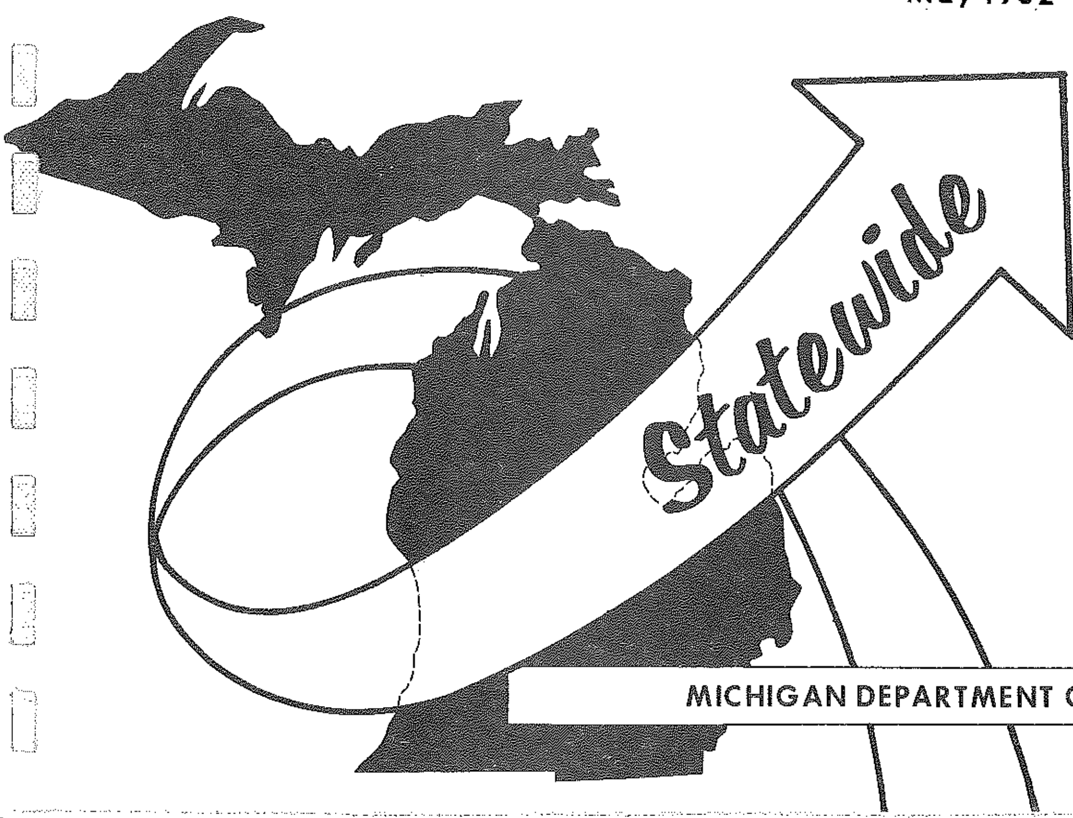
Statewide Transportation Analysis & Research

Michigan's Statewide
Transportation Modeling System

PLANNING PRODUCTIVITY
DEVELOPMENT OF MICHIGAN'S STATEWIDE STRATEGIC TRANSPORTATI MODELING SYSTEM

Vol. I (1)

Transportation Planning Procedures Secti
May 1982



MICHIGAN DEPARTMENT OF TRANSPORTATION

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BUREAU OF TRANSPORTATION PLANNING

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Planning Productivity
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Modeling System

by

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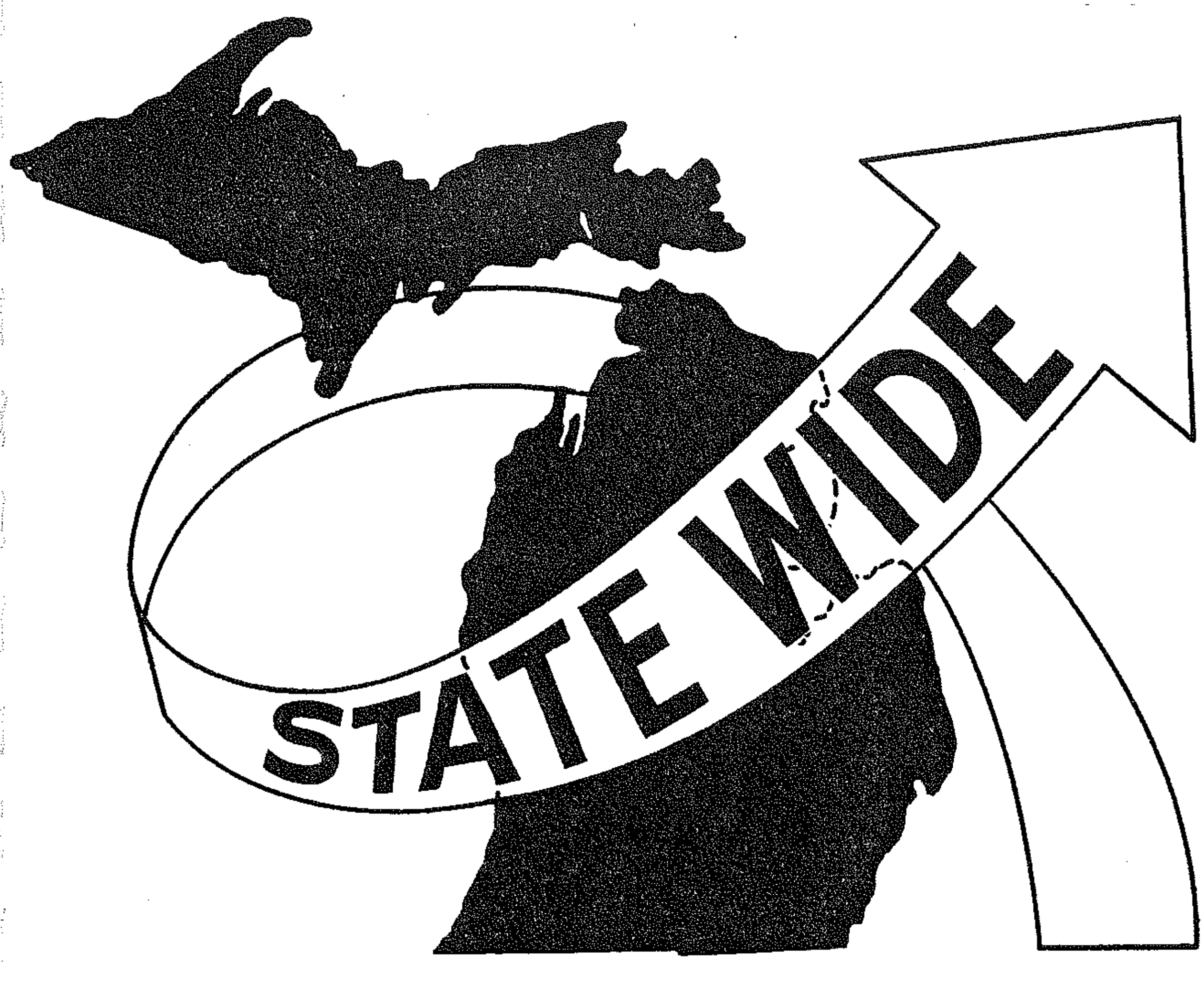
INTRODUCTION



