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TECHNICAL RECORD

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1963

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VOL. 1

NO. 1

OCTOBER - NOVEMBER

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* * * * * IN THIS ISSUE * * * * *

REGIONAL PLANNING IN SOUTHEASTERN
WISCONSIN * THE SEWRPC LAND USE-TRANS-
PORTATION STUDY * HOME INTERVIEW
SURVEY SAMPLE SELECTION * TRUCK &
TAXI SURVEY SAMPLE SELECTION *

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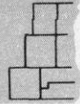
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Dear Reader:

The bimonthly "Technical Record" has been developed by the Southeastern Wisconsin Regional Planning Commission to perform three distinct and important functions:

1. To provide a concise historical record of the technical work accomplished under the Commission's regional land use-transportation study.
2. To disseminate information on technical methods, techniques and procedures applied in the land use-transportation study and in other Commission programs.
3. To encourage an exchange of knowledge, ideas and concepts between technicians, engineers and planners engaged in similar endeavors elsewhere.

We hope you will find this and ensuing issues of the "Record" of particular interest and look forward to your comments.

Sincerely,

Kurt W. Bauer
Executive Director

J. Robert Doughty
Transportation Study Director

Dear Reader:

The bimonthly "Technical Record" has been developed by the Southeastern Wisconsin Regional Planning Commission to present timely, significant and important information to its members.

1. To provide a concise but technical record of the technical work accomplished under the Commission's regional land-use-transportation study.
2. To disseminate information on technical methods, techniques and procedures applied in the land use-transportation study and in other Commission programs.
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Robert W. Bauer
Executive Director



Robert Doughty
Transportation Study Director

THE TECHNICAL RECORD

Volume one

Number one

October - November 1963

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The preparation of this publication was financed in part through a joint planning grant from the State Highway Commission of Wisconsin, the U. S. Department of Commerce, Bureau of Public Roads and the Housing and Home Finance Agency, under the provisions of the Federal Aid Highway Legislation, and Section 701 of the Housing Act of 1954, as amended.

A BACKWARD GLANCE

by R. E. Rehberg, Editor

Planners seldom underestimate the importance of history upon their work. Land use and public utility patterns developed over the years reflect the influence of the environmental and socio-economic aspects of an area and its people. To the planner, these patterns represent basic inputs to the planning process.

In southeastern Wisconsin we have a history overflowing with color and diversity, unique in many aspects, revered and prized, particularly by those who helped shape it. The Technical Record will regularly recollect some of the more fascinating facets of the Region's past.

TOLL ROADS IN SOUTHEASTERN WISCONSIN

In the two years between 1838 and 1840, the population of southeastern Wisconsin had nearly doubled from 7,234 to 14,111, and by 1850, 113,486 people resided in the seven-county Region.

The need for better "year around" transportation, particularly from farm to market, to serve this rapidly expanding population, was of paramount importance. To this end, the territorial legislature of 1846 granted the first charter incorporating a company with authority to construct, on an experimental basis, "a toll road of timber or planks" from Watertown to Milwaukee at a cost of about \$119,000.

The First Successful Plank Road

The Watertown plank road proved so successful (receipts at one time averaged \$1,000 a week) that soon applicants for charters were bombarding the legislative assembly; and between 1846-1852, sixteen charters for the construction of toll roads, most of them plank roads, were granted by the Wisconsin State and Territorial Legislatures. These included, among others: a road from Milwaukee, via Big Bend and East Troy, to Janesville; from Milwaukee via the iron mines and Horicon to Beaver Dam; from Milwaukee, via Waukesha, Delafield and Summit to Watertown; from Waukesha to the Rock River via Genesee, Palmyra and Whitewater; and from Milwaukee to Muskego, Waterford and Wilmot.

Oak planks two inches thick and eight feet long were nailed crosswise to four inch square stringers laid lengthwise. Every three miles, there was a toll gate with turnpike. For vehicles drawn by a single "animal", the

(continued on page 20)

REGIONAL PLANNING IN SOUTHEASTERN WISCONSIN

by Kurt W. Bauer, Executive Director

The southeastern Wisconsin regional land use-transportation study represents the first major transportation planning effort within this country to be carried out by a legally constituted, comprehensive, regional planning agency as an integral part of its work program. In order to provide the background necessary to a proper understanding of this study and how it differs from the previous major transportation studies, it is necessary to understand the need for and objectives of regional planning in southeastern Wisconsin and the manner in which these needs and objectives are being met. The attainment of this understanding requires a review of some important definitions and the basic concepts which these definitions represent.

DEFINITIONS AND BASIC CONCEPTS

First of all, it will be necessary to define the term "planning". Planning is simply deciding, rationally and in advance, what to do. It is a process which involves, first, the establishment of goals or objectives and, second, the establishment of a systematic course of action for their attainment over time. This definition of planning implies three functions:

1. Research; to answer the question: "Where are we now?"
2. Goal formulation; to answer the question: "Where do we want to go?"
3. Specific plan making; to answer the question: "How do we get there?"

We should note that this basic process is the same whether it is carried on in the military, in business, industry, government or even in our own family and personal lives.

Planning may be classified in many ways. It may be classified according to the realm within which the planning decisions lie; as public or private planning. It may be classified according to the disciplines involved in the planning; as military or economic planning. It may be classified according to the thing being planned; as highway, sewerage, water supply, park or land use planning; or it

may be classified according to the geographic area of planning jurisdiction; as city, county or state planning.

The term regional planning is, then, a way of classifying planning according to the geographic area being planned for, as are the terms city, county, and state planning. It should, however, be noted that the manner of defining the jurisdictional area of regional planning is basically quite different from that of city, county, or state planning; in that such definition is not necessarily related to fixed political boundaries. This must be so, because the fundamental purpose of regional planning is to solve development problems which transcend or extend beyond political boundary lines. Regions may, therefore, be delineated in many ways, usually on the basis of the problem at hand. They may be delineated on the basis of economic linkages, topography or topographically related resources, or on the basis of an areawide problem such as urbanization.

Regional planning, it should be noted, is not a substitute for local planning which necessarily exists to solve local development problems. Rather, regional planning is a supplement to local planning and exists to solve areawide development problems which cannot be properly resolved within the framework of a single political boundary.

Sound regional planning must meet three basic criteria. First, sound regional planning must be relatively long-range, looking well beyond the obvious needs of the moment and the attendant expedient solutions. Second, sound regional planning must be comprehensive. It must consider and weigh all aspects of regional development and relate all of these aspects to common unifying objectives. Only in this way can intelligent decisions be made about relative needs and can resources be applied effectively to the areas of greatest need. Finally, sound regional planning must coordinate all related planning activities within a single geographic area. Regional plans must, therefore, be developed cooperatively with all agencies and levels of government operating within the particular region, with private enterprise, and without regard to artificial jurisdictional boundaries.

NEED FOR REGIONAL PLANNING

The need for regional planning has been brought about by certain important innovations of our time. These innovations include: greatly increased agricultural and industrial productivity, the urbanization of farm population, increasing income levels and leisure time, intensive use and consumption of natural resources, far flung electric power and communication networks, and, of course, limited access highways and mass automotive transportation. These innovations are reflected in the large urban regions taking form across our country today. Under the effects of these innovations, entire regions are becoming mixed rural-urban areas, creating new and intensified areawide problems of unprecedented scale and complexity.

The problem of providing economically feasible facilities for the importing, diverting, and transporting of potable water, sewage, and storm drainage; for safe and rapid surface transportation; and for controlling the pollution of streams, lakes, ground water, and air for such urban regions will tax our existing technology to its limits. The problems of adjusting urban growth and development to the resource base, of

preserving land to meet the park and open space requirements of our growing population, and of creating better regional settlement patterns will similarly tax our administrative and legislative ingenuity to its limits. The task is so great and the needs so many that only comprehensive, areawide planning can provide the framework within which these needs can be met.

THE REGIONAL PLANNING CONCEPT IN SOUTHEASTERN WISCONSIN

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) represents an attempt to provide such comprehensive, areawide planning services for one of the nation's large urbanizing regions on a voluntary, cooperative basis. The SEWRPC was created in August, 1960 under the provisions of Section 66.945 of the Wisconsin Statutes, and exists to serve and assist the local units of government in planning for the orderly and economic development of a seven-county region comprised of Milwaukee, Kenosha, Ozaukee, Racine, Walworth, Washington and Waukesha counties. (See Map 1.)

This seven-county Region has a total area of 2,689 square miles and comprises about 5 percent of the total area of the State of Wisconsin. About 40 percent (1.57 million) of the state's population, however, resides within this Region which contains three of the state's 5 1/2 standard metropolitan statistical areas. The Region contains approximately one-half of all the tangible wealth in the State of Wisconsin as measured by equalized, assessed valuation; and from 1950 to 1960 it accounted for 64 percent of the total population increase of the entire state. It also represents the state's greatest wealth producing area, and generates far more in state taxes than it receives in state services.

