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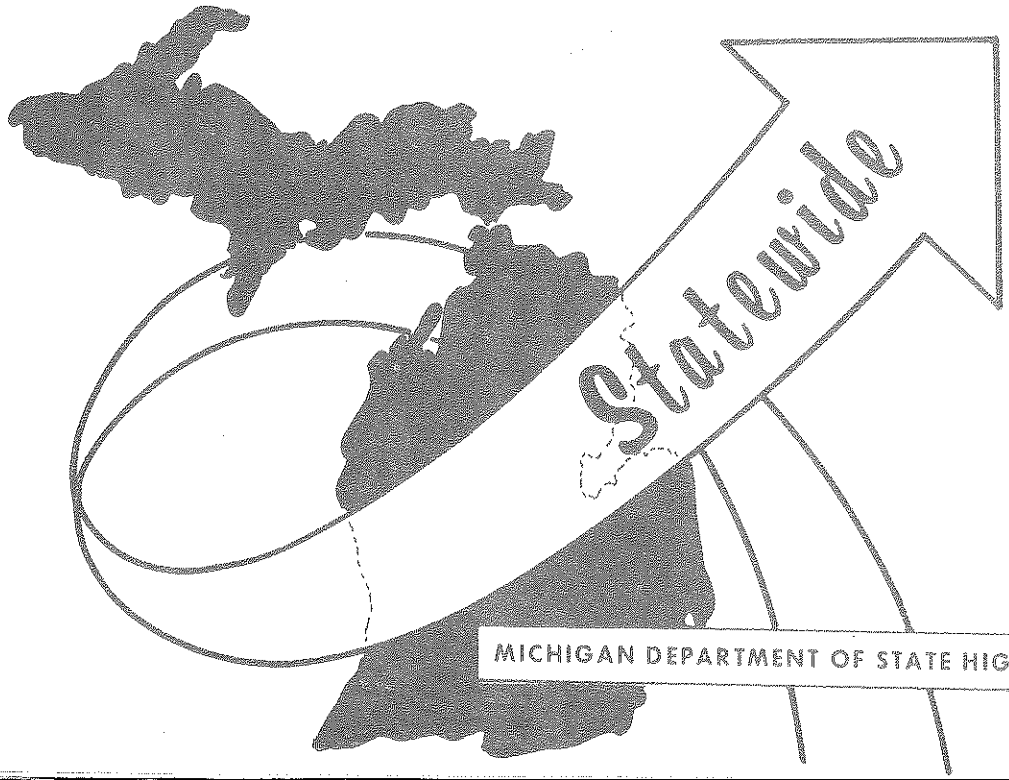
Statewide Transportation Analysis & Research

Michigan's
Statewide Transportation
Modeling System

Volume XI

COMPUTER RUN TIMES: AN AID IN SELECTING STATEWIDE TRAVEL MODEL SYSTEM SIZE

547 Zone Vs 2262 Zone
February 22, 1974



MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

MICHIGAN DEPARTMENT

OF

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Statewide Transportation
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547 Zone Vs 2262 Zone
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DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

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

JOHN P. WOODFORD, DIRECTOR

February 11, 1974

Mr. Sam F. Cryderman
Deputy Director
Bureau of Transportation Planning

Dear Mr. Cryderman:

The Transportation Survey and Analysis Section of the Transportation Planning Division is pleased to present Volume XI in a series of reports dealing with Michigan's "Statewide Traffic Forecasting Model". This volume documents the computer run times of alternate assignments for both the 547 and the 2262 zone systems.

~~This was done so that~~ other states the advantage of our experience ~~when determining system size.~~ By comparing the differences in run times between our two systems, it was hoped that other states could obtain a better idea of the size of system they may wish to use for the "uping" of their own statewide models.

This report was prepared by Mr. Lawrence J. Swick of the Statewide Studies Unit.

Sincerely,

Keith E Bushnell

Keith E. Bushnell, Engineer
Transportation Survey and
Analysis Section

~~This was done so that~~

~~Those~~

~~[illegible]~~

This was done so that each of the planning teams in the bureau might become more familiar with the modeling process and in the future they might have more reliable data to use in scheduling planning projects.

