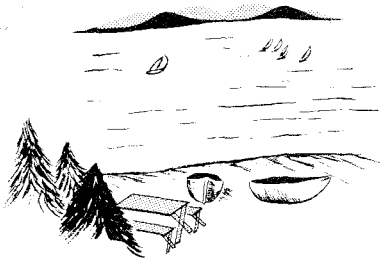
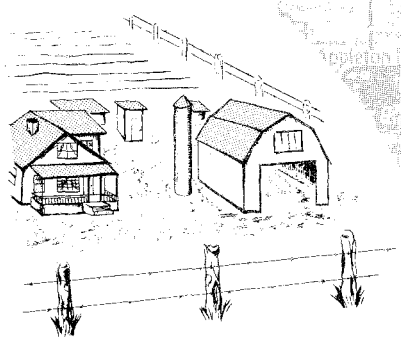
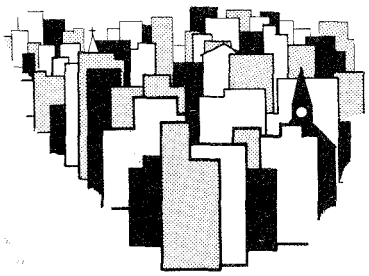
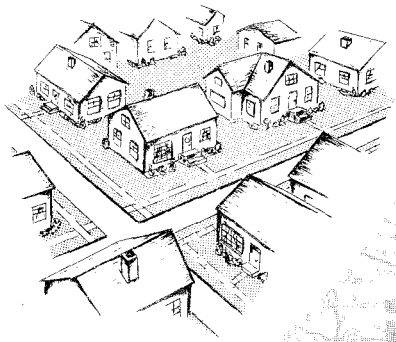




REGIONAL LAND USE · TRANSPORTATION STUDY

Study Design





SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

COMMISSION MEMBERS

KENOSHA COUNTY
- George C. Berteau, Chairman - Kenosha
- Erwin W. Lange - Kenosha
- George L. Schlitz - Burlington

MILWAUKEE COUNTY
- Richard W. Cutler, Secretary - Milwaukee
- John P. Murphy - West Allis
- Prof. Henry J. Schmandt - Milwaukee

OZAUKEE COUNTY
- Ray F. Blank - Grafton
- Nick R. Didier - Port Washington
- James F. Egan - Mequon

RACINE COUNTY
- Lester Hoganson - Burlington
- Milton F. LaPour - Racine
- Wilfred Patrick - Racine

WALWORTH COUNTY
- Charles B. Coe - Whitewater
- Eugene Hollister - Williams Bay
- John D. Voss - Elkhorn

WASHINGTON COUNTY
- Dr. Carlton M. Herman - Allenton
- Joseph Schmitz, Vice-Chairman - Germantown
- Arthur Weiner - West Bend

WAUKESHA COUNTY
- Fortney Larson, Treasurer - Brookfield
- Lyle L. Link - Waukesha
- Maynard W. Meyer - Pewaukee

REGIONAL
LAND USE - TRANSPORTATION
STUDY DESIGN

SOUTHEASTERN WISCONSIN REGIONAL

PLANNING COMMISSION

The preparation of this report was financed in part through an urban planning grant from the Housing and Home Finance Agency, under the provisions of Section 701 of the Housing Act of 1954, as amended.

August, 1963

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
II.	OVERVIEW OF THE LAND USE-TRANSPORTATION PLANNING PROCESS TO BE APPLIED	3
	A. Inventories	3
	B. Analysis	4
	C. Forecasts	6
	D. Planning	7
	E. Testing and Evaluation	8
III.	COLLECTION OF BASIC DATA	10
	A. Maps	10
	B. Inventory of Existing Highway Facilities	11
	C. Inventory of Existing Transit Facilities	13
	D. Inventory of Existing Land Use Plans	14
	E. Inventory of Existing Transportation Movement	15
	F. Inventory of Economic Activity and Trends	17
	G. Inventory of Existing Population Factors	19
	H. Inventory of Natural Resource and Public Utility Base	19
	I. Inventory of Financial Resources and Policies	20
	J. Inventory of Existing Legislation	20
IV.	ANALYSIS	22
	A. Coding	22
	B. Expansion of Sample Data	23
	C. Accuracy Checks	24
	D. Trip Linking	24
	E. Analytical Reports	25
V.	FORECASTS	26
	A. Population and Economic Growth	26
	B. Land Use	26
	C. Trip Origins - Total Person Travel	27
VI.	PLANNING	30
	A. Land Uses	30
	B. Transportation	32
VII.	TESTING AND EVALUATION	38
	A. Land Use Plans	38
	B. Transportation Plans	39

TABLE OF CONTENTS (CONT'D.)

CHAPTER		PAGE
VIII.	TIMING	41
IX.	STAFF AND EQUIPMENT REQUIREMENTS	42
X.	COST ESTIMATES	43
XI.	SUMMARY.	44

LIST OF EXHIBITS

1. Aerial Photography - Land Use Data Contract
2. Land Use Survey Manual
3. Prospectus
4. Home Interview Survey Manual
5. Coding Manual
6. Truck and Taxi Survey Manual
7. Roadside Interview Survey Manual
8. Regional Planning Systems Study
9. Regional Activity Model Variables and Constants
10. Cooperative Agreement for Soil Survey
11. Procedural Outline for a Regional Public Utilities Survey and Analysis
12. Policy Statement on Technical Services
13. Staff Memorandum on Regional Park and Open Space Planning
14. Organization Charts and Position Descriptions Manual
15. Minutes of Origin-Destination Subcommittee

Study Design
of the
Southeastern Wisconsin Regional Land Use-Transportation Study

I. Introduction

The following outline of the major elements of the work to be undertaken in the regional land use-transportation study is intended to describe the basic approach and the work program for the study in greater detail than did the Regional Planning Program Prospectus. Where applicable, the detailed design of the travel inventory, including the detailed location of cordon and screen lines, the establishment of traffic analysis zones, the designation of roadside, truck-taxi, and home interview sample sizes, and similar survey procedures will generally follow the U. S. Bureau of Public Roads standard practices and will, as well, reflect the procedural advances made by predecessor studies.

It should be recognized, however, that new techniques, methods and approaches will have to be developed to deal with some aspects of the work, not only to meet the unique problems inherent in the study but also to add to the overall knowledge of regional land use-transportation planning. To this extent the study design has been kept sufficiently general that the study staff retains latitude in the selection of specific techniques. Modifications may be necessary as the work progresses, and throughout the study, conferences and meetings will be arranged and conducted periodically with public and private groups directly concerned with study methods and results. Nevertheless, there will be sufficient detail to permit the development of cost estimates for budgeting purposes, to establish a practical time sequence and schedule of work, and to develop staff requirements.

The term "regional land uses", for which actual plans will be prepared, refers to the generalized human activities that group together to form the over-all pattern of urban, suburban, and rural development. Particular emphasis will be placed on those activities which require extensive sites: regional parks and open spaces, residential subdivisions (at the neighborhood scale), agricultural reserves, water and wet land reserves, and so forth. The requirement for local land uses, as distinct from regional land uses, will be estimated as to land area and approximate distribution but this requirement will not be translated into actual site locations, as will the regional land requirement.

The term "regional transportation networks", for which actual plans will be prepared, will be limited by definition to include only freeways and expressways, major primary streets and highways, primary streets and highways, (as defined in the 1958 Wisconsin Highway Needs Determination Study), bus routes and rail transit facilities, and this transportation network will be studied down to, but not including, the neighborhood level, in sufficient detail to meet the requirements of the 1962 Federal Aid Highway Act. Such transportation facilities as railways, airports and harbors will be studied only to the extent that they directly affect highway and public

transit development. For analytical purposes, the term "transportation" will, therefore, be defined to include the intra and inter-area movement of people by all modes of ground transportation and the movement of goods by truck. In this respect, the transportation phase of the study will be similar to transportation studies being conducted in other urban areas, and wherever practicable planning techniques will be adapted from these other studies.

The regional land use-transportation study will, however, differ from other studies now underway in at least three important aspects:

1. It will have primarily a regional instead of metropolitan focus, and thus will seek to shape development in the rural urban fringe areas as well as development and redevelopment in the urban core areas, and it will relate these two forms of development to each other. Unlike the situation facing other areawide studies at their inception, a regional planning agency already exists within the study area and is authorized to perform, on a continuing basis, comprehensive planning studies. Therefore, the study presents an excellent opportunity to truly integrate land use and transportation planning and to evaluate and implement this planning on a continuing basis.

2. It will, for the first time, seek to evaluate alternative regional development patterns and their accompanying transportation requirements in light of a comprehensive assessment of effects on the natural resource base, on the ecological balance, and on the resulting total environment as well as on the overall costs of developing and operating the combined regional land use-transportation system.

3. It will make extensive use of new systems engineering techniques involving the application of computer simulation models to test alternative land use-transportation plans. Economic and land use models will be attempted by the staff for use in the formulation and testing of land use-transportation plans.

Generally, it is intended that full use will be made of all existing and available surveys, studies, reports, and other data which will influence or affect phases of the study, and that additional data collection activities be conducted only as necessary to develop original data where currently unavailable or to supplement or update existing data. Although, at this writing, the data collection phase of the study is well underway, to preserve unity of verbal tense it is treated as still to be started. Obviously, this portion of the study design relating to data collection is the most thoroughly documented; other portions will be documented similarly as the study progresses.

The study design has several parts of which this introduction is the first. Part II provides the overview of the land use-transportation planning process. Parts III through VII provide further details of this planning process -- the collection of data, the coding and processing of data, the analysis and projection of data, the goal formulation and planning, and the testing and evaluation of alternative plans. Parts VIII, IX, and X add details relative to timing, costs, and staffing requirements. Part XI provides a short summary and general outlook.

II. Overview of The Land Use-Transportation Planning Process to Be Applied

In order to place the following detailed work outline in proper context, an over view of the entire land use-transportation planning process is in order. The land use-transportation planning process can be described as having at least five well-defined stages: the inventories of the present kinds, amounts, and distributions of land use and travel; the analysis of the present patterns of land use and travel relationships; the forecasts of population growth and economic activity; the planning for a desirable land use development and the transportation systems that will be needed to serve such land use development; and the testing and evaluation of the resultant land use-transportation plans. The end result is an integrated plan for regional land use development and transportation facilities that can be used as a frame of reference within which all of the necessary improvements in regional facilities by all of the responsible agencies can be directed toward a common goal and within which planning for local facilities can be made more meaningful. The following paragraphs are intended as a general introduction to the logic and sequence of the land use-transportation planning process.

A. The Inventories

Four major inventories will be necessary to serve the needs of the land use-transportation planning process. These are the travel surveys, the land use survey, the socio-economic surveys, and the travel facilities inventory. These are basic to an understanding of the sources and behavior of land development and travel. Without this understanding, prediction and planning are impossible.

The trip surveys proper will consist of the home interview, the truck-taxi, the postal questionnaire, and the roadside interview surveys. These will provide the detailed information necessary to demonstrate that travel is regular and orderly and to supply usable tools of measurement. The data to be collected will be limited to that minimum necessary for sound analysis of the planning problem. Common to all four surveys will be questions about the origin and destination of each trip, the mode of travel, the trip purpose, and the land use at origin and destination. Analysis of the responses will disclose the present travel habits that prevail within the Region.

As a part of the home interview survey there will be a household history survey. This will trace the home address and work address of the present heads of households for a 13-year period. For each change of address, the reason for change will be obtained along with corresponding information about household and personal characteristics at the time of change. Data from this household history will be used primarily to determine the constants for the spatial activity (land use) simulation model. Statistical analysis of this data will permit the determination of many of the parameters affecting the locational decisions of regional households.

The land use survey will yield information about the type, amount and spatial distribution of land use throughout the region. About sixty categories of land uses will be identified and the areas measured primarily through the use of aerial photography. One of the most comprehensive land use surveys

ever made, it will provide the means of understanding the comparative trip generating characteristics and linkages between all kinds of land activities throughout the area as well as providing the basic data necessary to a more complete understanding of regional development activity.

Additionally, the land use survey will include supporting studies which will furnish much valuable information needed for solving drainage, flood control, sewerage, water supply, water use, open space and other resource related problems. In combination with a knowledge of existing land uses, this information will provide the factual basis for sound land use planning on the regional level as well as by county and municipal governments throughout the region.

The socio-economic inventory will indicate the structure of the regional population and employment pattern. Data obtained from the survey will be used in the regional economic model for conditional forecasting of population and employment. Additional fact gathering will provide supplemental data relative to trends in auto ownership and truck registration and other items bearing on the projection and planning of future land use and travel. All of the data collected in both major and minor inventories will play a part in developing travel projections. Rather than simply projecting present trends, all of the important information available will be used to relate travel to its basic sources and to modify present trends as the analyses might warrant.

Finally, the travel facilities inventory will indicate the quantity and quality of highways and mass transportation routes presently available. Inventory facts will provide measures of highway capacity and performance and measures of the kind of mass transit service currently provided. This information will be of critical importance. The present supply of travel facilities is all that will be available to the future traveler unless new facilities are added. The differences between present supply and future demand will begin to show the magnitude of future highway and transit needs.

