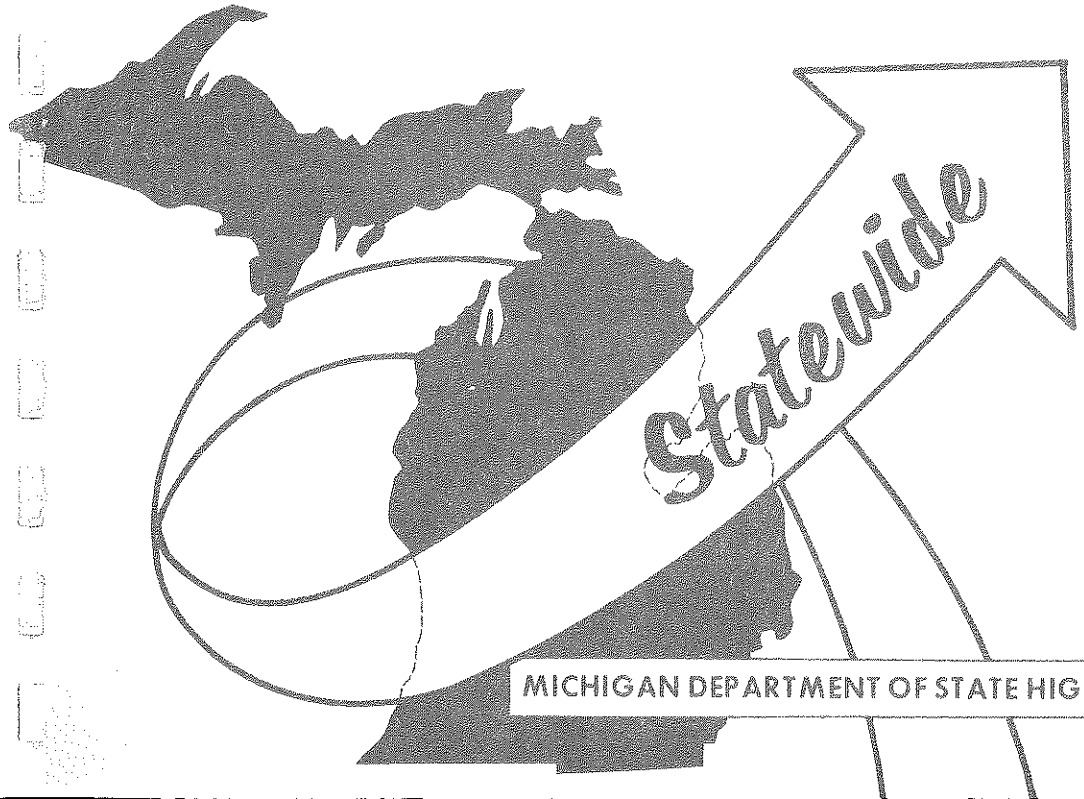
Statewide Transportation Analysis & Research

MICHIGAN STATEWIDE TRAFFIC FORECASTING MODEL

COMPREHENSIVE STATEWIDE PLANNING

A MULTIPLE BENEFIT OF A STATEWIDE TRANSPORTATION MODELING SYSTEM

STATEWIDE STUDIES UNIT



MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

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MODELING SYSTEM

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STATE OF MICHIGAN

WILLIAM G. MILLIKEN, GOVERNOR

DEPARTMENT OF STATE HIGHWAYS

STATE HIGHWAYS BUILDING – POST OFFICE DRAWER K – LANSING, MICHIGAN 48904

JOHN P. WOODFORD, STATE HIGHWAY DIRECTOR

August 28, 1973

Mr. Sam F. Cryderman
Engineer of Transportation Planning
Transportation Planning Division

Dear Mr. Cryderman:

A statewide transportation modeling system can symatically benefit many state agencies in addition to the highway agency. This report documents the application of the Michigan Department of State Highway's modeling system within a typical statewide comprehensive planning process.

Applications such as those identified in this document could lead to effective involvement and cooperation of both public and private agencies in the transportation planning process.

Sincerely,

Keith E. Bushnell

Keith E. Bushnell
Engineer of Transportation
Suvey and Analysis Section

MICHIGAN
THE GREAT LAKE STATE

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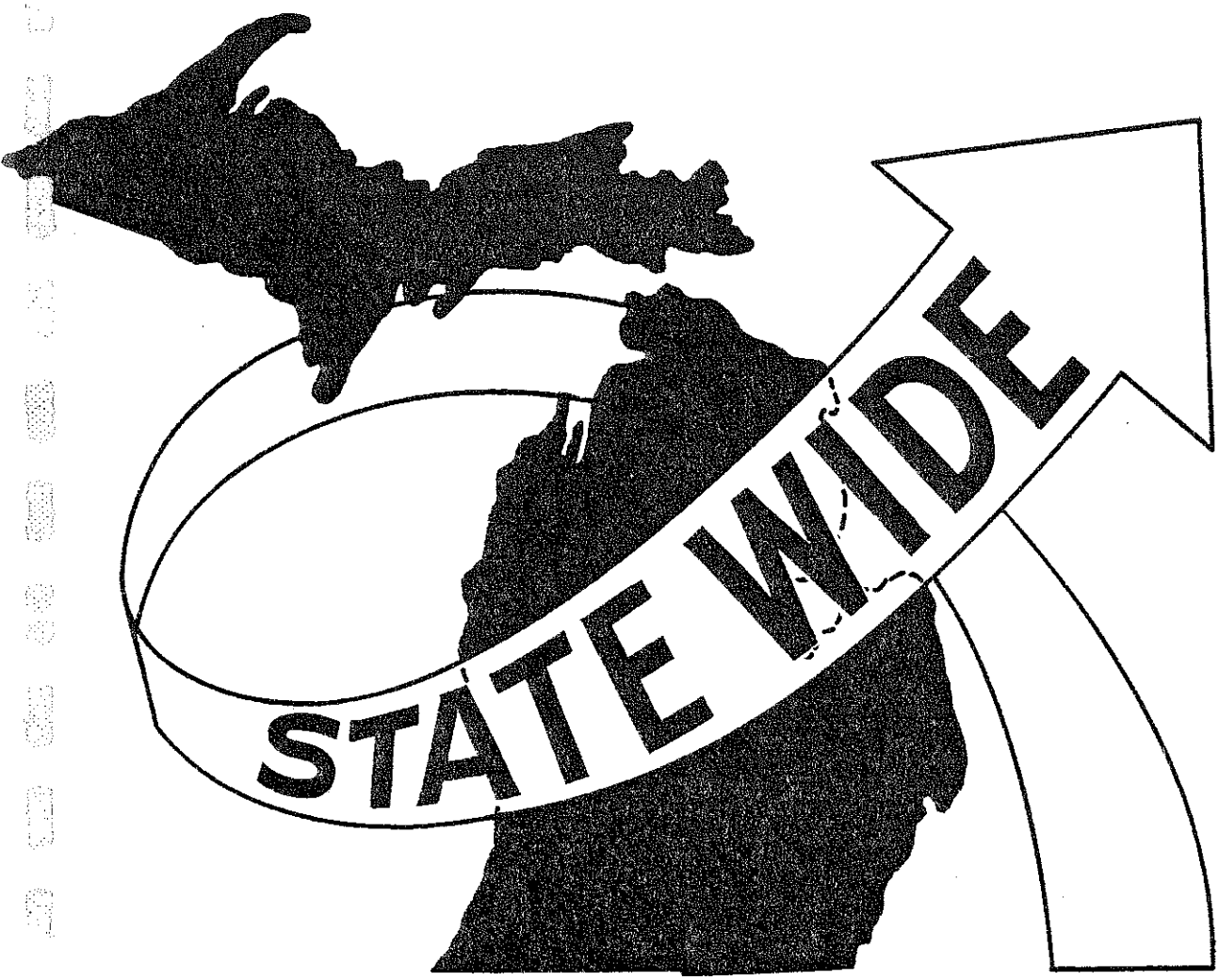
PREFACE



PREFACE

This is the first in a new series of reports that deal with issues directed at the multi-benefits a state may expect to receive as the direct result of the development of a statewide transportation modeling system.

