	19.8	10.4	10.3	20.7	13.3	13.1	26.4	17.2	17.2	34.4	21.1	20.9	42.0	24.6	23.9	48.5
10 - 14	8.3	7.6	15.9	10.1	9.5	19.6	11.1	10.5	21.6	11.1	11.2	22.3	14.2	14.2	28.4	18.5	18.6	37.1	23.1	22.4	45.5
15 - 19	5.7	5.1	10.8	8.8	8.3	17.1	11.5	10.9	22.4	12.3	11.8	24.1	12.3	12.6	24.9	15.9	15.9	31.8	21.0	20.6	41.6
20 - 24	3.5	3.9	7.4	6.2	5.9	12.1	10.3	9.7	20.0	12.7	12.6	25.3	13.9	13.7	27.6	14.0	14.2	28.2	18.2	18.2	36.4
25 - 29	4.7	5.2	9.9	4.8	5.3	10.1	7.8	7.0	14.8	11.7	11.0	22.7	14.8	14.4	29.2	15.9	15.4	31.3	16.4	16.5	32.9
30 - 34	6.0	6.0	12.0	5.4	6.2	11.6	5.2	6.1	11.3	8.6	7.9	16.5	12.5	12.5	25.0	16.1	15.4	31.5	17.8	17.3	35.1
35 - 39	6.0	6.1	12.1	6.9	7.1	14.0	5.7	6.8	12.5	5.5	6.4	11.9	8.9	6.6	15.5	13.3	12.4	25.7	17.0	16.7	33.7
40 - 44	5.4	5.2	10.6	7.5	7.1	14.6	7.2	7.7	14.9	5.9	6.9	12.8	5.7	6.6	12.3	9.1	8.1	17.2	14.0	13.5	27.5
45 - 49	4.7	4.4	9.1	6.3	6.5	12.8	7.4	8.1	15.5	7.9	8.6	16.5	6.6	7.8	14.4	6.2	7.2	13.4	10.2	9.7	19.9
50 - 54	3.9	3.7	7.6	5.1	4.6	9.7	6.1	5.8	11.9	7.1	7.2	14.3	7.6	7.6	15.2	6.3	7.5	13.8	6.2	6.5	12.7
55 - 59	3.1	2.9	6.0	4.8	4.4	9.2	5.8	5.6	11.4	6.9	6.8	13.7	8.0	8.4	16.4	8.4	9.5	17.9	7.1	8.0	15.1
60 - 64	2.5	2.5	5.0	3.5	3.2	6.7	4.5	4.3	8.8	5.2	5.3	10.5	6.2	6.6	12.8	7.2	8.7	15.9	7.6	8.5	16.1
65 - 69	2.0	2.1	4.1	2.7	2.7	5.4	3.2	3.1	6.3	3.9	4.2	8.1	4.6	5.3	9.9	5.5	6.8	12.3	6.4	7.9	14.3
70 - 74	1.4	1.7	3.1	2.0	2.2	4.2	2.3	2.5	4.8	2.6	3.0	5.6	3.2	4.1	7.3	3.8	5.0	8.8	4.6	6.0	10.6
75 - 79	0.9	1.1	2.0	1.3	1.6	2.9	1.5	2.0	3.5	1.6	2.2	3.8	1.9	2.6	4.5	2.4	3.2	5.6	3.0	4.3	7.3
80 +	0.6	1.1	1.7	1.0	1.9	2.9	1.4	1.7	3.1	2.1	2.3	4.4	1.7	3.0	4.7	2.3	2.7	5.0	2.4	4.2	6.6
Total	79.8	78.5	158.3	96.3	95.7	192.0	113.7	114.3	228.0	134.5	136.5	271.0	159.1	162.9	322.0	188.8	194.2	383.0	226.9	231.1	458.0

Source: SEWRPC.

Table A-11

FORECAST OF HOUSEHOLDS AND HOUSEHOLD POPULATION FOR KENOSHA COUNTY (1960 - 1990)

Year	Total Population	Household Population	Number of Households	Persons per Household
1960.	100,600	99,100	29,500	3.36
1970.	125,000	122,500	36,500	3.36
1980.	157,000	153,900	45,800	3.36
1990.	202,000	198,000	59,900	3.36

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

Table A-12

FORECAST OF HOUSEHOLDS AND HOUSEHOLD POPULATION FOR MILWAUKEE COUNTY (1960 - 1990)

Year	Total Population	Household Population	Number of Households	Persons per Household
1960.	1,036,000	1,010,800	314,900	3.21
1970.	1,170,000	1,146,600	358,900	3.21
1980.	1,305,000	1,278,900	401,500	3.21
1990.	1,446,000	1,417,100	444,300	3.21

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

Table A-13

FORECAST OF HOUSEHOLDS AND HOUSEHOLD POPULATION FOR OZAUKEE COUNTY (1960 - 1990)

Year	Total Population	Household Population	Number of Households	Persons per Household
1960.	38,400	38,000	10,400	3.65
1970.	54,000	52,900	14,500	3.65
1980.	75,000	73,500	20,100	3.65
1990.	106,000	103,900	29,500	3.65

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

Table A-14

FORECAST OF HOUSEHOLDS AND HOUSEHOLD POPULATION FOR RACINE COUNTY (1960 - 1990)

Year	Total Population	Household Population	Number of Households	Persons per Household
1960.	141,800	138,000	40,700	3.39
1970.	173,000	169,500	50,000	3.39
1980.	217,000	212,700	63,700	3.39
1990.	283,000	277,300	82,800	3.39

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

Table A-15

FORECAST OF HOUSEHOLDS AND HOUSEHOLD POPULATION FOR WALWORTH COUNTY (1960 - 1990)

Year	Total Population	Household Population	Number of Households	Persons per Household
1960.	52,400	50,500	15,400	3.28
1970.	62,000	60,800	18,500	3.28
1980.	73,000	71,500	21,800	3.28
1990.	87,000	85,300	27,000	3.28

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

Table A-16

FORECAST OF HOUSEHOLDS AND HOUSEHOLD POPULATION FOR WASHINGTON COUNTY (1960 - 1990)

Year	Total Population	Household Population	Number of Households	Persons per Household
1960.	46,100	45,500	12,500	3.64
1970.	58,000	56,800	15,600	3.64
1980.	74,000	72,500	19,900	3.64
1990.	96,000	94,100	26,900	3.64

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

Table A-17

FORECAST OF HOUSEHOLDS AND HOUSEHOLD POPULATION FOR WAUKESHA COUNTY (1960 - 1990)

Year	Total Population	Household Population	Number of Households	Persons per Household
1960.	158,300	155,200	42,400	3.66
1970.	228,000	223,400	61,000	3.66
1980.	322,000	315,600	87,200	3.66
1990.	458,000	448,800	124,600	3.66