MICHIGAN
THE GREAT LAKE STATE

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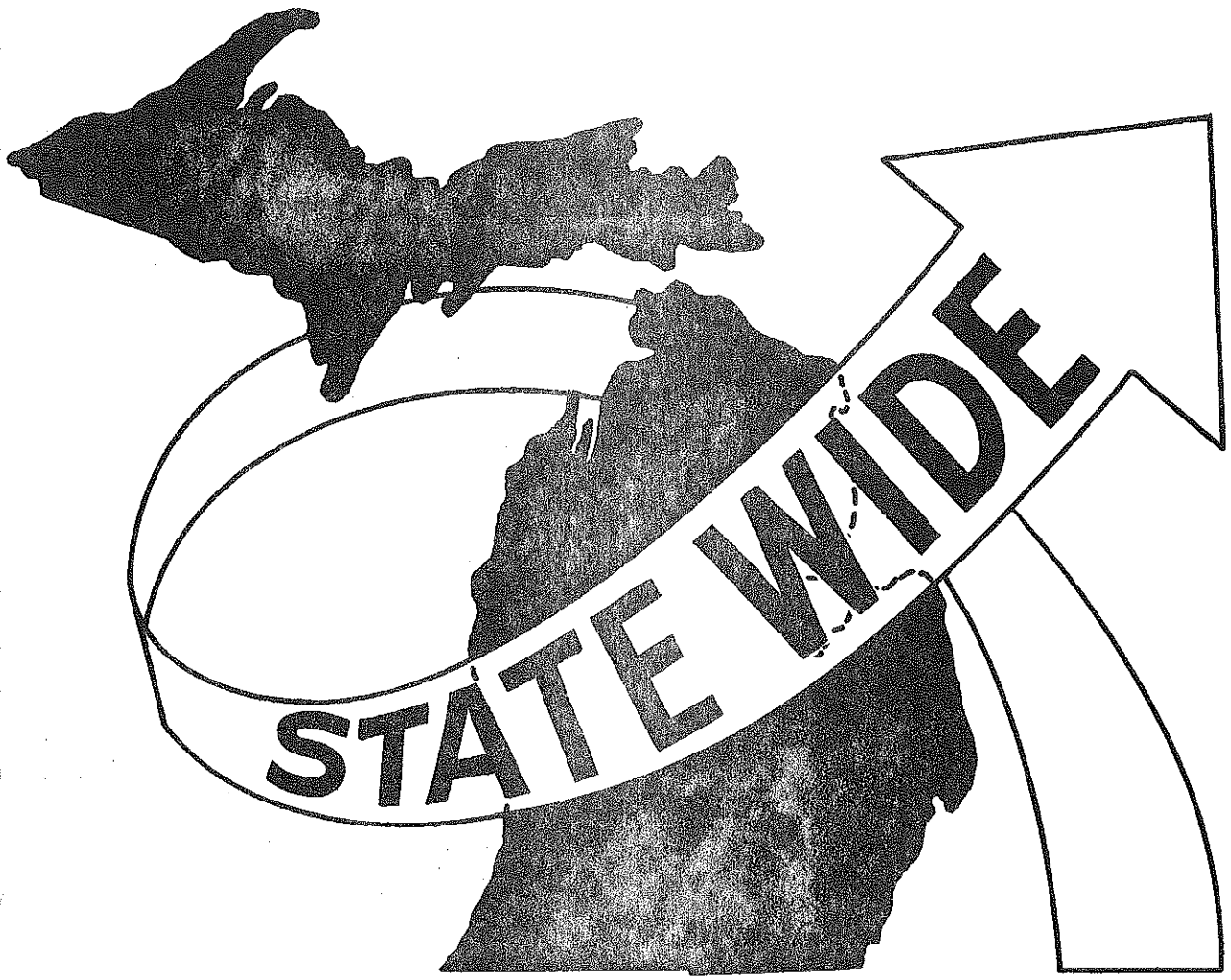
Computer Run Times: An Aid In Selecting Statewide Travel Model System Size