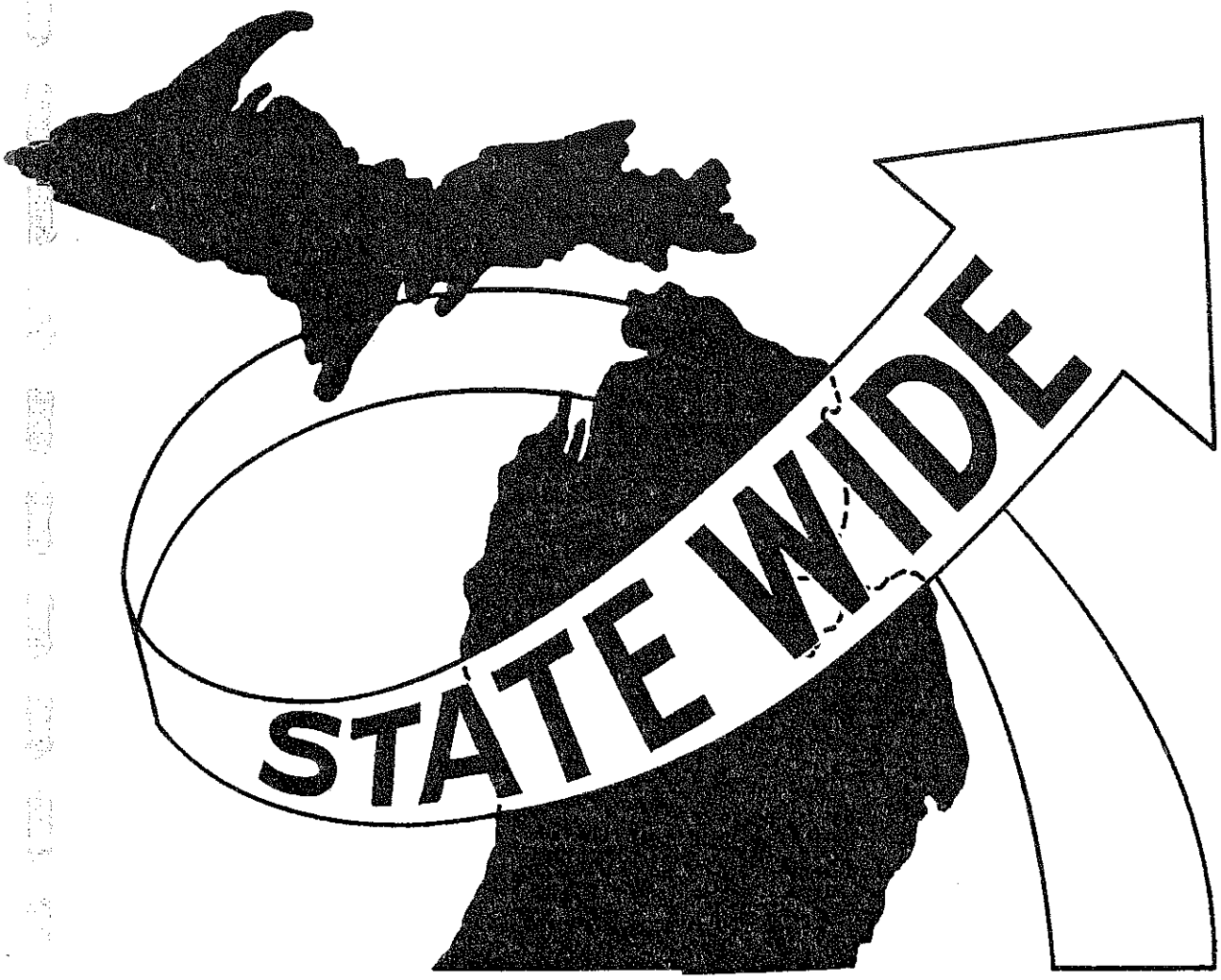
Many states have experienced difficulty in attempting to develop a comprehensive statewide planning operation. This report directs itself at some of the issues in this area. The idea being that certain elements within a statewide transportation modeling system will allow many states which select this technique to systematically eliminate many of the typical difficulties.

Previous reports in the statewide model series deal with technical model development and application. They are as follows:

Volume	I	Objectives and Work Program
Volume	IA	Workshops Topic Summaries
Volume	IB	Traffic Forecasting Applications Single and Multiple Corridor Travel Analysis
Volume	IC	Model Application: Turnbacks
Volume	ID	Proximity Analysis: Social Impacts of Alternate Highway Plans on Public Facilities
Volume	IE	Model Applications: Cost-Benefit Analysis
Volume	IF	Air and Noise Pollution System Analysis Model
Volume	IG	Transportation Analysis Psychological Impact Model
Volume	II	Development of Network Models

Volume III	Multi-level Highway Network Generator
Volume IIIA	Semi-Automatic Network Generator Using a "Digitizer"
Volume IV	Total Model Calibration - 547 Zone Travel Model
Volume VA	Travel Model Development Reformation - Trip Data Bank Preparation
Volume VB	Development of the Statewide Socio-Economic Data Bank for Trip Generation-Distribution
Volume VI	Corridor Location Dynamics
Volume VII	Design Hour Volume Model Development
Volume VIII	Statewide Public and Private Facility File
Volume IX	Statewide Socio-Economic Data File

INTRODUCTION



INTRODUCTION

Many states attempting to effectively develop a comprehensive statewide planning process do so through the assignment of the development process to some existing planning body. In other situations the task is "let out" to a consulting agency. Regardless of the method selected many comprehensive statewide planning operations lack the true success initially desired.

The staffs assigned these operations are very often highly skilled but lack the necessary system of tools to systematically meet the initial challenge. In other situations the system developed is often too complex to be applied on a daily routine basis. Those states which have developed or are presently developing a statewide transportation modeling system can expect to rapidly overcome many of the typical comprehensive planning problems.

Anyone desiring to do comprehensive planning must have information on a statewide basis. This information must cover a broad spectrum to effectively involve and meet the needs of:

The Executive Office

The Legislature

Various State Agencies

Commercial Interests

Industrial Interests

Citizens

Socio-economic characteristics of the population would be required by all groups involved in the process.

Information about public and private facilities such as universities, parks and hospitals would seem pertinent. Finally, to describe the interaction of the population with these facilities, information about the various forms of system communication is necessary. Therefore, statewide comprehensive planning should be developed in a manner such that each of these individual groups can effectively interact with other groups -- the end result of which is an orderly plan for development within the state.

Figure 1 is a generalization of a typical comprehensive planning process. Note that both public and private organizations must successfully interact if an orderly state development plan is the result. This paper proposes that the system interaction process should in fact be a statewide transportation modeling system.

COMPREHENSIVE PLANNING STRUCTURE
(Modeling Function)