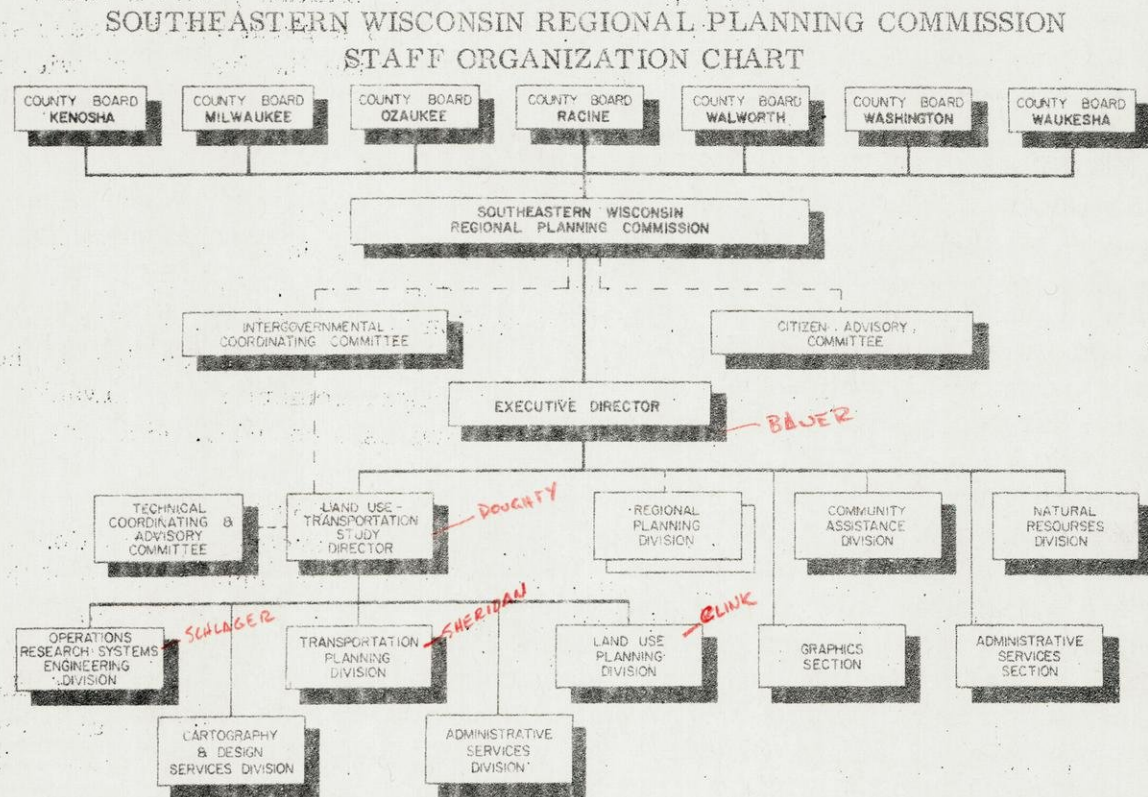
The seven-county planning area contains 11 major drainage basins ranging in size from 26 square miles to 926 square miles, at least nine of which will be seriously affected by the urban expansion of the Region's three urbanized areas. (See Map 2.) A subcontinental divide crosses the Region in a northwesterly-southeasterly direction, imposing severe constraints upon the range of feasible solutions to water related, resourcebased development problems.

The Region is located in a good position with regard to future development. It is bounded on the east by Lake Michigan which provides an ample supply of fresh water for both domestic and industrial use, as well as being part of a major international transportation network. It is bounded on the south by the rapidly expanding northeastern Illinois metropolitan region and on the west and north by the fertile agricultural lands and desirable recreational areas of the rest of the State of Wisconsin.

The Commission itself is composed of 21 citizen members who serve without pay. There are three Commissioners from each of the seven member counties. Two of the three in each county are appointed by the governor, and one is elected by the county board. The commissioners are appointed for 6-year terms, and the terms are made non-coterminous so as to provide continuity in the membership of the Commission.

Basic funds necessary to support SEWRPC operations are provided by the member counties, and the budget is proportioned among the several counties on the basis of rel-

Figure 1



active equalized assessed valuation. The SEWRPC is authorized to request and accept aid in any form from all levels and agencies of government for the purpose of accomplishing its objectives, and it is authorized to deal directly with the Federal government for this purpose. The SEWRPC's present committee and staff structure is shown on Figure 1.

The SEWRPC is charged by statute with the function and duty of "making and adopting a master plan for the physical development of the Region". The permissible scope and content of this master plan, as outlined in the statutes, is extremely broad and extends to all phases of regional development. Such a plan is intended to serve as a basis for the extension of assistance and advice to the various levels and agencies of government functioning within the Region.

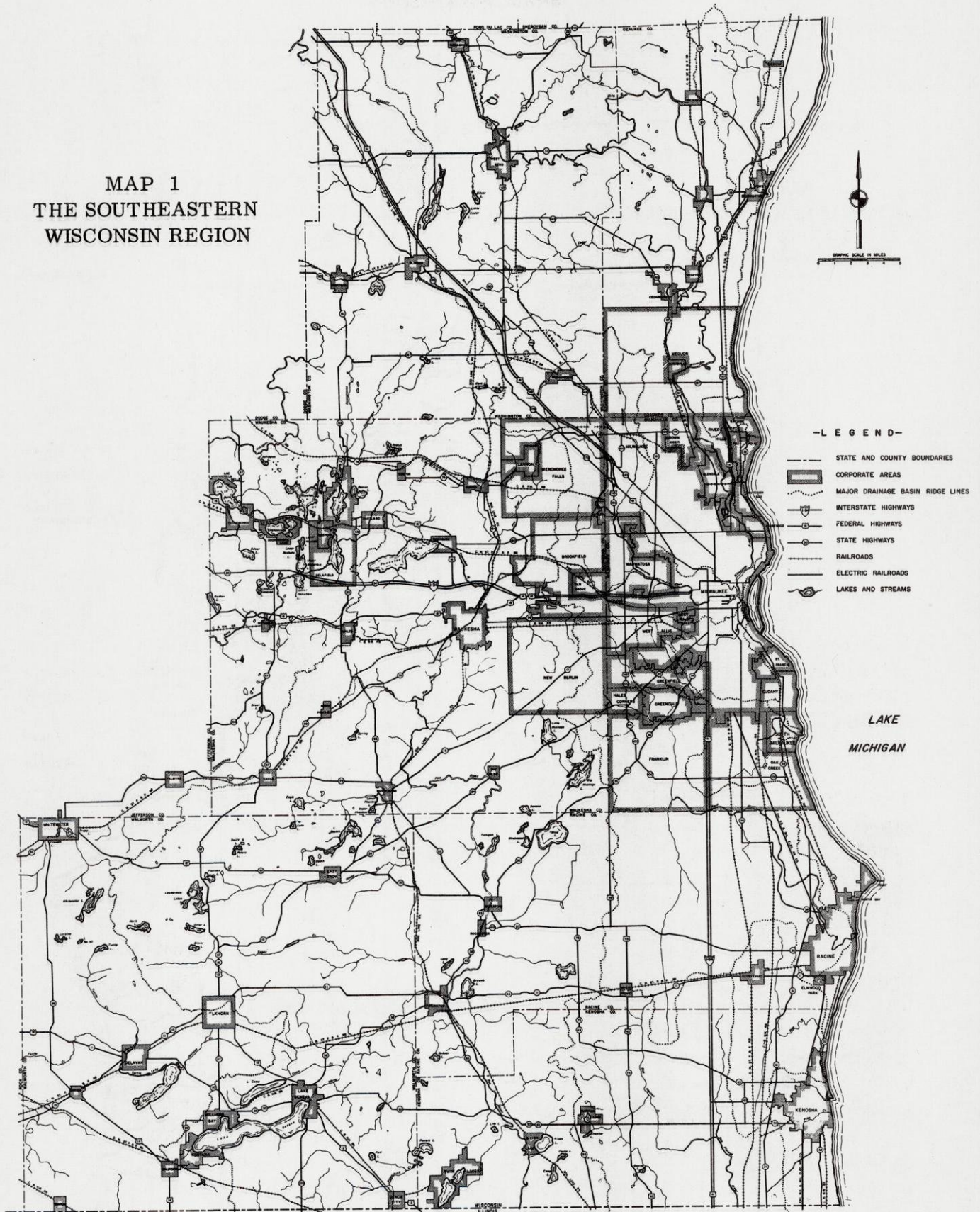
Specific Areawide Problems

The areawide problems which necessitate a regional planning effort in southeastern Wisconsin all have their source in the Region's unprecedented population growth and urbanization. These areawide problems include, among others: drainage and flood control, water supply and pollution, sewerage and sewage disposal, park and open space reservation, economic development and transportation.

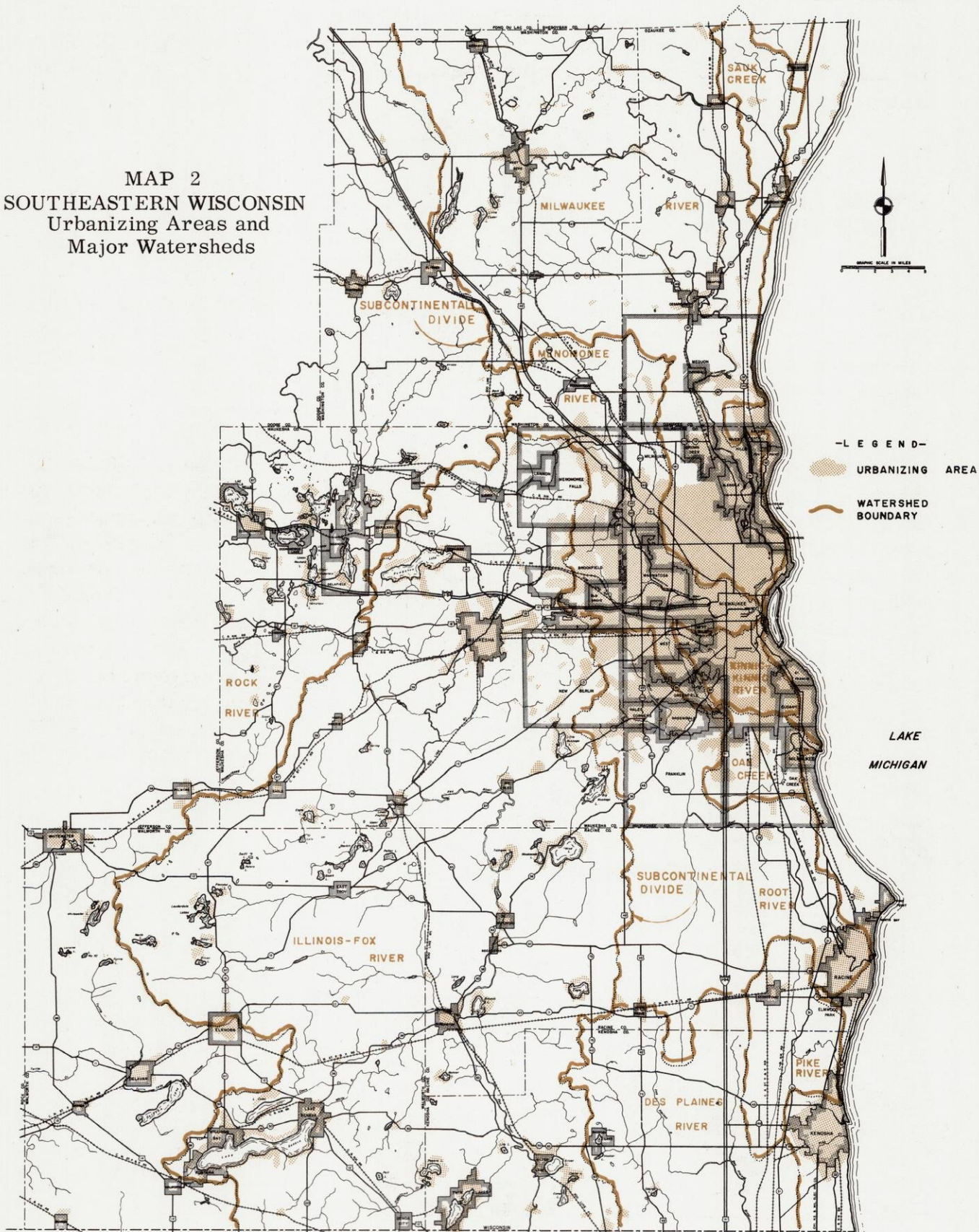
INITIAL WORK PROGRAMS

Reliable planning and engineering data, collected on a uniform, areawide basis, is ab-