B. The Analysis

The analysis will first consider the components of regional growth -- the relationships between land use development and such factors as the availability of developable land, public sewerage and water supply systems, transportation access, schools, police and fire protection, and the ability of the resource base to sustain urbanization. A major purpose of the analysis of land use-related data is to permit a greatly increased understanding of regional development phenomena in the Southeastern Wisconsin Region and to determine the manner in which sound land use planning can best achieve more desirable patterns of growth.

A second purpose of the analysis of land use-related data will be to provide a basis for the determination of specific goals and objectives. What is a desirable pattern of regional growth? What makes it good? What planning standards ought to be established? The answers to these questions and a thorough and factual knowledge of the existing land use development will be the key to the preparation of a demonstrably sound land use plan for the region.

Moreover, a determined statistical analysis is necessary to make a simulation model workable. For this purpose multiple correlation and regression analysis techniques will be used to determine the constants for the regional economic and land use models.

For sound, long-range planning it will be necessary to examine the component parts comprising the total travel pattern. Although travel by individuals will prove unpredictable, to be sure, by grouping individuals into families and families into communities the resulting aggregative travel from given traffic zones can be predicted by mathematical models. The research and experimentation required to assure acceptable results from such programs constitute a most critical part of the analysis that precedes the planning and evaluation of alternate transportation systems.

Another critical part of the analysis will pertain to the sources of travel demand -- trip propagation at the household and at the sites of urban activity. The factors affecting present trip generation must be measured before future trip generation, or travel demand, can be estimated reliably. Questions requiring quantitative answers are: How many trips are made on an average day by each family? How does this trip generation vary with such factors as net residential density, distance from the central city, auto ownership, and family size? How many trips are by car and how many by transit? Are those by transit a matter of choice or necessity? How many trips are to work, to shop, to play? How many trips are to stores, to banks, to firehouses, to airports? What are the rates of trip generation per unit of ground area or floor space? A mechanical, unimaginative cataloguing of facts is not enough; these kinds of questions require clear understanding and accurate quantitative answers before subsequent planning decisions can be made.

Ultimately, the region's transportation needs will be determined by comparing the present supply of travel facilities with the future demand for them. The capacity provided by streets and the scheduled service provided by transit companies will be contrasted with their present usage; this begins to locate already serious capacity shortages and to suggest those areas likely to require early improvement. At the same time, the quality of urban traffic service will be analyzed in terms of typical speeds, safety records, and operating costs. Clearly, the present nature of the transportation system has a great deal to do with determining what additions to that system will be needed with continued regional growth.

C. The Forecasts

Separate forecasts will be required for employment, population, vehicle registration, and land use. These will generally describe the region of the future and serve as intermediate steps toward the forecast of person and vehicle travel. These are not plans as such. In determining the kind and amount of new land that must be developed, for example, the land use forecast does not necessarily describe how the region might best develop but, rather, how the region is most likely to develop, given present public policies and directions of growth. Thus, the land use forecast is a necessary first step toward the land use plan.

The target year of 1985 has been set as the basis for the final plans of this study. Planning less far ahead would be short sighted; traditional engineering economics suggests that the target year be sufficiently advanced so that planned public improvements should pay out by the end of the period. Planning farther ahead would be too risky -- technological changes are coming too rapidly,and contemporary facilities might become outmoded quickly. Twenty years is the minimum period required to plan, program, and complete an integrated system of major physical improvements such as freeways or rapid transit routes. In many respects, however, a specific target date is an analytical convenience; in effect, plans are drawn for the conditions forecast for 1985. These conditions may be reached a few years before or after 1985 without affecting the usefulness and accuracy of the regional land use or transportation plan.

Forecasts of future population and economic activity are a necessary prerequisite to the planning work. Although they are clearly and directly interrelated, they will be first estimated independently and then compared and brought into balance. Conventional economic and demographic projections will be based, for the most part, on assumptions regarding the labor force participation and unemployment rates for the employment estimate and also on natural increase and net-migration statistics for the population projections. The results of these conventional, but detailed, projections will be compared with an integrated socio-economic forecast obtained with the regional economic model. In this model population and employment growth are interrelated through time.. The resulting estimates will be reviewed for reasonableness by the study's Technical Coordinating and Advisory Committee and by other specifically qualified persons, and a single, best estimate selected for planning purposes.

With future employment and population levels assumed, auto ownership will be estimated. Again, the results must be adjusted as necessary to balance against the previously completed forecasts. Truck registrations by vehicle type -- light, medium, and heavy -- will be estimated from changes in business and industrial activity. In making these registration estimates, particularly, it will be routine to review the present and predicted rates of vehicle registration in other metropolitan areas. Similar checks on the realism of other study forecasts will always precede the review by the committee structure.

The land use forecast grows out of the population and economic activity forecasts and is, essentially, a tabulation of the anticipated growth in population and economic activity. The amount and location of land needed for homes and for home-oriented activities such as schools, parks, and shopping districts is closely related to the population growth in the area. Similiarly, the amount of additional land to be developed for service industries is largely dependent upon the employment increase in those industries. Changing land use densities are accounted for and play an important role in determining the future characteristics of the region. It should be emphasized, again, that this particular forecast is a first step toward the land use plan, not an end product or plan in itself.

The land use forecast will be accomplished by two different methods. The first represents an analytic procedure which takes into account the over-

riding development patterns of regularly decreasing urban density and proportions of land in urban use with increasing distance from a central city.

The second method represents growth simulation through time by applying the spatial activity, or land use model. The model will, when perfected, better bring into play the inter-action between continuing land use development and continuing transportation system development. Again, however, both methods have validity and usefulness and it will be necessary to compare results and come to a single, best estimate.

After the first land use plan has been prepared, based upon the present trend and with estimates of the future employment, population, and vehicle registration, the first approximation of future travel by study area residents will be prepared. Using socio-economic and land use trip generation rates as a control, the number of trips to particular areas within the region will be specified. The linkages between trip ends will be predicted by mathematical models developed from present trip distribution patterns as attained in the Origin and Destination Surveys. Later, when the additional regional land use plans have been prepared, revised travel plans will be required.

Perhaps the most difficult part of the tripmaking and travel distribution forecasts will be specifying the location and amount of travel by auto and transit. Transit and highway facilities are not necessarily competitive. Rather, transit often represents a complementary kind of transportation service for a special kind of traveler. The basic question is whether present forms of transit can be significantly improved and whether this improvement will begin to attract more riders. At least one, transit-oriented transportation plan will be predicated on the assumption that an improvement in Transit will attract more riders.

D. The Planning

In principle, land use planning must precede transportation planning. To prepare a land use plan as an accommodation to a particular form of transportation system would represent a gross distortion of the ultimate objectives of the planning process. Rather, the transportation system plan should be prepared to serve a particular land use plan. In practice, however, the planning of land use and transportation facilities can be accomplished as a single, inter-related and concurrent process. This is the kind of process envisioned for the study.

Following the initial land use proposal based on present trends, two or more regional land use proposals will be prepared. They will deal with broad, conceptualized regional land use patterns.

As each of the land use proposals is completed, the Transportation Division will devise and test alternate transportation proposals capable of accommodating the future travel within the Region. To start with, the areas of greatest need will be determined by "assignment" of future travel to the existing streets and transit routes and to programmed improvements. The calculation of this future travel demand will depend on the refinement of

the transportation model -- the third and last of the study's simulation models. Plans can then be prepared to augment the existing transportation system and thereby provide the capacity necessary to carry the future travel demand. These completed plans, in turn, will be referred back to the Land Use Division for further implementations within their plan.

Selected elements of the regional land use proposals can, however, be proposed at some intermediate level of detail by a cooperative approach with responsible, implementing agencies. Open space plans for regional facilities, for example, can be refined beyond the conceptual level by mutual efforts with the Wisconsin Department of Resource Development and the Wisconsin Conservation Department. Selected elements of the regional land use plan will be thus refined, without interference in local decisions, wherever possible.

E. The Testing and Evaluation

As stated above, there will be a number of alternate regional land use proposals with each having several possible transportation plans to serve it. This will pose the serious dilema of choosing the most appropriate for the region. Although the alternatives will be passed through a very fine screening review and will be considered at both technical and political levels for feasibility, there will need to be a very rigorous means of in-staff testing and evaluation prior to this review.

Careful analyses of the consequences of each major alternative land use-transportation plan will be required. Such analyses will include assessment of effects on land values, tax revenues, travel demand, resource base, ecological balance, and environmental surroundings, and on the over-all costs of developing the region.

Several types of analyses will be utilized. Application of the land use model will provide approximations of regional growth for assumed developmental policies and assumed major planning goals. In effect, the land use model will be helpful in determining the degree of guidance that can be exerted by alternative plans. Besides the land use model, there will be other quantitative tests of long-range growth affects, for example, tests will be made to determine the maximum population that might be sustained in the urbanizing watersheds without the principal streams becoming seriously polluted, and similar examples. And finally there will be over-all benefit-cost analyses of the consequences of each alternative plan.

This kind of testing and evaluation will require the refinement of new tools and techniques.

In engineering work, the traditional benefit-cost analysis provides an objective means of comparing alternates. Something like this will be needed for testing alternative land use plans since, obviously, each land development plan will carry with it certain costs and benefits. If these can be measured, and assuming that each plan is founded on common principles of design and on comparable goals and objectives, then, other things being equal, the plan with the highest ratio of benefits to costs should be recommended.

But this approach to land use planning often has been thwarted because certain costs and benefits cannot be measured easily. Because social consequences of particular plans provide ready grounds for debate, it may be well to admit at once that some of these consequences cannot be measured. This does not invalidate, however, the concept of measuring the more concrete costs and benefits. For example, public services such as police and fire protection,schools and public sewers and water supply will cost more or less per capita depending upon the density of urban development. Even if such costs cannot be determined exactly, they can be estimated for purposes of comparative benefit cost analysis of alternative plans. This study will, to the maximum extent possible, test and evaluate alternative regional land use plans both quantitatively and qualitatively.

The quantitative approach to the evaluation of transportation systems, fortunately, has been much farther advanced by previous transportation studies. The allocation of future trips to a highway or transit plan will indicate how well each may be expected to perform, the appropriateness of route and access point spacing, and the over-all feasibility of system design. Certainly, what will be needed is a realistic system for which construction designs may be drawn. The allocation of future trips will yield travel cost information also. This is perhaps the most important evaluating information because, by comparison with construction cost, it determines which of the various plans will represent the best public investment.

III. Collection of Basic Data - The Inventories

A. Maps

1. General Base Maps

General base maps of the study area will be required to provide a medium for recording and presenting in graphic form the results of the surveys and planning studies as well as the natural and man-made features of the region. A secondary purpose of the mapping program will be to permit the information collected in the various planning studies to be related to the geographic area from which it was taken; that is, to permit geographical identification by machine methods of all data collected. Another purpose is to make such maps available for county, municipality and private agencies.

Base maps are being prepared by the staff of the SEWRPC and will be available by about July 1, 1963. These maps are being prepared utilizing the latest photogrammetrically compiled USGS quadrangle maps as source maps. The base maps are being prepared by county at the two scales of 1:24,000 and 1:62,500 and can be assembled by mosaic processes to cover any desired part of the region as well as the entire region. The base maps can be expanded or reduced in scale for use in the various phases of the study, and will show among other information: all streets and highways, including urban street systems; all railroad lines; all airports; all major power transmission lines, communication cables and pipe lines; all township, range and section lines; all major lake, stream and water course lines; relief by contour and all civil division lines. The maps under preparation are being compiled utilizing the Wisconsin State Plane Co-ordinate System Grid (South Zone) as a map projection. It is recommended that for the purposes of automatic data plotting a modified Cartesian Co-ordinate Grid based upon and adjusted to the U. S. Public Land Survey System be utilized as the primary unit of geographic identification. Such a grid is well adapted to automatic data processing methods, and permits analyses by geographic units of almost any degree of coarseness or refinement.

2. Aerial Photographs

Current aerial photography will be required for the entire study area. These photographs will serve the three purposes of: providing the basic data source for the necessary updating of all base maps; providing the basic data source for the necessary land use inventory; and providing information on changes in land use through comparison with older photography.

It should be noted that during the preparation of this study design, a number of projects have been carried forward to completion. One of these now-completed projects has been aerial photography. Early this year, a staff memorandum titled "A Procedural Outline For A Regional Land Use Inventory" was prepared as the basis for negotiating a combined aerial photography-land use data collection program contract (see Exhibit I). Discussions were held with some six photogrammetric engineering firms. As a result, a contract for aerial photography was signed, all of the photography has been flown and the negatives are in process of delivery to the SEWRPC.

This photography provides complete and entirely new coverage of the seven-county region (approximately 2,600 square miles) and of the Milwaukee River Watershed which extends for about 400 square miles outside the region, including: a set rectified photo enlargements at a scale of 1:24000 covering the entire 3,200 square mile area in 80 sheets approximately 24" x 24" in size; a set of 9" x 9" stero-pair prints, also at a scale of 1:24000, covering the seven-county region only; and a set of 300-line screened halftone Chronoflex reproducibles at a scale of 1:4800 covering the seven-county region only. Each reproducible shows an index number at the upper edge of the right-hand corner, and an index which relates quarter sections on the Commission's base maps to particular photo enlargements.