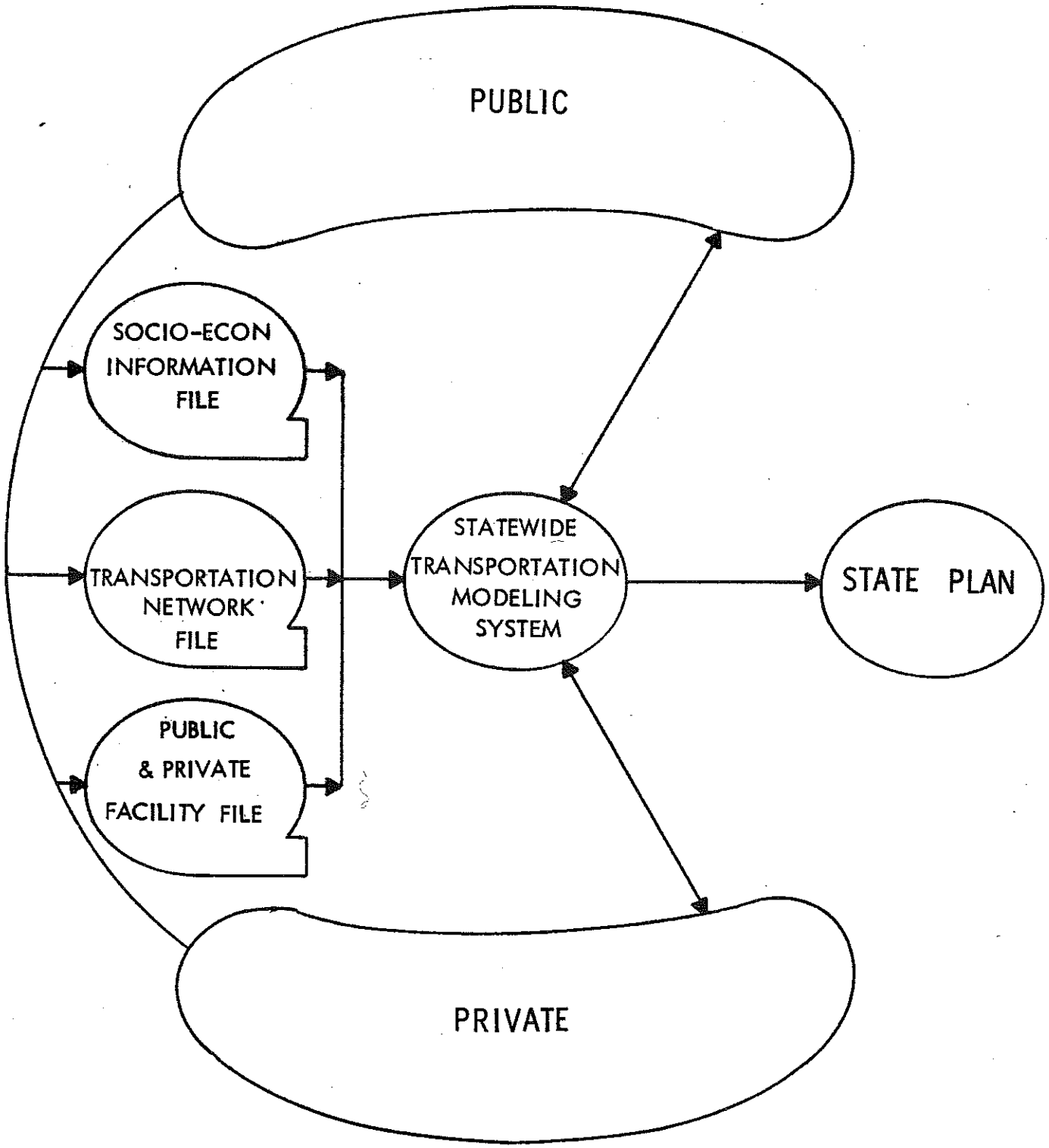
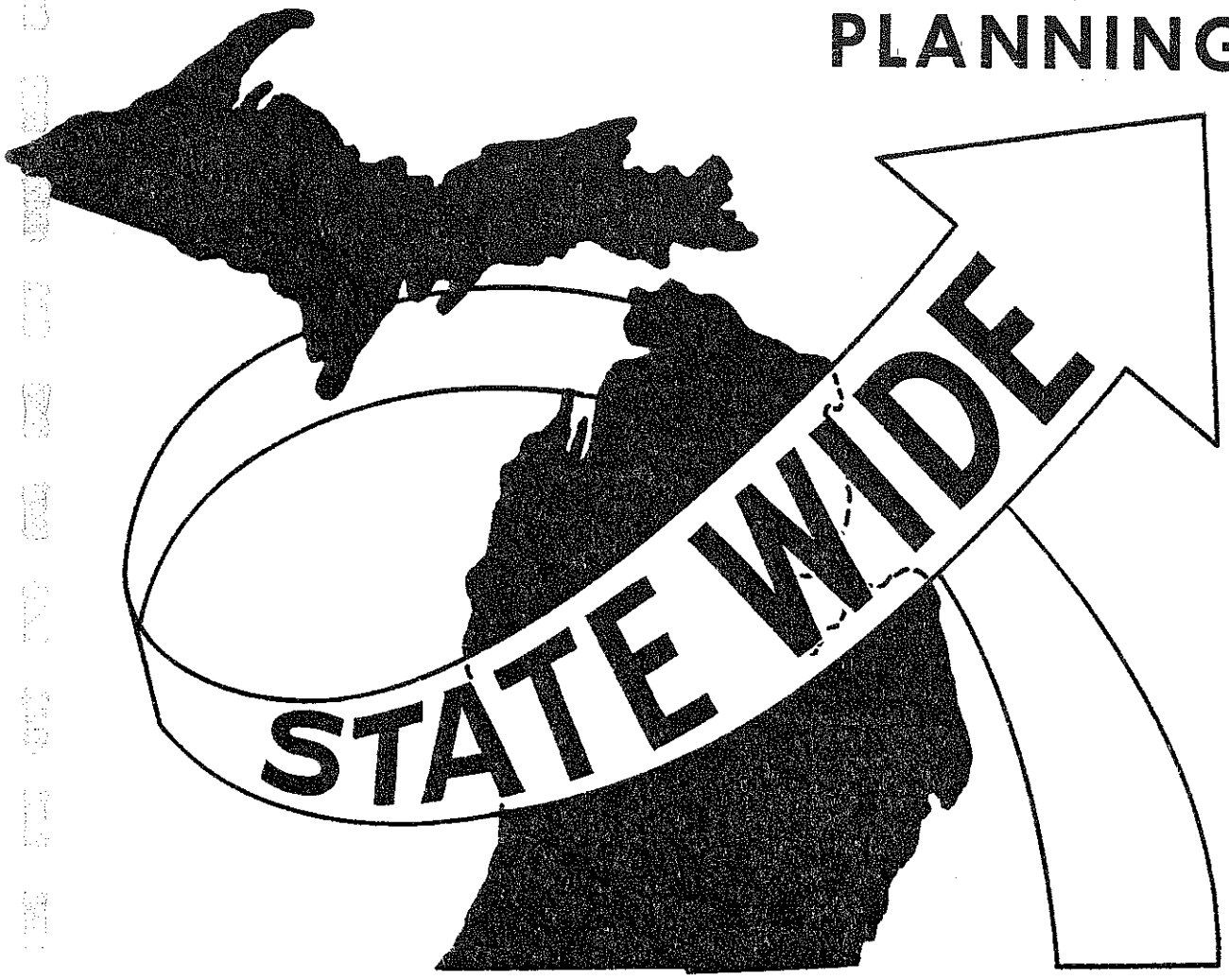


FIGURE 1

MODELING SYSTEM MULTI-BENEFITS-

STATEWIDE COMPREHENSIVE PLANNING



MODELING SYSTEM | MULTI-BENEFITS-STATEWIDE COMPREHENSIVE PLANNING

The Statewide Studies Unit of the Transportation Planning Division of the Michigan Department of State Highways has developed a statewide transportation modeling system which contains the elements that appear in Figure 2.

Those individuals desiring a detailed documentation of the complete Statewide Transportation Modeling System and its components should obtain a copy of the report entitled "A Statewide Transportation Modeling System Effectively Meets the Challenges of the 70's" published in June, 1973 by the Michigan Department of State Highways.