INTRODUCTION

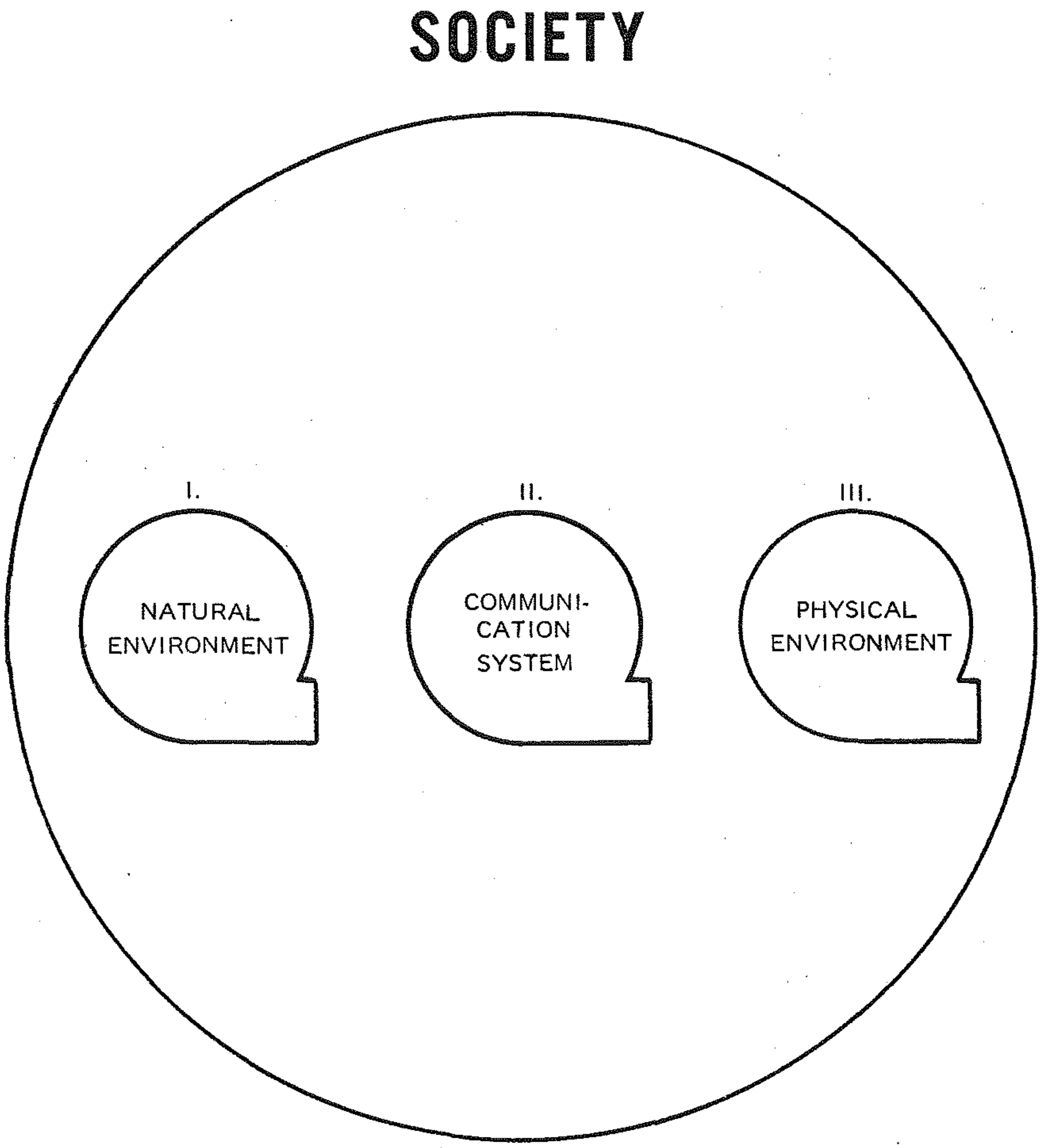
Early in the development of Michigan's Statewide Travel Forecasting Model, it was decided that a system such as this should be designed so that the applications could be extensive serving both detailed analytical and administrative needs. Because the transportation network is a dominant element in the functioning of the world around us and because this element was the prime responsibility of the Highway Department at that time, it was decided that the opportunity for successful application was possible.

In order to serve many users and varied applications in the planning profession, the planning data base for this system would have to be extensive. Figure 1 is a simplified diagram of how that data base was divided into elements that represent the society.

Also in order to insure the success of the development of a statewide transportation modeling system, the utility would have to be extensive. The primary reason being the fact that in the time when this system was being developed, mathematical computer-oriented systems such as this were not too popular or successful.

With many applications and system productivity as the basic driving force behind the process, development of

Figure 1



I. STATEWIDE SOCIO-ECONOMIC DATA FILE

II. STATEWIDE TRANSPORTATION NETWORK

III. STATEWIDE PUBLIC & PRIVATE FACILITY FILE

Michigan's planning productivity process slowly emerged. This process is made up of four major elements identified below:

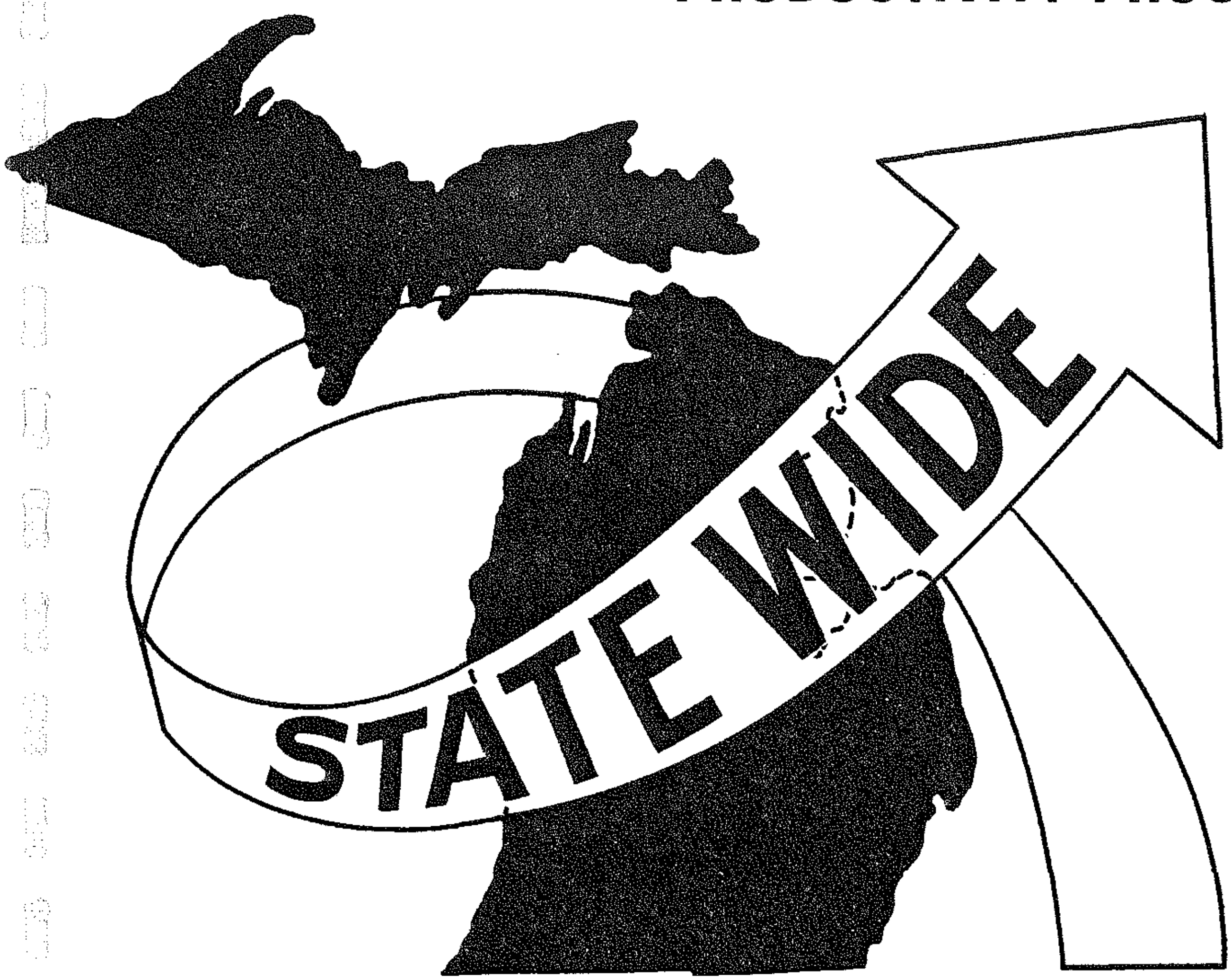
1. **Planning Data Base**
2. **XYZ Concept**
3. **Maximum User Concept**
4. **Dual Purpose Concept**