MAP 1
THE SOUTHEASTERN
WISCONSIN REGION



MAP 2
SOUTHEASTERN WISCONSIN
Urbanizing Areas and
Major Watersheds



olutely essential to the formulation of workable regional development plans. Such data was virtually nonexistent at the time of the creation of the SEWRPC. The initial work program of the Commission was, therefore, directed toward basic data collection and included six basic regional planning studies, initiated in July 1961 and completed in July 1963:

1. Statistical Program and Data Processing Study
2. Base Mapping Program
3. Economic Base and Structure Study
4. Population Study
5. Natural Resources and Environmental Problems Study
6. Public Utilities Study

These six initial planning studies were carried out under a Section 701 Federal planning grant and provide a basic foundation for all of the Commission's future planning work. A brief description of these studies is warranted in order to properly relate them to the land use-transportation study and other future studies of the Commission.

Statistical Program and Data Processing Study

Effective regional planning is increasingly dependent upon the collection and interpretation of current and historical statistical data covering a complex variety of physical and social factors. A well-defined and continuing program for collecting and processing basic planning and engineering data is, therefore, needed for adequate comprehension of complex regional relationships and evaluation of alternative development patterns. The primary objective of the statistical program and data processing study, therefore, was to develop the basic framework of an information system for regional planning. The framework used in the development of this information system was a series of mathematical simulation models. These models serve to define requirements for future data collection and analysis programs and establish a logical and detailed set of data requirements consistent with the application involved. In addition, the models when further developed and refined will provide a means for quantitatively testing the feasibility of alternative plans.

Four kinds of models were conceptualized in the study:

1. Regional activity model
2. Spatial activity model
3. Transportation model
4. Water resource model

The regional activity model¹ is a socio-economic model intended to simulate economic activity and population growth in the Region. This model is of basic importance since no sound plans can be formulated which ignore the dynamic nature of the Region's economy and population.

The spatial activity model² is intended to simulate the development of regional land use patterns. Inputs to this model are economic activity and population growth levels generated in the regional activity model, site accessibility factors, site suitability factors and existing or proposed land use development plans and policies.

③
The transportation model is intended to simulate trip generation from land use characteristics, distribute these trips to zonal areas within the Region and assign the resulting interzonal traffic to highway and transit networks.

④
The water system model is intended to simulate the flow of water supply and waste water disposal systems, relating these to surface and ground water supplies and to land use patterns.

The scope of the study was limited to the conceptualization of the models in sufficient detail to permit the definition of data requirements. Further development and computer programming is required to make the models fully operable. All of the models, except the water system model, are being further developed and applied in the regional land use-transportation study.

Base Mapping Program

Good base maps are essential to any regional planning program, and the primary objective of any regional base mapping program is to provide a means of recording, in a permanent useful form, a great deal of information about the natural and manmade features of the Region. A secondary objective of the SEWRPC base mapping program was to provide a means by which information collected in various planning studies could be related to the geographic area from which it was taken: i. e., permit geographic identification of all planning data by machine methods.

The SEWRPC base mapping program resulted in the preparation of a unique and highly versatile series of regional base maps. The series includes regional maps and county maps in a choice of scales ranging from 1:24000 to 1:500000, and in a choice of sizes ranging from 7 by 9 foot county wall maps to 8 1/2 by 11 inch regional hand maps. All of the base maps were compiled on the Wisconsin state plane coordinate system grid. This grid not only serves as a true map projection for the work but also provides the primary system of geographic identification for data collection programs, and when linked to the U. S. Public Land Survey system, is well adapted to analysis by geographic areal units of almost any degree of coarseness or refinement.

The various map sheets can be combined by simple mosaic processes to depict, in its entirety, any natural or rational planning area such as a watershed, a commutershed, a special purpose district or a group of communities within the Region. The base mapping program provided the first true maps which accurately portray all of the counties within the Region at a uniform scale and upon which distances and areas can be accurately measured. As such, the maps represent a permanent and valuable capital investment for the Region.

Economic Base and Structure Study

This study was intended to provide a basis for an understanding of the Region's economic base and structure. Such an understanding is essential not only to the preparation of practical and workable long-range plans for the physical development of the Region, but to any development program which might attempt to strengthen the Region's economy.

The study also analyzes the growth tendencies, strengths and weaknesses of the Region's mature economic core and causative factors in the growth or decline of important economic activities. The study includes regional employment forecasts for the years 1965, 1970, 1975, 1980, and 1985; and these employment forecasts are expanded to obtain total population levels which could be supported by the forecast employed labor force. The study also provides data on analyses of such important economic indicators as labor force, disposable income, retail sales, wage rates, value added by selected manufacturers and agricultural activity.

Population Study

This study was intended to provide information on three basic aspects of the Region's population (population size, composition and spatial distribution). Since the economic study examined many of the economic factors which influence these three aspects, the population study was limited to examination of purely demographic influences. More specifically, this study included analyses of birth rates, death rates, net migration rates, gross density patterns, educational attainment, marital status, family size, age and sex composition, race and nativity, as well as sheer population size.

In order to meet the needs of comprehensive planning, all of the population data were organized and analyzed in both a current and historic frame of reference for a variety of statistical area units: for the Region as a whole, for each of the seven counties within the Region, for each of the three urbanized areas within the Region, and, on a limited basis, for each of the minor civil divisions within the Region.

Population projections were prepared by age and sex for the Region as a whole for 1965, 1970, 1975, 1985 and for each of the seven counties for 1970 and 1980.

The results of the study are useful to county and local as well as regional planning efforts since the population projections provide a suitable basis for local projections by the ratio method.

Natural Resources and Environmental Problems Study

Sound regional planning must concern itself with the problems of adjusting urban growth and development to the underlying resource base. Such concern is essential if land is to be preserved to meet the park and open space requirements of the Region's growing population; if pollution of the Region's streams, lakes, ground water and air is to be controlled; and if severe environmental problems due to flooding, soil erosion, stream siltation, and destruction of fish and wildlife habitat is to be avoided.

Specific data concerning the natural resource base and its capability to sustain increasing urbanization is, therefore, essential to sound regional planning. This study was intended to begin to provide such data by inventorying, organizing, evaluating, and interpreting all existing data relating to the regional resource base. Much of this existing data was directed toward the solution of single purpose problems and lacked interpretation for comprehensive planning purposes. Topics covered in the study include historic resource patterns, climate and weather, geography, mineral and nonmetal resources, forests, soils, air, surface and ground water, flooding, fish and wildlife, recreation

and open space. Among the unique contributions of the study are a series of 47 flood hazard maps.

The study outlines needs and problems requiring additional research and recommends a number of specific resource planning and action programs based upon the study data and its analysis. Recommended programs include regional surface and ground water studies, a regional operational soil survey and interpretation, a detailed regional park and open space inventory and comprehensive watershed planning programs for each of the major watersheds within the Region. Some of these recommended studies are being carried out as an integral part of the SEWRPC regional land use-transportation study. Others will require the formulation of new joint inter-agency programs, while still others will require future action by the local units of government concerned.

Public Utilities Study

Urban development today is highly dependent upon the utility facilities which serve the individual land uses with power, light, heat, water and sewerage. How well a region can sustain urban development will, therefore, depend to a considerable extent upon the location and capacity of these facilities. Moreover, certain of these utility facilities are closely linked to the surface and ground water resources of any region and, therefore, may affect greatly the overall quality of the regional environment.

This study was intended to provide such a basic physical inventory of the various utility systems serving the Region, provide data on their existing and probable future service areas and on their capacity to absorb new urban growth and development.

The physical inventory included the collection of large scale maps of each city, village and sanitary district within the Region showing the geographic location of all existing and proposed sanitary trunk sewers, sewage pumping stations, sewage treatment plants, storm water trunk sewers, storm water pumping stations, improved water courses and drainage channels, water transmission mains, water pumping stations, water treatment plants, water reservoirs and elevated storage tanks, wells and intakes. Sizes, invert grades and invert elevations were obtained for critical points in all gravity flow systems so as to permit capacity analyses to be made. The existing and proposed service areas of all sanitary sewer, water, gas, and electric power systems were mapped as were the tributary drainage areas to all major storm water drains. Planning and engineering data were collected and tabulated for all systems, including data on the location area served in square miles, treatment provided, disposal of effluent, treatment plant capacity, present flows, estimated population served, present per capita flows, existing excess capacity of treatment plants, percent metered, and source of supply.

All of the foregoing six studies were directed toward providing a basic foundation of planning and engineering data for regional planning and are documented in published reports. None of these studies involved the preparation of plans.

OTHER PROGRAMS AND ACTIVITIES

Also as a part of its initial work program, the SEWRPC has adopted a policy of community planning assistance wherein functional guidance and advice on local planning

problems are extended to local units of government, upon request, and through which regional planning studies are interpreted locally and regional plans integrated with local plans. This program will become increasingly important as a framework of regional development plans is created. Four local planning guides or handbooks are currently being prepared under the community assistance program to provide municipalities throughout the Region with information helpful in the preparation of sound local codes and ordinances which will aid in implementing local as well as regional plans and which will assist local public officials in carrying out their day to day planning functions. The subjects of the first four guides include: organization of local planning agencies; subdivision control; official mapping; and zoning. All include model ordinances.

The SEWRPC also carries on a modest public information program. A bimonthly newsletter is mailed to about 3,000 persons within the Region, and a weekly staff letter is mailed to a selected list of interested persons. The SEWRPC sponsors an annual regional planning conference which is attended by about 300 interested public officials, technicians and citizens from throughout the Region.