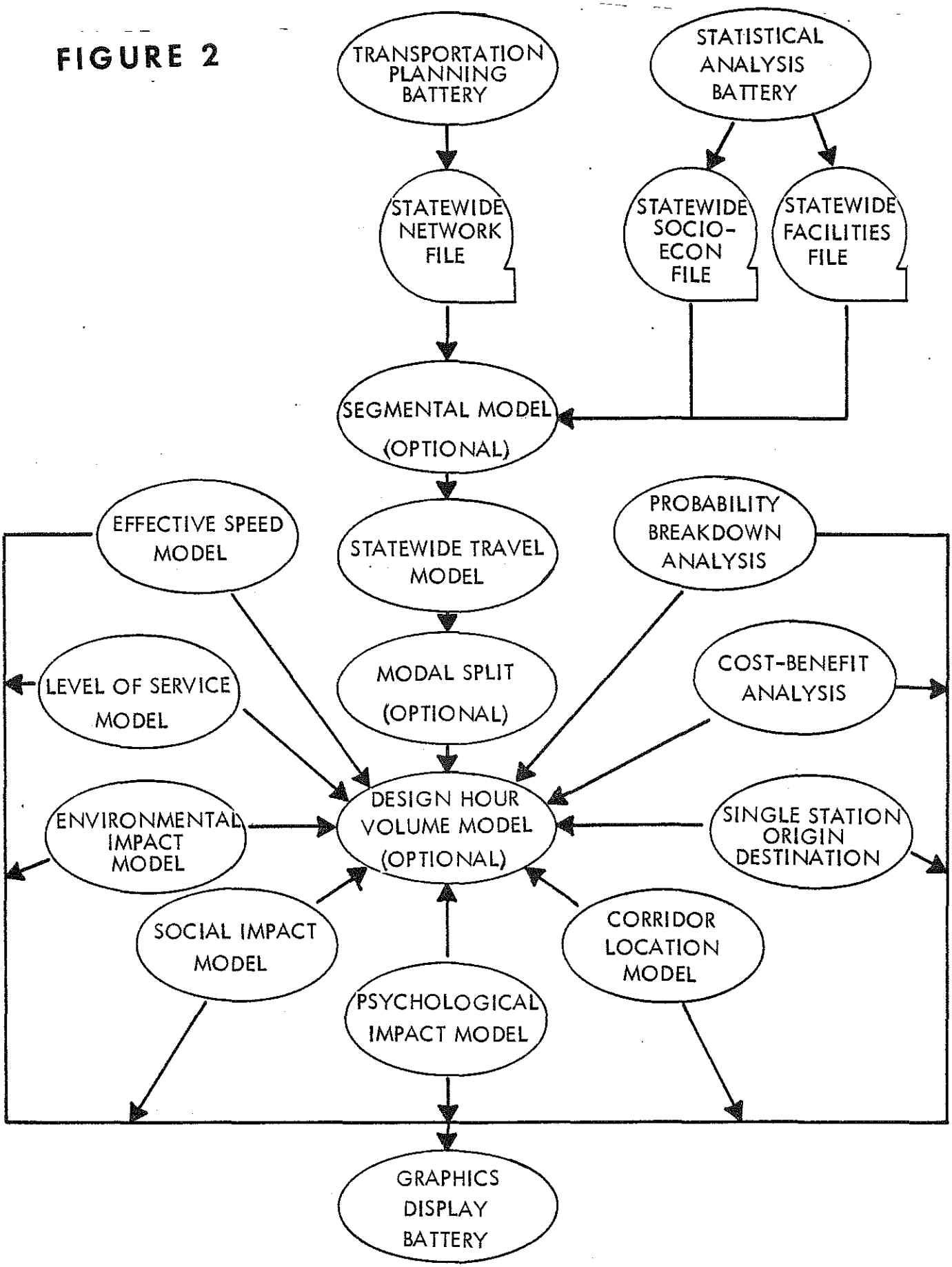
Necessary to the successful development of any statewide transportation modeling system is the creation of three basic information files which have been identified in Figure 3. These same three files are basic to the success of the transportation planning process and appear to contain a majority of the information previously identified as necessary to operation of a successful comprehensive planning process. A summary of information in these files appears in Figure 4-6. Those persons wishing to become familiar with all the information available should obtain copies of the following Michigan Department of State Highways reports:

"Statewide Public and Private Facility File" - March, 1973.

"Statewide Socio-Economic Date File" - March, 1973.

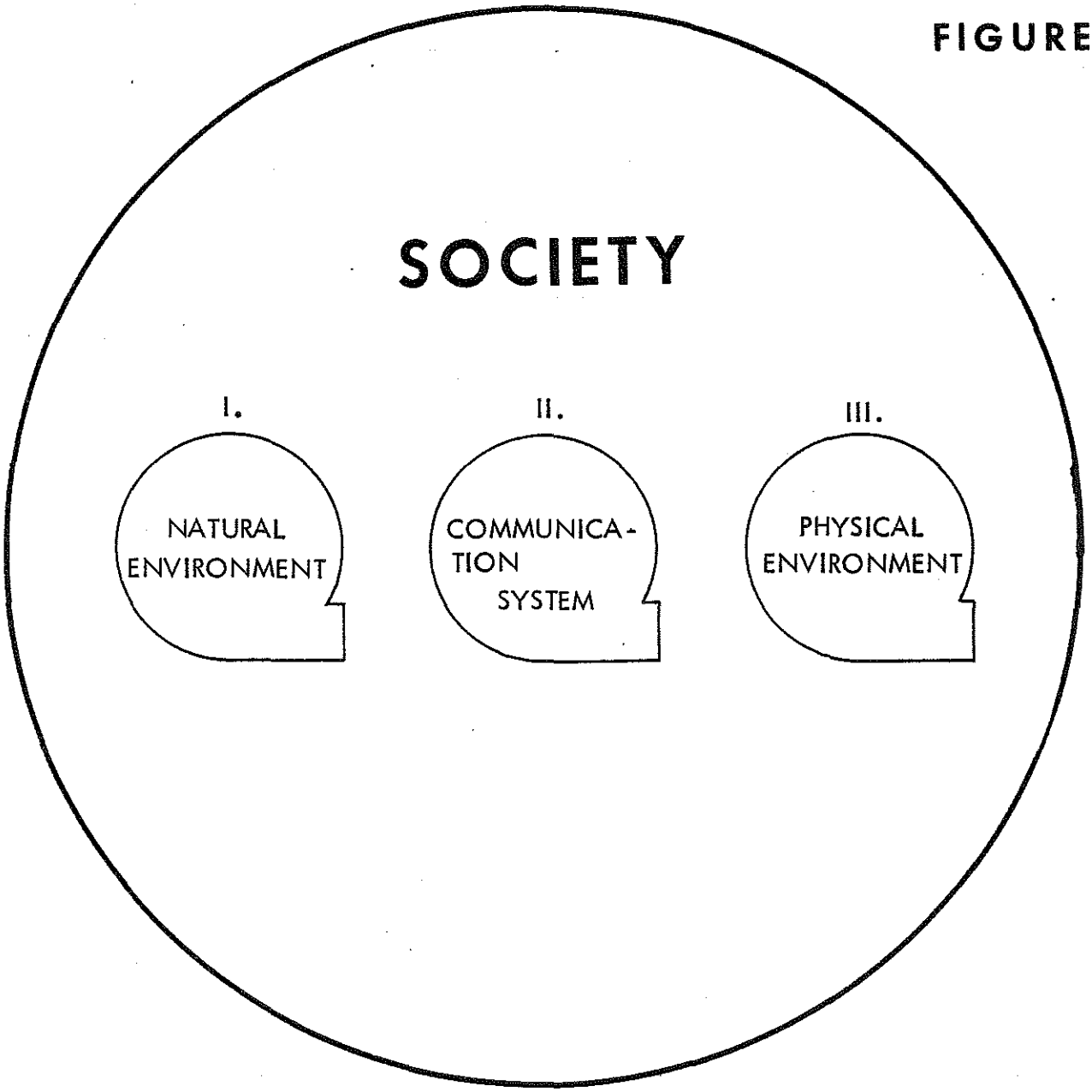
STATEWIDE MODELING SYSTEM COMPONENTS

FIGURE 2



SOCIETY COMPONENTS

FIGURE 3



I. STATEWIDE SOCIO-ECONOMIC DATA FILE

II. STATEWIDE TRANSPORTATION NETWORK

III. STATEWIDE PUBLIC & PRIVATE FACILITY FILE

STATEWIDE SOCIO-ECONOMIC DATA FILE *

GENERAL CHARACTERISTICS OF POPULATION

SCHOOL ENROLLMENT BY TYPE OF SCHOOL
YEARS OF SCHOOL COMPLETED
CITIZENSHIP BY AGE

INCOME CHARACTERISTICS OF POPULATION

FAMILY INCOME
INCOME BY OCCUPATION AND SEX
RATIO OF FAMILY INCOME TO POVERTY LEVEL

LABOR FORCE CHARACTERISTICS OF POPULATION

EMPLOYMENT BY AGE
EMPLOYMENT BY OCCUPATION AND SEX
EMPLOYMENT BY INDUSTRY AND SEX

SOCIAL CHARACTERISTICS OF POPULATION

AGE BY SEX
TYPE OF FAMILY
MARITAL STATUS

AREA CHARACTERISTICS

LAKE FRONTAGE
ASSESSED VALUATION
WATER AREA

FIGURE 4

*THOSE ITEMS LISTED HERE ARE SAMPLES TAKEN FROM THE COMPLETE FILE WHICH CONTAINS OVER 700 ITEMS.