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

Table A-18

INPUT-OUTPUT MATRIX FOR REGIONAL ECONOMIC SIMULATION MODEL

	Selling Industries \ Purchasing Industries	NATIONAL									REGIONAL											
		Foreign Purchases (export spending)	Consumer Purchases	Government Purchases	Agriculture	Mining	Construction	Manufacturing	Electric Utilities	Other Industries	Agriculture	Mining	Construction	Food	Leather, Apparel, Textiles	Paper, Lumber, Furniture	Newspaper, Periodical, & Book Publishing & Printing	Chemicals	Primary Metals	Fabricated Metals	Machinery, Engines & Turbines	Machinery, Farm
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		DIRECT REQUIREMENTS PER DOLLAR OF GROSS OUTPUT																				
NATIONAL	4 Agriculture	0.0789	0.0168	0.0217	.54212			.06247		.00769												
NATIONAL	5 Mining	0.0206	0.0010	0.0040	.00230	.16991	.02060	.01936	.17553	.00101												
NATIONAL																						
NATIONAL	6 Construction	0.0001	0.2	0.0830																		
NATIONAL	7 Manufacturing	0.5041	0.3558	0.3047	.14072	.13140	.67479	.64938	.05313	.20600												
NATIONAL	8 Electric Utilities	0.0015	0.0278	0.0065	.00674	.03568	.00392	.01493	.34650	.05233												
NATIONAL	9 Other Industries	0.2020	0.5865	0.2153	.30910	.48238	.30066	.25383	.42481	.73294												
REGIONAL	10 Agriculture	.00019	.00004	.00005	.00132			.00015		.00001	.54212			.43968	.04681	.05455		.00119	.00027			.00274
REGIONAL	11 Mining					0.00001		0.00023	0.00003	0.00018		0.00727	0.00122		0.00003	0.01024	0.00031	0.05695	0.06233	0.00073		0.00001
REGIONAL	12 Construction			.00083																		
REGIONAL	13 Food	.00063	.00208	.00005	.00069			.00035		.00018	.05252	.00002		.22443	.00084	.00659		.01335	.00065	.00001		.00013
REGIONAL	14 Leather, Apparel, Textiles	.00011	.00031	.00002	.00004			.00064		.00006	.00867	.00087	.00026	.00303	.65780	.02936	.00288	.05645	.00339	.00382	.00347	.00410
REGIONAL	15 Paper, Lumber, Furniture	.00009	.00006	.00001	.00005	.00006	.00041	.00050	.00001	.00013	.01007	.01226	.07897	.02794	.01922	.42768	.33944	.03639	.06011	.03152	.01874	.01618
REGIONAL																						
REGIONAL	16 Newspaper, Periodical, & Book Publishing & Printing	.00007	.00015	.00003				.00031		.00073	.00027	.00039	.00018	.00253	.00245	.00906	.24923	.00405	.00279	.00295	.00448	.00102
REGIONAL	17 Chemicals	.00029	.00013	.00009	.00019	.00021	.00066	.00028	.00008	.00021	.06207	.06885	.21861	.01816	.07735	.08431	.03227	.43133	.07338	.03988	.03407	.09411
REGIONAL	18 Primary Metals	.00049	.00001	.00009		.00049	.00216	.00185	.00006	.00009	.00067	.04256	.18617	.01329	.00217	.03427	.00231	.02466	.36118	.56204	.43067	.35328
REGIONAL	19 Fabricated Metals	.00038	.00004	.00017	.00008	.00026	.00253	.00099	.00027	.00009	.00485	.01542	.15000	.03678	.00352	.03710	.00369	.02680	.03304	.13081	.07879	.09105
REGIONAL	20 Machinery, Engines & Turbines	.00127	.00005	.00063																		
REGIONAL																						
REGIONAL	21 Machinery, Farm	.00073																				
REGIONAL	22 Machinery, Construction & Mining	.00216		.00025																		
REGIONAL	23 Machinery, Metalworking	.00031		.00007																		
REGIONAL	24 Machinery, Special	.00075	.00002	.00014				.00022		.00001	.00009	.00034	.00005	.00001	.00003	.00044	.00009	.00176	.00588	.00688	.09156	.03239
REGIONAL	25 Elec. Mach., Transmission Distribution & Industrial	.00075		.00021																		
REGIONAL																						
REGIONAL	26 Electrical Machinery, Lighting & Medical	.00006	.00002	.00002		.00001	.00024	.00012		.00004	.00065	.00143	.02010	.00053	.00030	.00183	.00021	.00119	.00713	.00499	.05514	.01842
REGIONAL	27 Electrical Machinery, Household Appliances	.00012	.00015				.00017	.00004		.00003			.00938			.00036		.00029	.00035	.00703	.00012	.00786
REGIONAL	28 Electrical Machinery, Communications & Components	.00020	.00008	.00049		.00002	.00005	.00053		.00014		.00148	.00342		.00013	.00028	.00087	.00064	.00053	.00193	.00027	.00018
REGIONAL	29 Transportation Equipment	0.00190	0.00160	0.00030																		
REGIONAL	30 Instruments	.00012	.00002	.00013				.00002		.00004		.00005			.00022	.00020	.00759	.00088	.00016	.00042	.00018	.00015
REGIONAL																						
REGIONAL	31 Miscellaneous Manufacturing	.00012	.00011	.00003			.00004	.00010	.00001	.00009	.00106	.00176	.00798	.00120	.01966	.00483	.01172	.00473	.00358	.00658	.00615	.00967
REGIONAL	32 Transportation	.00096	.00029	.00026	.00023	.00069	.00046	.00039	.00037	.00042	.02420	.07075	.04683	.05408	.02093	.05961	.02843	.04898	.07908	.03133	.03804	.03554
REGIONAL	33 Communication	.00002	.00010	.00002	.00004	.00001	.00002	.00006	.00003	.00003	.00525	.00186	.00283	.00327	.00418	.00511	.02434	.00517	.00591	.00554	.00777	.00546
REGIONAL	34 Electrical, Gas, & Sanitary Utilities	.00004	.00029	.00009	.00006	.00043	.00004	.00017	.00619	.00091	.00653	.04519	.00426	.00855	.01066	.02047	.02210	.02580	.05329	.01574	.01652	.01691
REGIONAL	35 Trade	.00054	.00194	.00011	.00041	.00053	.00198	.00063	.00022	.00061	.04552	.05815	.21667	.04955	.05559	.06947	.04550	.04698	.06394	.06446	.08257	.08811
REGIONAL																						
REGIONAL	36 Banking & Insurance		.00028		.00013	.00017	.00005	.00008	.00007	.00065	.01937	.02476	.00774	.00710	.01028	.00943	.01858	.01217	.01580	.01383	.01807	.01550
REGIONAL	37 Real Estate	.00012	.00152	.00002	.00067	.00219	.00006	.00020	.00006	.00189	.06120	.19797	.00548	.00598	.01448	.01080	.06980	.01559	.01057	.01173	.01374	.01160
REGIONAL	38 Services, Except Medical	.00011	.00042	.00074	.00034	.00042	.00012	.00039	.00020	.00150	.05333	.06564	.01885	.04687	.03191	.03571	.13298	.07436	.03947	.04392	.08601	.08149
REGIONAL	39 Services, Medical		.00125	.00003	.00005	.00004	.00002	.00003	.00002	.00016	.00286	.00229	.00151	.00131	.00173	.00158	.00210	.00160	.00186	.00180	.00286	.00217
REGIONAL	40 Households																					
REGIONAL	41 Government																					

Table A-18 (continued)