3. Miscellaneous Maps

It is intended that full use be made of all existing maps available in the area to supplement the regional base maps. To the extent possible, city and county plat books, property boundary line maps, general county highway maps and topographic maps will be used for pertinent inventories, field work and studies wherever the regional base maps are not of sufficient scale or detail. It should be noted, however, that in addition to the general base maps and photographs a relatively large number of highly specialized maps will be required for analytical and planning purposes. These include analytical "zone" maps, "traffic assignment" maps, a "growth" map, and many others, both for analytical purposes and for display and illustration of reports.

4. Detailed Planning Base Maps

As the study efforts reach a more precise and definitive stage, maps providing the necessary inventory of the facts relating to the land and its ownership to a much greater degree of accuracy and precision than furnished by the general regional base maps will be required. At this stage, full and detailed information concerning the land itself, with its topography and physical characteristics, and the boundaries of real property ownership, will be required. Such maps will have to be at scales of one inch equals 100 feet or one inch equals 200 feet with a vertical contour interval of two feet or five feet, respectively, and must be based on a monumented control survey network relating the U. S. Public Land Survey System to the State Plane Coordinate System. These maps will be required only along the major traffic corridors established by the long range plan and will serve as the basis for precise planning and plan implementation.

B. Inventory of Existing Highway Facilities

An inventory will be required to determine the functional classification of the existing street system and the existing service level, as reflected by traffic volume, travel time and delay, and accident rates. All streets and highways in the region will be classified as to existing use into the following categories: freeways (including the Milwaukee County Expressway System), major primaries, primaries, and secondaries. This functional classification will generally follow the methods, procedures, and definitions established in the 1958 Wisconsin Highway Needs Determination Study, and will utilize as much of the results of this study as possible. The functional definition of the

existing street system is the first step toward a definition of the "arterial street" (traffic assignment) system used for testing and evaluating the street and rapid transit proposals.

An inventory will be required to determine the location, alignment, characteristics, capacities, and travel times for the transit and street networks. Existing rail, air, pipe, and water transportation facilities will be studied as they directly affect highway and public transit development. The 1958 Wisconsin Highway Needs Determination Study and current Urban and Rural Roads Inventories, conducted by the State Highway Commission and major cities, will be excellent sources of information for the street and highway portion of this inventory; and, to the extent feasible, the required data will be extracted from these sources and updated.

The street inventory, for example, will include a variety of information about each street. It will describe the street location, traffic counts, widths, grades, types of area traversed, average vehicle operating speeds, and various other factors necessary for the calculation of each street's carrying ability and quality of service provided. As a locational key for traffic assignment and to facilitate data summarization, each arterial intersection will be assigned a four-digit number and each of the route sections between intersections, an eight-digit number. These items will be essential to a generalization of street capacity throughout the region.

In this respect, it should be noted that the capacity of a street is changeable depending on the use that is made of it. Different proportions of commercial vehicles, turns at intersections, parking maneuvers, pedestrians, and other factors will cause the capacity of a street to fluctuate from minute to minute. The measurements of capacity must, therefore, be approximations based on average conditions of use. They are quite adequate for the purpose intended (that of establishing realistic limits for planning) because average use conditions can be determined with some consistency.

The application of average use conditions differs according to whether a street is typically urban or rural in design and operation. In urban operation, the principal design factor is the signalized intersection. It controls both the capacity and the quality of service on the street. In rural operation, however, there are a number of important design factors which are controlling, among them the number of lanes, access control, and the vertical and horizontal alignment. Generally, urban designs are characterized as having interrupted flows; rural and limited access designs as having continuous or uninterrupted flows.

By 1985, many of the arterial streets in the metropolitan areas will have sufficient development at intersections with other arterials so that they may be characterized as urban designs. This means that average urban use conditions may be applied for capacity calculations to most arterial streets in these areas. From empirical studies, these conditions can be summarized as follows: all arterial intersections, other than rural, will be signalized with an equal share of green time for each crossing stream; ten percent of all vehicles will turn right and ten percent will turn left from each approach; ten percent of all vehicles will be trucks or buses; there will be a moderate number of pedestrians at all intersections, with heavy concentrations in downtown areas; and parking

will not be allowed during the peak traffic hour. These rules will have to be modified for the more rural intersections.

With these average conditions, which should be typical of 1985 as well as 1963, practical capacities per unit of street width can be adapted from published supplements to the Highway Capacity Manual. Hourly standards can usually be expanded to a 24-hour basis through two assumptions; during the peak traffic hour, 60 percent of the traffic on any street will be in the predominant direction of flow and 40 percent in the other direction; and the nondirectional peak traffic hour will represent from 8 to 11 percent of the total daily traffic. However, these general percentages will be checked for local conditions and reviewed with local officials prior to adoption.

The need for an arterial street system derives partly from the objectives of the transportation plan and the methods chosen to evaluate its efficiency. The principal objective of the highway portion of this plan is to find the best locations for the major improvements needed -- freeways and other major arterials. The principal method of testing these locations is to assign non-local traffic to the proposed network. Since the arterial streets that now serve such through traffic will compete with these freeways, they will have a strong bearing on the freeways' location and must be included in the testing network. The remaining, or local, streets are omitted from it.

To a considerable extent, then, the mechanics of the traffic assignment process determine the nature of the arterial street system selected. The minimum time path method requires that all trips between any pair of analysis zones be allocated to that overall route having the least total travel time. The route may consist of only one street if the zones are close together; or, of many streets with turns at intersections if they are far apart. All zones must be inter-connected, with sufficient streets entering each zone to carry the number of trips terminating in it. From these and related criteria comes the definition: an arterial street is one having significant carrying ability for interzonal travel as a link in a probable minimum time path. Actually, this means that all of the streets that would be classed as freeways, major primaries, primaries, and some that would be separately classed as secondaries or collectors, by the criteria of other methods, are included in the system. Additionally, some streets are included which would not otherwise qualify as either; in outlying portions of the study area, for example, several unpaved roads between adjacent zones could be designated as arterial streets for lack of any other connectors with higher design standards.

C. Inventory of Existing Transit Facilities

An inventory will be required to determine existing transit policies and service levels by service frequency and regularity, transit travel time and passenger load data studies as well as by a transit route location and coverage inventory. Maximum use will be made of data available from mass transportation companies operating in the study area.

An inventory of transit routes and facilities is undertaken for the same reasons that an inventory of streets is needed -- to obtain an objective measurement of the quantity and quality of service provided. The capability of transit, however, is much more flexible than that of streets. A street potentially provides a relatively fixed carrying ability during its lifetime. A transit route, on the other hand, can be rescheduled at different headways with different equipment, thus expanding or contracting its carrying ability. In fact, whole routes can be added or taken out of service. The capability of transit on a given set of routes, therefore, depends entirely on the limitations of the equipment used, the spacing and facilities for passenger stops, the sources of power, and similar features more easily changed than the design of a street.

Thus, transit routes have no inherent measure of capacity as do streets. Rather, they provide a particular supply of service at a particular point in time, according to scheduling requirements. Rapid transit on exclusive right-of-way, of course, is a special case; but, once built, its supply of service provided also can be expanded or contracted. The inventory of mass transit, then, will represent what is supplied on a typical weekday in 1963, but unlike the inventory of streets, it cannot be definitely projected as being available in 1985 as well.

D. Inventory of Existing Land Use and Existing Land Use Plans and Policies

An inventory will be required to determine the existing and proposed amount, type, intensity, and spatial distribution of all land uses within the study area; and to establish historic patterns and trends. In addition to land uses, data should be included relative to travel accessibility, land and improvement values, characteristics of structures, residential and employment densities and, for currently undeveloped land, the extent and physical characteristics of available sites and the availability of utilities and community facilities.

For the most part the inventory of land uses will be taken from up-to-date aerial photography. Fortunately, much of the three metropolitan areas (Milwaukee, Racine and Kenosha) has already been surveyed by their own planning agencies. Arrangements will be made to obtain the punch card records for the City of Milwaukee; these are current to 1963. Land use data for the Cities of Racine and Kenosha will require updating and will require punching of cards. Wherever else there is already land use data available, it will be incorporated so that there is no duplication of effort. However, there will need to be some field listing of land uses in outlying urban places and some spot-checking of already available land use data. In the end, the inventory will produce a consolidated punch card record of the area of some sixty types of land uses by quarter section (See Exhibit 2).

Different activities not only require different amounts of area but utilize that area at varying levels of intensity. Two of many possible measures of use intensity are the number of residents and the number of workers per unit of land area. Both measures will be approximated from 1963 surveys by combining areas from the land use inventory and population and employment

data from the home interview and postal questionnaire surveys and will be checked against the census and utility records. In this process, of course, geographically comparable data will be required for both. This is why all surveys will have a common basis in the U. S. Public Land Survey system of sections and quarter sections and why the same land use classification system will be used to code trip origins and destinations as will be used to delineate and measure land use areas.

A growth map will be separately assembled to portray, graphically, the spread of urban development in the region. This will show the progressive development of any certain area. Basically, historic topographic maps, land use inventories, insurance atlases and areal photography will be used. The growth map will help in the prediction of future development in commercial, industrial and residential areas. Travel accessibility will be measured from this growth map and from parallel changes in the transportation system in recent years.

E. Inventory of Existing Transportation Movement and Behavioral Factors Affecting Urban Development Patterns and Modes of Transportation Utilities

Surveys of the daily travel throughout the region will be required, including volume and classification counts; points of origin and destination; trip lengths, frequencies and purposes; modes used and reasons for selecting modes used; and the establishment of historic patterns and trends. The home interview portion of the origin-destination study will provide for the inclusion of an attitudinal (personal opinion) survey directed at defining public preferences, behavior factors, and desired patterns of residential location and development, and at travel habits as these may affect future regional settlement patterns, transit use, and the practicability of a transit oriented plan. Data will be used in conjunction with land use and socio-economic data to determine measurable relationships between land use and the amount and distribution of traffic.

To delineate the coverage of the home interview survey, cordon lines will be established around the three principal study areas as shown in the Prospectus (See Exhibit 3). The Milwaukee study area sample rate will be 1 in 30 dwelling places; the Racine and Kenosha study areas will represent a 1 in 10 sample rate. The total "take" will be about 18,000 sample addresses. The samples will be drawn systematically from punch card records furnished by a utility company.

After the sample is drawn, field interviewing will be scheduled May 1 through June 30 with preselected travel dates for every sample address. The daily assignment for each interviewer (8 addresses per day) will be printed out on three-part paper; "Dear Householder" letters will be prepared and the usual scheduling controls provided in advance. During the survey, it will be necessary to field list "special" dwelling places; that is, hotels, motels, YMCA's, and so forth. These will be interviewed toward the end of the survey period.

The survey will be accomplished by staff personnel. There will be four field offices and a central office in Waukesha including three offices in the Milwaukee study area and one for Racine-Kenosha; each will have in charge a home interview district chief. These chiefs will be employed early to

establish field offices, obtain necessary furniture and equipment, and begin to employ staffs. Each district office will have approximately 10 interviewers, 2 lead interviewers, 2 editors and 1 clerk-typist. Each district chief will report to the home interview supervisor who will work from the Waukesha office and who will report to the Administrative Officer. The entire home interview staff will be paid on an hourly basis and will be recompensed for necessary travel and expenses.

The survey will generally conform to established practice. The manuals, forms, procedures and so forth will generally follow U. S. Bureau of Public Roads standards (see Exhibit 4, "Home Interview Manual", for all further details). Coding operations will begin as soon as practicable to facilitate a feedback to the field operations. Additional temporary office space in Waukesha will be acquired. Because of the feedback effect, coding should properly be considered an extension of the field operations (see Exhibit 5, "Coding Manual", for all further details).

The "household history" will be an important part of the home interview survey. Every sample dwelling place will be asked to report where the head of the household lived and worked in 1962, 1960, 1958, 1956, 1954, 1952, and 1950. For each reported address change, the questionnaire will obtain the reason for the move, whether the home was owned or rented and its cost or rental, the family income and the number of family members contributing to it, and related household history questions (a sample and instructions are included in the "Home Interview Manual").

The household history questionnaire will be developed to provide the basic data for analyzing the locational choices of regional households in selecting their place of residence. After statistical analysis this data will provide constants necessary for the operation of the land use model.

The attitudinal or personal opinion survey includes not only questions relating to choice of travel mode but also general questions as to what kind of public facilities are wanted by residents of the region. A two-page questionnaire is left at 1 in 8 of the home interview sample addresses; the questionnaire is returned by mail (a sample and instructions are included in the "Home Interview Manual").

To reach the residents of the region outside the cordoned-off study areas, there will be a postal questionnaire survey of all dwelling places; the mailing addresses will be taken from utility company records. A return of up to 30 percent seems feasible, although 10 - 20 percent would be acceptable. The questions must necessarily be concentrated on origin-destination information. One-fifth of the cards are to be mailed out for five successive days to enumerate travel on each weekday (excluding Saturdays and Sundays as do the regular home interview and truck-taxi surveys). There will need to be much publicity and encouragement for making returns. This survey will be relatively inexpensive and will have the additional virtue of acquainting all outlying residents of the region with the goals of the study and of the Commission.