STATEWIDE HIGHWAY NETWORK

LINK FILE

CONTENTS OF EACH HIGHWAY SEGMENT OR LINK

AVERAGE SPEED
DISTANCE
URBAN-RURAL DESIGNATION
TYPE OF ROUTE
TRAFFIC VOLUME CAPACITY
AVERAGE ANNUAL DAILY TRAFFIC VOLUME
COMMERCIAL TRAFFIC VOLUME
DESIGN HOUR VOLUME
ACCIDENT FATAL RATE
ACCIDENT INJURY RATE
ACCIDENT RATE
NUMBER OF LANES
LANE WIDTH
SURFACE CONDITION
RIGHT OF WAY
SIGHT RESTRICTION

FIGURE 5

STATEWIDE FACILITY FILE

HISTORIC SITES
HOSPITALS
AIRPORTS
WHOLESALE TRADE CENTERS
MAJOR PARKS
NON-PUBLIC COLLEGES
PUBLIC COMMUNITY COLLEGES
CITIES OVER 30,000 POPULATION
UNEMPLOYMENT OFFICES
MENTAL HEALTH CENTERS
CERTIFIED INDUSTRIAL PARKS
MICHIGAN'S UNIVERSITIES
SKI AREAS
SNOWMOBILE TRAILS
CBD w/5,000 POPULATION
TRUCK TERMINALS
STATE POLICE POSTS
DAILY NEWSPAPERS
WEEKLY NEWSPAPERS
SEWAGE TREATMENT FACILITIES
TOURIST ATTRACTIONS
BUS TERMINALS
MANUFACTURERS
CAMPSITES

FIGURE 6

Although the modeling system defined in Figure 2 was developed to systematically allow any state transportation agency to meet the challenges of the 70's, the reader should note the wide range of jurisdictional responsibility within the Statewide Public and Private Facility File as identified in Figure 7.

Creation of this file was the first hint of multi-department application of the statewide transportation modeling system. The generalized comprehensive planning diagram in Figure 1 has now been expanded so as to identify the role the three basic information files and the statewide transportation modeling system play in a typical statewide comprehensive planning process. (Figure 8).

As presently developed, this system supplies the user with the following multi-department applications.

1. Statewide Information Data Base
2. Transportation Analysis Process
3. Statistical Analysis Process
4. Graphic Display Process

Initially, with this system all users have access to the same information base and can place information in the system or retrieve information from the system. Therefore, with the three basic information files (Figure 3) much of the duplication of effort at storing and editing information for various departments has been eliminated.

STATEWIDE FACILITY FILE

JURISDICTION	FACILITIES
DEPT. OF STATE	HISTORIC SITES
DEPT. OF HEALTH	HOSPITALS
AREONAUTIC	AIRPORTS
GENERAL	WHOLESALE TRADE CENTERS
DEPT. OF NAT.RES.	MAJOR PARKS
PRIVATE	NON-PUBLIC COLLEGES
DEPT. OF EDUCATION	PUBLIC COMMUNITY COLLEGES
GENERAL	CITIES OVER 30,000 POPULATION
DEPT. OF LABOR	UNEMPLOYMENT OFFICES
DEPT. OF HEALTH	MENTAL HEALTH CENTERS
DEPT. OF COMMERCE	CERTIFIED INDUSTRIAL PARKS
DEPT. OF EDUCATION	MICHIGAN'S UNIVERSITIES
PRIVATE	SKI AREAS
PRIVATE	SNOWMOBILE TRAILS
GENERAL	CBD w/5,000 POPULATION
PRIVATE	TRUCK TERMINALS
DEPT. OF JUSTICE	STATE POLICE POSTS
PRIVATE	DAILY NEWSPAPERS
PRIVATE	WEEKLY NEWSPAPERS
CITY GOV'T.	SEWAGE TREATMENT FACILITIES
PRIVATE	TOURIST ATTRACTIONS
PRIVATE	BUS TERMINALS
PRIVATE	MANUFACTURERS
DEPT. OF NAT.RES.	CAMPSITES

FIGURE 7

COMPREHENSIVE PLANNING STRUCTURE
(Generalized)

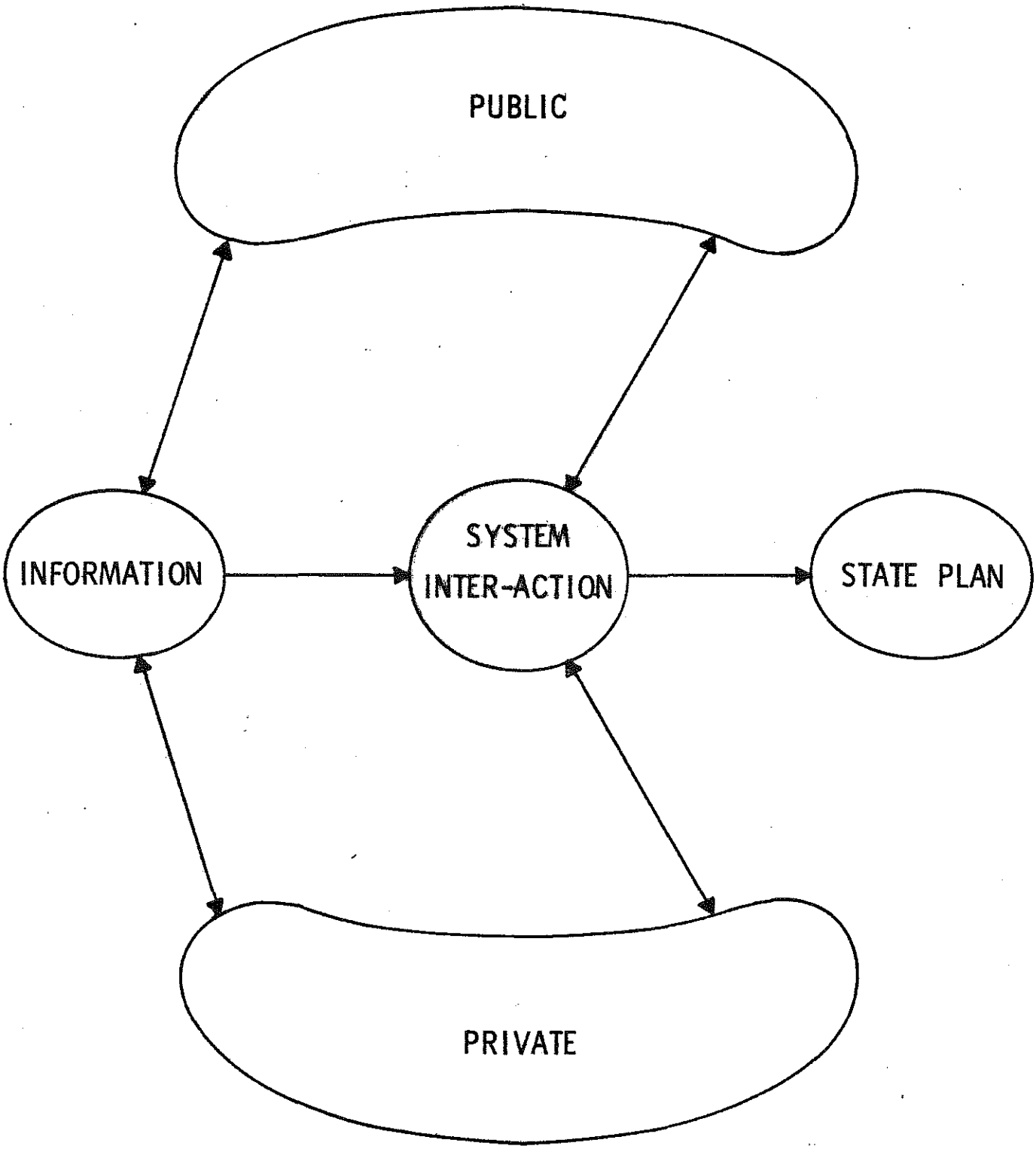


FIGURE 8

This modeling system also benefits each state in that these same three data files may be used directly, without additional development costs, as the basic information files for a comprehensive statewide planning process.

The third major benefit each state may expect to gain is the fact that the statistical analysis process and the graphic display battery have direct application throughout most state agencies, again without additional costly computer program definition and testing.