INPUT-OUTPUT MATRIX FOR REGIONAL ECONOMIC SIMULATION MODEL

Selling Industries \ Purchasing Industries	Machinery, Construction & Mining	Machinery, Metalworking	Machinery, Special	Electrical Machinery, Transmission Distribution & Industrial	Electrical Machinery, Lighting & Medical	Electrical Machinery, Household Appliances	Electrical Machinery, Communications & Components	Transportation Equipment	Instruments	Miscellaneous Manufacturing	Transportation	Communication	Electrical, Gas, & Sanitary Utilities	Trade	Banking & Insurance	Real Estate	Services, Except Medical	Services, Medical	Households	Government
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
	DIRECT REQUIREMENTS PER DOLLAR OF GROSS OUTPUT																			
NATIONAL																				
4 Agriculture																				
5 Mining																				
6 Construction																				
7 Manufacturing																				
8 Electric Utilities																				
9 Other Industries																				
REGIONAL																				
10 Agriculture									.00210	.00282	.00323			.00618		.20218	.00072	.00155	0.0168	0.0010
11 Mining	0.06066	0.00007	0.00352	0.00183	0.00025			0.00372	0.00026	0.00037	0.01610	0.00167	0.02419	0.03824	0.01086	0.02512	0.00998	0.00091		
12 Construction																				0.3803
13 Food	.00007		.00024			.00001			.00562	.00142	.00862		.00004	.02136		.00561	.00123	.02702	0.0300	0.0013
14 Leather, Apparel, Textiles	.00380	.00404	.00570	.00426	.00252	.00956	.00250	.01865	.02614	.03888	.00394	.00859	.00020	.00584	.00466	.00499	.03904	.01595	0.00056	0.00003
15 Paper, Lumber, Furniture	.00827	.00559	.02180	.03409	.03251	.03750	.06079	.02489	.05787	.08342	.00591	.00197	.00197	.03980	.01094	.00444	.01984	.01721	0.0006	0.0002
16 Newspaper, Periodical, & Book Publishing & Printing	.00130	.00026	.00319	.00307	.00055	.00127	.00223	.00194	.00112	.00733	.00650	.09181	.00051	.00949	.03420	.00511	.16414	.05136	0.0084	0.0043
17 Chemicals	.06674	.03538	.04391	.06280	.11961	.09458	.04526	.07073	.08462	.10993	.16071	.01988	.02718	.04891	.01370	.04749	.06245	.11587	0.0431	0.0216
18 Primary Metals	.43873	.36846	.33856	.36179	.30730	.25564	.12080	.26942	.15491	.15170	.00827	.01868	.00562	.01002		.00511	.00983	.00101	0.0012	0.0001
19 Fabricated Metals	.11967	.16733	.10813	.06835	.07999	.20374	.06625	.14448	.07566	.05120	.00491	.00235	.01618	.00852		.00211	.00564	.00329	0.0024	0.0012
20 Machinery, Engines & Turbines																			0.0004	0.0001
21 Machinery, Farm																				0.0004
22 Machinery, Construction & Mining																				0.0017
23 Machinery, Metalworking																			0.0001	0.0001
24 Machinery, Special	.02146	.01994	.05131	.00455	.00898	.00194	.00191	.02300	.01312	.09364	.00058			.00088		.00077	.00278	.00003	0.0012	0.0044
25 Elec. Mach., Transmission Distribution & Industrial																			0.0001	0.0001
26 Electrical Machinery, Lighting & Medical	.00937	.00223	.00799	.04959	.14980	.01608	.02122	.03086	.01224	.01684	.00691	.00364	.00029	.00272	.00016	.00055	.00517	.00184	0.0020	0.0010
27 Electrical Machinery, Household Appliances	.00032	.00628	.01748	.00152	.00264	.02129	.00095	.00487	.00145	.00219				.00096		.00094	.01110		0.0083	
28 Electrical Machinery, Communications & Components	.00214	.00049	.04164	.09792	.02244	.00059	.38519	.05594	.07083	.04455	.00368	.10504	.00039	.00295		.00222	.02286	.00173	0.0052	0.0015
29 Transportation Equipment														0.03132					0.00160	0.00015
30 Instruments	.00019	.00046	.00147	.00173	.00047	.00290	.00326	.00308	.04695	.00081			.00002	.00146		.00044	.01693	.01150	0.0028	0.0025
31 Miscellaneous Manufacturing	.02534	.01165	.00626	.00784	.00806	.00342	.04231	.08241	.06425	.08348	.00786	.03881	.00236	.01356	.01380	.00422	.04582	.01902	0.0238	0.0078
32 Transportation	.03902	.02659	.03183	.03151	.02722	.03144	.02258	.04206	.02911	.02799	.18756	.01389	.03807	.01598	.02042	.03488	.01496	.01910	0.0298	0.0099
33 Communication	.00922	.02662	.01949	.01068	.00594	.00823	.00627	.00976	.00966	.01028	.02340	.07945	.00477	.04084	.03576	.02121	.07298	.03031	0.0135	0.0047
34 Electrical, Gas, & Sanitary Utilities	.01849	.02287	.01875	.02475	.01571	.01654	.01438	.01943	.01273	.01211	.08119	.08241	.64808	.13129	.04535	.08398	.05869	.07104	0.0311	0.0138
35 Trade	.10614	.09640	.11974	.08206	.10482	.08372	.08458	.07952	.10929	.09582	.08664	.04326	.02457	.06382	.02221	.09581	.08288	.06692	0.2122	0.0045
36 Banking & Insurance	.02048	.02547	.01854	.01189	.00879	.00648	.00779	.01077	.01313	.01571	.06055	.04522	.01132	.06374	.46817	.18519	.03597	.04214	0.0407	0.0047
37 Real Estate	.01839	.05713	.02657	.02023	.01734	.01044	.02211	.01291	.02585	.01911	.08829	.13848	.00571	.20364	.17867	.11370	.10288	.24809	0.1378	0.0058
38 Services, Except Medical	.07712	.07981	.08755	.08829	.06442	.19127	.07782	.05454	.11488	.07368	.12847	.25506	.03173	.30258	.12861	.16208	.21205	.20692	0.0654	0.0179
39 Services, Medical	.00271	.00306	.00261	.00260	.00202	.00198	.00201	.00280	.00236	.00213	.00270	.00733	.00168	.00384	.01219	.00338	.00169	.04717	0.0705	0.0077
40 Households																				
41 Government																				

Table A-19

AUTOMOBILE AVAILABILITY AND NUMBER OF PERSONS PER AUTOMOBILE BY COUNTY FOR THE REGION (1950 - 1990)

Year	County													
	Kenosha		Milwaukee		Ozaukee		Racine		Walworth		Washington		Waukesha	
	Autos Available	Persons per Auto	Autos Available	Persons per Auto	Autos Available	Persons per Auto	Autos Available	Persons per Auto	Autos Available	Persons per Auto	Autos Available	Persons per Auto	Autos Available	Persons per Auto
1950. . . .	18,400	4.11	197,600	4.41	6,500	3.60	26,900	4.07	12,100	3.44	9,400	3.61	22,700	3.78
1955. . . .	24,500	3.53	244,400	3.96	8,900	3.24	34,700	3.61	15,100	3.06	11,600	3.19	33,500	3.19
1960. . . .	32,500	3.10	288,800	3.58	12,600	3.05	43,200	3.28	18,000	2.91	14,300	3.22	51,800	3.06
1965. . . .	38,100	2.94	328,100	3.36	15,900	2.89	53,300	2.93	21,100	2.70	18,300	2.84	71,100	2.70
1970. . . .	45,700	2.74	373,100	3.14	20,000	2.70	64,400	2.69	24,400	2.56	22,000	2.64	89,900	2.54
1975. . . .	51,300	2.71	409,100	3.02	24,400	2.62	73,900	2.61	26,800	2.50	25,800	2.52	110,800	2.45
1980. . . .	59,000	2.66	446,900	2.92	29,300	2.56	83,700	2.59	29,500	2.47	29,900	2.47	133,900	2.40
1985. . . .	68,400	2.61	484,100	2.84	35,300	2.52	96,300	2.56	32,600	2.45	34,400	2.45	160,800	2.38
1990. . . .	78,300	2.58	521,700	2.77	42,500	2.49	111,200	2.54	35,600	2.44	39,500	2.43	194,000	2.36

Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Table A-20

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASSIFICATION FOR KENOSHA COUNTY (1950 - 1990)
(in Thousands)

Year	Total	Trucks Under 8,000 Pounds Net Weight	Farm Trucks	Trucks Over 8,000 Pounds Net Weight	Tractor-Trailer Combinations	Municipal Trucks
1950. . . .	3.5	1.4	0.9	1.1[a]	--[a]	0.1
1955. . . .	4.3	1.9	1.0	0.7	0.5	0.2
1960. . . .	5.5	2.1	1.0	0.9	1.3	0.2
1965. . . .	5.5	2.7	1.1	0.9	0.5	0.3
1970. . . .	6.2	3.2	1.2	0.9	0.5	0.4
1975. . . .	6.9	3.6	1.1	1.0	0.7	0.5
1980. . . .	7.5	3.9	1.2	1.0	0.8	0.6
1985. . . .	8.0	4.1	1.3	1.1	0.8	0.7
1990. . . .	8.5	4.4	1.3	1.1	0.9	0.8

[a] *Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.*

Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Table A-21

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASSIFICATION FOR MILWAUKEE COUNTY (1950 - 1990)
(in Thousands)

Year	Total	Trucks Under 8,000 Pounds Net Weight	Farm Trucks	Trucks Over 8,000 Pounds Net Weight	Tractor-Trailer Combinations	Municipal Trucks
1950. . . .	27.3	15.2	1.3	9.4[a]	--[a]	1.4
1955. . . .	27.9	14.3	1.0	8.9	2.1	1.6
1960. . . .	28.8	14.0	0.7	9.3	2.9	1.9
1965. . . .	29.2	13.9	0.7	9.0	3.4	2.2
1970. . . .	30.4	14.1	0.7	9.1	4.1	2.4
1975. . . .	31.1	14.2	0.6	9.3	4.4	2.6
1980. . . .	31.9	14.5	0.6	9.3	4.7	2.8
1985. . . .	32.6	14.7	0.5	9.3	5.0	3.1
1990. . . .	33.4	14.9	0.5	9.4	5.2	3.4

[a] *Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.*

Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Table A-22

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASSIFICATION FOR OZAUKEE COUNTY (1950 - 1990)
(in Thousands)