The productivity process is primarily built around the second element which uses the idea that each of the tasks within one level serve several purposes and that each of these purposes is integrated with and enhanced by the next level of development. This "XYZ Concept" has allowed the Bureau of Transportation Planning to complete well over 600 applications in the last three years. These applications cut across four divisions in the Bureau, three bureaus in the Department, and over 90 applications across 12 other state agencies.

This system is now the core for the Strategic Planning System in the Bureau of Transportation Planning and also has laid the groundwork for the development of a State Transportation Plan. The transportation planning process in Michigan is beginning to take on a dramatically different role by supplying timely analytical information for decision makers in the departmental, commission, and legislative area.

The following section will deal with a discussion of the four productivity process elements.

MICHIGAN'S PLANNING PRODUCTIVITY PROCESS



MICHIGAN'S PLANNING PRODUCTIVITY PROCESS

The Michigan Department of Transportation has experienced an extensive increase in planning productivity as the result of the development of a Statewide Transportation Modeling System within the Bureau of Transportation Planning. This planning productivity process contains four basic elements. These elements are:

1. PLANNING DATA BASE
2. XYZ CONCEPT
3. MAXIMUM USER CONCEPT
4. DUAL PURPOSE CONCEPT

The increased productivity is the direct result of the development of the first element which is an extensive data base. The planning data base diagram appearing in Figure 1 is detailed further in Figure 2. This information is one element of Michigan's Planning Productivity Process and the foundation upon which the other three concepts operate.

The second element is the "XYZ Concept" outlined in Figure 3. This concept has three extremely simple operating levels. But in combination with the planning data base, this philosophy has generated well over 600 applications in three years. Even though the application projects have