The first work program actually directed toward the preparation of long-range development plans to be undertaken by the Commission is the regional land use-transportation study.

LAND USE - TRANSPORTATION STUDY PROSPECTUS

There were a number of reasons why the Commission chose the transportation problem as the object of its first large scale planning effort. First of all, the Commission was aware of the fact that providing for the movement of people and goods within the rapidly urbanizing Region was one of the most complex and difficult problems facing public officials. The magnitude of the transportation problem and its importance to sound regional development required that early consideration be given to this problem. Secondly, the Commission was aware of many local traffic and transportation problems, some of these very pressing, which could only be resolved properly within the framework of a regional transportation plan. Thirdly, the Commission through close liaison with the State Highway Commission of Wisconsin, anticipated the fact that the Federal Aid Highway Act of 1962 would limit Federal monies for new highway construction in large urban areas after July 1, 1965, unless such urban areas have established a comprehensive, areawide, continuing transportation planning program. The provisions of the new Federal Aid Highway Act directly affect 32 cities and villages within the Region which are a part of the Racine, Kenosha, and Milwaukee urbanized areas.

Finally, the Commission knew that a comprehensive approach to the transportation problem would provide much valuable information for the ultimate solution to drainage and flood control, sewerage, water supply, land and water use, and other resource related planning problems. Indeed, comprehensive transportation planning, as envisioned by the SEWRPC, provides the broadest possible first approach to any comprehensive planning effort.

The SEWRPC, therefore, requested that an inter-agency technical advisory committee be established to develop a transportation study prospectus. Such a committee was es-

established and included representatives of the U.S. Bureau of Public Roads, State Highway Commission of Wisconsin, Milwaukee County, and the SEWRPC itself. This committee held regular semimonthly meetings from October of 1961 to February of 1962 and prepared a prospectus for a regional land use-transportation study.

This prospectus was endorsed by the SEWRPC on April 5, 1962, published, and, in accordance with the advisory role of the Commission, was transmitted and recommended to the governmental agencies comprising the Region for their consideration and action. All seven constituent county boards subsequently endorsed the prospectus and provided the local funds necessary for its implementation. The U.S. Bureau of Public Roads, the State Highway Commission of Wisconsin, and the Housing and Home Finance Agency of the Federal government also endorsed the prospectus and have provided the Federal and state funds necessary for its implementation.

The prospectus, as prepared, was not a finished study design. It was a preliminary design prepared with the objective of obtaining support and financing for the necessary study, an objective which it has fully attained. The prospectus, however, specifies basic principles to be recognized in the study; outlines a staff organization; specifies major work elements, techniques and procedures; establishes a time schedule; and, of course, provides cost estimates for the necessary work.

SUMMARY AND CONCLUSIONS

The need for regional planning has been brought about by certain important social and technological innovations of our time. Most of these innovations are only at their beginning. They are resulting in the creation of many severe areawide environmental problems, problems which will require careful study of our environment for solution.

Officials and citizens who are daily involved in such areawide problems have come to realize that these problems can only be resolved within the context of a framework of regional research and analysis. Regional planning, therefore, as envisioned by the SEWRPC has three principal functions:

1. Areawide research: i.e., the collection, analysis, and dissemination of basic planning and engineering data on a uniform, areawide basis; so that, in light of such data, the various levels and agencies of government, private enterprise, and citizens' groups can better make decisions concerning community development.
2. Preparation of long-range plans for the physical development of the Region; these plans being limited to those functional elements having regional significance: e.g., regional trafficways, regional storm water drainage channels, regional park and open space reservations.
3. Provide a center for the coordination of the planning and plan implementation activities of the various levels and agencies of government operating within the Region.

No one should underestimate the enormity of these tasks or their importance to society.

THE SEWRPC LAND USE-TRANSPORTATION STUDY

by J. Robert Doughty, Study Director

The objective of the regional land use-transportation study, as set forth in the prospectus, is to produce two key elements of a master plan for the physical development of the Region; a land use plan and a transportation plan. The prospectus established a work schedule to be completed in three and a half years at a total cost of \$1,987,000. This overall cost will be financed with 23.61 percent of local monies and 76.39 percent state and federal funds.

this is outrageous!

ORGANIZATION OF THE STUDY

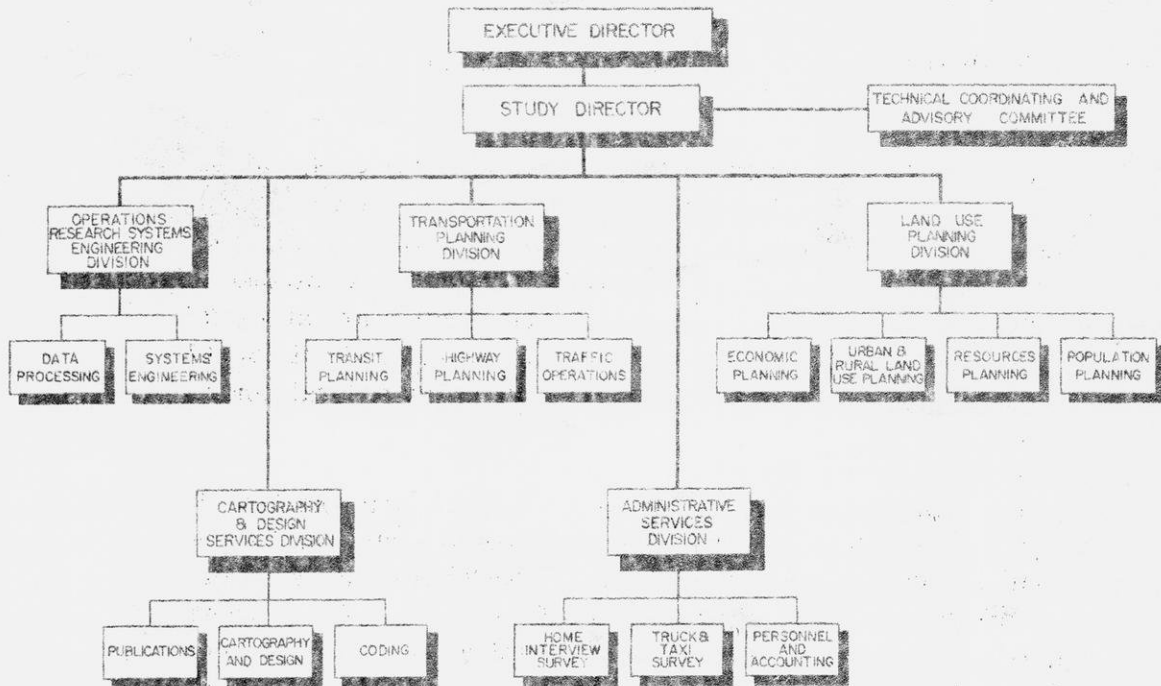
The basic organizational structure for the study was outlined in the study prospectus. Staffing began during the last quarter of 1962 and extended through the spring of 1963 before all key personnel were retained. The organization of the study staff, as shown on Figure 1, consists of five divisions reporting to the study director who in turn reports to the executive director and the Commission itself. A brief description of the functions of the five divisions and their staffing follows:

The systems engineering division includes the data processing center and is responsible for refining simulation models of regional activity (economic-population), spatial activity (land use), and transportation (highway and transit). This division is headed by an experienced systems engineer and includes among its key personnel; a data processing supervisor, mathematicians, programmers, computer technicians, and key punch operators.

The transportation planning division is responsible for the gathering of all pertinent data on existing traffic service demand and facilities. This division assists in the projection of traffic service demand, in the refinement of the transportation model, and cooperating with other divisions, in the preparation of a transportation plan for the target year of 1985. The staff is headed by an experienced transportation planning engineer and includes planning and traffic engineers from the State of Wisconsin, Milwaukee County and the City of Milwaukee. These engineers, who keep their respective organizations current on the progress of the study, are assigned to a special field such as transit or highway planning and operations.

The land use planning division is responsible for the collection of

Figure 1
LAND USE - TRANSPORTATION STUDY
STAFF ORGANIZATION CHART



all pertinent data on existing and proposed land use; on the natural resource base, including soil and water capabilities; on property values; on economic activity; on population; and on related socio-economic factors. This division is also responsible for preparation of a land use plan in cooperation with the other divisions. The staff is headed by an experienced land use planner and includes section heads with backgrounds in economics, statistics, geography, **marketing**, and city and regional planning.

The administrative division is responsible for providing general administrative and accounting services, the collection of the home interview and truck-taxi origin and destination (O & D) survey information, and the dissemination of study data to sponsoring and requesting agencies or individuals. The staff is headed by an experienced administrative officer with transportation planning experience and includes an O & D supervisor with field personnel, a bookkeeper, and clerk-typists.

The cartography and design division is responsible for the design, preparation, and production of all maps, drawings, and reports for the study and for the coding of all data collected in the origin and destination surveys. The staff is headed by an experienced supervisor of a division of cartography and design and includes coders, artists, draftsmen, cartographers, and technical editing personnel.

Coordinating Committees

In addition to the five divisions, a technical coordinating and advisory committee has been created, consisting of key officials and department heads from various governmental agencies and private organizations operating within the Region. The Committee advises the study director and staff on technical methods, techniques and procedures; it

serves as a clearinghouse for the assembly and evaluation of pertinent data; and it generally provides coordination between the various operating departments and agencies of each government and private agency participating in the study. This committee has been subdivided into eight subcommittees. These smaller groups are organized so that, considering their individual specialized backgrounds, the members will be able to contribute more significantly to the study. The subcommittees include: origin and destination, urban highway, rural highway, urban land use, rural land use, natural resources, utilities, and transit and railroads.

Membership on the committee includes representatives: from the U. S. Bureau of Public Roads, Housing and Home Finance Agency and Soil Conservation Service; from the central and district offices of the State Highway Commission of Wisconsin, Wisconsin Conservation Department, Department of Resource Development and University of Wisconsin; from municipal and county traffic, planning, engineering, highway and public works departments; from electric, telephone and gas utilities; and from railroad and transit companies.

BPR
HWEA
SCS
WCHC
WCD
WDRD
UW

Two additional committees will be formed as the study progresses and as the need arises. One committee is the intergovernmental coordinating committee, which will consist of elected legislative and executive officials, the other committee is the citizen's advisory committee, which will consist of individuals chosen from citizen groups and organizations and will include representation from the commercial, industrial, agricultural, professional, and labor communities. The inter-governmental coordinating committee will assist the Commission in determining and coordinating basic non-technical public policies. The citizen's advisory committee will evaluate and recommend regional development and transportation policies.