Year	Total	Trucks Under 8,000 Pounds Net Weight	Farm Trucks	Trucks Over 8,000 Pounds Net Weight	Tractor-Trailer Combinations	Municipal Trucks
1950. . . .	2.0	0.5	0.9	0.5[a]	--[a]	0.1
1955. . . .	2.2	0.7	0.8	0.5	0.1	0.1
1960. . . .	2.4	0.8	0.8	0.5	0.1	0.2
1965. . . .	2.6	0.9	0.8	0.6	0.1	0.2
1970. . . .	2.8	1.1	0.7	0.6	0.2	0.2
1975. . . .	3.1	1.2	0.7	0.6	0.2	0.4
1980. . . .	3.4	1.3	0.7	0.6	0.3	0.5
1985. . . .	3.7	1.4	0.7	0.7	0.3	0.6
1990. . . .	4.0	1.6	0.6	0.7	0.4	0.7

[a] *Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.*
Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Table A-23

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASSIFICATION FOR RACINE COUNTY (1950 - 1990)
(in Thousands)

Year	Total	Trucks Under 8,000 Pounds Net Weight	Farm Trucks	Trucks Over 8,000 Pounds Net Weight	Tractor-Trailer Combinations	Municipal Trucks
1950. . . .	4.7	1.9	1.3	1.3[a]	--[a]	0.2
1955. . . .	5.7	2.4	1.4	1.2	0.4	0.3
1960. . . .	6.4	2.7	1.4	1.5	0.5	0.3
1965. . . .	7.3	3.4	1.5	1.4	0.6	0.4
1970. . . .	8.0	3.9	1.5	1.4	0.7	0.5
1975. . . .	8.8	4.3	1.5	1.5	0.9	0.6
1980. . . .	9.6	4.8	1.6	1.5	1.0	0.7
1985. . . .	10.2	5.2	1.6	1.5	1.1	0.8
1990. . . .	10.9	5.5	1.6	1.6	1.2	1.0

[a] *Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.*
Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Table A-24

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASSIFICATION FOR WALWORTH COUNTY (1950 - 1990)
(in Thousands)

Year	Total	Trucks Under 8,000 Pounds Net Weight	Farm Trucks	Trucks Over 8,000 Pounds Net Weight	Tractor-Trailer Combinations	Municipal Trucks
1950. . . .	3.7	1.3	1.5	0.8[a]	--[a]	0.1
1955. . . .	4.2	1.4	1.7	0.8	0.1	0.2
1960. . . .	4.6	1.6	1.8	0.9	0.1	0.2
1965. . . .	5.0	1.9	1.8	0.8	0.2	0.3
1970. . . .	5.5	2.3	1.8	0.9	0.2	0.3
1975. . . .	6.1	2.7	1.9	0.9	0.2	0.4
1980. . . .	6.6	3.0	1.9	0.9	0.3	0.5
1985. . . .	7.1	3.3	1.9	1.0	0.3	0.6
1990. . . .	7.7	3.6	1.9	1.0	0.4	0.8

[a] *Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.*
Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Table A-25

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASSIFICATION FOR WASHINGTON COUNTY (1950 - 1990)
(in Thousands)

Year	Total	Trucks Under 8,000 Pounds Net Weight	Farm Trucks	Trucks Over 8,000 Pounds Net Weight	Tractor-Trailer Combinations	Municipal Trucks
1950. . . .	2.9	0.7	1.3	0.8[a]	--[a]	0.1
1955. . . .	3.2	0.8	1.4	0.7	0.1	0.2
1960. . . .	3.6	1.0	1.4	0.8	0.2	0.2
1965. . . .	4.0	1.3	1.4	0.8	0.2	0.3
1970. . . .	4.4	1.6	1.5	0.8	0.2	0.3
1975. . . .	4.9	1.9	1.5	0.9	0.3	0.3
1980. . . .	5.4	2.2	1.6	0.9	0.3	0.4
1985. . . .	5.8	2.5	1.6	0.9	0.3	0.5
1990. . . .	6.4	2.9	1.6	0.9	0.4	0.6

[a] *Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.*

Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Table A-26

MOTOR TRUCK AVAILABILITY TRENDS AND FORECASTS BY CLASSIFICATION FOR WAUKESHA COUNTY (1950 - 1990)
(in Thousands)

Year	Total	Trucks Under 8,000 Pounds Net Weight	Farm Trucks	Trucks Over 8,000 Pounds Net Weight	Tractor-Trailer Combinations	Municipal Trucks
1950. . . .	5.3	1.8	2.1	1.2[a]	--[a]	0.2
1955. . . .	6.6	2.6	2.0	1.5	0.2	0.3
1960. . . .	8.2	3.4	2.0	2.1	0.3	0.4
1965. . . .	9.8	4.5	1.9	2.5	0.4	0.5
1970. . . .	11.3	5.5	1.8	2.8	0.6	0.6
1975. . . .	12.6	6.3	1.8	3.1	0.7	0.7
1980. . . .	13.8	7.1	1.7	3.3	0.8	0.9
1985. . . .	14.7	7.6	1.7	3.4	0.9	1.1
1990. . . .	15.4	8.1	1.6	3.5	1.0	1.2

[a] *Trucks over 8,000 pounds net weight and tractor-trailer combinations were not recorded separately in 1950.*

Source: State of Wisconsin Motor Vehicle Department; SEWRPC.

Table A-27

LAND USE PLANNING STANDARDS RANKED IN ORDER OF IMPORTANCE FOR EACH LAND USE DEVELOPMENT OBJECTIVE

OBJECTIVE NO. 1

A balanced allocation of space to the various land use categories which meets the social, physical, and economic needs of the regional population.

STANDARDS

1. Residential Land	
Low Density	250 acres/1000 persons
Medium Density	70 acres/1000 persons
High Density	25 acres/1000 persons
2. Park and Recreation Land	
Regional	4 acres/1000 persons
Local	10 acres/1000 persons
3. Industrial Land	7 acres/100 added employees
4. Commercial Land	5 acres/100 added employees
5. Governmental and Institutional Land	
Regional	3 acres/1000 added population
Local	6 acres/1000 added population

OBJECTIVE NO. 2

A spatial distribution of the various land uses which will result in a compatible arrangement of land uses.

STANDARDS

1. Residential uses should be located within planning units which contain, within a reasonable walking distance, necessary supporting local service uses, such as neighborhood park, local commercial and elementary school facilities, and should have reasonable access through the appropriate component of the transportation system to employment, commercial and cultural centers, and secondary school facilities.

2. Industrial uses should be located to have direct access to highway facilities and reasonable access through the appropriate component of the transportation system to residential areas and to railways and airport facilities and should not be intermixed with commercial, residential, governmental, recreational, or institutional land uses.

3. Regional commercial uses should be located in centers of concentrated activity on only one side of an arterial street and should be afforded direct access to the arterial street system.

OBJECTIVE NO. 3 A

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.

STANDARDS

1. Urban development, particularly for residential use, shall be located only in those areas which do not contain significant concentrations of soils rated in the regional detailed operational soil survey as poor, questionable, or very poor for such development. Significant concentrations are defined as follows:

a. In areas to be developed for low-density residential use, no more than 2.5 percent of the gross area should be covered by soils rated in the regional soil survey as poor, questionable, or very poor for such development.

b. In areas to be developed for medium-density residential use, no more than 3.5 percent of the gross area should be covered by soils rated in the regional soil survey as poor, questionable, or very poor for such development.

c. In areas to be developed for high-density residential use, no more than 5.0 percent of the gross area should be covered by soils rated in the regional soil survey as poor, questionable, or very poor for such development.

2. Land developed or proposed to be developed without public sanitary sewer service should be located only on areas covered by soils rated in the regional soil survey as very good, good, or fair for such development.

3. Rural development, principally agricultural land uses, shall be allocated primarily to those areas covered by soils rated in the regional soil survey as very good, good, or fair for such uses.

OBJECTIVE NO. 3 B

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: Inland Lakes and Streams.

STANDARDS

1. A minimum of 25 percent of the perimeter or shoreline frontage of lakes having a surface area in excess of 50 acres and of both banks of all perennial streams should be maintained in a natural state.

2. No unauthorized structure or fill should be allowed to encroach upon and obstruct the flow of water in the perennial stream channels and floodways.