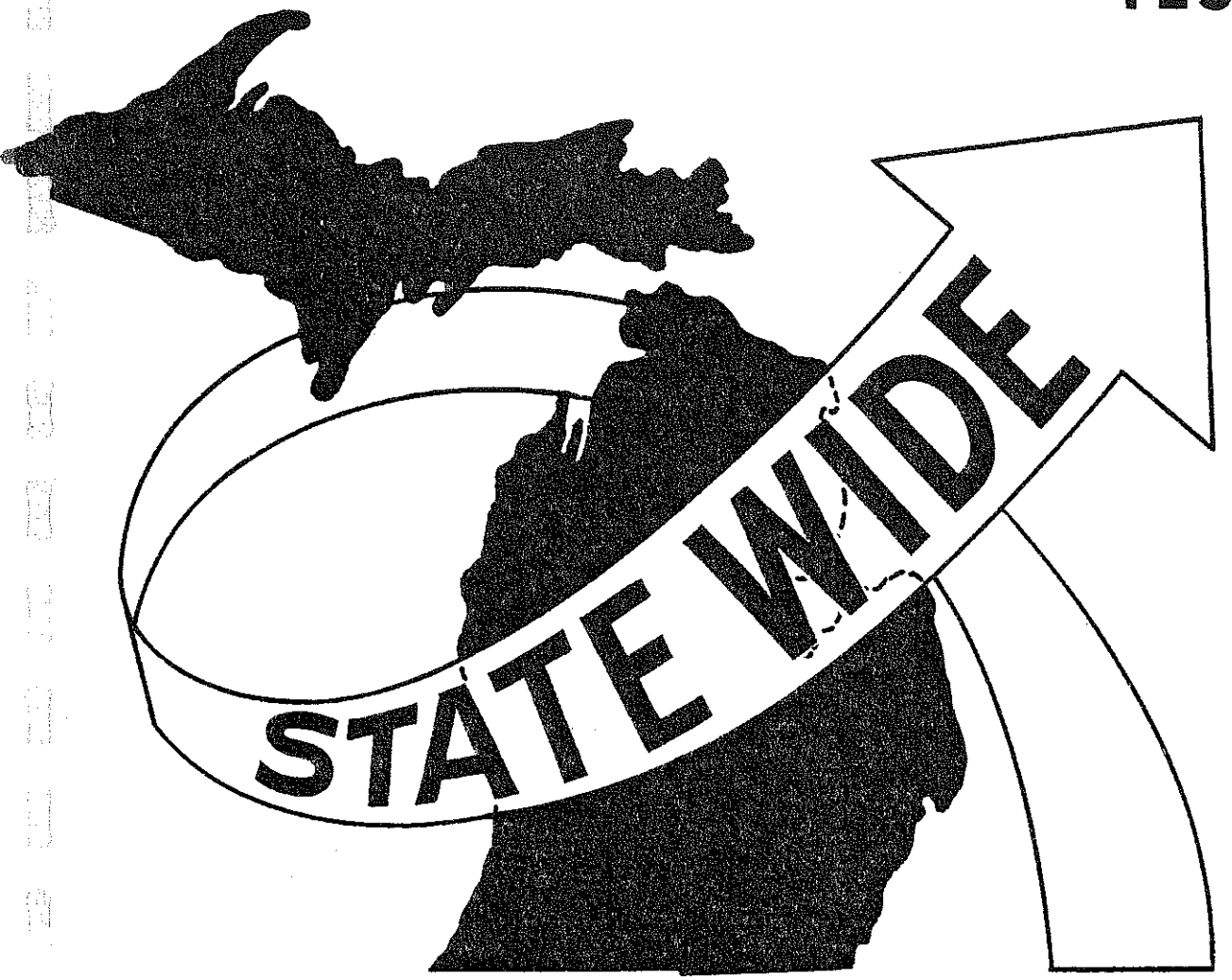
Additionally all planning for a vast array of state agencies is completed using the same data base. All analysis and display is processed with the same system components thereby effectively generating consistency throughout all state agencies.

Finally, system development, access and operation was initiated using a simple technology so that all system users could:

1. Easily initiate system component changes.
2. Rapidly train personnel in system application.
3. Quickly enter information into the system or retrieve it from the system.

The verification of the multi-benefits of the development of a statewide transportation modeling system and its probable impact on the statewide comprehension planning process have been documented by actual system tests in the area of inter-agency analysis projects. The following section is a discussion of these tests.

SYSTEM ANALYSIS TESTS



SYSTEM ANALYSIS TESTS

The true test of any proposed process is an actual application of the system within the daily operational routine. This is exactly what has been done in order to substantiate the multi-benefit aspects resulting from the application of a statewide transportation modeling system. Projects were completed that involved those agencies identified in Figure 9. These were cooperative projects that required the analysis of information from several agencies. Over the past eight months upwards to ten state agencies have been involved in varying degrees.

Those states considering strengthening or modifying their statewide comprehensive planning process through the direct application of a statewide transportation modeling system should note that these test projects were completed without modification to the original modeling system. The inter-agency analysis projects were completed without additional development cost to the state, thereby testing the true multi-benefit aspects of the original system.

All of the tests completed were selected to cover a vast diversity in subject matter. This was carried out in this manner so as to effectively test the versatility of the system as it was applied to analysis operations in other state agencies. All tests were completed using the statewide transportation modeling system components in Figure 2. A single test has been summarized in this report for reference.

INTER-DEPARTMENTAL TEST PROJECTS

DEPARTMENT OF NATURAL RESOURCES

- -STATE PARK PLANNING
- -RIFLE RANGE STUDY

AERONAUTICS

- -AIRPORT PLANNING

DEPARTMENT OF COMMERCE

- -INDUSTRIAL SITE ANALYSIS
- -RECREATION INDUSTRY ANALYSIS

DEPARTMENT OF STATE

- -REGIONAL OFFICE PLANNING

DEPARTMENT OF PUBLIC HEALTH

- -HOSPITAL PLANNING
- -ACCIDENT LOCATION ANALYSIS

DEPARTMENT OF TREASURY

- -DATA COLLECTION CENTER ANALYSIS

EXECUTIVE OFFICE

- -LEGISLATIVE PLANNING - AMBULANCE SERVICE

DEPARTMENT OF EDUCATION

- -COMMUNITY COLLEGE SERVICE AREA ANALYSIS

MSU

- -ECONOMIC DEVELOPMENT - RECREATION
- -RECREATION DEMAND STUDY

FIGURE 9

A detailed analysis report was completed for each of the other projects and this list appears in Appendix A for those who wish to review those projects in detail.

A typical project was the analysis of the concentration of air-carrier airports and of labor force around each of the state's certified industrial parks, performed for the Department of Commerce. The analysis used the following components from the statewide transportation modeling system in Figure 2:

1. Socio-Economic Data File
2. Statewide Public and Private Facility File
3. Transportation Planning Battery
4. Proximity Analysis ("Social Impact Analysis") Model
5. Graphic Display Battery.

Using this modeling system, an analysis formerly requiring several man-weeks was completed in approximately thirty man-minutes. The computer time for the total analysis was approximately 20 minutes. A very small part of the output for a single industrial park appears below. Analysis pertaining to the Huron Industrial Park in Alpena, is summarized here:

Driving Time From Alpena	Number of Airports Included	Number of Members of 1970 Labor Force Included
0-30 Minutes	0	27,399
0-60 Minutes	8	270,979
0-90 Minutes	14	520,397
0-120 Minutes	23	655,291

Information resulting from analysis similar to this may also be presented graphically using various system components. The graphics from the Department of Public Health project appear in Figure 10. Each agency may also complete statistical