BASIC PRINCIPLES RECOGNIZED

The prospectus, used to establish and activate the regional land use-transportation study, provided that the study must recognize four basic principles:

1. ✓ An individual highway or transit line cannot be planned in isolation, since the total urban transportation network acts as a system in which every element affects the use and effectiveness of other elements of the system. This means that the capacities of the sections and intersections of the transportation system, studied as a whole, must be carefully fitted to future traffic loads by careful quantitative analysis.
2. ✓ Highway and transit systems must be planned together, and each mode of transportation should be assigned that part of the total travel demand for which it is best suited.
3. ✓ The transportation planning must be areawide in scope, in that it cannot be accomplished successfully within a single municipality or county if that municipality or county is part of a larger urban complex.
4. ✓ Transportation planning cannot be separated from land use planning, since the land use pattern determines the amount and spatial distribution of travel within an urban area, and since the transportation system that is planned and

built will be one of the most important determinants of the future land use pattern.

UNIQUE VARIATIONS

Even though most of the major transportation studies now underway recognize these basic principles, this study will differ from all previously completed studies in the following aspects:

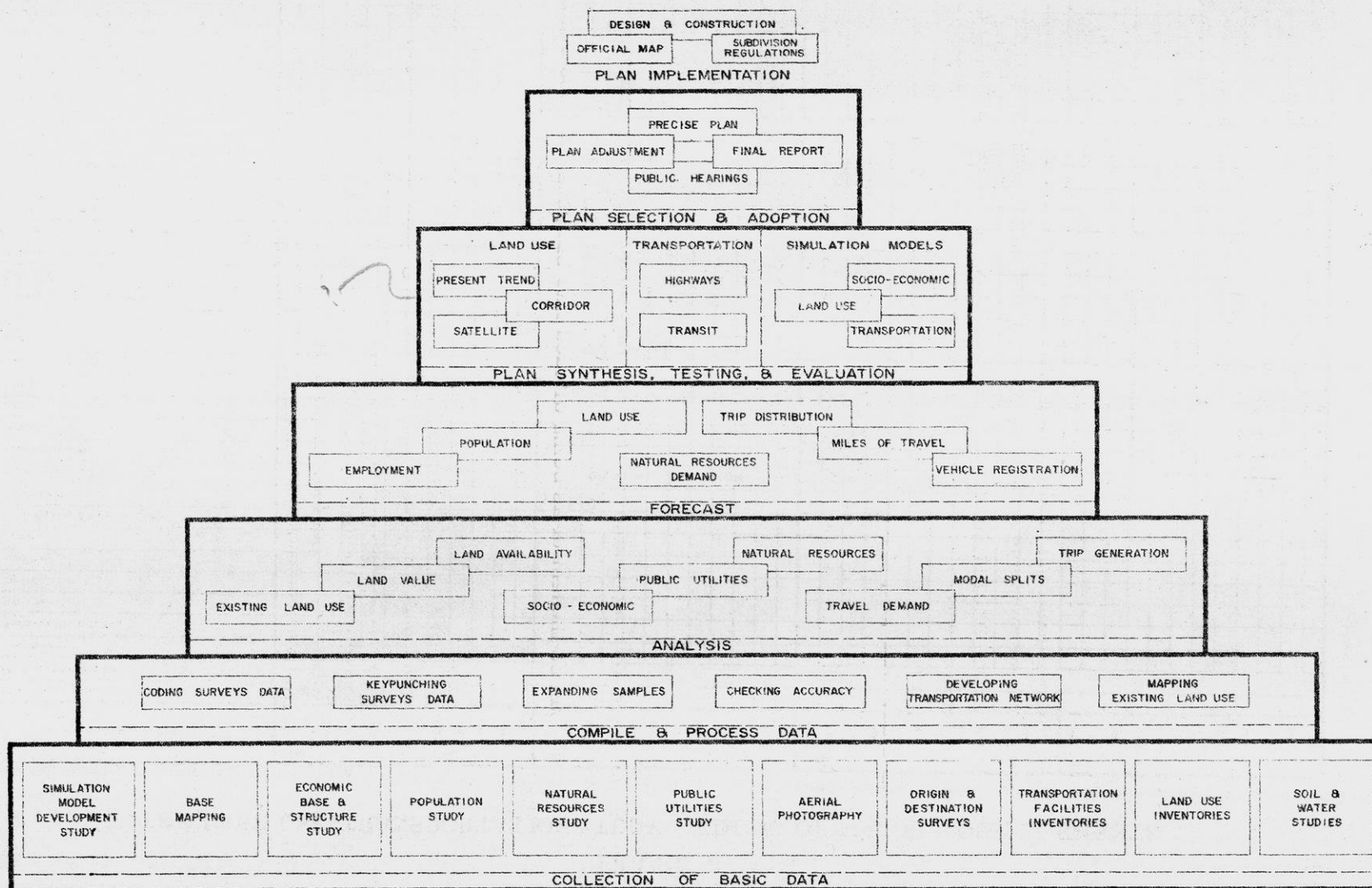
1. This study will have primarily a regional focus instead of a metropolitan focus and, thus, will seek to shape development in the rural urban fringe areas as well as development and redevelopment in the urban core areas, and it will relate these two forms of development to each other.
2. This study 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 resulting total environment, and on the over-all cost of developing and operating the combined regional land use plan and transportation system.
3. This study will prepare alternate plans in close cooperation with technical, intergovernmental and citizen advisory committees, and will submit the plans to public hearings for review, final approval and adoption.
4. This study will prepare precise plans for some of the major highways within the Region after the final land use-transportation plan has been approved for adoption.

MAJOR STUDY ELEMENTS

To better understand the scope and purpose of this study, it is necessary to examine the major elements of the study and some of the operational details involved in each phase. The study can be thought of as being divided into six phases. (See Figure 2.) A brief description of each phase follows:

The basic data collection phase involves the preparation of aerial photographs, the preparation of base maps of the Region and its subdivisions, existing travel pattern surveys, existing travel facilities inventories, existing land use surveys, and a socio-economic inventory. A household survey history is included as a part of the home interview survey to trace the home address and work address of the present heads of households for a thirteen year period. Data from this household history information 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 socio-economic inventory will indicate the structure of the regional population and employment pattern. This data will be used in the regional economic model for conditional forecasting of population and employment. It will also 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.

FIGURE 2
MAJOR PHASES OF THE LAND USE-TRANSPORTATION STUDY



The analysis phase is of critical importance in the study. In this phase, the staff increases its understanding of the forces shaping regional development and of the traffic patterns in the Region, in order to prepare for goal formulation, demand projections and plan synthesis. Phenomena to be examined will include:

1. The relationships between land use development and such factors as the availability of land for development, public sewerage and water supply, land value, soil capability, accessibility, and other related factors.
2. The sources of travel demand, including quantification of trip propagation at the household and at other sites of urban activity.
3. The factors affecting present trip generation.

The forecast phase will require separate projections and forecasts of employment, population, vehicle registration, miles of travel, land use and other factors. These projections and forecasts will provide a quantitative measure of the aggregate future demand for land and other natural resources and for public facilities and services within the Region, and they will serve as intermediate steps toward the forecast of person and vehicle travel.

The plan synthesis phase will be conducted as a team effort of all divisions. In principal, land use planning must precede transportation planning. However, the planning of the land use and transportation facilities can and will be accomplished as a single inter-related and concurrent process. As each of the alternate land use plans is completed, the transportation division will devise and test alternative transportation proposals capable of accommodating the future travel demand. These transportation plans, in turn, will be referred back to the land use division for use in further refinement of the land use plans.

The testing and evaluating phase will require careful analysis of the consequences of each major alternative land use-transportation plan. Such analysis will include assessment of effects on land values, tax revenues, travel demand, resource base, environmental surroundings, and the over-all cost of developing the Region. After test and evaluation by the study staff, the recommended plan with its alternates will be submitted to the various advisory committees for review and recommendation.

The reporting phase will include submission of the final plans to public hearings prior to final adoption by the Commission. A final report and precise plans for some of the major highway facilities will be prepared after the final plan has been adopted. These precise plans will undertake the determination of center line location, right-of-way widths, and the geometric design of the major intersections in the transportation facilities plan; and they are intended to serve as a basis for the application of plan implementation devices at the disposal of local planners, as well as a basis for the intelligent investment of private capital in relation to major transportation facilities.

PROPOSED TIMING

The proposed timing of the major work elements of this regional land-use-transportation study is reflected in Figure 3.

These elements have been expanded by the staff and inserted in a critical path diagram, which will be updated on a monthly basis. This critical path method will be used as a management tool for the planning, scheduling and controlling the numerous stages of the study.

SUMMARY AND CONCLUSIONS

This three and a half year study, as outlined in the prospectus, proposes full participation by local municipalities, counties, Federal and state agencies in the preparation of the regional plans and provides an unprecedented opportunity for the cooperative solution to areawide land use and transportation problems. It is anticipated that plan implementation will develop as the study progresses through the media of the technical coordinating and advisory committee, the interagency staff assignments, and through the community assistance program of the SEWRPC.

* * * * *

(Backward Glance continued)

toll was a cent a mile, half a cent extra for each additional "animal". (Mules and oxen were frequently hitched along with horses to the wagon in which the farmers hauled their produce to market).

Boon to the Farmer

Keen rivalry between the lake towns competing for the farmer's grain stimulated the construction of the toll roads. Life became easier for the farmer. A round trip from West Bend to Milwaukee by a farmer with a wagon and team, for example, cost less than a dollar. Travel on the toll roads was luxurious and fast compared to the task of traversing the partial quagmires that formerly had been called "roads". Only heavy snowfalls would impede travel on the toll roads, and then only for a day or two.

A Short Life

A novelty at the outset, the plank roads soon proved to be a physical and financial failure. Oak planks, thought to be good for a decade, were rotten and worthless in less than three years. Tolls were being evaded, a state license drastically cut receipts. By 1871, the plank road which had only twenty years before been considered the ultimate solution to southeastern Wisconsin's transportation problem, had almost ceased to exist.

Source: Southeastern Wisconsin: A History of Old Milwaukee County, the S. J. Clarke Publishing Company, Chicago, 1932.