STATEWIDE TRANSPORTATION MODELING SYSTEM'S INFORMATION

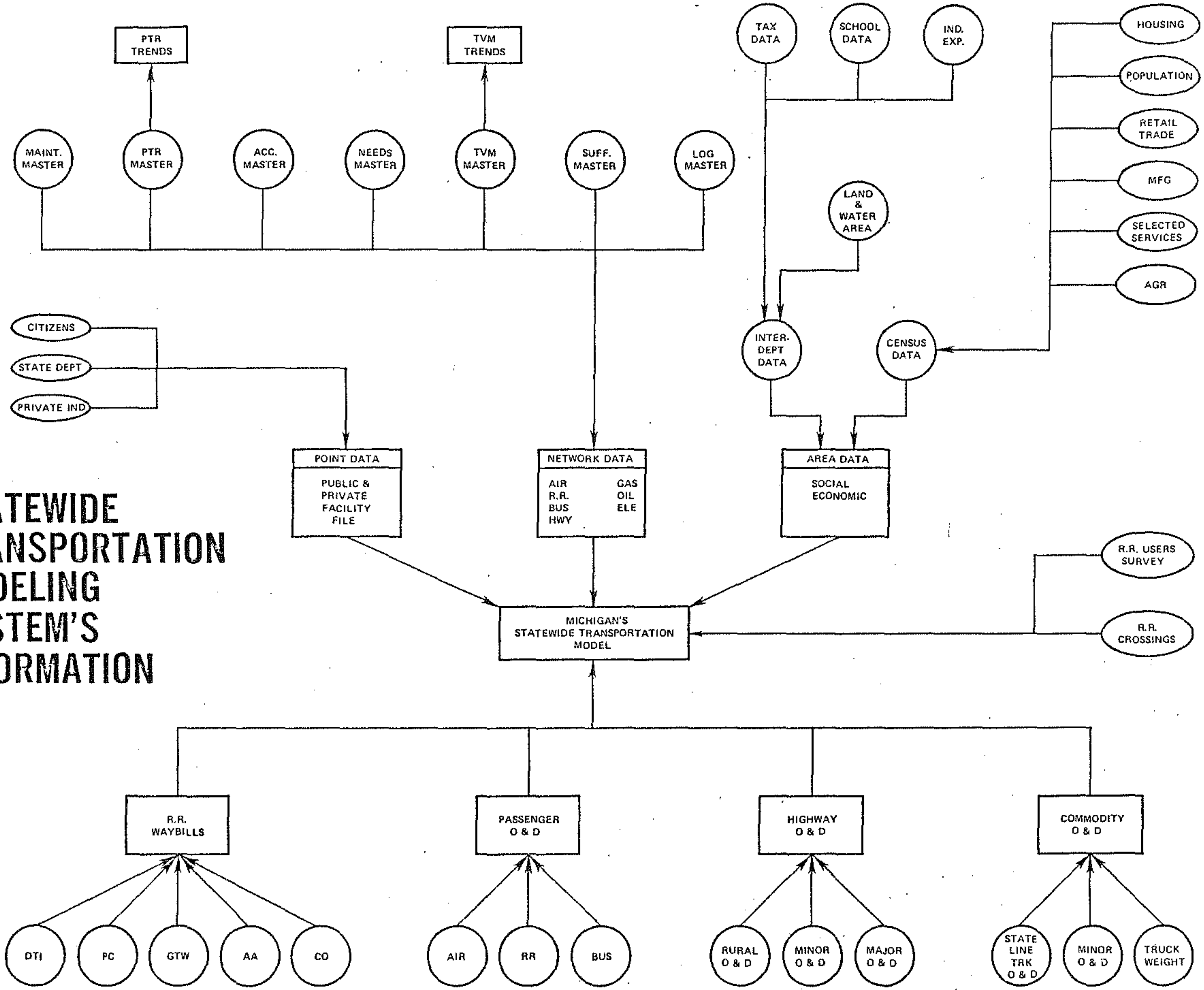


Figure 2

Michigan's XYZ Productivity Concept

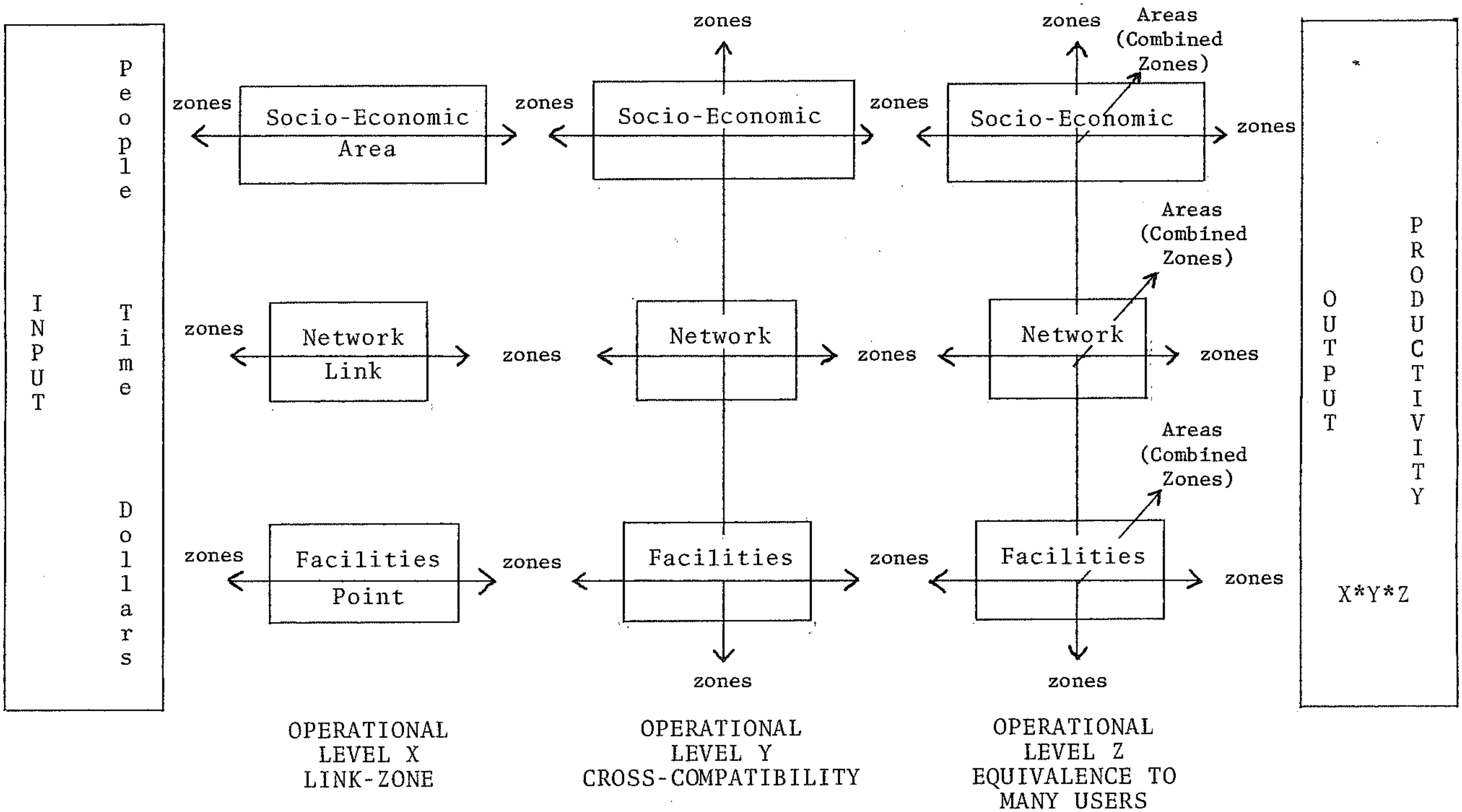


Figure 3

increased (20% to 40% per year) and development work still continued, the number of staff assigned this project has remained constant.

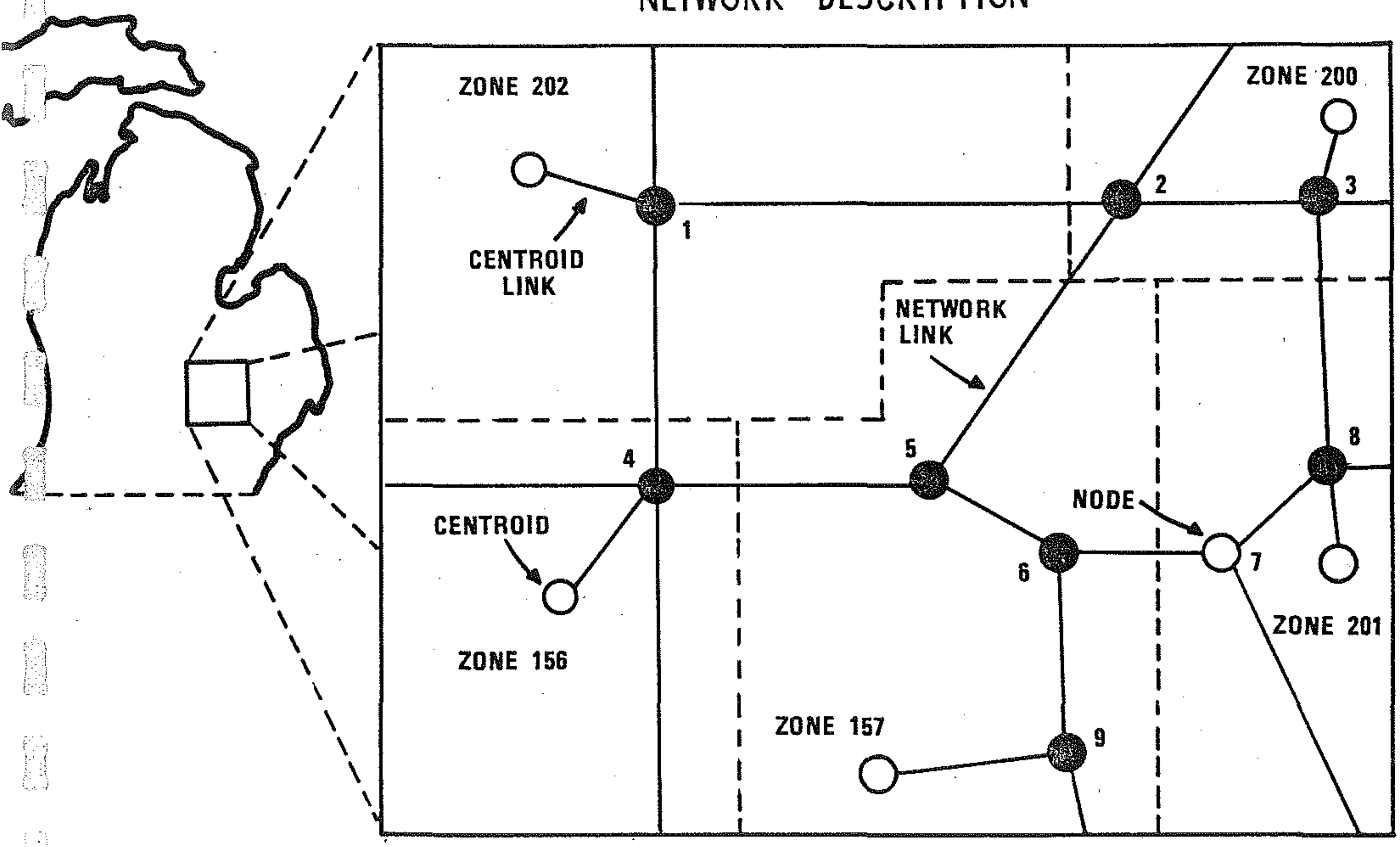
Operational Level X was defined so that any socio-economic information, any network information, or any facility file information would be uniform within each of these three areas by using the A-node/B-node link concept defined in Figure 4 for all networks and the zone concept defined in Figure 5 for the other two areas. Much productivity is generated at Level X because computer utility programs, system analysis programs, and most graphic display tools will operate on any network type file, socio-economic file, or facility file. Therefore, staff time spent in one mode or on one type of socio-economic data has additional utility in many other modes or several kinds of socio-economic and facility file data.

Operational Level Y was defined so that each of the three master files has cross compatibility by virtue of the zone number in all records. (Even link data is associated with the zone within which it lies.) Although this concept is simple, it is extremely productive for two reasons.