The areas of coverage of the truck-taxi survey will coincide with the regular home interview survey. The bulk of the sample (1 in 12 in Milwaukee and 1 in 4 in Racine-Kenosha) will be drawn from punch card records in Madison; taxi registrations and lists of U. S. Government operated trucks will have to be compiled from other sources. The sample "take" will involve about 4,300 licences. Within the same period, all truck owners in the region but outside the cordoned-off study areas will receive postal questionnaires asking for data relative to truck trip-making. Again, data would necessarily be concentrated on trip activity, not business activity. The training and management schedule will parallel that for the home interview survey (for further details, see "Truck-Taxi Manual", Exhibit 6).

The roadside interview survey will be taken at the periphery of the region only and only at major entry points. All details of the survey will be accomplished by study staff. After selection of station locations, passing vehicles will be stopped in proportion to the traffic volumes; for example, where daily counts exceed 10,000 vehicles, a 20 percent sample should be adequate; at lesser volumes, the sample rate should be increased. On very lightly travelled roads, the rate might be 100 percent. The survey is scheduled for June and July. Field operations will follow generally standard procedures. (See Exhibit 7, "Roadside Interview Manual", for further details).

Screen line mechanical and classification counts will be made along an east-west line bisecting the Milwaukee study area and extending westward to the edge of the region. By comparing trips across this line as reported in the interview surveys, the extent of under-reporting will be determined and later compensated. Additional screen lines will be located in the Racine and Kenosha areas and cordon lines established around Union Grove and Hartland for a similar purpose. These counts will be concurrent with the trip surveys.

For the arterial street system, existing traffic flow maps will be updated to provide a measure of the total vehicular travel at the time of the surveys (another kind of accuracy check) and to use to verify the results of later traffic assignments. These machine counts, which will be made by SEWRPC, State, County, and City personnel, will be taken through November as found necessary.

F. Inventory of Economic Activity and Trends

An inventory of existing and historic economic activity will be necessary to determine conditions and trends affecting the growth of population and employment. Data should be included on the location, size and skills of the labor force; the number, type, and location of the jobs; evolving technological changes affecting employment and industrial and business linkages in the chain of supplies, services, processes and markets. Field surveys will be made of major economic activities - industrial, commercial and service functions - to develop original information about present and future requirements for labor, building area and land, and about location and transportation preference.

The data to be collected, classified and tabulated in the economic data collection program will generally be based upon the regional activity model described in the Southeastern Wisconsin Regional Planning Commission's Planning Report No. 1, The Regional Planning Systems Study (See Exhibit 8), but will not be limited strictly to the relationships, variables and constants listed in that report since the model has changed in detail since the publication of that report. To accomplish the objectives of the land use-transportation study, the original model has been simplified to minimize the number of internal relationships in the model. All of the external relationships have been retained in the model. Internal relationships emphasize long term investment-type decisions since the primary initial use of the model will be in developing a series of long range conditional economic forecasts of the region.

The following general tasks will be performed by a consultant:

1. Collection, classification and tabulation of specified variable and constant data available from existing sources required to implement the specified regional activity model.

2. Classification by industry of data not available from published sources and conducting industrial surveys or other programs needed to complete the collection of this data. At the completion of this program, all specified model data must be tabulated and delivered to the Commission.

3. Consultation on changes in the model indicated by data collection and analysis.

All tabulated data will conform to specifications established by the Commission. Final data processing of data tabulated by the consultant will be performed by the Commission.

A "variable" is any time-subscripted equation term listed in the model; a "constant" is any equation term without a time subscript listed in the model. Additional variables and constants may be needed as a result of changes to the model during its development. A sample set of variable data and constant data is included as Exhibit 9.

In effect, this work will be a continuation of that recently completed under the Wisconsin P-6 Program by the Wisconsin Department of Resource Development. Both the P-6 Program and the economic activity model will provide long range employment forecasts. Then it will be the responsibility of the staff, in conjunction with the Economic Development Committee and the Technical Coordinating and Advisory Committee, to select the most reasonable employment expectations at five-year intervals to 1985. In this selection process, too, must be reflected the long range population forecast to be prepared as part of another P-6 Program conducted under contract by the University of Wisconsin. The future employment and future population, distributed spatially, together with a consideration of inter-regional traffic patterns, will be the vital determinants of future land and transportation requirements.

G. Inventory of Existing Population Factors

A detailed demographic analysis will be required to determine the current size and characteristics of the region's population. Data will be included on the number, size, income, age, sex, and occupational characteristics of households; and social trends such as the desire for various housing types, immigration and internal migration and automobile ownership. A large portion of this work has already been accomplished under the P-6 Program with the Wisconsin Department of Resource Development. Much additional demographic data will later be available from the 1963 travel surveys.

A considerable difficulty is expected in determining population emigration from southeastern Wisconsin. It is proposed to establish estimates from income tax records by assuming that where returns are interrupted the taxpayer has left the area; this may or may not prove feasible. Estimates for immigration into southeastern Wisconsin, of course, can be made with some accuracy from results of the household history survey previously described.

H. Inventory of Natural Resource and Public Utility Base for Regional Development

An inventory of the soil and water resources of the region and of the location, capacity and service areas of public utilities and governmental services affecting regional development will be required. Such data is essential to the preparation of sound land use forecasts and to the formulation of policies and plans relating regional development to the resource base. The data will also be useful to park and open space planning, comprehensive watershed planning, route location studies, and engineering design.

Perhaps the most important of these several, related studies is that of soils suitability. Under the regional land use-transportation planning program it is proposed to develop, test, and evaluate, not one, but several alternative long range land use-transportation plans. Each major alternative regional land use plan and its accompanying regional transportation plan will be carefully analyzed and evaluated prior to the selection of the most desirable plan. Such analysis and evaluation must include, among other things, assessment of the effects of each particular alternate land use-transportation plan on the natural resource base. Such evaluation will require a regional soil suitability study.

Soil properties exert a strong influence on the manner in which man uses land. Historically the study of soils has been directed primarily at single problems and situations and little attention has been given to soil potentials on a comprehensive, areawide basis. Soils are an irreplaceable resource and mounting pressures upon land are constantly making soil more and more valuable. A need, therefore, exists in any comprehensive regional planning program to examine not only how soils are used but how they can best be used and managed (See Exhibit 10 for further details).

Much of the remaining work connected with the inventory of natural resources will involve the study of water -- basically, the quantity and quality of supply and demand. The inventory of surface water, of course, is highly related to the land use survey and to the soils suitability study. For example, the latter includes the estimated soil properties significant to flooding

potential, runoff and watershed characteristics, depth to water table, susceptibility to erosion, and percolation rate. Beyond these studies, the inventory and technical interpretation of surface water quality will require special investigation by consultants, as may the inventory of ground water. Closest attention will be given to those watershed areas most likely to experience extensive urban development in the next two decades.

In this line, the staff is negotiating with the State Committee on Water Pollution to enter into a cooperative agreement by which information will be gathered and interpretated on the water quality of ten river basins in the region. A number of parameters (alkalinity, sulfate, chloride, C. O. D., B. O. D., etc.) shall be measured to help in the determination of what use can be made of the river and its abutting lands.

Another important study is that concerning the location and capability of existing public utility systems. A basic inventory of the public utility facilities which provide the various land uses with power, light, heat, water and sewerage is essential to any consideration of regional development patterns. Accordingly, the public utility study is intended to inventory and map all existing sanitary sewerage, storm water drainage, water, gas, and electric power systems; delineate existing and proposed service areas; and tabulate relevant capacity and cost data. Analysis will be required to identify current problems and needs, and to explore the relationships of the utility systems to each other, to supporting land and water resources and to land use areas. Such a study will include conclusions concerning the general needs of the region for coordination and expansion of present utility systems and for the provision of new systems (See Exhibit 11 for further details). Nearly all of this basis information, fortunately, has already been collected by a consulting engineering firm employed under the Wisconsin P-6 Program.

I. Inventory of Financial Resources and Policies

A survey of the financial resources, policies, responsibilities and institutional relationships affecting transportation plan implementation will be required to permit a realistic appraisal of the financial feasibility and acceptability of the various alternative plans to be prepared. This survey will include a review of the federal, state and local aid structure for financing, a review of the methods of financing, that is, bonds, legislative appropriations and user taxes, and a review of past and current public expenditures on all phases that affect land use or transportation.

Regional land use-transportation planning must not call for expenditures beyond the economic capabilities of the area. Clearly one objective of transportation planning is to see that the transportation dollar is spent efficiently. This does not mean that a plan cannot be imaginative, nor does it mean that a less-than-adequate plan should be proposed. It means that a desirable pattern of land development and safe, fast travel should be planned and provided for at a cost compatible with the region's ability to support it financially.

J. Inventory of Existing Land Use-Transportation Planning Legislation

A detailed survey of the legislative framework for transportation planning and plan implementation will be required in order to provide a sound background

to plan implementation recommendations and policies. For example, the implications of present subdivision control ordinances, zoning practices, and land acquisition controls will be explored for their affect on furnishing guidance toward a desirable pattern of land development. The affect of other planning, such as the official map, must be similarly explored. This survey will be closely related to those problems which come to attention through the SEWRPC community assistance program. The aim of the survey will be to discover and to recommend legislative changes which can provide the best chances for plan implementation. To an extent, this kind of survey has been started through the Wisconsin P-32 Project.

IV. Data Translation and Processing -- the Analysis

A. Coding

1. Travel Survey Coding

"Coding" is that process of translating written information into numbers for key punching. It will be a meticulous and time-consuming process. With about 100,000 trips expected to be reported in the home interview survey, about 30,000 in the truck-taxi survey, about 70,000 in the roadside interview survey, and perhaps another 50,000 in the postal questionnaire survey and with about 50 bits of information to be coded for each trip, a grand total of about 12,500,000 bits of information must be handled. A staff of about thirty coders will be required for up to eight months.

The coding of this vast amount of information will have an important bearing on the final results of the study. No matter how complete the information collected in the field may be, it must be coded accurately to be valid for machine processing and subsequent analysis. The information obtained is the basis for all analysis and projections made by the study staff. The importance of coding accuracy cannot be stressed too much. A number of "guides" must be developed and employed (see exhibit 5 for further details).

Geographic Coding Guides are used for locating trip origins and destinations found on the survey forms. These trip ends, when in the study area, may be recorded in many ways. The full street address is most desirable. If this is not obtained, the nearest street intersection is recorded, and if this is not known, a nearby prominent building or place is named. If the origin or destination lies outside the study area, the municipality, county, and state may serve. To be able to locate as many trip ends as possible, various geographic coding guides are furnished:

Street Address Guide: This guide lists streets in the study area alphabetically and numerically, and the corresponding range of house numberings. Each street address is given a seven digit geographic code.

Street Intersection Guide: This guide lists all street intersections in the study area. Streets are listed alphabetically, and intersecting streets are given. Each intersection has a seven digit geographic code.

Trip Generator Guide: This guide lists alphabetically such major trip generators in the study area as schools, churches, office buildings, theaters, stores and work places, each having a seven digit geographic code.

Local Place Name Guide: This guide lists alphabetically such land locations as subdivisions, unincorporated villages, and school districts, and gives their seven digit geographic code.

External Guide: This guide, which has also been adopted by the State, lists municipalities outside the study area and gives their eight digit geographic code.

General Numeric Guides are used for converting information, other than geographic locations, into numeric codes. Following is a brief description of each group:

Occupation - Industry Guide: This guide lists major occupations and industries found in the area. A one digit code is assigned each occupation, and a one digit code is assigned each industry from the information received in the personal interview. This guide is supplemented by the 1960 Census of Population, Alphabetical Index of Occupations and Industries.

Time of Day Guide: This guide breaks down a 24-hour period into a three digit code, basically, the U. S. Army system is used. Minutes in an hour are grouped into tenths of an hour.

Land Use Guide: This guide lists each of the 60 land uses by a two digit code. Establishments such as drug stores, schools, food markets, and department stores are classified by a two digit code.

Commodity Guides: This guide lists alphabetically various commodities carried by trucks as reported in the interview. Each commodity is assigned a three digit code as established by Association of American Railroads.

Business - Industry Guide: This guide lists various businesses and industries of truck owners as reported in the interview. A two digit code is used to define the types.

2. Land Use and Other Coding

Another massive coding and checking operation will come in connection with the land use inventory. After separate land uses have been delineated on aerial photographs, of course, they must be identified (or coded) and measured as to land area. The tabulation of areas by quarter section, posting to a summary form, and checking will require over 10,000 quarter section summary forms. Up to 15 coders will be required for about six months to complete this task. Similarly, almost all other inventory data -- population and housing characteristics, soils characteristics, highway and transit system capacities, and so forth -- will all require coding because eventually all of this data must be stored in punch card form.