HOME INTERVIEW SAMPLE SELECTION - PART I

by Kenneth J. Schlager, Chief Systems Engineer

This report on the home interview sample selection utilized in the SEWRPC regional land use-transportation study will be presented in two parts. Part I, represented by this report, describes the rationale for selecting the method used, together with its underlying theory and procedure. Part II, to be prepared upon completion of data processing, will set forth an analysis of the accuracy of the sample and make suggestions for improving the usefulness of the method in future applications.

SELECTING A SOURCE

The home interview survey area was subdivided into three sub-areas. The first, and by far the largest, included Milwaukee County, the metropolitan fringes of Ozaukee and Washington Counties, and the eastern third of Waukesha County. The second and third areas encompassed the cities of Racine and Kenosha respectively with their immediate surrounding areas. (See Map 1, pg. 28.)

Two alternative sources from which the home interview sample could be selected were considered. The first alternative, and the one finally selected, was the electric utility customer billing data system for the survey area.¹ This system is maintained by the electric utility to record power usage from electric meters for billing purposes. A second alternative, more commonly used in transportation studies, would have involved a complete field listing of the households in the Region.

In selecting the sampling method, two criteria were considered to be of primary importance: the cost of the method and the time schedule necessary for its completion. The first approach, electric utility data, was rated superior in terms of both criteria. A sample could be selected from the electric utility files at a much lower cost than a field listing. Based on the experiences of previous transportation studies, the cost of a field listing for the

1. One electric power company, the Wisconsin Electric Power Company, serves all of the communities in the home interview area. (A previous SEWRPC public utility inventory indicated that all dwelling units within the Region are supplied with electric power.)

study area was estimated at between \$50,000 to \$75,000. As finally accomplished, the cost of sample selection from the electric utility records, was less than \$3,000.

The second criteria, time, was interrelated with the first, cost, in that a field listing would have delayed the entire study by a period of at least three months, and the final cost of the study would have been substantially increased by this delay. A three month delay, based on actual monthly expenditures, would have increased the cost of the final study by about \$60,000. From a total cost consideration, then, the difference between the two sampling methods was fairly estimated at approximately \$100,000.

Apart from the cost consideration, it was desired that the home interview survey be initiated in the spring of 1963 and be completed prior to the summer vacation months of July and August. Since the study was initiated in January 1963, to meet this schedule would have been virtually impossible using a field listing approach. An electric utility sample, however, could be drawn within this period and offered no obstacles to the expedited program.

Based on the cost-schedule evaluation, the electric utility data method was chosen as the method for home interview sample selection.

SAMPLE SIZE DETERMINATION

The problem of selecting a suitable sample size for a home interview survey of the kind considered here is a very complex one. The basic problem results from the need to measure a number of characteristics of the households sampled. In addition to the basic information relating to family characteristics and trip-making behavior usually collected in such surveys, this particular survey was expanded to include questions on locational behavior and on the personal opinions of the households relative to transportation facilities and housing preferences. An additional statistical complication was added by the requirement that interzonal traffic volumes be determined from the trips reported by each household. The number of characteristics being measured was therefore quite large, and the systematic determination of a sample size was quite a formidable task.

A sound procedure for sample size determination requires the following steps:

1. Specification of the desired standard error required for each characteristic to be measured.
 2. Estimation of the percentage of the universe within each subgroup² of each characteristic to be measured.
 3. Calculation of the sample size for each characteristic subgroup using the
-
2. A subgroup example as defined here, for a measured characteristic such as family income, would be the \$7,000-\$9,000 income subgroup. The number of subgroups within each characteristic will vary with the data application. Some characteristics, such as race and sex, have a natural predetermined number of subgroups. Other characteristics may not be subdivided, in which case there would be only one subgroup for the characteristic.

formula:

$$\sigma_p = \sqrt{\frac{p q}{N}}$$

where:

p = percentage of items in characteristic subgroup class;

q = percentage of items not in characteristic subgroup class;

σ_p = standard error desired.

N = Sample size

The largest of the sample sizes determined in step 3 is then the overall sample size required for the survey, unless a compromise is accepted in the accuracy requirements, or unless a separate sampling is possible for an isolated characteristic.

Statistical Difficulties

The difficulties in the above procedure are evident. Estimates of the subgroup percentages for many of the characteristics would be crude, at best, because some of these characteristics, such as locational behavior, have not been measured in previous surveys. Even for those characteristics such as vehicle ownership, that have been measured in previous surveys, the analytic and computational effort required to determine the standard error for each subgroup of each characteristic would be quite large. Some of the characteristics might require quite a large sample for subgroups of small size, and it would be quite uneconomic to impose such sample size requirements on the survey as a whole.

An additional complicating feature is added to the problem by the diverse nature of the households in the Region. Many of the characteristics being measured in the survey vary significantly with the type of household. In effect, there is not one, but a number of statistical universes existent within the Region. In the SEWRPC land use-transportation study, the concept of a household type is being used as a decision-making unit in a land use simulation model being developed as a part of the study. For this reason, it was necessary to obtain characteristics data for each of the household types. Even without such a concept, however, some allowance for diversity is needed to obtain meaningful data for land use-transportation planning. This diversity of household types adds a third dimension to the sample size determination problem. The sample size must be determined for each characteristic, each subgroup and each household type. Since the number of household types will be determined from the results of the survey household history data, a statistical determination of household types was not possible prior to the beginning of the present survey. In a future survey, the use of a similar household type classification and some carefully formulated assumptions as to the distribution of these types would allow for a statistical determination of sample size in advance of the actual study.

The Final Criteria

The sampling rate selected in the present survey was, therefore, based on experience in previous transportation studies. The principal overall check on the accuracy of the travel data collected in the home interview survey is the trip volume check provided by screen line traffic counts as compared to the trips reported by the interviewed households. Accuracy checks in previous studies provide an indication of the sampling rate

necessary for acceptable estimates of interzonal traffic volumes. Since traffic volume estimates represent an important end product of the study, it is reasonable to predicate the sample size on past relationship between sample size and traffic volume accuracy checks.

Selection of traffic volume as a characteristic for sample size determination is quite likely to lead to a larger sample than would certain other characteristics, such as trip generation. For interzonal traffic volume estimates, the least populated zone establishes the sample size, and this sample may be considerably larger than that required for other survey characteristics. In this survey, however, with its attempt to determine locational history of households, it seemed best to use a somewhat larger sample size because of the uncertainty of the characteristics being measured. These characteristics included locational preference and turnover rate. While these characteristics have been measured in some other surveys, their relation to household types was not known at the beginning of this survey. This was because the number and nature of these types were unknown at that time.

For all of the above reasons, the final sample size was selected based on standards established by the U.S. Bureau of Public Roads in other metropolitan areas of equivalent size. Therefore, a 1 in 30 sample was specified for the greater Milwaukee area and a 1 in 10 sample for both the Kenosha and Racine areas.

Analysis of each of the household types, household characteristics and household subgroups within each locational characteristic, after the survey is completed, will permit determination of confidence intervals for guidance in data analysis and reference for future survey sample size determinations.

SAMPLING TECHNIQUES AND PROCEDURE

The sampling technique utilized was strongly influenced by the need to provide uniform sample coverage throughout the area. A simple random sample was not suitable because it would have resulted in a non-uniform areal coverage. A random sample stratified by areal zones would have been more suitable, since it would have provided uniform coverage throughout the area. Because the size of the universe was large (over 425,000 households) a mechanized method for selecting the sample was extremely desirable. A convenient method for mechanized sampling is systematic sampling. In this method, a random starting point is selected, and samples are then selected from successive counts determined by the sample size. This resulted essentially in a stratified random sample. In this instance, every thirtieth household unit was sampled in the Milwaukee area and every tenth unit in the Kenosha and Racine areas.

The dangers in systematic sampling are hidden periodicities in the universe that would lead to a bias in the sample. The utility meter route and account numbering was such that the sample selection sequence proceeded from one area to another in a seemingly random manner. Therefore, although the possibility of a bias still exists, its probability seems to be minimal.

The Milwaukee Area Sample

The selection of the Milwaukee sample was performed using an IBM 1401 electronic

computer. Household units were arranged by meter routes and account numbers and then sampled, beginning with the lowest numbered route. In the Milwaukee area, the Wisconsin Electric Power Company still used an Addressograph billing system at the time of the sample selection. Customer data were printed by the Addressograph on punched cards which were then sampled on the IBM 1401. During the sampling process, the customer accounts preceding and succeeding the sampled account were also drawn to provide a check on sample coverage. It was originally intended that the interviewer would verify that the preceding and succeeding units were adjacent to the sampled unit at the time of the interview. As it turned out, this check was not always a valid one because utility meter route order did not always correspond with locational order.

In the process of drawing the preceding and succeeding units in the Milwaukee area, the succeeding unit was mistakenly selected as the thirty-first count in a 29-30-31 sequence. This procedure resulted in a sample size of 1 in 31 instead of the original 1 in 30 requested. Because this mistake was not discovered until the selection was almost complete and because the difference in sample size resulting was not considered significant, the smaller sample was accepted.

The Racine-Kenosha Survey Area Sample

In the Racine-Kenosha survey area, the billing system used a punched card data storage and customer billing procedure. For this reason, it was much easier to select the desired sample. The electric utility actually selected the sample for the study using an IBM 407 accounting machine and listed the 1 in 10 sample with the preceding and succeeding units on a printed page.

The sampled household units were geographically identified by coding the appropriate U.S. public land survey quarter section and then key punched as a new card for compilation on interviewer assignments.

REVIEWING SELECTED SAMPLING SOURCE AND TECHNIQUE

The cost and time schedule advantages of the selected sample source and technique were discussed earlier in this report. Additional advantages of the approach became evident in the course of using the sampled data. A significant advantage of the system is the check provided by the financial nature of the system used as a data source. The fact that the primary purpose of the data is revenue calculation and collection, provides an incentive to maintain a current accurate file of customer addresses. Other data sources of a non-financial type do not have this self-correcting feature. The limitations of this check should also be understood. It became evident during the survey that incorrect addresses can remain uncorrected for some period of time without apparently interfering with the billing process. In many areas, the meter reader and the postman can apparently perform their duties based on personal knowledge of the addressee, independent of the correctness of the address.