HOSPITAL DENSITY

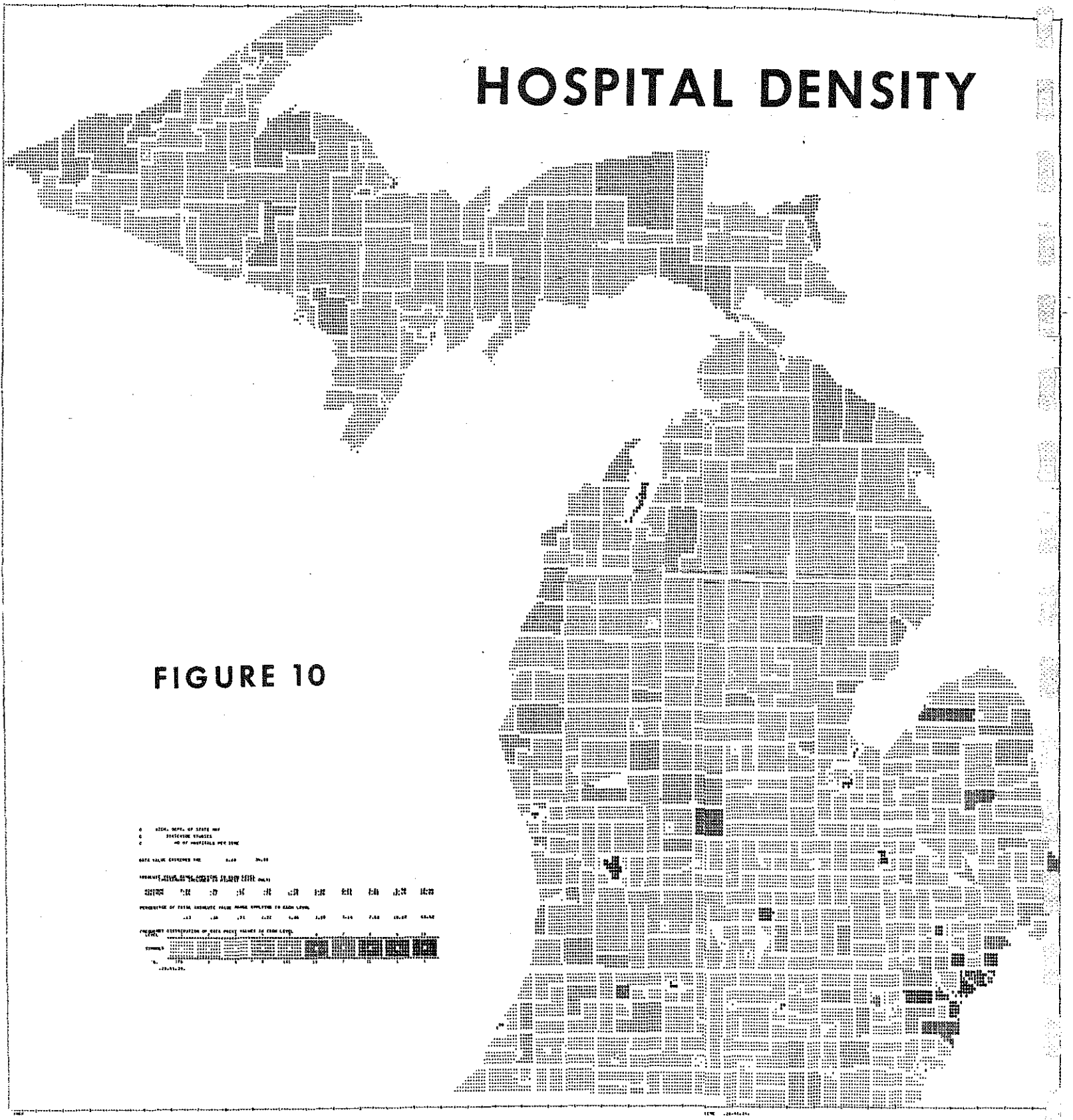


FIGURE 10

analysis on information in the socio-economic file and display it in a manner similar to Figure 11. The remaining projects identified in Figure 8 also use similar components without system modification.

Transportation information on a "link" basis may also be displayed in a manner similar to Figure 12, which is a band-width plot of highway accident information. If desired, the actual numeric information could have been plotted beside the link instead of using band-widths. These analysis tasks were effectively accomplished through direct application of selected statewide transportation modeling system components.