After manual checks of coding, of course, there will be machine checks of the punch cards. These are called contingency checks: where column 10 is a "1" punch, for example, it may be that column 12 must be a "2" punch: if it is not, there is an error. Such errors are returned to the coders for correction and all punch card decks are exhaustively checked and rechecked until absolutely correct. Typically this coding and checking process is one of the most time-consuming parts of a large data collection survey.

B. Expansion of Sample Data

With sample data, it will be necessary to expand that data to the universe from which it was drawn. This would seem rather simple; if every scheduled home interview in the Milwaukee study area were completed, for example, the expansion factor would simply be 30, that is, each interview

would be counted 30 times since a 1-in-30 sample had been drawn. What complicates the picture are the non-interviews or incomplete interviews. The completed interviews will also have to represent a variable number of non-interviews as they are a part of the same universe. This involves a lengthy operation to ensure that there is no systematic bias in the expanded sample.

The expansion factoring procedure will vary with the particular survey data being expanded. For example, the roadside interview survey will require "factors" according to station number, hour of the day, type of vehicle, and direction of travel. This becomes so involved as to require a computer rather than ordinary punch card equipment. Moreover, the present study will have several new types of sample surveys, the personal opinion, for example, for which new expansion techniques may be devised. Expanding a sample will be as critical as was drawing a valid sample in the first place; extreme care is required.

C. Accuracy Checks

All origin-destination studies are characterized by the under-reporting of trips. This is the natural result of respondent misunderstanding, forgetfulness, imperfect knowledge, and other factors. To determine the extent of under-reported trips, as well as to further test the accuracy of recording and processing of reported trips, a number of accuracy checks will be required. These will include the so-called screen line checks, the population checks, the labor force and work place checks, and a number of others. Not only are trip data evaluated, but also as much other data as possible.

In determining an overall level of accuracy a number of factors will be considered. First, there is a certain non-comparability of definitions between trip surveys data and data obtained by other agencies for other purposes. Second, there is frequently a lack of comparability between geographic areas. Third, the accuracy of the material against which survey data is checked is subject to substantial variation. And, lastly, there is the problem of sampling variability which may be present both in survey data and in the data against which they are checked. In general, the larger the number of events (e.g. trips, employment, or population of a given characteristic) the smaller is the sampling variability and the more accurate should be the comparison. While these factors will make it difficult to establish absolutely the exact level of accuracy of survey data, the composite result of the various accuracy checks will show the general degree of reliability that can be placed upon them. This is critical to meaningful analysis, either by study staff or by outside users of the data.

D. Trip Linking

Trip "linking" is the process of combining, or linking, a series of trips that have occurred in sequence but which, for analytical purposes, should be considered as a single trip. For example, a man is driven to a railroad station by his wife; there he takes a train downtown; there he takes a bus to his office. In the surveys, these would be recorded as three distinct trips; in reality, they are parts of a single journey to work. Linking will collate

the three trips mechanically and produce a single punch card combining the essential elements of the single journey. This procedure is, of course, just one of a great many processing tasks that precede further analysis but is noted here because of its rather unique and difficult nature.

E. Analytical Reports

Once basic punch cards have been prepared and initial processing completed, there will be a continuing order for analytical reports by study planners. The procedure will be for them to prepare a work request which is transmitted to the machine room and to other division heads so that combined needs can be anticipated in advance. In response, they will get listings, summaries, tabulations, or other specified punch card outputs. These are extremely varied and defy complete description. In prior transportation studies, it has not been uncommon to develop (by combination of various data sources) some 300 separate punch card decks, ranging from less than 100 to over 100,000 cards each, from which about 400-800 separate, bound tables and reports were prepared. At an early stage of the study, there will be a constant backlog of machine work to be accomplished, and it will be necessary to set work priorities on a weekly basis.

The speed and accuracy with which reports come from the machine room will determine the pace of the study. They must not be interrupted for any reason whatsoever; every interruption means a delay in the completion of the study. To guard against the delays that can occur because of trying to do work for outside agencies, simultaneously, a policy will be established that such work will not be done if it threatens to interfere with continuous progress (see exhibit 12). The study will perform all of its data processing itself. To this end, it will at first have the following machines on premises (with supporting hardware):

IBM Key Punch	(6)
IBM Verifier	(3)
IBM Sorter	(2)
IBM Collator	(1)
IBM Reproducer	(1)
IBM Tabulator	(1)

Somewhat later an IBM 1401 will be installed. This will eliminate the need for the tabulator, reproducer, and collator. Still later, an IBM 1620 may be installed in place of the IBM 1401. This computer is capable of much of the model building work expected to be necessary. Since it is not capable of accommodating the "transportation" model, however, it will be necessary to rent time outside on an IBM 7090 computer. These computers, along with the other punch card equipment, and the staff to run them will give the study a strong capability for all kinds of data processing.

V. Data Projections - The Forecasts

A. Population and Economic Growth

1. Demographic Projections

Demographic projections of population will be made for 1965, 1970, 1975, 1980, and 1985. Much of this work has already been completed under the Wisconsin P-6 Program by the University of Wisconsin, using standard demographic procedures. As previously mentioned, these projections will be compared with those resulting from the P-6 program's economic base study and from those which may result from application of the economic model which may be developed and single "reasonable" estimates for each target year derived. The latter will then be distributed by small unit of area -- the analysis zone -- according to the land use forecast and according to each subsequent land use plan.

2. Employment Projections.

Employment projections will be made for the same five-year intervals. Again, much of this work has already been completed under the Wisconsin P-6 program by the Wisconsin Department of Resource Development. The results will be compared and brought to single best estimates with the results of the demographic projections and with the results of the regional activity model. Subsequently, employment will be distributed by analysis zone for each pattern of land use development under consideration. Type of employment will, at a minimum, distinguish between manufacturing and nonmanufacturing.

3. Vehicle Registration Projections

After population growth rates have been established, and after population has been distributed by zone, estimates of automobile ownership and truck registration will be prepared. The number of no-car, one-car, and multicar households will be established by zone. Similarly, truck registrations will be established by zone and by light, medium, and heavy body types.

B. Land Use

A land use proposal will be prepared for 1985 and will specify the quantities and spatial locations of major types of land uses, probably not more than twenty in number, by zone. This proposal will represent a best estimate, given corresponding best estimates of population and employment distributions, given best estimates of pertinent public and private development practices and policies, and given assumptions with respect to continued prosperity and peace. All known plans and commitments will be incorporated. Where plans are lacking, judgment decisions will be made. This projection is meant to reflect the kind of development which would occur without the present planning program.

The first land use proposal will follow a simple step-by-step sequence: 1) the land available for intensive development will be defined; 2) the changes in already developed land -- including those resulting from or due to

result from renewal, redevelopment, highway and conservation projects, and other plans or commitments -- will be incorporated; 3) the added regional activities, whose locations would not be related directly to the population distribution, will be quantified and distributed; 4) the future net residential densities and the areas of potential residential development will be specified, and population holding capacities calculated; 5) the region's added population will be distributed according to accessibility standards; and 6) finally, the added local activities directly necessary to support the added population will be quantified and distributed.

Certainly, a land use forecast is not a land use master plan. A land use forecast is a projection of prevailing trends, shaped to conform to past and present experience but also anticipating any probable changes in the underlying market forces. A land use forecast describes what is most likely to happen without a change in existing development policy; a land use plan describes what should happen for the best directed and most orderly growth. In fact, a land use forecast can be a positive asset for land use planning: wherever the predicted pattern of development within a particular area appears unreasonable or inefficient, active steps can be taken to shape something different.

C. Trip Origins-Total Person Travel

1. Person Travel

A preliminary estimate of person travel will be developed for 1985 from the separate and prior forecasts of population, employment, vehicle registration, and land uses. Since the key to predicting future travel patterns is an understanding of the interacting relationships between travel characteristics and the regional environment, careful analyses of the factors determining future transportation requirements will be required. Included will be analyses of economic functions, structure and trends; future employment levels by small geographic areas; trends in consumption and production patterns; population trends by small geographic area; soil and water capabilities to support urban development together with relative levels of improvement and capital investment necessary to support such urban development; existing land use structure, trends, plans and policies; and of travel patterns, modal splits, and trends. Measurable relationships between travel patterns and land use will have to be derived as will network analyses, techniques and procedures; and the work will include model formulation, calibration, test, and if necessary, modifications and adjustment.

2. Auto and Truck Travel

Vehicle travel and transit travel will be derived from person travel. A preliminary estimate of person travel fixes the total number of trips produced by the study area population and specifies trip destinations (or origins) by zone by type of activity (land use). After the potential transit ridership is subtracted, the remaining person trips are converted to automobile trips by predicting the average number of persons per car by trip purpose. Truck and taxi trip destinations are predicted separately to derive the total vehicle activity inside the region. Finally, all vehicle trips with origins outside the region will be separately predicted.

3. Transit Travel

A preliminary estimate of transit travel will be developed for 1985 by assuming that the present level of transit service per capita will continue. This estimate will, therefore, derive mainly from household characteristics -- real family income, automobile ownerships, net residential density, and similar factors not directly related to the supply of transit facilities available.

It must be recognized, however, that there is an interaction between the supply of travel facilities provided and the demand for them. Neither the demand for transit nor the demand for highways is completely independent of the kind and amount of travel capability provided. But, the general adequacy of each transportation system will dictate the kind of travel that will occur in an urban area. The demand for transit, particularly, appears to be fixed more by factors external to the transit system itself. Most transit operators adjust the supply, or scheduled service, to meet the demand; most find that the demand is highly resistant to any efforts to shape it through special rates or other inducements to ridership.

Nevertheless, when improved transit facilities are considered in conjunction with alternate land use plans, an increment of transit ridership will be estimated as closely as possible for "diversion", that is, for automobile users who are attracted back to transit riding.

The three travel demand estimates -- total person travel, auto and truck travel, and transit travel -- will be made by rather conventional methods of trip generation developed by predecessor studies. Wherever possible, of course, improvements in technology will be attempted. Since conventional methods usually involve separate predictions of separate trip types, and a balancing and reconciliation of any differences by zone, a significant advance might stem from a trip generation model. A trip generation model would serve to speed the process appreciably.

4. Trip Distribution

The purpose of the trip distribution forecast will be to show how groups of trip ends, or origins and destinations, link up to create a reasonable amount and a predictable pattern of over-the-road travel. Thus are added the dimensions of length and direction, vehicle-miles indicating the demand for highway capacity, and passenger-miles indicating the demand for scheduled transit service. These measures are more meaningful for locating new travel facilities than are the gross numbers of trips to particular traffic zones or traffic generators within the study area.

The future distribution of travel will be simulated by applying the known rules of travel behavior that govern the linkage of trip ends. Since these rules can be applied to reproduce the present travel distribution with some accuracy, they can be used with reasonable assurance to predict the aggregate movement of persons and vehicles in the future. Individual trips cannot be traced through a complex highway or transit system; this would be an impossible task to achieve with any accuracy. But with a modern computer

the total trip movement between any pair of traffic zones can be calculated and allocated to the most probable travel path. Dealing with these groups of trips is manageable and reasonably accurate; the process is called trip distribution and traffic assignment and is presently the most effective device for testing and evaluating transportation plans. The preliminary trip distribution, based on the land use proposal will change for each subsequent land use-transportation plan. This first distribution and assignment of 1985 traffic will be made on the present plus committed facilities to reveal any deficiencies.

VI. Looking Ahead -- The Planning

A. Land Uses

1. Goals and Objectives

The first step in the preparation of a regional land use plan will be to establish those goals and objectives that must be met by the plan. This is a task not only for the professionals of the study staff but also for the three advisory committees to the study - the technical, citizen and intergovernmental - and for others converned with looking ahead in southeastern Wisconsin. Goals and objectives really determine the kind of plan that must be prepared. To be implemented, the plan must truly reflect realistic goals that accord with the deep-seated desires of the citizens of the regions. Because the goals may be largely inarticulate, they may be difficult to formulate quickly.

In considering the kind of plan desired, the goals and objectives will generally be stated in regional terms. It will not be possible, for example, to consider the detailed local goals and objectives of each of the 153 local units of government in the region. Nor is this the purpose of regional planning. Rather, overall regional considerations will be paramount. Which large areas should be set aside for regional open spaces and recreational reserves? Which large areas should be defined at least desirable for intense urbanization? Which large areas should be set aside as agricultural reserves? What densities of development might be best for the urbanizing fringe areas contiguous to presently built-up areas? What population might ultimately be supported by southeastern Wisconsin and how should it be distributed? What levels of service are desired for recreation, transportation and education? The answers to such questions will require at least tentative agreement among all interested parties before plan formulation can begin.

2. Park and Open Spaces

Perhaps the regional planning objective that is best recognized is the need to acquire, in advance of urbanization, sites for regional parks and open spaces. Preliminary discussions with the Wisconsin Conservation Department and the Department of Resource Development have been held and an agreement for joint work is expected shortly. Such work will produce a detailed survey of potential sites for park and open space reservation and development in the region. This should include the identification and delineation of all sites which have recreation or open space reservation potential. This will necessitate consideration of topography, ground cover, flood plains and flood ways, lakes and wetlands, sites of historic and scientific interest or of unusual scenic value, fish and game habitat, and public and private wildlife conservation areas (for further details, see Exhibit 13, "Staff Memorandum on Regional Park and Open Space Planning Program").