First, any combination of items in any of the three master files can easily be summarized and displayed as well

Figure 4

NETWORK DESCRIPTION



LINK DESCRIPTION

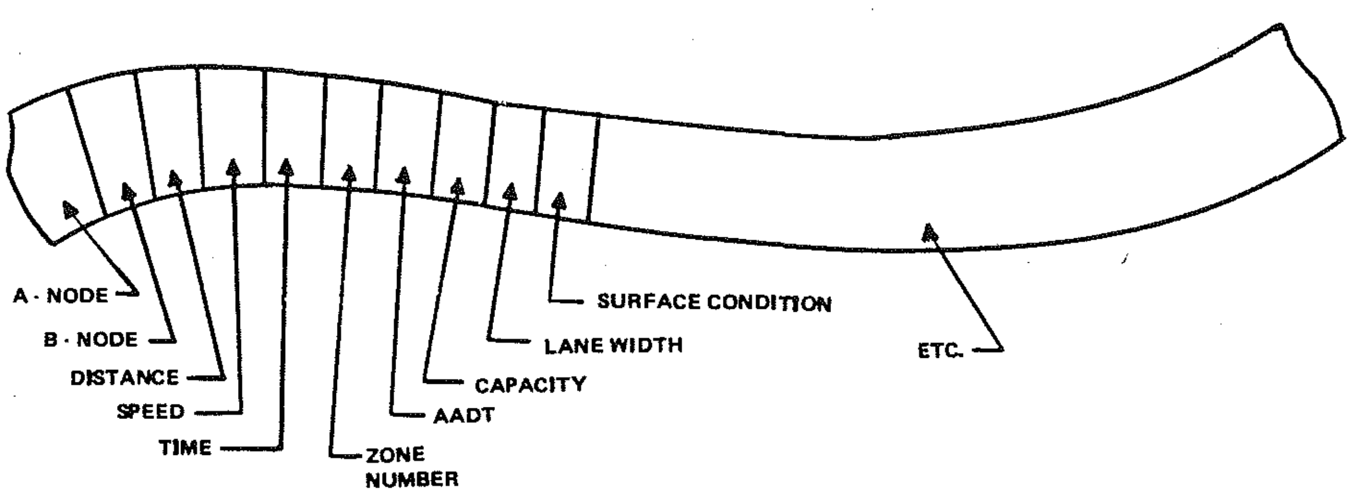


Figure 5

547 ZONE
STATEWIDE TRANSPORTATION
MODELING SYSTEM
INSTATE ZONE MAP
MAY 1974
LAKE SUPERIOR
WHITEFISH BAY
NORTH CHANNEL
LAKE HURON
SAGINAW BAY
LAKE MICHIGAN
GREEN BAY
WISCONSIN
CANADA
INDIANA
OHIO
LAKE ERIE

as any combination of items across the three master types of files. One of the major pitfalls of many planning studies is the collection and summarization of base data. Michigan's common tie to all data elements avoids many problems.

Secondly, because all files have a zone number in each record, any of the staff time spent on the development of analytical or graphic programs automatically have multi-benefits not only on individual files in Level X, but also cross-referenced files in Level Y.

Operational Level Z was defined around Levels X and Y by the addition of equivalency lists whereby the zones were equated to economic areas, health system areas, state police posts, community college districts, etc. A complete list of equivalency files appears in Figure 6. Using this concept, the same planning information used by the Department of Transportation has multiple utility throughout many other state agencies. These departments now receive the benefits generated at both Levels X and Y; plus staff system development time in the Department of Transportation has multi-departmental productivity.

Up to this point, the discussion has centered around the concept of increased productivity per person and the

Figure 6

ZONE EQUIVALENT FILES

COMMUNITY COLLEGE DISTRICTS

MICHIGAN COMMUNITY COLLEGE ASSOCIATION - 2
STATE BOARD OF EDUCATION - 3

COUNTIES - 4

ECONOMIC AREAS - 5

HEALTH SYSTEM AREAS - 6

HIGHWAY DISTRICTS - 7

PLANNING TEAM REGIONS - 8

STATE HOUSE OF REPRESENTATIVES DISTRICTS - 9

STATE PLANNING REGIONS - 10

STATE POLICE DISTRICTS - 11

STATE SENATE DISTRICTS - 12

WATER SHED REGIONS - 13

ZONE SYSTEM 2300 TO 547 - 14

ZONE SYSTEM 2300 TO 1500 - 15

fact that with the development of a statewide transportation modeling system which utilizes the concept just discussed, the productivity per person is constantly increasing.

There is now the third element of Michigan's Planning Productivity Process referred to as the "Maximum User Concept" that works in conjunction with the "XYZ Concept". This not only allows the increased productivity to continue, but does this with decreasing unit costs. The "Maximum User Concept" is graphically defined in Figure 7. The implication in this diagram is the fact that as users and applications increase, the people, time, and dollar costs decrease.

There are two different types of usage that generate the decreasing costs. A given user can apply many different parts of the system thereby generating many products per user. On the other hand, parts of the system such as census information can serve many different types of users.

In either case or both, the increasing usage means an ever decreasing development cost per project. The data collection process is greatly simplified and duplication of effort can be eliminated. Therefore, time is spent on more productive tasks.

The fourth element which is referred to as the "Dual Purpose Concept" has contributed extensively to system