By

Lawrence J. Swick

INTRODUCTION

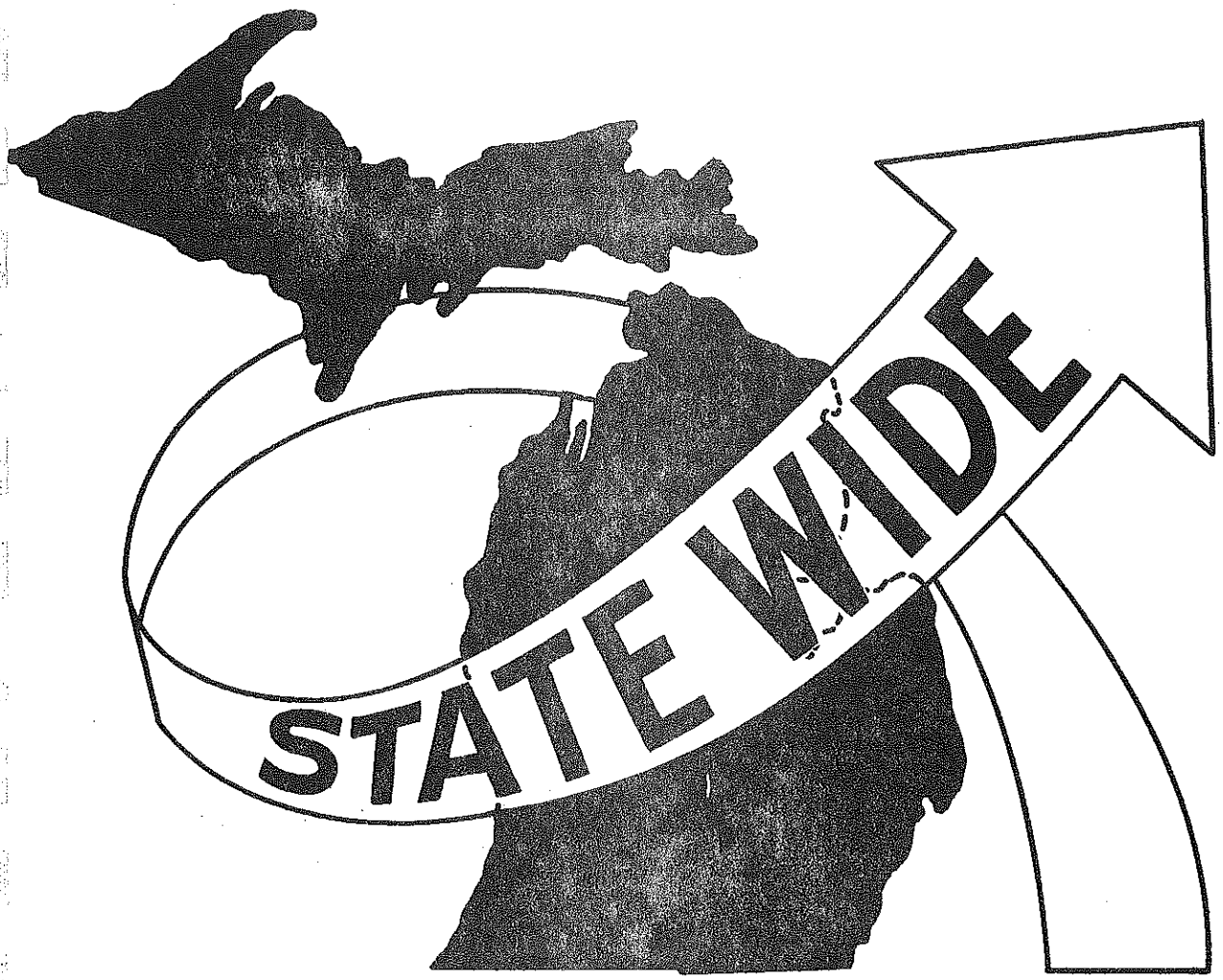


INTRODUCTION

As stated in the introductory letter, the primary purpose of this report is to list corresponding run (central processor unit) times for two statewide systems. One system contains 547 zones and the other contains 2262 zones. By comparing the run times and related methods of processing traffic assignments, it was hoped ~~that~~ the project planner might become more familiar with the system operation. other states could also gain a better idea of the size of model they may wish to employ relative to their own specific computer capabilities.

By describing the system (Burroughs 5500) used by Michigan, other users will at least have information to use as a comparison when choosing the level of assignment sophistication they may wish to employ. The report is very brief and does not cover all aspects of the system selection process. Michigan, however, would be more than willing to discuss with other states any problems they may be having in this area.