3. Flood plain lands should not be allocated to any urban development which would cause or be subject to flood damage.

4. A minimum of 10 percent of the shoreline of each inland lake having a surface area in excess of 50 acres should be maintained for public uses, such as a beach area, pleasure craft marina, or park.

5. Not more than 50 percent of the length of the shoreline of inland lakes having a surface area in excess of 50 acres and of perennial streams should be allocated to urban development except park and outdoor recreational uses.

6. In addition, it is desirable that 25 percent of the shoreline of each inland lake having a surface area less than 50 acres be maintained in either a natural state or some low-intensity public use, such as park land.

OBJECTIVE NO. 3 C

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: Wetlands.

1. All wetland areas adjacent to streams or lakes, all wetlands within areas having special wildlife values, and all wetlands having an area in excess of 50 acres should not be allocated to any urban development except limited recreation and should not be drained or filled. Adjacent surrounding areas should be kept in open-space use, such as agriculture or limited recreation.

OBJECTIVE NO. 3 D

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: Woodlands.

STANDARDS

1. A minimum of 10 percent of the land area of each watershed within the Region should be devoted to woodlands.

2. A minimum regional aggregate of 5 acres of woodland per 1,000 population should be maintained for recreational pursuits.

3. For demonstration and educational purposes, the woodland cover within each county should include a minimum of 40 acres devoted to each major forest type: oak-hickory, northern hardwood, pine species, and lowland forest.

OBJECTIVE NO. 3 E

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: Wildlife.

STANDARD

1. The most suitable habitat for wildlife, that is, the area wherein fish and game can best be fed, sheltered, and reproduced, is a natural habitat. Since 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.

OBJECTIVE NO. 4

A spatial distribution of the various land uses which is properly related to the supporting transportation and public utility systems in order to assure the economical provision of utility and municipal services.

STANDARDS

1. Urban development should be located so as to maximize the use of existing transportation and utility systems.

2. The transportation system should be located and designed to provide access not only to all land presently devoted to urban development but to all land well suited for urban development.

3. Land developed or proposed to be developed for medium- and high-density residential use should be located in a gravity drainage area tributary to an existing or proposed public sanitary sewerage system.

4. Land developed or proposed to be developed for medium- and high-density residential use should be located in areas serviceable by an existing or proposed public water supply system.

5. The transportation system should be located and designed to avoid the penetration of prime natural resource areas by through traffic.

6. The transportation system should be located and designed to avoid the penetration of residential planning units by through traffic.

7. Transportation terminal facilities, such as off-street parking, should be located in close proximity to the principal land uses to which they are accessory.

OBJECTIVE NO. 5

The development and conservation of residential areas within a physical environment that is healthy, safe, convenient, and attractive.

STANDARDS

1. Residential planning units should be physically self-contained within clearly defined and relatively permanent isolating boundaries, such as arterial streets and highways, major park and open-space reservations, or significant natural features, such as rivers, streams, or hills.

2. Residential planning units should contain enough area to provide: housing for the population served by one elementary school and one neighborhood park; an internal street system which discourages penetration of the unit by through traffic; and all of the community and commercial facilities necessary to meet day-to-day living requirements of the family within the immediate vicinity of its dwelling unit. To meet these requirements at varied residential densities, the following specific standards should be met:

Land Use	Low-Density Development (2 miles square) Percent of Area	Medium-Density Development (1 mile square) Percent of Area	High-Density Development (1/2 mile square) Percent of Area
Residential.	80.0	71.0	66.0
Streets and Utilities.	16.5	23.0	25.0
Parks and Playgrounds.	1.5	2.5	3.5
Public Elementary School	0.5	1.5	2.5
Other Governmental and Institutional	1.0	1.0	1.5
Commercial	0.5	1.0	1.5
Total	100.0	100.0	100.0

3. Each residential planning unit should be designed to include a wide range of housing types, designs, and costs.

OBJECTIVE NO. 6

The preservation and provision of a variety of suitable industrial and commercial sites both in terms of physical characteristics and location.

STANDARDS

1. New industrial development should be located in planned industrial districts which meet the following standards:

   a. Direct access to high speed, all-weather highway facilities.

   b. Reasonable access to railroad facilities.

   c. Reasonable access to airport facilities for the movement of both passengers and freight.

   d. Available adequate water supply.

   e. Available adequate sanitary sewer service.

   f. Available adequate storm water drainage facilities.

   g. Available adequate power supply.

   h. Soils rated in the regional soil survey as very good, good, or fair for such development.

2. New regional commercial development, which would include activities primarily associated with the sale of shopper's goods, should be concentrated in regional commercial centers which meet the following minimum standards:

   a. Accessibility to a population of between 75,000 and 150,000 persons located within either a 20 minute one-way travel period or a ten-mile radius.

b. Direct access to the arterial street system.

c. Available adequate water supply.

d. Available adequate sanitary sewer service.

e. Available adequate storm water drainage facilities.

f. Available adequate power supply.

g. A minimum site area of 60 acres.

h. Soils rated in the regional soil survey as very good, good, or fair for such development.

In addition to the above minimum standards, the following site development standards are desirable:

provision of off-street parking for at least 5,000 cars.

provision of adequate off-street loading facilities.

provision of well-located points of ingress and egress which are controlled to prevent traffic congestion on adjacent arterial streets.

provision of adequate screening to serve as a buffer between the commercial use and adjacent noncommercial uses.

provision of adequate building setbacks from major streets.

3. New local commercial development, which includes activities primarily associated with the sale of convenience goods and services, should be contained within the residential planning units, the total area devoted to the commercial use varying with the residential density:

a. In low-density areas, land devoted to local commercial centers should comprise at least 0.5 percent of the total gross residential area or about 3.2 acres per square mile of gross residential land use.

b. In medium-density areas, land devoted to local commercial centers should comprise at least 1.0 percent of the total gross residential area or about 6.4 acres per square mile of gross residential land use.

c. In high-density areas, land devoted to local commercial centers should comprise at least 1.5 percent of the total gross residential area or about 9.6 acres per square mile of gross residential land use.

OBJECTIVE NO. 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.

STANDARDS

1. Regional park and recreation open spaces should be provided within an approximately one-hour travel time of every dwelling unit in the Region and should have a minimum site area of 250 acres.

2. Local park and recreation open spaces should be provided within a maximum service radius of one-half mile of every dwelling unit in an urban area, and each site should be of sufficient size to accommodate a maximum tributary service area population at a use intensity of 675 persons per acre.

3. Areas having unique scientific, cultural, scenic, or educational value should not be allocated to any urban or agricultural land uses; and adjacent surrounding areas should be retained in open space use, such as agriculture or limited recreation.

OBJECTIVE NO. 8

The preservation of land areas for agricultural uses in order to provide for certain special types of agriculture, provide a reserve for future needs, and ensure the preservation of those unique rural areas which provide wildlife habitat and which are essential to shape and order urban development.

STANDARDS

1. All prime agricultural areas should be preserved.

2. All agricultural lands surrounding adjacent high-value scientific, educational, or recreational resources and covered by soils rated in the regional detailed operational soil survey as very good, good, or fair for agricultural use should be preserved.

Table A-28

TRANSPORTATION STANDARDS RANKED IN ORDER OF IMPORTANCE FOR EACH TRANSPORTATION SYSTEM DEVELOPMENT OBJECTIVE

OBJECTIVE NO. 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.

STANDARDS

1. Highway transportation facilities should be located and designed so as to provide adequate capacity, that is, a volume-to-capacity ratio equal to, or less than, 1.0 based on 24-hour average weekday traffic volumes, to meet the existing and potential travel demand between the various land uses consistent with the trip generating and trip interaction characteristics of these uses and the resulting forecast of travel.

2. The relative accessibility provided by the regional transportation system should be adjusted to the land use plan, and areas in which development is to be induced should have a higher relative accessibility than areas which should be protected from development.

OBJECTIVE NO. 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.