Maximum Usage Concept

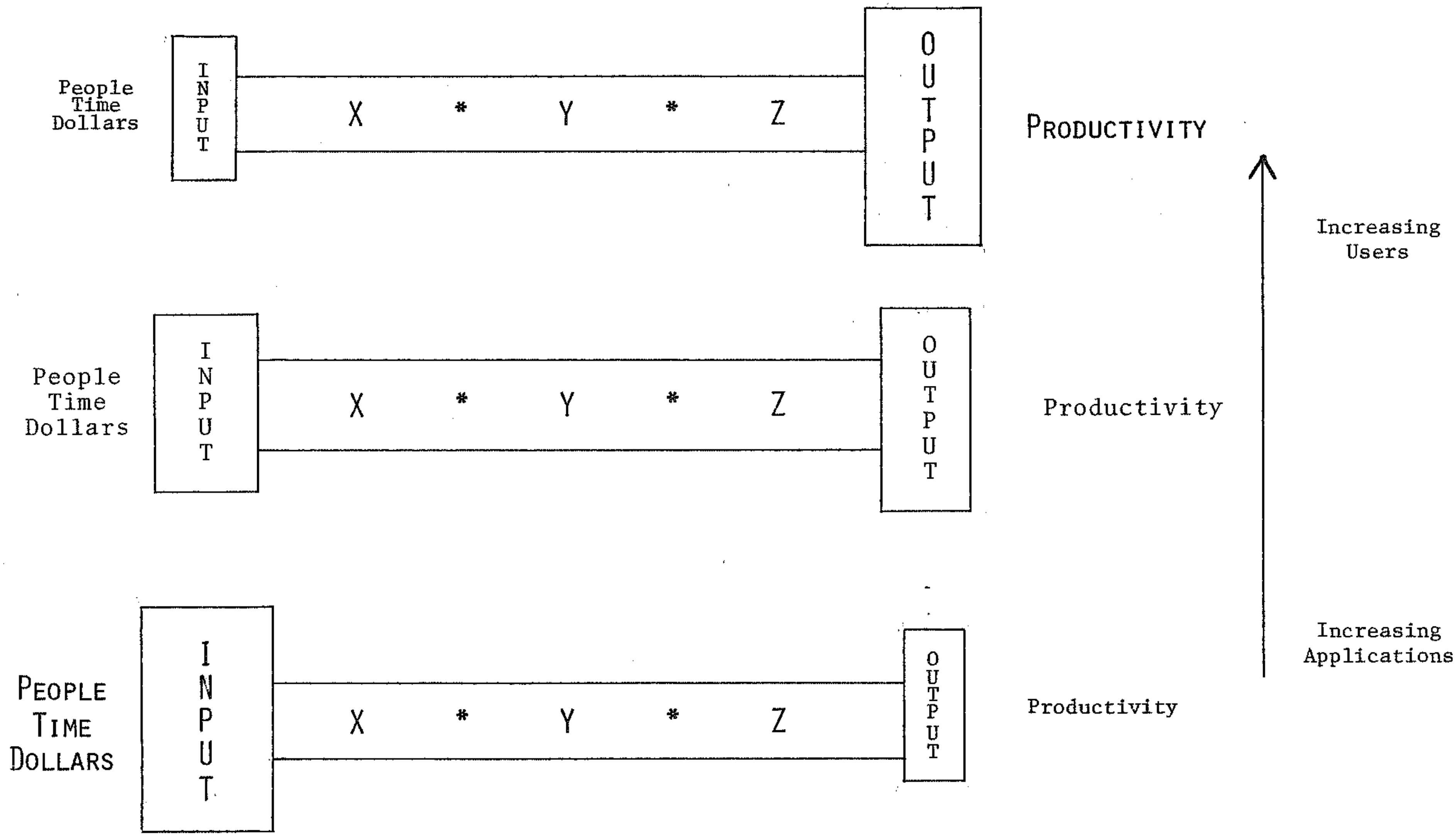


Figure 7

productivity for two reasons. The Statewide Transportation Modeling System was designed so the informational and analytical processes will generate very detailed answers that can be used by the technical staff within a department to solve daily problems. At the same time, it can generate simple graphic summaries (Figures 8 and 9) that can be used at the administrative level for decision making. Additionally, this concept has also been a major factor in the acceptance of the total process since all levels within a department can utilize the same system.

In conclusion, it is the data base that is the foundation on which the productivity of Michigan's Statewide Transportation Modeling System has been developed. But the fact that staff efforts utilizing the "XYZ Concept", the "Maximum User Concept", and the "Dual Purpose Concept" generate an extremely productive analytical transportation planning analysis process are the real key to success. A brief list of some of the applications appears in Figures 10, 11, 12, and 13.

The real proof of the productivity of the system is the fact that in many instances, the Bureau has taken on staff reductions and still continued to increase planning productivity. The nature of the planning function is also beginning to change directly as the result of the ability

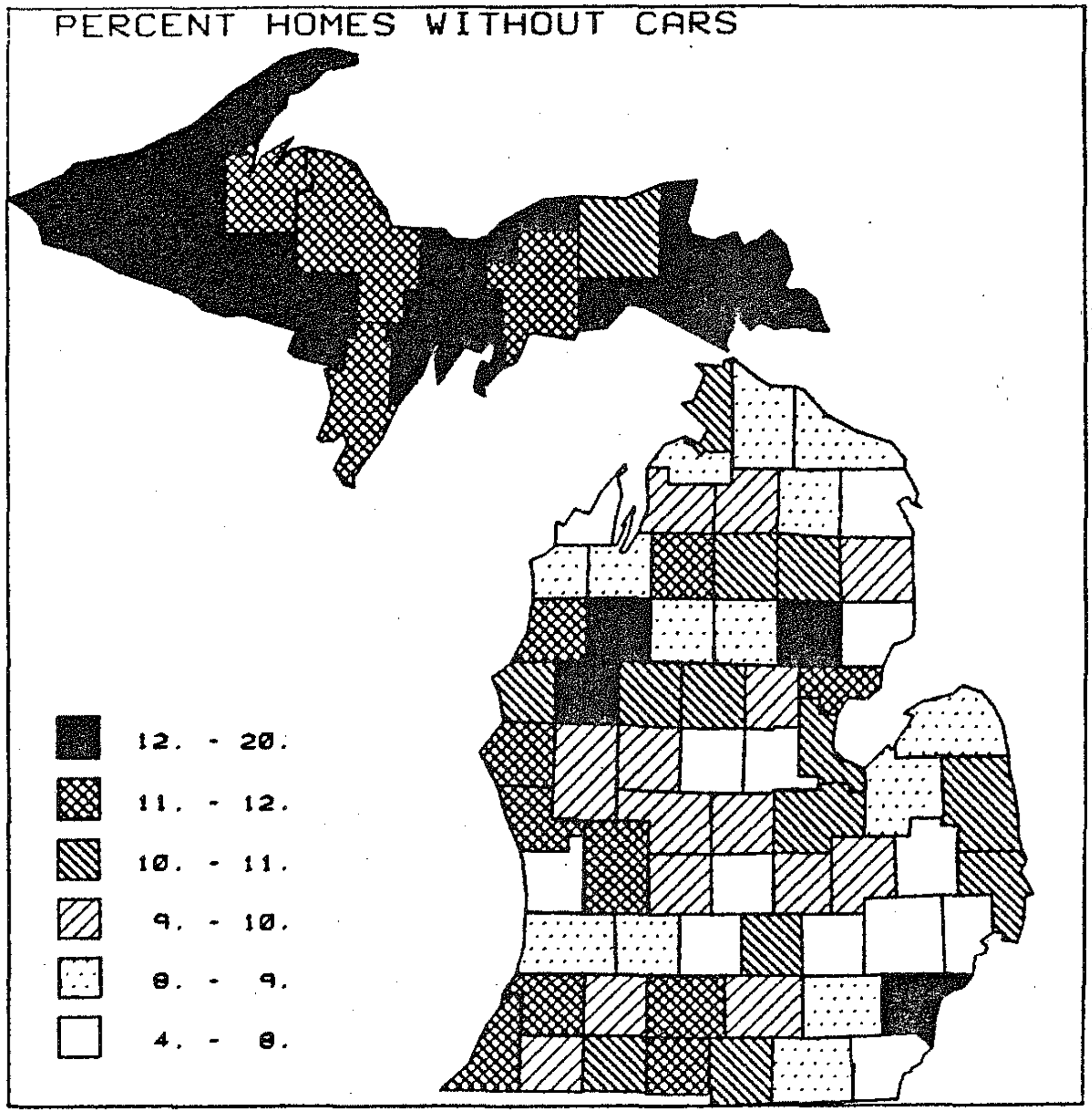


Figure 8

Figure 9

ACCIDENT RATES

1975

EACH LINE - 200 ACCIDENTS PER HUNDRED MILLION VEHICLE MILES of the Bureau to supply timely analytical information to decision-makers in the State of Michigan. Figure 13 is an example of that change since all of these applications occurred during 1981-82. People, time, and dollars have become extremely precious resources and the development of a Statewide Transportation Modeling System using the productivity concepts applied in Michigan will allow the Department to efficiently utilize these three resources.