Regional Coverage

A final advantage of the method (as applied in southeastern Wisconsin) that may not exist in many other locations, is the existence of a single electric utility (the Wisconsin Electric Power Company) that serves the entire home interview area. Although the

company's area is subdivided between two fairly autonomous operations, one is the Milwaukee area and the other in the Racine-Kenosha area, each with its own independent billing system, territorial integrity is maintained such that this single source provides a suitable universe for the entire home interview survey.³ In areas in which there are a number of electric power companies with complex boundaries, additional problems not encountered in southeastern Wisconsin would be presented.

Disadvantages and Shortcomings

Although the cost-schedule benefits of the selected sampling method have been emphasized, definite shortcomings exist in the method that should be understood for proper use of the method in future surveys. Some of these shortcomings may result only in temporary inconvenience, while others may seriously jeopardize the validity of the sample. The most serious shortcoming discovered after the initial sampling was the omission in the utility meter records of certain classes of households from the residential listing. Residential accounts are separately maintained from commercial accounts, but it was found that some of the commercial accounts included residential households as defined by the home interview survey. Accounts of tenant households which are paid by the landlord are classified as commercial accounts because of their different rate structure. This discrepancy was discovered as a result of an initial comparison of the sample size with the related 1960 U.S. Census data. Discovery of a sample size gap led to an investigation that uncovered the "commercial-residential" household units.

Remedial action was complicated by the lack of a utility code for these commercial-residential hybrid accounts. The only solution possible was a tedious account-by-account examination of all commercial accounts to allow separation of these additional household units. In some instances the identity of such an account was evident. Other accounts were doubtful, and some had to be checked through the use of directories and telephone calls. These accounts were separated and then sampled in the same fashion as the original residential accounts. The new samples were geographically coded, key punched, listed, and assigned to appropriate interviewers.

A second discrepancy, related to the first, was the existence of so-called master meters, that is, meters measuring the power usage of more than one household. These master meters existed only in the commercial-residential accounts and resulted in a further increase in the size of the sample.

The final problem encountered was of the inconvenience variety and did not threaten, as did the others, the basic validity of the sample. During the actual interview, a number of incorrect addresses were discovered and these caused some delay in the interview schedule. In all cases, however, the correct address was determined from a check of the original name, and the interview was accomplished.

3. Certain "special" samples drawn later which included places as trailer courts, institutions, and dormitories were not included in the electric utility records. The impact and selection of these samples will be discussed in later reports.

Future Use of the Sample Sources

The above discrepancies in the sampling method must not be interpreted as a criticism of the records of the electric utility. With the exception of the incorrect address problem, which is inherent in any data system with a high rate of turnover, the other discrepancies do not seriously affect the efficiency of the meter-reading and revenue collection process. The electric utility involved has had no occasion to use their data as a sample source and, therefore, has had no incentive to eliminate noted discrepancies.

Efforts are now being made to eliminate the discrepancies discovered in the meter data during the survey so that the billing system may serve as a means for continually updating planning inventories in the Region. The Wisconsin Electric Power Company is now in the process of converting to an IBM 1401-1410 data processing system, and this conversion provides an appropriate time to make the required changes in the system.

In Part II of this article, to appear in a future issue of the Technical Record, the statistical accuracy of the sample for each of the measured characteristics will be analyzed and suggestions for future improvements will be made.

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(Backward Glance continued from page 20)

ALL IN A DAY'S WORK

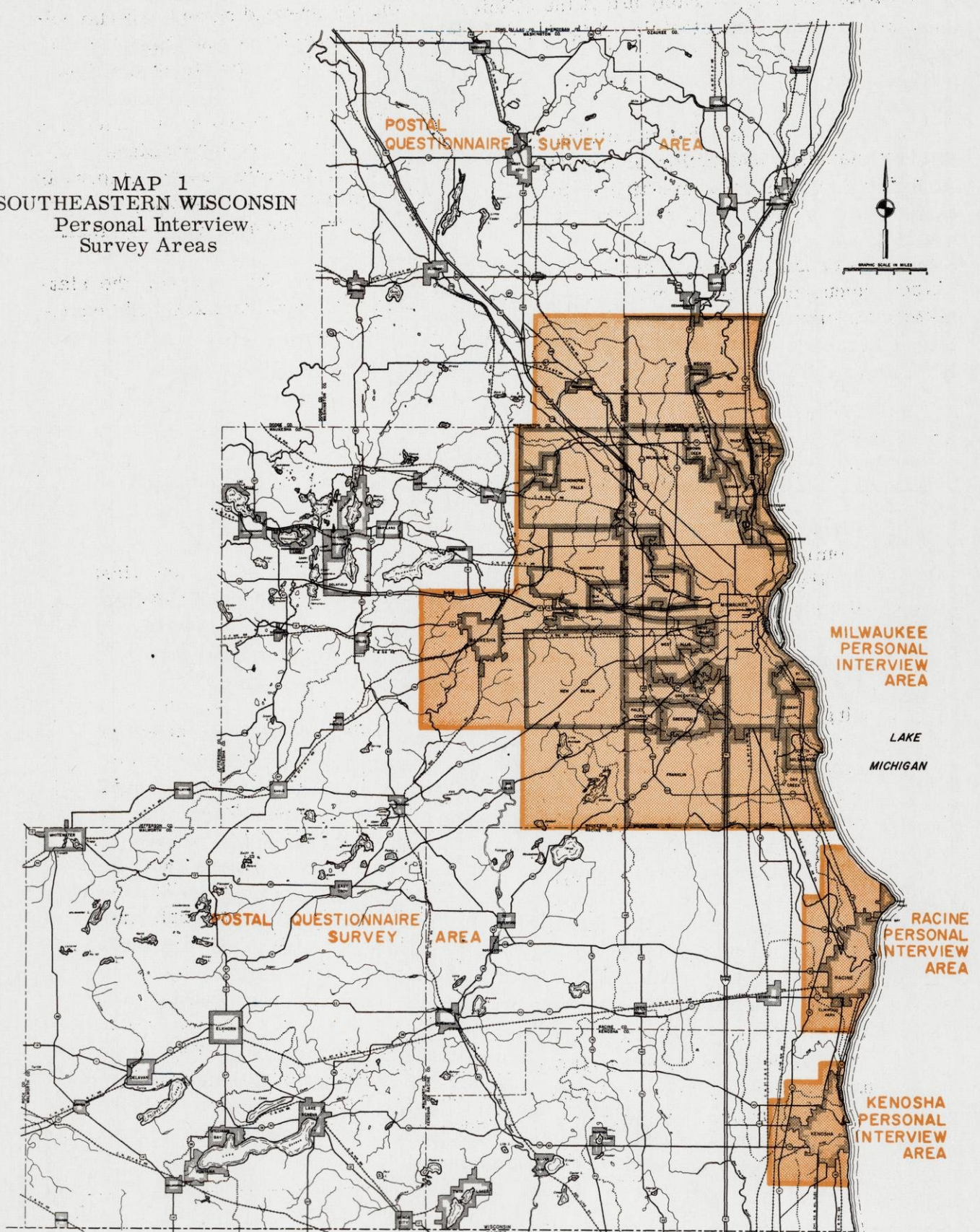
Coming to southeastern Wisconsin in the early 1830's with one of the first contingents of pioneers from the East, E.W. Edgerton, a surveyor, and prominent land developer, recorded nonchalantly in his journal a traveling feat that makes the 50-mile hikes of today seem like child's play.

"On the morning of December 24, 1836, we retraced our steps, recrossing the Bark River and making our way westward to Fort Atkinson where we arrived early in the afternoon. We continued down the river to Black Hawk's island where the non-combatants of Black Hawk's army lay in camp. It was here that Letaun (a Canadian Frenchman who served as guide and interpreter) discovered that Black Hawk had intentions of a raid on the settlement at Milwaukee. He lost no time in reporting the news to Mr. Juneau, (Solomon Juneau) who started him the next morning (Christmas) at sunrise with a message for the officer in command at Fort Dearborn, Chicago, asking for protection. Letaun, traveling on foot, the eighty-five miles, delivered the message the same day at sundown."

Edgerton noted further that, "it was thought that the mercury would not mark less than 25 or 30 below zero." Add to this the "substantial covering of snow" and uncharted footpaths through virgin, unsettled lands inhabited only by hostile Indians, and one can only wonder how even a French Canadian could have accomplished such a trek.

* * * * *

MAP 1
SOUTHEASTERN WISCONSIN
Personal Interview
Survey Areas



TRUCK AND TAXI SURVEY SAMPLE SELECTION

by Thomas A. Winkel, Urban Planning Supervisor

The truck and taxi survey was one of the several origin and destination surveys conducted by the transportation study staff of the Southeastern Wisconsin Regional Planning Commission as a part of the regional land use-transportation study. The purpose of this survey, which was scheduled for the months of May and June, 1963, was to obtain information relative to the travel of trucks and taxis within the Region.

Obviously, it would be far too costly and time consuming to obtain the necessary travel information by personal contact with each of the approximately 60,000 trucks and 500 taxis¹ within the Region. It was decided, therefore, to personally interview truck and taxi owners in the most highly developed areas of the Region by sampling technique and to contact all other owners in the Region by means of postal questionnaires.

The purpose of this report, then, is to explain in detail the procedures followed in selecting the sample trucks and taxis for the personal interview survey. Since the method used for selecting the sample trucks differed from that used for taxis, the discussion of drawing each sample is handled separately.

SELECTING SAMPLING AREAS

An examination of the general nature of the 2688 square mile Region revealed that, considering population density and socio-economic development, there are three highly developed areas, namely Milwaukee, Racine and Kenosha. More than 80 percent of the Region's population (1.6 million people) reside in these areas. (See Map 1, page 28.) The remainder of the Region contains a number of smaller cities, villages, and towns oriented into essentially rural and rural-urban fringe areas. For the purpose of this report, each reference to the Milwaukee survey area, the Racine survey area, and the Kenosha survey area will apply to these three highly developed portions of the Region where a sampling process was used. (The remaining portion of the Region will be referred to as the postal questionnaire survey area.)

1. State of Wisconsin Motor Vehicle Department "Motor Vehicle Registrations" for period July 1, 1961 through June 30, 1962.