3. Residential and Residentially-Oriented Land

Another quickly recognized planning objective is to plan for orderly growth of residential areas, both in the urban fringe and further out in the rural parts of the region. Along with land for residentially-oriented uses such as local shops, stores, schools, libraries, parks and other community

facilities, residentially-used land may represent up to three-fourths of all urban-used land in a metropolitan area. This marks it, aside from the human factor, for special attention.

Like other regional land use planning, of course, the problem of scale prohibits detailed residential area planning. Rather, the most appropriate contribution may be the delineation of natural neighborhood units within which detailed planning would be accomplished. Proposed neighborhood units, however, can be defined more readily on the basis of projected natural boundaries, net residential densities, public utility extensions, and highway networks. Although there may be some existing neighborhood units that may be difficult to define because they have "just grown", and have not been consciously planned.

In making such delineations, a major purpose will be to show those areas from which residential development should be excluded by reason of their unsuitability for septic tanks, their having bedrock too close to the surface for either public sewers or septic tanks, their having periodically high water tables, their inability to bear foundation loads, and other factors which should discourage development (but often do not). This is a basic function of the overall land use plan.

4. Industrial and Other Regionally-Oriented Land

Planning for regional industrial growth is important because industry provides the employment to support an expanding population. However, planning for new industry is rather difficult and the several approaches that have been used in the past are still somewhat controversial. For example, does setting aside industrial land reserves really increase the chance for attracting new industrial development? Or is it better to provide added industrial land adjacent to existing industrial sites through renewal or redevelopment? There seem to be mixed reactions to the concept of generating industrial growth. Typically, individual municipalities each will zone some portion of their land area as "industrial", hoping, apparently, to be in a position to attract industry, other things being equal. In other instances, a municipality may decide that it wants no industry at all. The problem for regional planning may be to estimate the total industrial reserve that should be maintained and to suggest the most appropriate of many potential sites. Short of an active participation in an industrial development program it would be difficult to do more.

Planning for other regionally-oriented land uses, such as colleges, hospitals, harbors, shopping centers, and the like, is perhaps equally difficult. Such activities as harbors and port facilities and airports have relatively unique site requirements and these sites are fairly obvious. Even so, the possibility of a new airport, for example, cannot be set forth realistically in a plan without demonstration of the real need for an airport and some reason to believe that the responsible public agency will provide for it. Other regional activities, such as colleges, do not have stringent site requirements and such sites cannot so easily be narrowed down to a few choices. This makes their planning all the more complicated.

To plan subsequently for a regional transportation system, of course, it is necessary to assume that selected sites will be occupied by the designated or planned activities. This is necessary to convert projected land activities

to trips. This trip generation by unit of area (or traffic zone) is necessary to test the efficiency of alternate transportation plans. With this end in mind, it is sometimes difficult to distinguish between a land use forecast and a land use plan. Whichever is more apt, for subsequent transportation planning purposes, there are at least three parts to the definition of future land uses: 1) the quantity of land needed for particular activities must be defined; 2) the general availability of suitable sites must be determined; 3) the future distribution must be specified.

B. Transportation

1. Goals and Objectives

Like land use planning, the actual planning of transportation facilities must be preceded by a statement of planning goals and objectives. The ultimate objective, of course, is "to develop a workable plan to guide the staged development of transportation facilities to serve the evolving region" (Prospectus, Page 10). It is quickly apparent, however, that this is not meant to be the single objective of the planning task. Implicit in the Prospectus statement is a group of related objectives which together shape the nature of the transportation planning process.

The following variables merit specific definition: the nature of the transportation system, the quality of travel service that it should provide, and the size of the capital investment that can be made. Beyond this, what of providing for the best development of particular land uses? What of transportation needs when the area has attained its ultimate growth? What of anticipating radical innovations in travel modes? These and similar considerations have an important bearing on the kind of plans to be developed. They must be resolved explicitly before the actual planning effort can begin.

The nature of the transportation system, its mixture between highways and transit, will be established in relation to the estimated market for person and vehicle travel. There are no arbitrary rules for achieving the so-called balanced system - for saying that a metropolitan area should have so many highways and so much transit. Instead, plans will be based on the travel demand for each travel mode as developed from the travel characteristics that influence the trip-maker's needs. Naturally, highway and transit planning must be co-ordinated closely to achieve an integrated transportation system to match the expected components of travel demand.

Establishing a desirable quality of travel service for both person and vehicle movements has several aspects - desirability is represented by a combination of speed, safety, economy, and accessibility. Although, for example, there is relatively good access to the urban center from all directions, travel speeds during peak hours indicate considerable restriction in the general freedom of movement. More rural sections of the region, on the other hand, may have adequate capacity and speed of movement in certain directions but not in others. Moreover, while either type of area may have a desirable quality of highway travel service, it may lack comparable transit service; in most urban areas at least both are required.

Actually, no plan can provide a desirable quality of travel service for all trips at all times of the day. This would be prohibitively expensive and uneconomical. But a good plan can recognize and provide speed and directness for major movements. By so doing the plan will create safer travel, too, because accident rates are much lower when streets and highways are less crowded. In drawing up the highway and transit plans, then, it is well to improve the quality of travel service to the point where the total cost of travel; that is, operating, accident, and travel time costs combined, cannot be reduced by further expenditures for transportation improvements. This criterion ensures desirable results by penalizing a poor quality of travel service in dollars and cents.

Simultaneously, the same criterion ensures an economic plan; that is, one whose benefits surpass its costs. The necessary level of annual investment may well be greater than that which seems feasible at first glance. It is realized that construction costs are only a part of the total since maintenance costs will always follow. However, each community will have to make the decision of whether it can afford to construct this facility or whether it can afford not to. If something less than the recommended plan is built, the resulting increases in vehicle operating costs, accident costs, and travel time costs may more than offset the savings effected by lower construction costs. This would not represent the least travel cost solution, but would be more expensive, all things considered, than the recommended plan.

Moreover, in providing for these major determinants of the transportation plan, attention must be given to serving the best development of land uses. In some cases this is a negative requirement; most parks and cemeteries, for example, should be inviolate for reasons of aesthetics and good planning practice. Planned transportation facilities should generally skirt, rather than penetrate, such areas. In most cases, however, the need for land use service is a positive requirement. Any efficient transportation system must provide good accessibility to the major traffic generators: business or commercial districts, industrial sites, cultural and recreational centers, and residential areas. Because the recommended plan will be predicated on the expected travel demand, which, in turn, will be based on the probable land development, this direct service requirement will be virtually built in.

The region's development will not stop in twenty years, of course, but will continue to some ultimate degree of maturity. This is the last major planning consideration: Although traffic in a particular travel corridor may call for one freeway by 1985, the ultimate development of that corridor may call for two freeways. Thus, while only one may be built by 1985, allowance must be made for the next one. Similarly, the possibility of extending rapid transit lines to areas that later may warrant such service must be considered in setting the 1985 route alignments. The transportation system must have the flexibility to grow and expand like the study area and the surrounding region.

With all these factors taken into account a more binding statement of objectives can be formed to guide plan development, for example: to develop an integrated plan of major highway and mass transit systems for the target year of 1985, designed to serve most effectively the planned land uses and to meet the anticipated travel requirements with an adequate quality of

service, within the practical economic reach of the responsible agencies, and compatible with the requirements of the ultimate development of the region. The foregoing statement requires the establishment of additional criteria to be applied to the several phases of the transportation planning process.

2. Highways

The methods of highway systems planning have become rather well defined. In general, the methods to be used in the present study will parallel those that were developed in Chicago and Pittsburgh and which are now in use in many other urban areas. Instead of attempting to summarize them here, it will be more appropriate to describe, generally, the sequence of the transportation planning process, starting at the point where a land use plan has been proposed.

The scale of highway planning has been broadly set: the prime objective is to develop a system of major highways -- in effect, a freeway and an arterial highway system. At this scale a comprehensive viewpoint is mandatory. With about 10,000 miles of local streets and with over 4,000 miles of arterial streets in a 2,600 square mile region, a firm stand must be taken to prevent the study from becoming too far immersed in what must be considered local planning decisions. Stopping to work out the circulatory systems of outlying commercial districts, or designating one way street pairs, would seriously dilute staff effort and would draw attention from more critical questions.

By definition, highway system planning has a broader scale than does highway planning which deals with a series of single route studies. Although a system of major highways cannot be built all at once, it must be planned and tested as if it were all put into place overnight. The location for one route directly affects the best location for another. This concept is so obvious that it scarcely needs specific acknowledgement. Yet it is surprising how often it is ignored. When the planning objective is to program a limited number of improvements only a few years ahead, the tendency is to plan a route at a time. This is not an adequate way to achieve efficient route locations and design; such achievement requires that the highway system be planned from the start as a system.

At the system planning level, moreover, it is impractical to pause and work out the construction design details needed to implement each of the systems for all plans. For example, freeway locations will be only approximate in the initial plans; construction centerlines finally may fall up to half a mile from the centerlines assumed for traffic assignment testing. Subsequent detailed engineering studies, after the approved system is established, will be required to determine the final centerline locations. Similarly, detailed construction designs for ramps and interchanges cannot be drawn up for a whole system; this calls for continuing work as the plan is implemented. Instead, initial interchange locations are assumed and provisions for all vehicle movements are made for traffic assignment testing prior to selecting the final plan.

When this best plan has been selected, of course, the general areas of remaining need will be demonstrated - the areas where there will be a deficit of highway capacity even after the freeway system is in place. The last step in the highway planning process will be to assess the relative extent and cost of providing arterial street improvements in such areas. Although it will be difficult to specify where new streets should be provided in lieu of widening old streets or where specific traffic engineering improvements, such as modern signalization or channelization treatments, would be more rewarding than would reconstruction, it will be possible to indicate the amount of capacity required and its directional orientation. The scale of highway system planning, however, was not meant to direct the year-to-year improvements required for the local and arterial street systems over a twenty year span.

However, since an extended freeway system for the entire region, at anything like urban spacing, is patently unlikely, considerable emphasis must be placed on planning major at-grade highways. This emphasis will be unlike that in any previous metropolitan area transportation study and may call for the development of new methodology. A critical goal will be the selection of an integrated system of major primary and primary highways for each of the region's seven counties. As with the recommendations for arterial street improvements in the more built-up areas, however, these recommendations must follow the designation of the regional freeway system, no matter how sparsely spaced in the hinterland.

Finally, as stated in the Prospectus, while a general plan setting forth the general location and characteristics of proposed major transportation facilities and traffic corridors is necessary as a statement of agreed upon long range objectives, it is, however, quite ineffective as a sound basis for plan implementation through land reservation and for extending technical planning assistance and advice to local government. Such advance reservation of right-of-way and the proper extension of local assistance, as well as the staged construction of facilities, require the preparation of precise and definitive plans setting forth the ultimate development of each of the traffic corridors specified on the general plan. In the case of highway facilities, such plans should set forth proposals as to centerline location, ultimate right-of-way width required, type of access control to be exercised, and type and location of interchanges and grade separations. Such plan preparation will require adequate topographic and cadastral maps along the major traffic corridors. It is intended that the preparation of precise plans proceed on the basis of priorities established in the general plan formulation, and be a continuing process. Such plans shall be prepared sufficiently far in advance of construction to allow proper reservation of land and encourage orderly development of adjacent areas and proper co-ordination with plans and programs of the State Highway Commission.

3. Transit

The methodology of transit planning is, despite the recent upsurge of interest, perhaps still less advanced than the comparable methodology of highway planning. Moreover, because the long range prospect for public transportation is one of the nation's most controversial metropolitan issues, an objective methodology may be difficult to establish. In private and public speechmaking, in the newspapers, in the professional journals, and wherever travel is a topic for discussion, the role of public transportation is debated,

often heatedly. Personal feelings run high, whatever the viewpoint. The one thing that is universally agreed to - and sometimes hidden by the controversy itself - is that all person travel should be made safer, faster, pleasanter, and cheaper by whatever means are available. In this controversial setting the guiding principle of the present study must be objectivity. The transportation planning process will regard both transit and highways as simply means to an end - the movement of people and goods.

The principal emphasis of the study, with respect to transit planning, is fixed on finding what major mass transportation systems will be needed. In effect, this refers to rapid transit facilities, such as elevated or subway trains, or to express buses operating on exclusive roadways, or to a combination of both. These facilities combine speed with high passenger-carrying ability. They are most effective where there are corridors of concentrated travel demand. The planning problem is first to determine if there are such corridors. Then, if there are, the next step is to fit the most appropriate kind of transit facility to them. Providing for local transit routes, such as the buses or streetcars servicing school and noncentralized transit travel demand, is less a matter of system planning than it is of scheduling the available equipment, to meet the need. This is a degree of detail best left to the transit operators, comparable to acknowledging the responsibility of local traffic engineers for working out the management of the arterial street system and supporting local streets.