STATEWIDE TRANSPORTATION MODELING SYSTEM

APPLICATION AND DEVELOPMENT

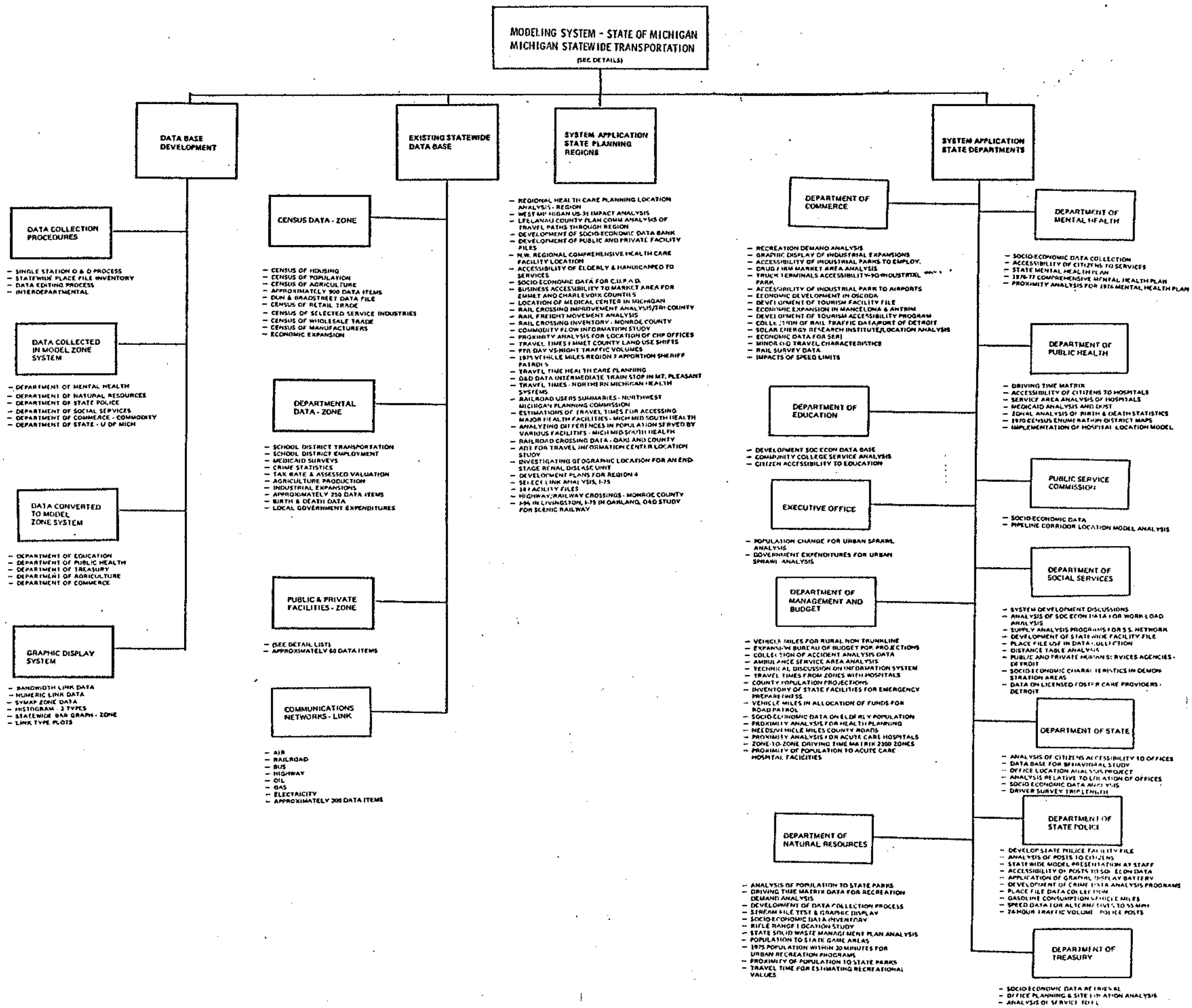


Figure 10

STATEWIDE TRANSPORTATION MODELING SYSTEM
APPLICATION DEVELOPMENT
WITHIN DEPARTMENT

Figure 11

MICHIGAN'S STATEWIDE TRANSPORTATION MODELING SYSTEM DEPARTMENT OF TRANSPORTATION
(SEE DETAILS)

INFORMATION ACCESSIBILITY

WITHIN DEPARTMENT

- USE OF L.O.G. DATA
- USE OF SUFFICIENCY DATA
- USE OF NEEDS DATA
- USE OF R.B.M.
- USE OF T.V.M. DATA
- USE OF ACCIDENT DATA
- USE OF ANY OTHER C.S. TYPE RECORD

OTHER DEPARTMENT

- CONVERTED DEPT OF ED DATA
- CONVERTED DEPT OF TREASURY DATA
- CONVERTED DEPT OF COMMERCE DATA
- CONVERTED DEPT OF PUBLIC HEALTH DATA
- CONVERTED DEPT OF MENTAL HEALTH DATA
- CONVERSION OF STATE POLICE CRIME DATA
- CONVERSION OF SOCIAL SERVICES DATA

APPLICATIONS

BUREAU OF HIGHWAYS

- GRAPHIC DISPLAY OF DEER ACCIDENTS
- TRAINING CLASS ON FORECASTING
- ANALYSIS OF STATEWIDE INTERSECTION ACCIDENTS
- DEVELOPMENT OF INTERSECTION ACCIDENT GRAPHIC DISPLAY
- ACCIDENT RATE ANALYSIS FOR FIXED OBJECT & GUARD RAIL ACCIDENTS
- COMPUTER GRAPHICS FOR OVERHEAD SIGNING
- TRAFFIC ANALYSIS - M-66
- AT-GRADE CROSSINGS
- RAIL CROSSING INVENTORY, HAZARD INDEX

BUREAU OF URBAN AND PUBLIC TRANSPORTATION

- COUNTY LEVEL PERSON TRIPS FOR R.R. PASSENGER ANALYSIS
- STATEWIDE TRIP DATA FOR INTERCITY BUS SCHEDULES
- SOCIO-ECONOMIC DATA INVENTORY FOR DIAL-A-RIDE
- TRAVEL INVENTORY FOR AUTO TRAIN POTENTIAL
- STATEWIDE COMMODITY FLOW FOR FREIGHT PLAN
- GTW CROSSING ANALYSIS
- LAKE MICHIGAN FERRY ANALYSIS
- STATEWIDE RAIL NETWORK ANALYSIS
- LAKE MICHIGAN FERRY-COST/BENEFIT ANALYSIS
- RAIL FREIGHT TRAFFIC STUDY
- MARKET AREA ANALYSIS/DIAL-A-RIDE
- AUTO-TRAIN SERVICE PROXIMITY ANALYSIS
- SOCIO-ECONOMIC ANALYSIS/DIAL-A-RIDE
- RAIL ROUTING AND SHIPPER'S ANALYSIS
- MULTI-MODAL ANALYSIS/DIAL-A-RIDE
- AMTRAK MARKET AREA STUDY
- AMTRAK RIDERSHIP ESTIMATES, DETROIT/CHICAGO
- O&D DATA CAR-ON-TRAIN PROJECT
- IDENTIFYING AREAS THAT HAVE HIGH POTENTIAL FOR FUTURE DART SYSTEMS
- NUMBER OF COLLEGE STUDENTS FOR EXISTING AMTRAK STATIONS

EXECUTIVE BUREAU

- O&D DATA FOR JACKSON COUNTY
- CONRAIL CROSSINGS
- ABANDONED RAILROAD CROSSINGS IN CITY OF DETROIT
- ACCESSIBILITY ANALYSIS I-275, SEMCOG AREA MODEL UPDATE AND CONVERSION

BUREAU OF ADMINISTRATION

- CONTROL SECTION COORDINATES FOR RELOCATION OF MAINTENANCE RESOURCES

BUREAU OF TRANSPORTATION PLANNING

(SEE DETAILS)