MICHIGAN'S COMPUTER SYSTEM



MICHIGAN'S COMPUTER SYSTEM

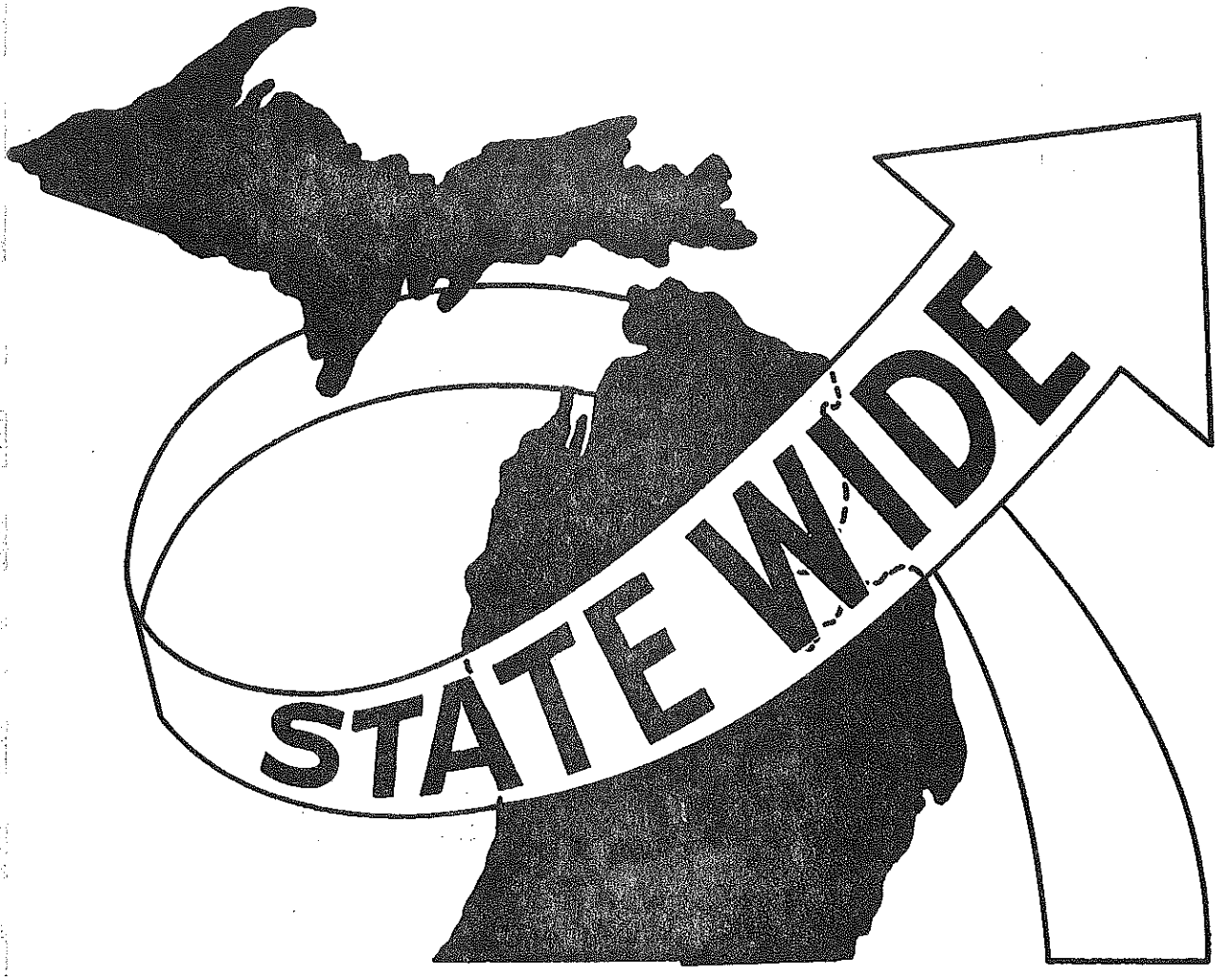
The following list is a description of the computer hardware system presently in use at the Michigan Department of State Highways and Transportation. The programs discussed in the next section are processed by this system.

The information on the following page is supplied only as technical reference material for those computer system analysts who may wish to make hardware comparisons.

MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION B-5500

#	Code	Description	
1	B5280	Basic System	
1	B5281	Processor B	
1	B5005	Aux. Mem.	1.2 us cycle time, 330 kcs
8	B5260	Memory Units	4 us cycle time
8	B425	Tape Drives	90 ips @ 72 kcs
2	B329	Printer	1040 imp, 132 pos
1	B124	Reader	800 cpm
1	B303	Punch	100 cpm
3	B5282	I/O Channels	
3	B871	Print Positions (132)	
3	B872	Extended Mag. Tape	
2	B5470	Disk Control	
3	B471	Disk Electronics Units	
11	B475	Disk Storage Modules	9.6 x 106 @ 20 mil access, 316 kcs for every 8 char. 1 parity char.
1	B451	Expanded Disk Control	
1	B249	Data Transmission Control	Up to 16 tu's
2	B487	Data Transmission Terminal Unit	
1	B873	B487 capability	
9	980	TWX/TY line adapter (Model 1)	
9	103A	Data Sets (modems)	
9		Voice Grade Lines	

547 ZONE SYSTEM



547 ZONE SYSTEM

The 547 zone system is comprised of 508 instate zones (Figure 1) and 39 outstate zones (Figure 1-a). It contains 20,623 miles of trunkline and county roads (this includes centroid distances as shown in Figure 2). There are a total of 3,566 links in the system, 547 centroids and 2,008 nodes. The following outlines will list the programs and corresponding CPUs for (1) a total single traffic assignment, and (2) a normal calibration series. The calibration series is longer because of the additional travel evaluations and print programs. A small definition of purpose accompanies each program so that other assignment package programs can be compared. The Michigan Department of State Highways and Transportation uses the Burroughs 5500 Transportation Planning package which was developed in conjunction with the Pennsylvania Department of Highways, the Federal Highway Administration and Alan M. Voorhees, Inc.