Even with the planning effort restricted to defining major systems, several difficult questions will persist. What is the potential ridership of a proposed rapid transit system? What benefits will it provide by comparison to its estimated costs? What sequence of construction would be best? These are questions that the present study should be able to answer. There are, however, other questions that can be answered by subsequent studies only. First would come the detailed physical design and the refined cost estimate. Then, the estimated passenger revenues resulting from alternate fare structures would be compared to the construction and operating costs as a guide to the magnitude of investment required. Finally, sources of capital and methods of financing would be arranged. The present study has no mandate to undertake these tasks (many of which will be shaped by the public policies that may be adopted). Rather, its principal contribution comes from the exploration of the demand side of the ledger - the probable ridership of alternate rapid transit systems and the travel benefits that accrue.

Taken in this perspective, the present transit planning effort is relatively straightforward. First, future transit tripmaking is estimated on the basis of the family home and auto-ownership characteristics. Second, trip origins and destinations are connected to produce the distribution of whole journeys. Third, the corridors of greatest transit travel demand are located and alternate systems of major transit tripmaking induced by these facilities is added to the initial tripmaking estimate and allocated to the complete transit system by transit assignment. Finally, the benefits that result from each alternative are examined to find which is the best transportation investment.

Clearly, highway and transit planning must be concurrent. Highway planning must not be undertaken without due regard for transit planning - more specifically, for rapid transit planning. Although the total amount of passenger-carrying ability to be provided by the integrated transportation system is

relatively fixed, there is some flexibility in the amount to be provided by each of the major travel modes. With some diversion of auto tripmakers to rapid transit, somewhat fewer vehicle-miles of highway capacity may be needed Moreover, the location of a rapid transit facility will affect the appropriate spacing of the adjacent freeways; providing rapid transit and freeway service within the same right-of-way, or even within the same travel corridor, is only rarely feasible. The trip density along Chicago's Congress Street Expressway, with its median strip providing rapid transit right-of-way for a two track line, is very much greater than any comparable trip density in the Milwaukee area. To protect the potential rapid transit ridership, such duplication of service must be avoided here. In fact, deliberately to promote rapid transit usage even the recommended freeways closest to rapid transit should be programmed for construction after rapid transit is built. Thus transit planning affects the amount, the location, and the staging of the recommended highway plan.

Unlike the restraints of scale and prior commitments, however, the coordination of highway and transit planning is more a local restraint than a general one throughout the study area. Generally, a rapid transit recommendation can reduce only the amount of highway capacity oriented to serving the central business district within the travel corridors likely to be served by rapid transit. Coordinating highway planning with strictly local transit service, such as local and feeder buses, is still more a matter for the area's traffic engineers and transit operators. The designation of suitable pickup routes, passenger stops, turnarounds, and similar details has relatively little bearing on the specifications for a regional highway plan.

VII. Comparing Alternative Plans -- The Testing and Evaluation

A. Land Use Plans

It was stated in the introduction to this study design that both alternate land use an d alternate transportation plans will be tested and evaluated by quantitative methods to the maximum extent possible. Generally this means the application of traditional benefit-cost analyses. This type of analysis is very well developed for testing transportation plans. It is not so well developed for testing land use plans. One of the major research undertakings of this study will be to devise improved methods, including but not limited to benefit-cost analysis, of evaluating land use plans quantitatively.

The land use model when perfected will provide one means of evaluating land use plans. For example, the long range practicality of a plan which proposes agricultural belts around urban places can be tested under the assumption that such belts will not, in fact, be protected and perpetuated by public action. If the consequences are great, that is, if the remainder of the regional land use plan is seriously jeopardized by this failure, and if there is a measurable probability for this failure, then this "test" would suggest the abondonment of this particular feature of the plan. If, however, this failure would not be a critical factor in the success of the entire plan, then the green belts concept could be incorporated as a desirable feature, even in the face of possible failure of implementation. In this way, the land use model will be used to test specific features of the land use plan.

The land use model when perfected will also be used to test the whole and entire developmental pattern represented by each alternative land use plan. For example, given today as a starting point, and given a staged and sequenced land use-transportation plan, the model should be able to demonstrate whether development will rather naturally follow the pattern required to make the plan achievable or whether a number of new policies, restraining individual decisions, must be inaugurated. Perhaps it will show that the plan cannot be achieved even with these new policies. There should be many other tests like this which can spell out the implications of the plan as a whole, as distinguished from tests of parts of the plan, and which will be extremely valuable.

In addition to quantitative tests, a very important means of choosing among alternative land use plans will be through organized public hearings. Often technicians lose touch with the citizens for whom they are planning. It is imperative, if the finally-recommended plan is to be implemented, that it capture and hold public interest and support. Obviously, there can be many approaches to securing such support, both when the plan is new and fresh and later when it faces the problems inherent in implementation. For the purpose of this study design, the initial support must be given paramount consideration; the continuing support is a function of the on-going Regional Planning Commission activity, not the time-limited regional land use-transportation study. And, it is felt, public hearings are the most direct and effective method of developing such initial acceptance.

The sequence of land use plan development, review, and acceptance may follow this pattern: the staff will develop at least two land use plans based on different regional concepts of land utilization, and concurrently, at least two alternate transportation plans to serve each of the land use plans. During this process, the Technical Coordinating and Advisory Committee will work very closely with the staff. When these alternative plans are complete, they will be presented, with the staff's recommendation, first to the Citizen's Advisory Committee, then to the Intergovernmental Committee, and finally to the SEWRPC. After thorough review at these levels, the alternative plans will be presented at public hearings. It must be recognized that changes are possible at all stages, through and including the public hearings. If necessary, additional rounds of review will be undertaken. The final land use-transportation plan will then be transmitted to each of the participating counties for its official adoption.

B. Transportation Plans

In a sense, generalized transportation planning of the sort normally undertaken by prior transportation studies will begin with the preliminary facility needs for each land use development concept. Detailed transportation planning, however, must follow selection of the final land use-transportation plan. By detailed transportation planning is meant the actual mapping of the centerline of selected route-miles, the right-of-way, the location and type of interchange, and the access control. This will, of course, involve designating certain necessary changes in arterial street patterns, not only with respect to physical improvements but also with regard to operational changes through traffic engineering improvement.

One of the generalized transportation plans to be developed will be "transit-oriented". In southeastern Wisconsin this suggests heavy reliance on express bus routes. Because of the current interest in rapid transit, however, it would seem desirable to devise and to test, also, alternate rapid transit systems to determine their potential ridership. It will be necessary, of course, that every transportation system devised include local buses; the real problem is to recognize the point at which a special form of transit, that is, rapid transit, is warranted.

The testing and evaluation of alternate transportation plans will generally follow the methodology established in prior studies.

For example, each highway system plan will produce particular costs for vehicle operation, accidents, and travel time. These costs are functions of the type of highway and its relative degree of crowding. Because freeway design provides superior traffic service in all three respects, the greater the proportion of freeway usage as against surface street usage, the lower the total travel cost will be. Generally, to get greater freeway usage requires the proper spacing of a greater mileage of freeways, naturally, at a greater capital expenditure. This is how the least travel cost system is found: freeway mileage is increased up to the point where further construction costs do not yield rewarding decreases in the sum of the construction and travel costs. The target is a 10 percent rate of return on the capital invested for construction.

Similarly, each rapid transit plan will produce different estimates of ridership and travel costs and, therefore, operating costs. These can be compared with the construction costs and benefit-cost analysis used to determine which plan makes the best investment. As with alternate freeway plans, however, additional criteria are needed to evaluate the indirect benefits for which the assessment of monetary value is difficult. The potential role of rapid transit, for example, in maintaining a strong central business district and in integrating various renewal, redevelopment, and master plans must be carefully considered. The satisfaction of such community goals might, in fact, dictate selecting the more expensive of several alternate rapid transit plans.

But the rapid transit and highway system plans must be evaluated by comparison with one another also. If a particular rapid transit mileage is provided, for example, how much freeway mileage can be saved? How carefully does the freeway system avoid serving areas in which the potential for rapid transit should be protected? How well does the total transportation system -- rapid transit and freeways together -- serve the central business districts, the industrial centers, and other dominant trip generators? What areas still require other transportation improvements, such as arterial street widening or express-bus service? These questions are considered during the simultaneous planning of freeways and rapid transit and again as part of the final review of plans.

However, as with the land use plans, there must be meaningful review beyond the study staff and beyond the Regional Planning Commission members. The advantages of review by the Citizens Advisory and the Intergovernmental Committees and, subsequently, through public hearings will be extremely important. Since highway financing, particularly, tends to be a state and federal responsibility, the additional detailed review by the Wisconsin State Highway Commission and by the U. S. Bureau of Public Roads is likely to have great impact.

A final step beyond such approval is the preparation of precise plans for some sixty route-miles of major highways. Reducing the broad, generalized highway plans into preliminary design drawings (not construction blueprints) will involve the hardest kind of test: Will the alignment of this route segment fit between these two parcels of expensive land? Will the gradient of the route segment at this point meet specified design standards? Will this interchange location allow for adequate distribution of traffic to surface streets? To answer such questions satisfactorily, it is not unusual for preliminary design projects to take many, many years. Therefore, this process can only be started as part of the land use-transportation study. However, whatever can be accomplished initially will serve as a final, very practical test of practicability.

TS110/30
LEK:jh
6/18/63

VIII. Timing

An estimated time schedule for the major elements of the study was shown in the Prospectus with the provision that such schedule was subject to revision after the detailed study design was completed. Based on transportation study experience elsewhere, and with the added requirements of (a) dealing with an entire region rather than a metropolitan area, and of (b) having a specific mandate to prepare, concurrently, a land use plan as well as a transportation plan, that timing was rather optimistic.

As always, completion dates are specified on the assumption of success in starting and management; of performing rather complicated research and reaching useful answers on some kind of schedule; of having no delays external to the study effort; of making no mistakes. There are obviously no guarantees that these assumptions will hold. Particularly, when a staff must be assembled and trained quickly to do unfamiliar work, there are clear reasons why predetermined timing can go astray.

Nevertheless, the current best estimate is that the work can be completed to the stage of having approved, regional land use and transportation plans by July, 1966. By this date, also, the first two out of three volumes of the final report should have been published. However, the last volume, assembling and documenting the plans themselves, probably cannot be published until after that date. This final volume might include the first of the precise plans for selected parts of the recommended freeway system. The current estimated completion dates for major work elements are shown in Figure 1.

It should be pointed out that the staff is using the Critical Path Method as a management review and coordination tool during the life of the study.

TIMING OF MAJOR WORK ELEMENTS OF THE REGIONAL LAND USE - TRANSPORTATION STUDY

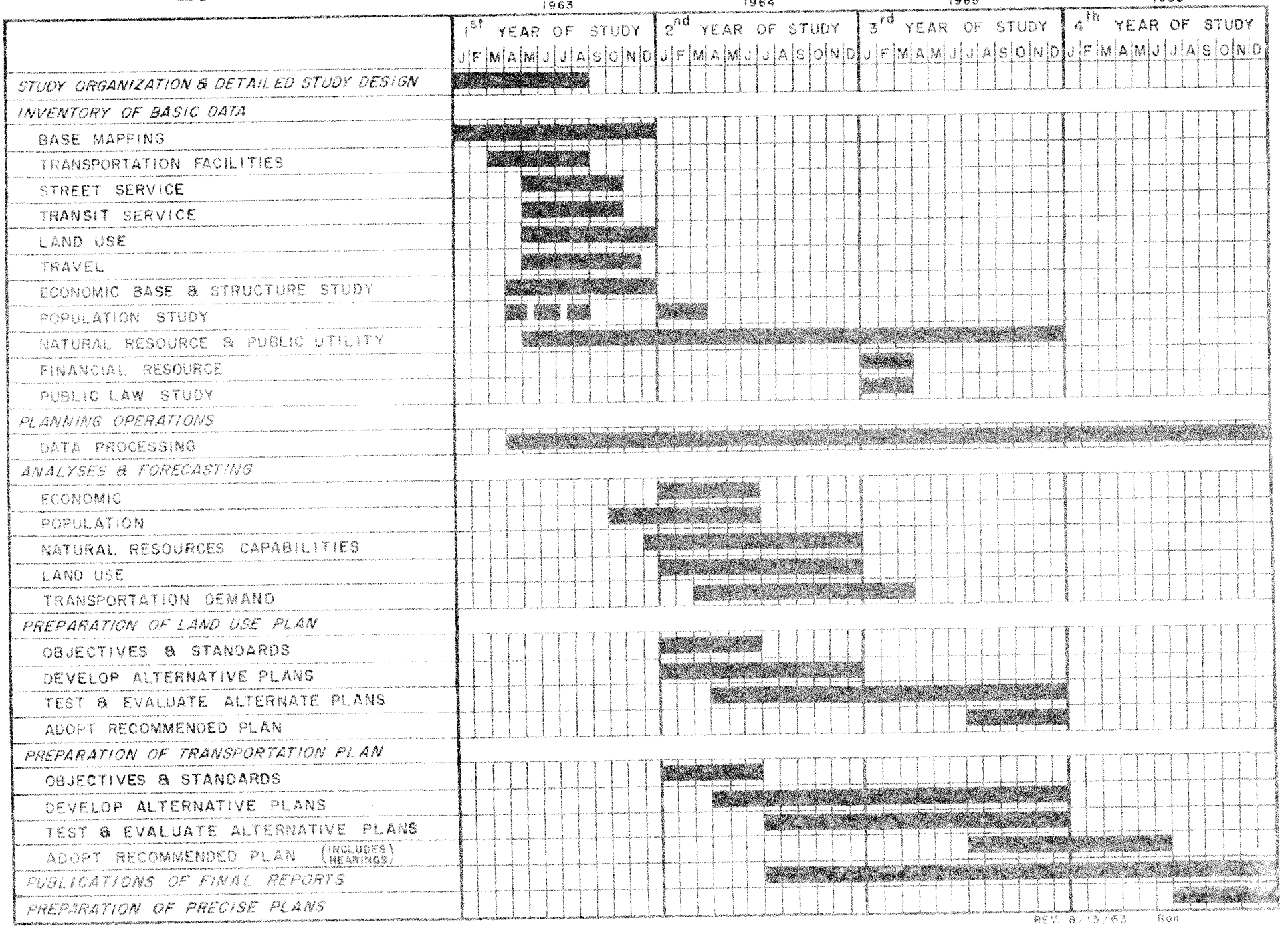


FIGURE 1

IX. Staff and Equipment Requirements

A. Staff Requirements

The broad scope of the proposed study requires a staff trained and experienced in many different skills and professional disciplines. Moreover, the enormity of the task to be accomplished coupled with the fact that some important phases of the work will have to be done with little precedent requires that the staff be able to function as a smoothly operating team geared to tight production schedules and able to meet critical deadlines.