NATIONAL AND REGIONAL WORKSHOPS

- GUEST OF REGION NO. 8 BECAUSE OF MICHIGAN'S EXTENSIVE WORK ON STATEWIDE MODELING - 8 STATES
- CO-SPONSOR WITH FHWA IN REGION NO. 4 STATEWIDE MODEL WORKSHOP - 7 STATES
- PRESENTED A PAPER AT AASHTO NATIONAL CONFERENCE ON COMPUTER TECHNOLOGY
- PRESENTED PAPER IN ANN ARBOR AT INTERNATIONAL SYMPOSIUM ON ERTS TECHNOLOGY
- SPEAKER AT ERTS IN MICHIGAN WORKSHOP FOR AIAA
- SPEAKER AT SYMPOSIUM ON APPLICATIONS OF REMOTELY SENSED DATA IN NORTH CENTRAL U.S.
- SPEAKER FOR U.S. DEPARTMENT OF INTERIOR'S WORKSHOP ON MODEL APPLICATIONS IN ANALYSIS OF OUTDOOR RECREATION
- A.I.P. PRESENTATION ON STATEWIDE TRANSPORTATION PLANNING (INDIANAPOLIS)
- RECREATIONAL VEHICLE TRAVEL IN MICHIGAN
- COMPUTER GRAPHICS AND INTERACTIVE TECHNIQUES PRESENTED AT 1980 TRB MEETING - WASHINGTON, D.C.
- PARTICIPATION IN 1979 ANNUAL TRAFFIC AND SAFETY CONFERENCE
- "IMPACT OF POPULATION AND ENERGY ON TRANSPORTATION NEEDS: MULTIMODAL APPROACH" PRESENTED AT 1979 TRB MEETING

SYSTEM DEVELOPMENT INFORMATION REQUESTS

UNITED STATES

- ARIZONA
- CALIFORNIA
- FLORIDA
- IDAHO
- ILLINOIS
- INDIANA
- IOWA
- KANSAS
- KENTUCKY
- MARYLAND
- MASSACHUSETTS
- MICHIGAN
- MINNESOTA
- MISSOURI
- NEBRASKA
- NEW JERSEY
- NORTH CAROLINA
- PENNSYLVANIA
- TENNESSEE
- TEXAS
- WASHINGTON
- WASHINGTON, D.C.
- WISCONSIN

OTHER

- CANADA
- INDIA
- ISRAEL
- POLAND
- TURKEY

UNIVERSITIES

- UNIVERSITY OF CALIFORNIA
- UNIVERSITY OF ILLINOIS
- NORTHWESTERN UNIVERSITY - ILLINOIS
- UNIVERSITY OF KANSAS
- UNIVERSITY OF KENTUCKY
- MICHIGAN STATE UNIVERSITY
- UNIVERSITY OF MICHIGAN
- WESTERN MICHIGAN UNIVERSITY
- UNIVERSITY OF MINNESOTA
- MISSISSIPPI STATE UNIVERSITY
- RUTGERS UNIVERSITY - NEW JERSEY
- UNIVERSITY OF NEW MEXICO
- DUKE UNIVERSITY - NORTH CAROLINA
- UNIVERSITY OF PENNSYLVANIA
- TEXAS A & M UNIVERSITY
- WASHINGTON UNIVERSITY
- UNIVERSITY OF WISCONSIN

STATEWIDE TRANSPORTATION MODELING SYSTEM APPLICATIONS WITHIN BUREAU

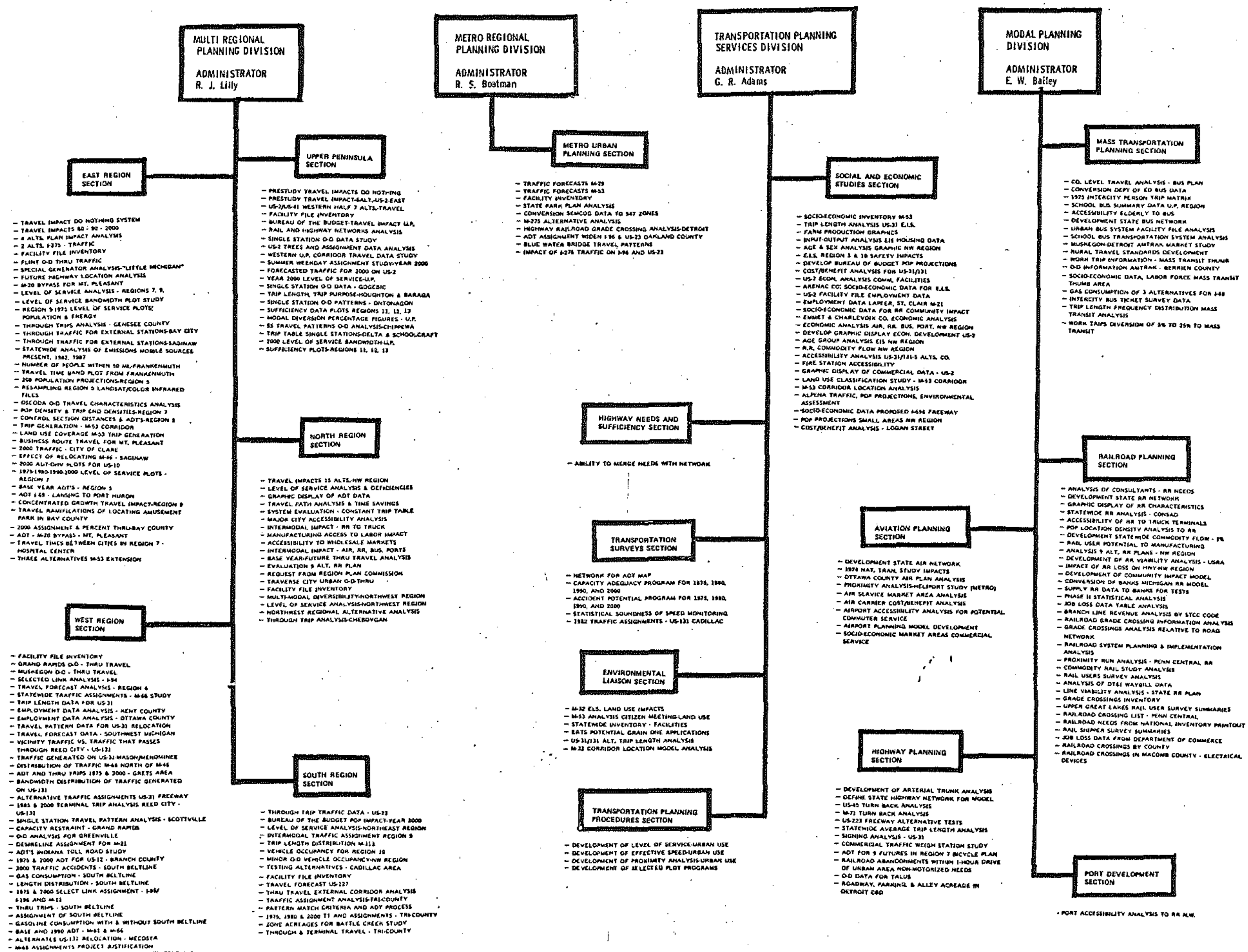


Figure 12

MICHIGAN'S STATEWIDE TRANSPORTATION MODELING SYSTEM

DEPARTMENT OF TRANSPORTATION

BUREAU OF FINANCE

- Revenue forecasts - 40 alternates leading up to original "Brown" bills
- Comparison of gasoline taxes to price of regular gasoline
- Methodology for quick estimation of fuel tax revenues
- Evaluation of three "Brown" amendments
- Evaluation of final "Brown" bills

DIRECTOR

- I4R Fund reallocation proposal
- Present and future deficiency patterns
- State of existing highway system
- Analysis of fixed cents per gallon vs. ad-valorem fuel taxes

COMMISSION

- M-275 Travel Impacts
- Rail rationalization - support
- Region 10 analysis: taxes paid vs. returned

LEGISLATURE

- Evaluation of effects of Governor's tax proposal on highways.
- Comparison of Michigan's tax burden with that of other states.

Figure 13