STANDARDS

1. Street and Highway System

   a. Arterial streets and highways should be provided at intervals of no more than one-half mile in each direction in high-density residential areas, at intervals of no more than one mile in each direction in medium-density residential areas, and at intervals of no more than two miles in each direction in all low-density residential areas.

   b. Freeways or expressways should be provided for all routes within the Region where all of the following criteria are met:

      1) The route provides intercommunity service;
      2) The desired speeds or a volume-to-capacity ratio of 1.0 requires control of access and uninterrupted flow;

3) Alternative routes exist or will be provided to adequately serve local traffic; and
4) Potential average weekday traffic exceeds 25,000 vpd. in urban areas and 15,000 vpd. in rural areas.

2. Transit System

a. Transit service of an appropriate type should be provided for all routes within the Region wherein the minimum potential average weekday revenue passenger loading equals or exceeds the following values:

Type of Transit Service	Minimum Potential Average Weekday Revenue Passengers	Transit Service Area Radius (miles)
Local Transit	600/day/bus	¼ in high-density residential areas ½ in medium and low-density residential areas
Modified Rapid Transit		
A. All Day	600/day/bus	3
B. Limited	300/4-hrs./bus	3
Bus Rapid Transit	21,000/day/preempted freeway lane	3
	For separate right-of-way, see Appendix A	3
Rail Rapid Transit	See Appendix A	3

b. Service Level

1) Local transit routes should be provided at intervals of no more than one-half mile in all high-density residential areas.
2) Modified rapid transit or rapid transit service should be provided as necessary to reduce peak loadings on arterial streets and highways in order to maintain a desirable level of transportation service between component parts of the Region.
3) Maximum operating headways for all transit service throughout the daylight hours should not exceed one hour.
4) Loading factors should not exceed:

Type of Transit Service	Maximum Loading Factor For Periods Exceeding 10 Minutes (percent)
Local Transit	
A. 10 minute headway on route	100
B. 5-10 minute headway on route	125
C. Less than 5 minute headway on route	140
Modified Rapid Transit	100
Bus Rapid Transit	100
Rail Rapid Transit	100

5) The average distance between transit stops should not be less than:

Type of Transit Service	Average Distance Between Stops
Local Transit	660 feet
Modified Rapid Transit	No stops between terminal areas
Bus Rapid Transit	2 miles (for line haul sections)
Rail Rapid Transit	2 miles (for line haul sections)

6) Transit routes should be direct in alignment, with a minimum number of turning movements, and arranged to minimize transfers and duplication of service.

c. The proportion of transit ridership to the central business district of each urbanized area within the Region should be maintained at least at the present level and increased if possible.

3. Parking

a. Parking should be provided at park-and-ride transit stations to accommodate the total parking demand generated by trips which change from auto to transit modes at each such station.

b. In the major central business districts of the Region, parking should be provided sufficiently near concentrations of demand so that 80 percent of the short-term parkers need walk no more than one block.

c. On a gross area basis, parking in the major central business districts of the Region should be provided at the following minimum levels:

Urbanized Area Population	Spaces Per 1,000 Auto CBD Destinations
50,000	110
100,000	140
500,000	210
1,000,000	235
2,000,000	255

OBJECTIVE NO. 3

The alleviation of traffic congestion and the reduction of travel time between component parts of the Region.

STANDARDS

1. The total vehicle-hours of travel within the Region should be minimized.

2. The proportion of total travel on freeway, expressway, and rapid and modified rapid transit facilities should be maximized.

3. Adequate capacity and a sufficiently high level of geometric design should be provided to achieve the following overall speeds based on potential 24-hour average weekday traffic volumes for arterial street and highway facilities:

Type of Facility	Overall Speed in M.P.H. for Various Type Areas			
	Downtown	Intermediate	Outlying	Rural
A. Arterials:				
1. Freeway	35-55	40-55	55-65	60-70
2. Expressway	25-40	30-45	40-50	50-65
3. Standard Arterials:				
a. Divided	15-25	25-35	35-45	45-60
b. Undivided	15-25	20-35	25-40	40-50
B. Collectors	10-20	15-30	20-35	40-50
C. Locals	5-15	10-20	15-25	30-40

OBJECTIVE NO. 4

The reduction of accident exposure and the provision of increased travel safety.

STANDARDS

1. Travel on facilities which exhibit the lowest accident exposure, that is, freeways, expressways, and all forms of transit, should be maximized.

2. Traffic congestion and vehicle conflicts should be reduced by maintaining a volume-to-capacity ratio equal to or less than 0.9, based on 24-hour average weekday traffic volumes.

OBJECTIVE NO. 5

A transportation system which is both economical and efficient, meeting all other objectives at the lowest cost possible.

STANDARDS

1. The sum of transportation system operating and capital investment costs should be minimized.

2. Full use should be made of all existing and committed major transportation facilities, and such facilities should be supplemented only with such additional major facilities as necessary to serve the anticipated travel demand derived from the land use plan at the desired level of service.

3. The total vehicle miles of travel should be minimized by reducing trip length, total number of trips made, or both.

OBJECTIVE NO. 6

The minimization of disruption of desirable existing neighborhood and community development and of the deterioration or destruction of the natural resource base.

STANDARDS

1. The proper use of land for, and adjacent to, transportation facilities should be maximized and disruption of future development minimized through advance reservation of the following minimum rights-of-way for highway facilities:

Type of Facility	Right-of-Way Width To Be Reserved
Freeway (6 lane)	300 feet
(8 lane)	325 feet
Expressway (4 lane)	200 feet
Standard Arterial Streets and Highways	130 feet
Collector Streets	80 feet

2. The penetration of neighborhood units and of neighborhood facility service areas by arterial streets and highways and rapid transit routes should be avoided.

3. The dislocation of families, businesses, and industries should be minimized.

4. Transportation facilities should not be located in or through environmental corridors except as necessary to serve the proper utilization of these areas.

5. The use of land for transportation and supporting terminal facilities should be minimized.

6. The destruction of historic buildings and of historic, scenic, scientific, and cultural sites should be avoided.

OBJECTIVE NO. 7

A high aesthetic quality in the transportation system with proper visual relation of the major transportation facilities to the land and cityscape.

STANDARDS

1. Transportation facility construction plans should be developed using good geometric, structural, and landscape design standards which consider the aesthetic quality of the transportation facilities and the areas through which they pass.

2. Transportation facilities should be located to avoid destruction of visually pleasing buildings, structures, and natural features and to avoid interference with vistas to such features.

Table A-29

MATRIX TABLES FOR EVALUATION OF THE SATISFACTION OF THE LAND USE DEVELOPMENT OBJECTIVES FOR EACH ALTERNATIVE LAND USE PLAN

OBJECTIVE NO. 1

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Residential Land	5	3	3	3
a. Low-Density, 250 acres/1,000 persons		3	3	3
b. Medium-Density, 70 acres/1,000 persons		3	3	3
c. High-Density, 25 acres/1,000 persons		3	3	3
2. Park and Recreation Land	4	3	1	2
a. Regional, 4 acres/1,000 added population		3	3	3
b. Local, 10 acres/1,000 added population		3	1	2
3. Industrial Land	3	2	1	3
a. 7 acres/100 added employees		2	1	3
4. Commercial Land	2	2	1	3
a. 5 acres/100 added employees		2	1	3
5. Governmental and Institutional Land	1	2	2	2
a. Regional, 3 acres/1,000 added population		2	2	2
b. Local, 60 acres/1,000 added population		2	2	2
Plan Value (V)		39	26	40
Rank Order Value		2	1	3

OBJECTIVE NO. 2

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Residential Planning Units	3	1	1	1
2. Major Industrial Land Location	2	3	3	3
3. Regional Commercial Land Location	1	3	3	3
Plan Value (V)		12	12	12
Rank Order Value		2	2	2

OBJECTIVE NO. 3

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Soils	5	3	3	3
a. Urban uses		3	3	3
b. Rural uses		3	3	3
c. Sanitary sewer areas		3	3	3
2. Inland Lakes and Streams.	4	2	2	2
a. Lakes, 25 percent of shore in natural state		2	2	2
Streams, 25 percent of shore in natural state		2	2	2
b. Restrict development in channels and floodways.		3	3	3
c. Restrict urban use in flood plains		3	3	3
d. Inland lakes, 10 percent of shore in public use.		2	2	2
e. Inland lakes, 50 percent of shore in nonurban use.		2	2	2
Streams, 50 percent of shore in nonurban use.		2	2	2
f. Small inland lakes, 25 percent of shore in natural state		1	1	1
3. Wetlands.	3	3	3	3
a. Protect wetlands over 50 acres and those with high resource value		3	3	3
4. Woodlands	2	2	2	2
a. 10 percent of each watershed		2	2	2
b. 5 acres/1,000 population		3	3	3
c. 40 acres of each of 4 types.		1	1	1
5. Wildlife.	1	3	3	3
a. Maintain a wholesome habitat		3	3	3
Plan Value (V)		39	39	39
Rank Order Value		2	2	2