Because of highly variable work loads normally encountered during the course of such a study, transportation study staff requirements change rapidly with time. Generally the staff must be greatly expanded to a peak level during the period of basic data collection. As the large data collection projects are accomplished, personnel requirements decrease sharply to the level of staff required for analyses, planning and report preparation.

The present table of organization is shown in exhibit 14, "Organization Charts and Position Descriptions Manual". It reflects a staff decision to rely principally on permanent staff for all phases of the work load. The staff presently numbers about 250, including about 130 field interviewers and about 50 coders and general clerks. By the end of the year the staff will be reduced to about 70, approximately a third of whom will be professionals. The study is currently fully staffed. Only 12 employees came from beyond the boundaries of the region - 6 beyond the boundaries of the state.

B. Equipment

Besides the usual office equipment, there will be completely equipped data processing and graphics-publications-cartographic operations. The data processing center will include both punch card equipment and computer. For the first two years, it is planned to install an IBM 1401 computer; for the second two years it is tentatively planned to install an IBM 1620 computer. The publications and mapping center will combine conventional drafting capabilities with limited reproduction equipment including a black-white Ozalid printer. It is planned to consider the rental of a mechanical data plotter. In general, it is intended that all necessary tools be directly available to study staff.

X. Cost Estimates

Estimated study costs are set forth in Table 1. The costs presented are based upon the scope of work, time schedules, and study organization set forth in this study design, and were prepared by estimating time and personnel requirements necessary to complete the various subcategories of the work and adding necessary equipment, data processing, and report costs to obtain total costs.

In any consideration of these cost estimates, it must be recognized that precise cost estimates are often impossible until the work is underway. This is particularly true with respect to the analytical phases of the work, since the depth and detail of the analysis required becomes apparent only as the work progresses. Consequently the cost estimates presented in Table 1 must be considered tentative with respect to allocation of total fund requirements among the various subcategories of the work, and changes in this allocation must be expected. The allocations for the subcategories of work do differ from the Prospectus. However, the total cost of the overall project and the allocations of the Federal, State and County Governments remain as originally proposed.

XI. Summary

A great and urgent need exists for this land use-transportation study covering the seven-county southeastern Wisconsin region. This need exists because of changes in regional development patterns which have made available planning data largely obsolete; the necessity of coordinating all governmental planning efforts within the rapidly developing region; and because of the revolutionary changes in recent planning concepts and technology. The importance of such a study to the region, as outlined above, cannot be over emphasized. However, it should be pointed out that the need is further augmented by the Federal Aid Highway Act of 1962 as amended by the addition of section 134 which states in part:

> "After July 1, 1965, the Secretary shall not approve under section 105 of this title any program for projects in any urban area of more than fifty thousand population unless he finds that such projects are based on a continuing comprehensive transportation planning process carried on cooperatively by States and local communities in conformance with the objectives stated in this section."

Perhaps its greatest impact will be the fostering of truly coordinated planning. Regional planning, of course, is no substitute for local planning, and, indeed, a major stumbling block to success would be the growth of feeling that regional planning was meant to supplant local planning. Just the reverse is true. Regional planning, to be effective, must in fact stimulate and promote local planning. One of the ways it can do so best, is by coalescing the overall goals and objectives of the many separate municipalities that together make up the region -- by helping bring local aims into agreement with regional aims. This coordinative role may have some difficulties, but may, in the long run, be more conclusive than the first creation of a regional plan.

Several means of furnishing the basis for continuing cooperation are available and will be pressed into play. The first is represented by the Prospectus itself: to develop this document, local, regional, state, and federal officials met repeatedly to establish the cooperative nature of the present planning effort. As a group, they made strong suggestions regarding an advisory committee structure that would carry forward the cooperative approach that they began. Three important committees were recommended, as described next.

It was recommended that three advisory committees be established as integral parts of the organization for the study, namely: an Intergovernmental Co-ordinating Committee, a Citizen's Advisory Committee, and a Technical Co-ordinating and Advisory Committee. The basic purpose of these committees will be to actively involve the various governmental bodies, technical agencies and private interest groups in the planning process. The recommended committees will be indispensable if the full potential contribution of the land use-transportation study is to be realized and required planning decisions achieved. A final land use-transportation plan will have to be selected on the basis of desirable regional development objectives in light of such questions as: will such development be economically productive, socially desirable, aesthetically attractive, politically attainable, as well as realistic in an evolutionary sense? A consensus on such fundamental

objectives will have to be achieved by the governmental and private agencies concerned, and such agreement can be best encouraged by an appropriate committee structure. The purpose and tentative composition of each committee follows:

1. Intergovernmental Co-ordinating Committee

The basic purpose of the Intergovernmental Co-ordinating Committee will be to assist the Southeastern Wisconsin Regional Planning Commission in determining and co-ordinating basic non-technical public policies involved in the conduct of the study and in the resultant plans and programs. It is therefore recommended that membership consist of elected legislative and executive officials. This Committee will have a particularly important role in the selection of a final land use-transportation plan and in assuring its financial and administrative feasibility. To this end this Committee will have the important functions of familiarizing political leadership within the region with the regional framework and components of the study and of generating agreement and decisions on basic objectives, land use-transportation service levels and standards, and implementing procedures among the region's political units. Such activity is essential if the endorsement of the objectives expressed in the plan and ultimate attainment of these objectives through implementation is to be achieved through co-ordinated action of the local units of government within the region.

It is tentatively recommended that membership on this Committee consist of the Chairman of the County Board of each of the seven counties within the region, the Chairman of the County Highway Committee of each of the seven counties within the region, the County Executive of Milwaukee County, the Mayors of the Cities of Milwaukee, Racine, and Kenosha, and one additional member elected by the Municipal League of Milwaukee County. It is further recommended that state representation on this Committee include the Chairman of the State Highway Commission and one state legislator to be appointed by the Governor. The suggested membership totals 21.

2. Citizen's Advisory Committee

The basic purpose of the Citizen's Advisory Committee is to facilitate the active involvement of citizen groups in evaluating and recommending regional development and transportation policies and to this end participating in the plan preparation. Membership should be chosen from citizen groups and organizations and should include representation from the commercial, industrial, agricultural, professional, and labor communities. It is recommended that this Committee be appointed by the Southeastern Wisconsin Regional Planning Commission.

3. Technical Co-ordinating and Advisory Committee

The basic purpose of the Technical Co-ordinating and Advisory Committee will be to advise the study director on technical methods, techniques, and procedures; to serve as a clearing house for the assembly and evaluation of pertinent data; to recommend technical standards; to exchange ideas and concepts concerning possible solutions to technical problems; and to generally co-ordinate the various operating departments and agencies of government within the region directly concerned with land use and transportation.

This committee has already been named and is comprised of key officials and department heads, appointed by their respective agencies upon the request of the Chairman of the Southeastern Wisconsin Regional Planning Commission, with the assistance and advice of the study director. Membership includes representatives from the U.S. Bureau of Public Roads, the Housing and Home Finance Agency, the State Highway Commission of Wisconsin, the Planning Division of the Wisconsin Department of Resource Development and the Milwaukee County Department of Public Works - Expressway Commission; selected representatives from municipal (county, city, village and town) public works, planning, and traffic engineering departments; and selected technical representatives from private transit and railroad companies operating in the region. The present roster of membership, including named alternates, along with sample minutes of several recent meetings, is shown on exhibit 15.

Further, technical representatives from the Northeastern Illinois Metropolitan Area Planning Commission and from the Chicago Area Transportation Study have been invited to meet with this Committee in order to assure co-ordination with the work of these agencies covering the region lying immediately to the south of the study area recommended herein, and have indicated their intention of doing so.

In addition to these committees, the SEWRPC is coordinating several related groups. One of these is the Technical Advisory Committee on Natural Resources and Environmental Design. Another is the Committee on Economic Development. Others include the Root River and the Fox River Watershed Committees. Although these were committees created independently of the land use-transportation study, they do in fact provide extremely valuable liaison with other individuals and agencies who are, of course, much concerned with the tasks of the land use-transportation study. Considering all of the committees so far named it is safe to say that seldom before have so many diverse interests been brought together so dramatically to accomplish a single purpose.

TS130/25
JRD/jh
8/2/63

Table 1 - Regional Land Use-Transportation Study

Cost Estimates (revised from Prospectus)

Item	Source of Funds HHFA	SHCW-USBPR	Local	Total
I Study Design	16,000	3,400	8,600	28,000
II Collection of Basic Data				
1. Maps				
a. Update base maps	1,467		733	2,200
b. Aerial photography	19,000		9,500	28,500
c. Detailed base maps		67,320	11,880	79,200
Subtotal	20,467	67,320	22,113	109,900
2. Inventories				
a. Travel facilities		22,100	3,900	26,000
b. Land use	73,333		36,667	110,000
c. Travel	14,833	261,205	53,512	329,550
d. Economic	18,333		9,167	27,500
e. Demographic	5,867		2,933	8,800
f. Natural resources and public utilities	99,667		49,833	149,500
g. Financial resources	5,867	7,480	4,253	17,600
h. Planning legislation	2,933	3,740	2,127	8,800
Subtotal	220,833	294,525	162,392	677,750
Collection of Basic Data Total	241,300	361,845	184,505	787,650
III Planning Operations				
1. Data Processing	124,667	158,950	90,383	374,000
2. Analysis				
a. Economic	27,867		13,933	41,800
b. Population	11,733		5,867	17,600
c. Natural resources	34,467		17,233	51,700
d. Land use	58,667		29,333	88,000
e. Travel demand	6,666	85,212	18,372	110,250
Subtotal	139,400	85,212	84,738	309,350
3. Plan Preparation				
a. Standards	5,867	7,480	4,253	17,600
b. Alternative plans	28,600	36,465	20,735	85,800
c. Testing plans	28,600	36,465	20,735	85,800
d. Evaluating plans	23,100	29,453	16,747	69,300
Subtotal	86,167	109,863	62,470	258,500

TS130/25
JRD/jh
8/2/63

Table 1 - (continued)

Item	Source of Funds HHFA	SHCW-USBPR	Local	Total
Planning Operations (continued)				
4. Plan Publication	14,666	18,700	10,634	44,000
5. Precise Plans		28,050	4,950	33,000
Planning Operations Total	364,900	400,775	253,175	1018,850
IV Office Expenses, Rent and Equipment				
1. Rent				50,000
2. Furniture and Equipment				
a. Drafting equipment				7,500
b. Typewriters, copy machines and calculators				15,000
c. Office furniture				15,000
d. Other equipment				3,000
Subtotal				40,500
3. Materials and Supplies				19,000
4. Reproduction and Publication				10,000
5. Telephone and postage				18,000
6. Travel				15,000
Office Expenses Total		129,625	22,875	152,500
Total Project Costs	622,200	895,645	469,155	1987,000

STAFF

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Kurt W. Bauer . . . . . Executive Director

Land Use-Transportation Study Office

J. Robert Doughty . . . . . Study Director

Harlan E. Clinkenbeard . . . . . Chief Land Use Planner

Kenneth J. Schlager . . . . . Chief Systems Engineer

Richard Sheridan . . . . . Acting Chief Transportation Planner

Sheldon W. Sullivan . . . . . Administrative Officer

Wade G. Fox . . . . . Cartographic and Design Supervisor

Central Office

William J. Kockelman. . . . . Chief Community Assistance Planner

David Fonseca, Jr. . . . . Chief Resources Planner

Dallas Behnke . . . . . Chief Draftsman

Acknowledgements

Special recognition should be given to Mr. L. E. Keefer, past Study Director, who prepared the first draft of this report.