HISTOGRAM OF VARIABLE PPOVER

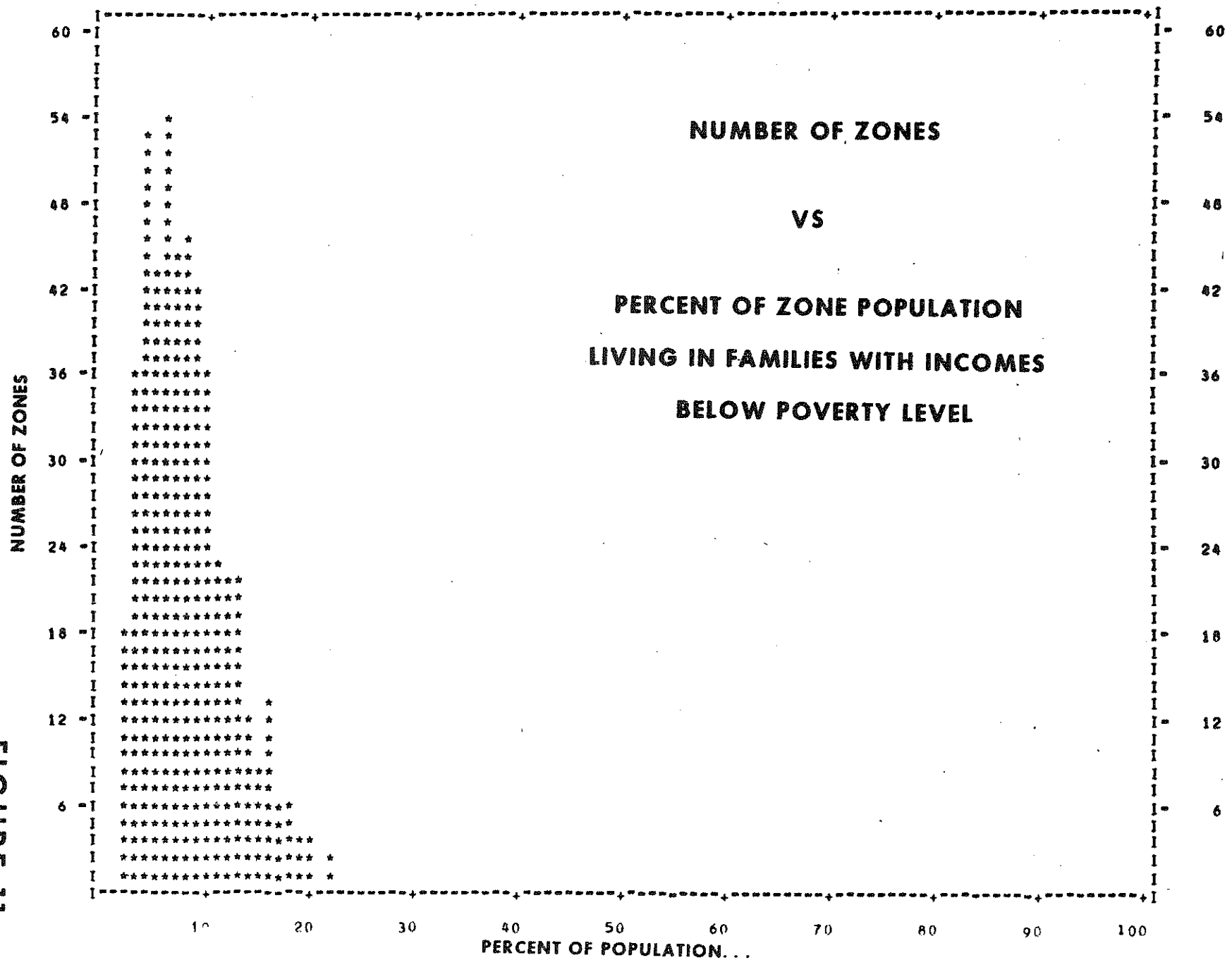


FIGURE 11

ACCIDENT RATE BAND WIDTH PLOT

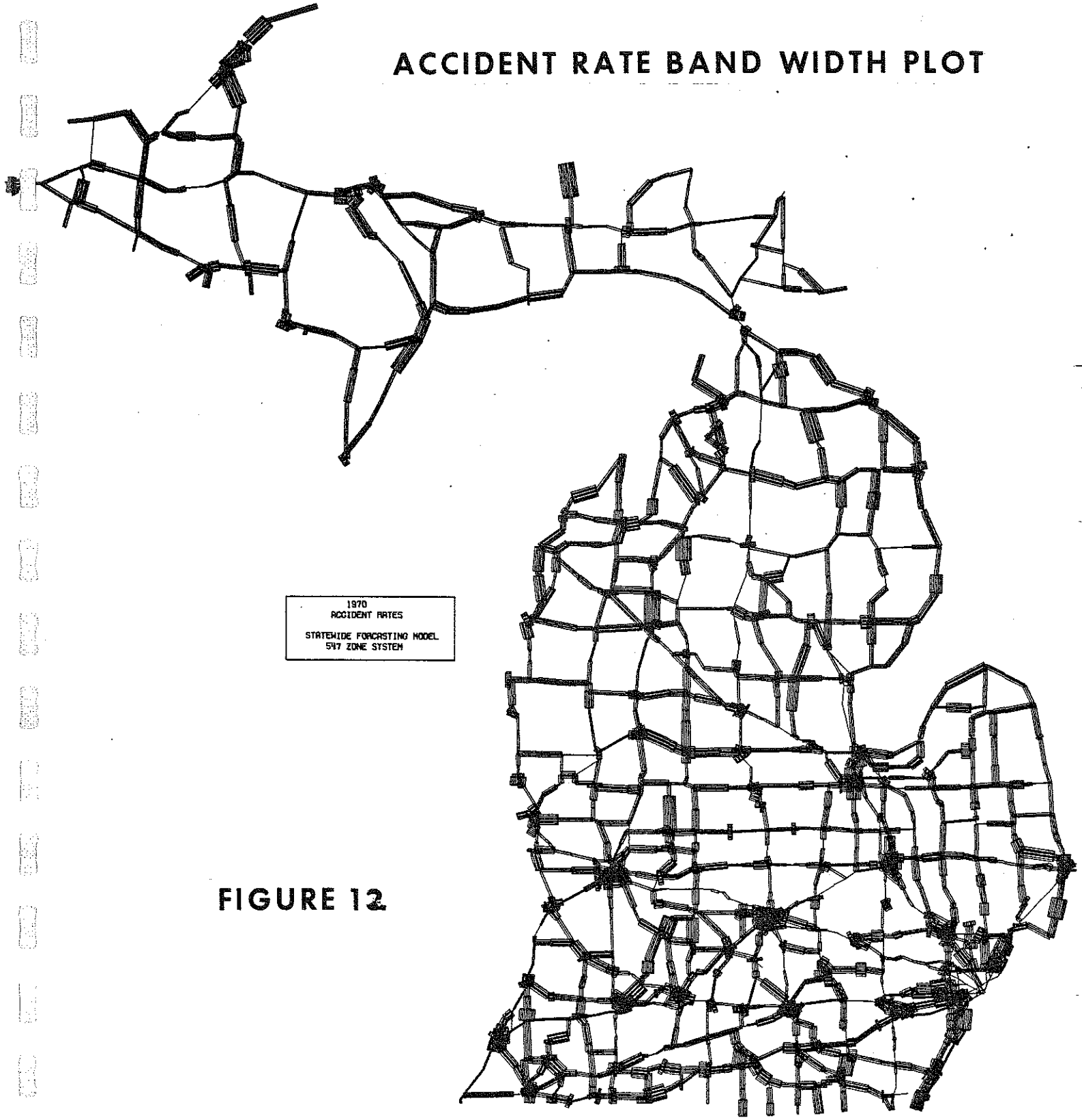


FIGURE 12

CONCLUSION

CONCLUSION

Each state agency has been assigned additional responsibilities as the result of recent Federal legislation. Because of the complexity of many of these additional responsibilities, few agencies will be able to effectively meet these responsibilities using existing staff if the same analysis methods are retained. If, in fact, the same methods are retained, in most situations additional staffing will be required. Requests for additional staff are coming under heavy pressure as the results of increased tax burdens on all governmental agencies. Therefore, as the results of the research and development on the statewide modeling system completed by the Statewide Studies Unit, this document defines what the unit feels is possibly the only effective solution. This solution was the development of a modeling process that has multi-department application. Development of a modeling system such as the one defined in Figure 2 will allow many agencies to systematically meet the challenge of the 70's.

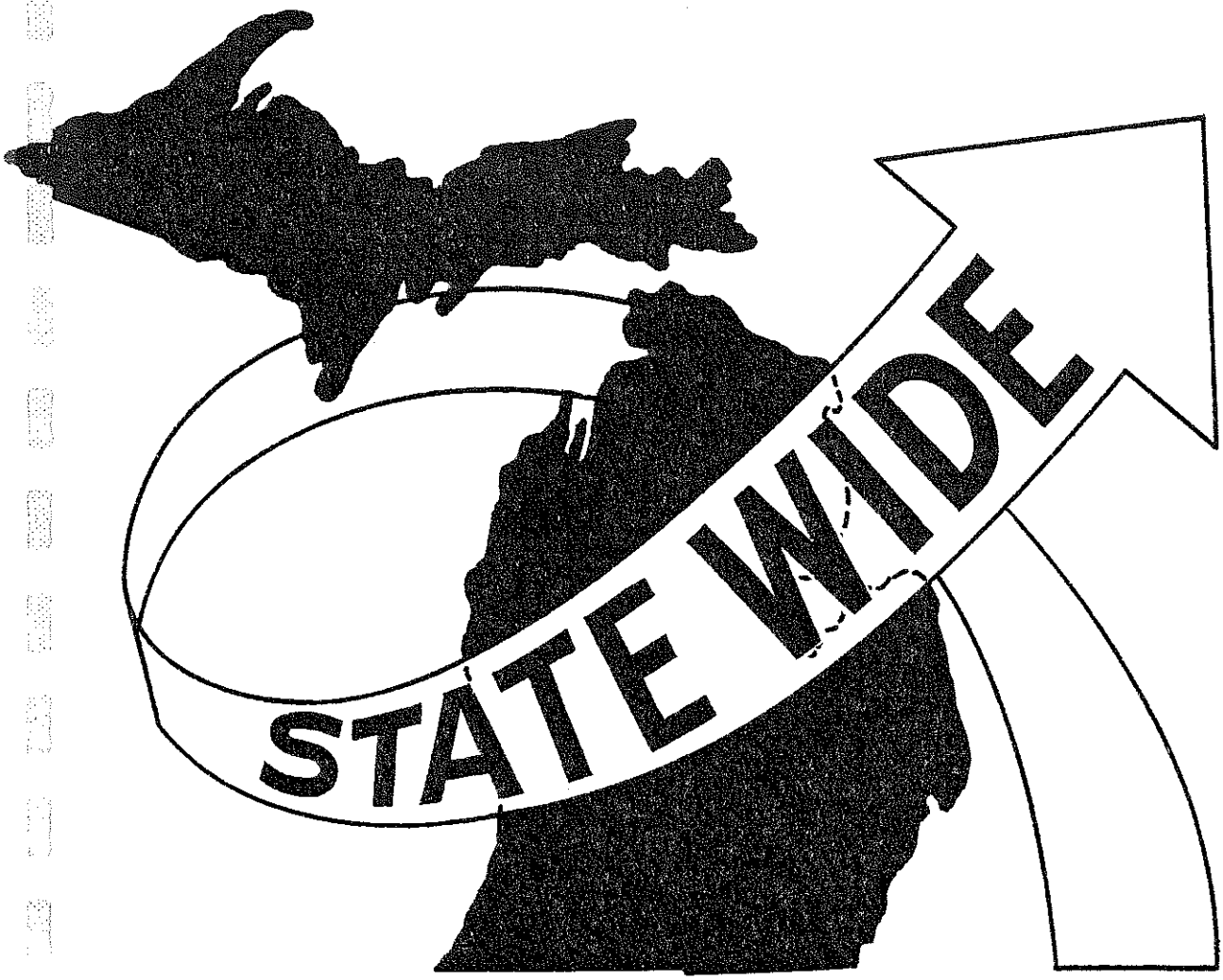
Secondly, this system has received acceptance in inter-department operation as a result of those test projects identified in Figure 9. Each test was conducted so that other state agencies would have an opportunity to apply selected system components in their particular operation. The success of these tests indicate the true multi-department benefits to be gained by the development of a statewide transportation modeling system.

Additionally, the system has been developed in a manner such that users of the system are not confronted with massive data reformation efforts in order to apply the system. For example, all data on 248 hospitals in the state was prepared and entered in the system in approximately three man-hours.

Finally, the process was developed with the idea that the system could effectively assist agency management in the daily decision making process. System analysis output is not measured in thousands of pages of computer listings or tons of output, but is presented in process single page graphic displays such as those in Figure 10 and 12.

Techniques available as the result of the development of the statewide transportation modeling system will effectively allow all levels of state government to accumulate and analyze vast amounts of planning information in a very short time frame for later use in the statewide comprehensive planning process.

APPENDIX A



APPENDIX A

Regional Park Proximity Analysis

Proximity of Airports with Scheduled Service to Population

Industrial Park Proximity Analysis

Recreation Industry Analysis

Rifle Range Proximity Analysis

Proximity of General Purpose Hospitals to Population

Statewide Ambulance Service Information

Proximity of Automobile Injury Accidents to Hospitals

Community College Service Area Analysis