OBJECTIVE NO. 4

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Maximize Use of Existing Transportation and Utility Facilities.	7	3	3	3
2. Transportation Service to Appropriate Areas	6	1	1	1
3. Sewer Service to Residential Areas.	5	3	2	1
4. Water Supply to Residential Areas	4	3	2	1
5. Major Transportation Penetrating Resource Area	3	2	2	2
6. Major Transportation Route Penetrating Residential Planning Units.	2	1	1	1
7. Transportation Terminal Areas	1	1	1	1
Plan Value (V)		63	54	45
Rank Order Value		3	2	1

OBJECTIVE NO. 5

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Physical Self-Containment of Residential Planning Units.	3	1	1	1
2. Appropriate Land Uses Within Residential Planning Units.	2	1	1	1
3. Variety of Housing Within Residential Planning Units.	1	1	1	1
Plan Value (V)		6	6	6
Rank Order Value		1	1	1

OBJECTIVE NO. 6

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Major Industrial Site Requirements.	3	3	3	3
2. Major Commercial Site Requirements.	2	3	3	3
3. Local Commercial Site Requirements.	1	1	1	1
Plan Value (V)		16	16	16
Rank Order Value		2	2	2

OBJECTIVE NO. 7

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Regional Park Spatial Locations	3	3	3	3
2. Local Park Spatial Locations.	2	1	1	1
3. Unique Value Sites.	1	3	3	3
Plan Value (V)		14	14	14
Rank Order Value		2	2	2

OBJECTIVE NO. 8

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Preserve Prime Agricultural Areas	2	1	2	3
2. Preserve Other Appropriate Agricultural Areas	1	1	3	2
Plan Value (V)		3	7	8
Rank Order Value		1	2	3

Table A-30

MATRIX TABLES FOR EVALUATION OF THE SATISFACTION OF THE TRANSPORTATION SYSTEM DEVELOPMENT OBJECTIVES FOR EACH ALTERNATIVE LAND USE PLAN

OBJECTIVE NO. 1

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Volume-to-Capacity Ratio Equal to or Less Than 1.0.	2	2	2	3
2. Adequate Accessibility	1	3	1	2
Plan Value (V).		7	5	8
Rank Order Value.		2	1	3

OBJECTIVE NO. 2

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Street and Highway System	3	3	3	3
a. Arterial streets and highway warrants. . .		3	3	3
h. Freeway and Expressway warrants.		3	3	3
2. Transit System.	2	3	2	1
a. Service warrants		1	1	1
b. Service level.		1	1	1
c. Percent transit to CBD		3	2	1
3. Parking	1	1	1	1
a. Parking at park and ride stations.		1	1	1
b. Walking distance for short term parkers. .		1	1	1
c. Parking spaces in CBD.		1	1	1
Plan Value (V)		16	14	12
Rank Order Value		3	2	1

OBJECTIVE NO. 3

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Minimize the Vehicle Hours of Travel.	3	3	2	1
2. Maximize the Proportion of Total Travel on Freeways, Expressways, Rapid and Modified Rapid Transit.	2	2	3	1
3. Overall Speeds.	1	3	3	3
Plan Value (V)		16	15	8
Rank Order Value		3	2	1

OBJECTIVE NO. 4

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Maximize the Proportion of Total Travel on Freeways, Expressways, Rapid and Modified Rapid Transit.	2	2	3	1
2. Volume-to-Capacity Ratio Equal to or Less Than 0.9	1	2	1	3
Plan Value (V)		6	7	5
Rank Order Value		2	3	1

OBJECTIVE NO. 5

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Minimize Total Costs.	3	3	2	1
2. Use of Existing Plus Committed Transportation System	2	3	3	3
3. Minimize the Vehicle Miles of Travel.	1	3	2	1
Plan Value (V)		18	14	10
Rank Order Value		3	2	1

OBJECTIVE NO. 6

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Advance Reservation of Right-of-Way	6	2	2	2
2. Minimize Penetration of Neighborhoods	5	1	1	1
3. Minimize Dislocation	4	1	1	1
4. Minimize Penetration of Environmental Corridors	3	1	1	1
5. Minimize Use of Land for Transportation System	2	2	3	1
6. Minimize Destruction of Cultural Sites	1	1	1	1
Plan Value (V)		47	49	45
Rank Order Value		2	3	1

OBJECTIVE NO. 7

Standard	Rank Order Value of Standard (n)	Rank Order Value of Land Use Plans (m)		
		Controlled Existing Trend	Corridor	Satellite City
1. Design Standards	2	1	1	1
2. Visual Axes	1	1	1	1
Plan Value (V)		3	3	3
Rank Order Value		1	1	1

Table A-31

SPECIFIC LAND USE DEVELOPMENT OBJECTIVES
RANKED INTO MAJOR GROUP OBJECTIVES

A. Provide for a Balanced Allocation of Land

1. A balanced allocation of space to the various land use categories which meets the social, physical, and economic needs of the regional population.

B. Provide for an Appropriate Spatial Distribution of Land Uses

1. 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.

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 is properly related to the supporting transportation and public utility systems in order to assure the economical provision of utility and municipal services.

C. Meet the Design Requirements of the Major Land Uses

1. The development and conservation of residential areas within a physical environment that is healthy, safe, convenient, and attractive.

2. 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.

3. The preservation and provision of a variety of suitable industrial and commercial sites both in terms of physical characteristics and location.

4. The preservation of land areas for agricultural uses in order 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.

Table A-32

SPECIFIC TRANSPORTATION SYSTEM OBJECTIVES
RANKED INTO MAJOR GROUP OBJECTIVES

A. Serve Land Use Pattern and Meet Travel Demand

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. The minimization of disruption of desirable existing neighborhood and community development and of the deterioration or destruction of the natural resource base.

3. A high aesthetic quality in the transportation system with proper visual relation of the major transportation facilities to the land and cityscape.

B. Provide Appropriate Transportation at an Adequate Service Level

1. 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.

2. The alleviation of traffic congestion and the reduction of travel time between component parts of the Region.

3. The reduction of accident exposure and the provision of increased travel safety.

C. Provide for an Economical Transportation System.

1. A transportation system which is both economical and efficient, meeting all other objectives at the lowest cost possible.

Table A-33

UNIT COST ESTIMATES PER MILE FOR ARTERIAL STREETS AND HIGHWAYS
(In Thousands of Dollars)

Functional Facility Type	Milwaukee and Eastern Waukesha Counties					Racine and Kenosha Counties East of IH-94					Remainder of Region				
	Right-of-Way	Construction	Engineering	Reconstruction and Repaving	Annual Maintenance	Right-of-Way	Construction	Engineering	Reconstruction and Repaving	Annual Maintenance	Right-of-Way	Construction	Engineering	Reconstruction and Repaving	Annual Maintenance
Two-Lane Arterial															
Downtown.	165	265	15	102	6	100	250	15	92	6	100	250	15	80	6
Outlying.	65	240	15	76	4	50	160	12	66	3	--	--	--	--	--
Rural	--	--	--	--	--	--	--	--	--	--	30	150	10	29	2
Four-Lane Arterial															
Downtown.	330	530	30	138	9	200	400	20	128	8	100	375	20	110	7
Outlying.	130	490	28	102	6	100	350	18	92	5	--	--	--	--	--
Rural	--	--	--	--	--	--	--	--	--	--	75	350	18	50	4
Six-Lane Arterial															
Downtown.	500	800	45	138	12	350	550	22	128	10	--	--	--	--	--
Outlying.	192	740	43	102	8	130	500	20	128	8	--	--	--	--	--
Four-Lane Expressway															
Intermediate. . .	330	1,000	53	136	9	300	475	25	136	9	300	450	25	120	6
Outlying.	174	735	49	136	6	150	425	25	136	7	--	--	--	--	--
Rural	--	--	--	--	--	--	--	--	--	--	75	400	25	120	4
Six-Lane Expressway															
Intermediate. . .	500	1,250	80	160	17	350	550	25	160	10	--	--	--	--	--
Outlying.	261	1,100	73	160	8	200	550	25	160	8	--	--	--	--	--
Four-Lane Freeway															
Downtown.	2,200	1,765	100	140	14	--	--	--	--	--	--	--	--	--	--
Outlying.	450	1,270	75	140	12	400	600	30	140	12	--	--	--	--	--
Rural	--	--	--	--	--	--	--	--	--	--	100	550	30	125	2
Six-Lane Freeway															
Downtown.	3,300	2,650	150	176	20	--	--	--	--	--	--	--	--	--	--
Outlying.	650	1,900	110	176	17	450	750	35	176	14	--	--	--	--	--
Rural	--	--	--	--	--	--	--	--	--	--	125	700	35	160	3
Eight-Lane Freeway															
Downtown.	4,130	3,320	185	210	23	--	--	--	--	--	--	--	--	--	--
Outlying.	814	2,380	140	210	20	--	--	--	--	--	--	--	--	--	--

Source: State Highway Commission of Wisconsin; City of Milwaukee; SEWRPC.