An estimate based on Wisconsin State Motor Vehicle Department records showed that approximately three-fourths or 45,000 of the 60,000 trucks in the Region were garaged in these same three highly developed areas and that, except for a very few, all of the Region's 500 taxis were likewise operated within these areas. A further breakdown indicated that approximately 36,000 of the 45,000 trucks were garaged in the Milwaukee survey area, 5,000 in the Racine survey area, and 4,000 in the Kenosha survey area. The Region's remaining 15,000 trucks, it was revealed, were garaged in the postal questionnaire survey area.

SAMPLE SIZE DETERMINATION

Personal Interview Survey

First, considering the personal interview truck and taxi survey in the Milwaukee, Racine and Kenosha survey areas, it was thought that experience in previous transportation studies served as the best basis for the determination of the sample rates in the proposed survey. The sample rates selected, therefore, were based on the standards established by the U.S. Bureau of Public Roads in other metropolitan areas of equivalent sizes. These standards take into account such characteristics, concerning the data and its uses, as population and size of the area.

Previous transportation studies have primarily been concerned with a single metropolitan area and could, therefore, be represented by a single universe from which the samples could be drawn. It was felt, however, that three separate areas would be needed for this survey, and separate consideration would be needed in the determination of sample sizes for each personal interview survey area.

In consideration of all the aforementioned factors, a sample rate of 1 in 12 was selected for the Milwaukee area and a sample rate of 1 in 4 for both the Racine and Kenosha areas.

Postal Questionnaire Survey

Previous studies again served as the basis for the determination of the sample rate for the postal questionnaire survey. A 100 percent sample size was selected for the postal questionnaire survey because there were only approximately 15,000 trucks and less than 100 taxis distributed over the 2113 square mile postal questionnaire survey area.

It was further felt that only by using the 100 percent mail-outs to truck and taxi owners in this area, could a return of an adequate number of completed questionnaires be expected which would be representative of all parts of the postal questionnaire survey area.

SELECTING THE SOURCE

An evaluation and appraisal of all possible sources was made. It was found for example that, though records of truck registrations and taxi licensing in Wisconsin are maintained by the Wisconsin State Motor Vehicle Department, government trucks are not listed by any single agency, and there is no list separating taxi licenses from those of private passenger cars. These limitations were overcome, however, by localizing

the search for valid source information.

Truck Registrations

During examination of the records, it was found that there were actually two truck files: 1) a data processing card file of all trucks having a gross weight of less than 8,000 pounds, together with all farm trucks, and 2) a complete file of all truck registration certificates in alphabetical sequence by owners' last name for each post office. This second file also contained records on buses, all types of municipal vehicles, semi-trailers, motorcycles, mobile homes, ambulances, and hearses.

Trucks in Wisconsin may be registered either for the entire year, by quarter or by any combination of quarters. For example, a road building contractor who does not use certain trucks in the winter season, may choose not to license these vehicles until the second quarter of the calendar year which begins on the first of April. By doing this, some of the expense of licensing these vehicles in the first quarter of the year is saved. This, of course, means that the file of truck registrations for any given year is not complete until the end of that calendar year. (No truck license may carry over from one calendar year to the next calendar year.)

United States Government Trucks

Since United States Government trucks are not registered or licensed with the State of Wisconsin, no records of these vehicles were available from the state motor vehicle department. Also, it was discovered that no single agency within the Federal government could furnish information about all of the U. S. Government trucks operating within the Region.

Through the use of telephone directories and personal knowledge of the Region, a list was compiled of U. S. Government agencies having trucks garaged within the Region. A letter was written to each of these agencies (post offices, military commands, and the central Federal motor pool) requesting information about each of their trucks. The information obtained included the make, size, and U. S. Government registration number. From the replies to these letters and from further inquiries, a list was compiled of all U. S. Government trucks garaged in the Region.

Supplemental Truck Samples

After the survey was underway, further checking of the Wisconsin State Motor Vehicle Department files revealed a considerable number of truck registrations that were filed after April 1st (after the original sample lists had been compiled). It was then decided that these trucks should be included in the universe, since they were operating on the streets and highways of the Region during the survey period. Approximately two man-weeks were required to carefully check the files and hand list all of these vehicles. This listing and subsequent sampling was completed after the middle of June and, therefore, included all registrations through June 15, 1963. Records indicate that approximately 500 additional sample trucks were obtained by this operation.

Taxi Registrations

Taxis are licensed with the Wisconsin State Motor Vehicle Department. Unfortunately, however, a separate file for taxis is not maintained. They are included as part of the

passenger car file and cannot be sorted in any convenient manner. Hand sorting of the complete passenger car file would have been the only available means of obtaining a list of taxis from the state motor vehicle department. Fortunately, two other sources of information were available. One source was the records in the clerk's office of each community and the other source was the taxi companies themselves.

Taxis are required to be registered with the municipality in which they operate so that the municipality can exercise some control over operations within its boundaries. A check did reveal that all taxis operating within the three highly developed areas were registered with the appropriate clerk's offices. However, some of the clerk's records were only updated once each year and were not current. Therefore, all of the taxi companies within the Region were also contacted to help compile a complete and accurate list of all taxis.

THE TRUCK SURVEY SAMPLING METHOD

To select the sample trucks and complete the pre-survey operations by the end of April for the interviews, it was necessary to begin obtaining data from the motor vehicle department in March. This was actually prior to the time the sample size had been determined. The Wisconsin State Motor Vehicle Department was most cooperative and willing to make any information available to the study itself. Unfortunately, however, since no duplicate copies of the truck registrations were available in the department files, it was impossible to remove any of the records from the state office building without interfering with their daily operation. After considering various means of drawing the sample, it was decided to make a complete copy of the truck registration file which included all vehicles in the Region except passenger cars and taxis.

To accomplish this, these registration cards were microfilmed with the assistance of the motor vehicle department personnel. This microfilming was completed in about two weeks at a cost of approximately \$175.00. It took eleven rolls of microfilm containing approximately 5,500 vehicle registrations per roll to accommodate the information. Originally, it was planned to display the microfilm registrations by the use of a microfilm reader² and have the sample data keypunched into cards for electronic sorting or to hand list the desired sample. However, tests using the reader indicated that these procedures were not satisfactory.

First of all, it was found that neither the keypunch operator nor the editor, reading the sample registration certificate and recording the data, were able to keep an accurate count of the certificates. Also, since the film was not marked, there was no means of checking the sampling accuracy at a later time. Because of this and other problems (including a high estimated cost and time requirement) this method was rejected.

It was decided finally to have an enlarged print made of each microfilm roll so that each certificate would be approximately 2 inches by 3 inches in size. (Each roll of microfilm was printed on a continuous paper roll - 8 inches wide and 1500 feet long.)

2. The microfilm reader is a projector and screen combination unit which displays an enlarged picture of the microfilm onto a lighted glass screen.

Drawing the Sample

After the sample size had been determined and the prints of all registration certificates were on hand, the physical work of drawing the sample was started. The first step was to separate the data into four groups: the Milwaukee survey area, the Racine survey area, the Kenosha survey area, and the remainder of the Region. The registration certificates were then counted and numbered on the prints in accordance with the selected sample rates of 1 in 12 in the Milwaukee survey area and 1 in 4 in the Racine and Kenosha survey areas. The fact that there were semi-trailers, buses, mobile homes, motorcycles, and municipal vehicles in addition to the trucks complicated the sample selection. It was decided to select the sample vehicles in the following manner (using the Milwaukee survey area as an example). Each twelfth registration certificate was marked and then examined to determine the type of vehicle. If the twelfth registration was a truck, it was selected as a sample. If the twelfth registration was not a truck, it was discarded based on the theory that vehicles other than trucks were distributed randomly throughout the list. This same procedure was followed for the Racine and Kenosha survey areas, except that every fourth vehicle was considered for selection as a sample truck in these areas. All truck registrations in the Region outside the three highly developed areas were set aside for the postal questionnaire survey.

After the sample vehicle registrations were selected, a numerical code was assigned which geographically located the vehicle owner's address. Information on the sample certificate, such as the owner's name and address, the vehicle type, make, year, and license number along with the geographic code was keypunched into IBM cards. The cards were then arranged by quarter section³ for convenience in making interview assignments by area. Once this was accomplished, a further breakdown by owner's address within the quarter section made possible the assignment, for interview, of all of the sample trucks operated by a single owner on one day or, if necessary, on succeeding days. This procedure minimized the inconvenience to truck owners and resulted in a more satisfactory work schedule for the interviewers.

Some difficulty was experienced during the keypunch operation because some of the information printed on the enlarged microfilm was not legible. At first, it was thought that this was due to poor quality control in the process of enlarging and duplicating the microfilm records on the paper rolls. However, investigation revealed that, in most cases, it was the original copy of the registration certificate in the motor vehicle department files that was not clearly readable. All of the questionable samples were referred back to the source and correctly identified.

The government vehicles were grouped by survey area and the sample was selected in the same manner as that used for taxis (see below).

THE TAXI SAMPLING METHOD

Once a complete list of taxis had been compiled as previously described, the procedure for drawing the sample was relatively simple. The list was sorted and each taxi lo-

3. The quarter section, representing an area of approximately one quarter square mile, was considered the smallest areal unit for analysis in the land use-transportation study.

SEWRPC LIST OF PUBLICATIONS:

STUDY REPORTS

Regional Planning Program Prospectus

Coordinated Urban, Resource and Transportation Planning - April 1962.
40 pages; text, maps, tables, and diagrams - \$2.00

Root River Watershed Planning Program Prospectus

February 1963. 25 pages; text, maps, tables and charts (out of print.)

Planning Report No. 1 - Regional Planning Systems Study

December 1962. 73 pages; text, tables and diagrams - \$5.00 (out of print.)

Planning Report No. 2 - Regional Planning Base Mapping Program

July 1963. 23 pages; text and figures. Maps separate - \$1.00 (out of print.)

Planning Report No. 3 - The Economy of Southeastern Wisconsin

July 1963. 175 pages; text, maps, figures and tables - \$2.75

Planning Report No. 4 - The Population of Southeastern Wisconsin

July 1963. 100 pages; text, maps, figures and tables - \$2.75

Planning Report No. 5 - The Natural Resources of Southeastern Wisconsin

July 1963. 173 pages; text, maps, figures and tables - \$2.75

Planning Report No. 6 - The Public Utilities of Southeastern Wisconsin

July 1963. 90 pages; text, maps, and tables - \$2.50

PERIODICALS

Annual Report - 1961 - (out of print.)

Annual Report - 1962 - \$1.00

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