Table A-34

HIGHWAY ACCIDENT RATES PER 100 MILLION VEHICLE MILES OF TRAVEL FOR FREEWAYS AND ARTERIALS IN COMPONENT PARTS OF THE REGION: 1990

Facility Type and Area	Fatality Rate	Injury Rate	Property Damage Rate
Freeways - Milwaukee County. . . .	1.57	NA	127.0
Freeways - Balance of Region . . .	2.27	88.9	67.0
Arterials - Milwaukee County . . .	3.23	NA	522.0
Arterials - Balance of Region. . .	8.98	157.1	162.0

Source: SEWRPC.

Table A-35

ANNUAL ROAD USER COSTS UNDER EACH ALTERNATIVE LAND USE PLAN FOR THE EXISTING PLUS COMMITTED HIGHWAY SYSTEM AND THE PROPOSED HIGHWAY SYSTEMS IN THE REGION: 1990
(In Millions of Dollars)

Cost Item	Controlled Existing Trend Plan	Corridor Plan	Satellite City Plan
Vehicle Operating Costs:			
Existing Plus Committed Network.	$ 664.1	$ 676.9	$ 671.6
Proposed Network.	669.0	671.6	680.5
Travel Time Costs:			
Existing Plus Committed Network.	613.8	621.3	616.5
Proposed Network.	500.1	501.3	501.3
Accident Costs:			
Existing Plus Committed Network.	59.6	60.9	59.8
Proposed Network.	55.9	55.7	56.2
Total Road User Costs:			
Existing Plus Committed Network.	$1,337.5	$1,359.1	$1,347.9
Proposed Network.	$1,225.0	$1,228.6	$1,238.0

Source: SEWRPC.

Appendix B

TECHNICAL COORDINATING AND ADVISORY COMMITTEE ON REGIONAL LAND USE -- TRANSPORTATION PLANNING

SOCIO-ECONOMIC SUBCOMMITTEE

John Doyne
County Executive
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Northwestern Mutual Life Insurance
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University of Wisconsin Extension
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Henry Kinkade
United Community Services
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Carl H. Quast
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City of Milwaukee

Norman N. Gill
Executive Director
Citizen's Govt. Research Bureau
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Industrial Management Department
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Marquette University - Milwaukee

Dr. Eric Schenker - Professor
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University of Wisconsin - Milwaukee

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Park and Planning Commission -
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Wisconsin Department of Resource
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Wisconsin Gas Co.
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Wisconsin Electric Power Company
Milwaukee

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Superintendent, Sewage Disposal Plant
City of Racine

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General Manager, Milwaukee-
Metropolitan Sewerage Commissions
Milwaukee

Hampton Waring
Engineer - Wisconsin Telephone
Company - Milwaukee

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Elkhorn

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Racine

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Park Commission - Milwaukee

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Waukesha Co. Agri-Business Agent
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URBAN AND RURAL LAND USE SUBCOMMITTEE

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Michael Drozd
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City Planner
City of Kenosha

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Village of Hales Corners

Norbert S. Theine
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City of Oak Creek

Bruce B. Wilson
Land Use Planner
State Highway Commission
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City of Kenosha

Francis D. Kuckuck
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Milton W. Schaefer
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City of West Bend

Walter H. Tacke
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City of Milwaukee

Rodney Vanden Noven
Director of Public Works
City of Waukesha

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Wisconsin Motor Carriers Association
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Director of Public Works
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Albert P. Rettler
Washington Co. Highway Commissioner
West Bend

Earl G. Skagen
Racine Co. Highway Commissioner
Sturtevant

Edward J. Stephan
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Sylvester N. Weyker
Highway Engineer, Ozaukee County
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The Milwaukee Road - Milwaukee

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State Highway Commission of
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State Highway Commission of
Wisconsin - District 9 - Milwaukee

Appendix C

INTERGOVERNMENTAL COORDINATING COMMITTEE ON REGIONAL LAND USE -- TRANSPORTATION PLANNING

George C. Berteau	Commissioner and Chairman, SEWRPC, Kenosha County; Committee Chairman
KENOSHA COUNTY	
George P. Connolly	Vice-President, Brown National Bank, Kenosha
Jacob Kammerzelt	County Board Supervisor; SEWRPC Commissioner
Donald L. Klupper	President, Village of Paddock Lake
MILWAUKEE COUNTY	
Phillip J. Fox	Wisconsin Bar Association; Advisory Board of Public Safety Committee; Civil Defense Director - Village of Fox Point
John P. Murphy	County Board Supervisor - City of West Allis; SEWRPC Commissioner
Thomas P. Rozga	South Side Businessmen's Club; Wisconsin National Guard
OZAUKEE COUNTY	
Ray F. Blank	County Board Supervisor; Chairman, County Board; Chairman, County Soil and Water Conservation District; SEWRPC Commisioner
David F. Egelhoff	County Board Supervisor - Village of Thiensville; Chairman, County Highway Committee
Adlai S. Horn	County Board Supervisor - City of Cedarburg; Chairman, County Park Commission; Chairman, County Finance Committee
RACINE COUNTY	
Willard Savage	Chairman - Town of Yorkville; Former County Board Chairman
Garth R. Seehawer	County Board Supervisor - City of Racine; SEWRPC Commissioner
Earl G. Skagen	County Highway Commissioner
WALWORTH COUNTY	
James Baker	Chairman, Agency School Committee of CESA; Former County Board Supervisor; Former Chairman - Town of Spring Prairie
Eugene Hollister	County Board Supervisor; Chairman, County Handicapped School Committee; Chairman, County Zoning and Industrial Division Committee; County Park Board; Lakeland Hospital Committee; SEWRPC Commissioner
Franklin Walsh	County Board Supervisor; Chairman - Town of Linn; Former County Board Chairman; Chairman, County Agriculture Committee; Chairman, County Finance Committee; Chairman, County Welfare Committee; Chairman, County Counseling Center
WASHINGTON COUNTY	
Paul Quick	City of Hartford Plan Commission
Reuben Schmahl	County Board Supervisor; Chairman - Town of Jackson; Chairman, County Highway Committee
Joseph A. Schmitz	County Board Supervisor - Village of Germantown; SEWRPC Commissioner and Vice-Chairman

WAUKESHA COUNTY

Reuben Bartelt	County Board Supervisor - Village of Menomonee Falls; County Highway Committee; Chairman, County Board Reorganization Committee
Mervin L. Brandt	County Board Supervisor; President - Village of Pewaukee; Secretary, Waukesha County Park and Planning Commission; SEWRPC Commissioner
Jerome Gottfried	Mayor - City of Muskego; Former County Board Supervisor; Chairman, County Health Board; County Mental Health Clinic Board

STATE HIGHWAY COMMISSION OF WISCONSIN

Stephan J. Banaszak	District Highway Engineer - District 2
Wesley J. Burmeister	State Highway Engineer
James E. Meier	District Highway Engineer - District 9

Appendix D

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION STAFF

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Bernadette T. Van Altena
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Eugene E. Molitor
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Robert L. Fisher
Senior Planner

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Population & Economic Analyst

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Ned F. Reiter
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