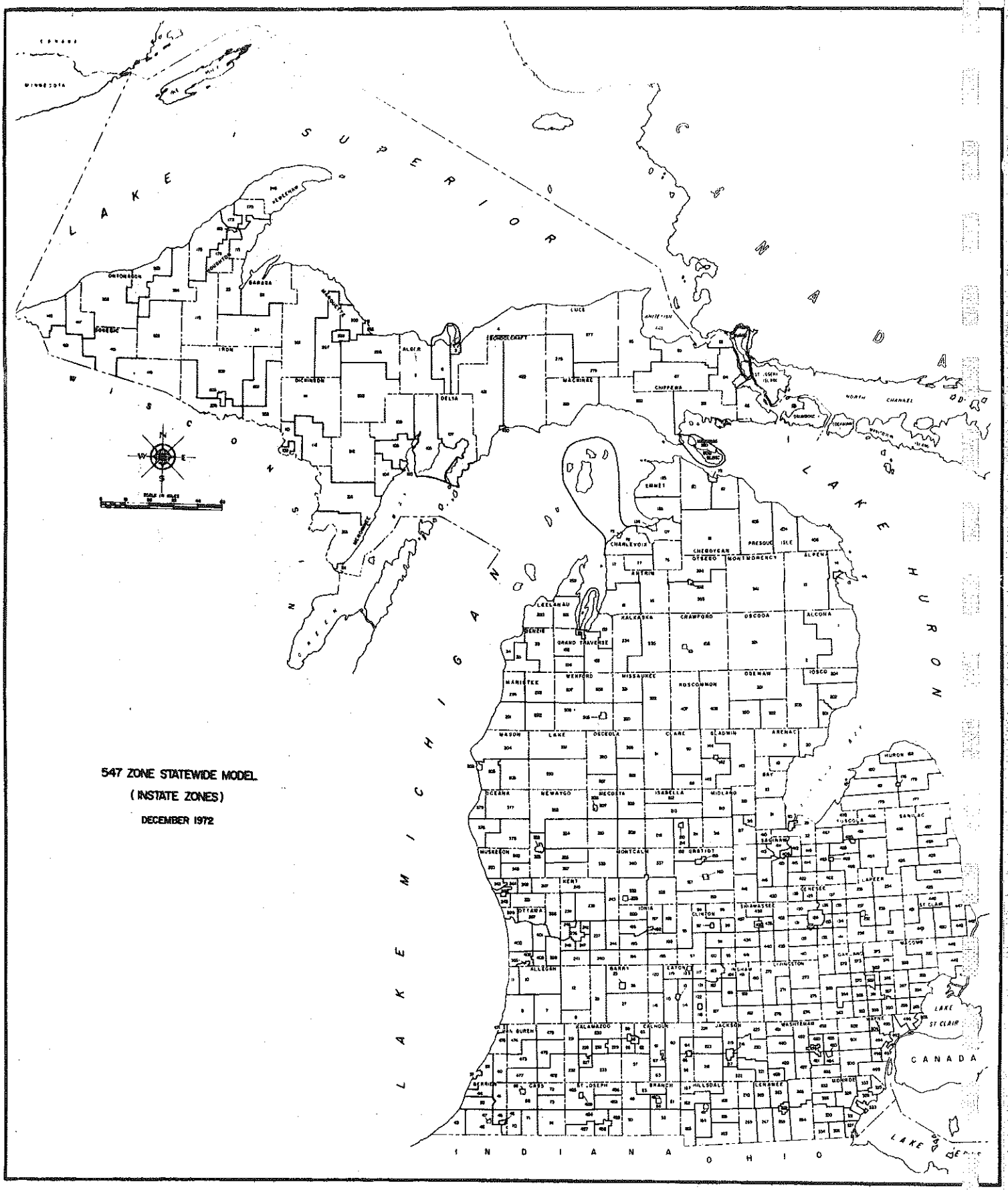
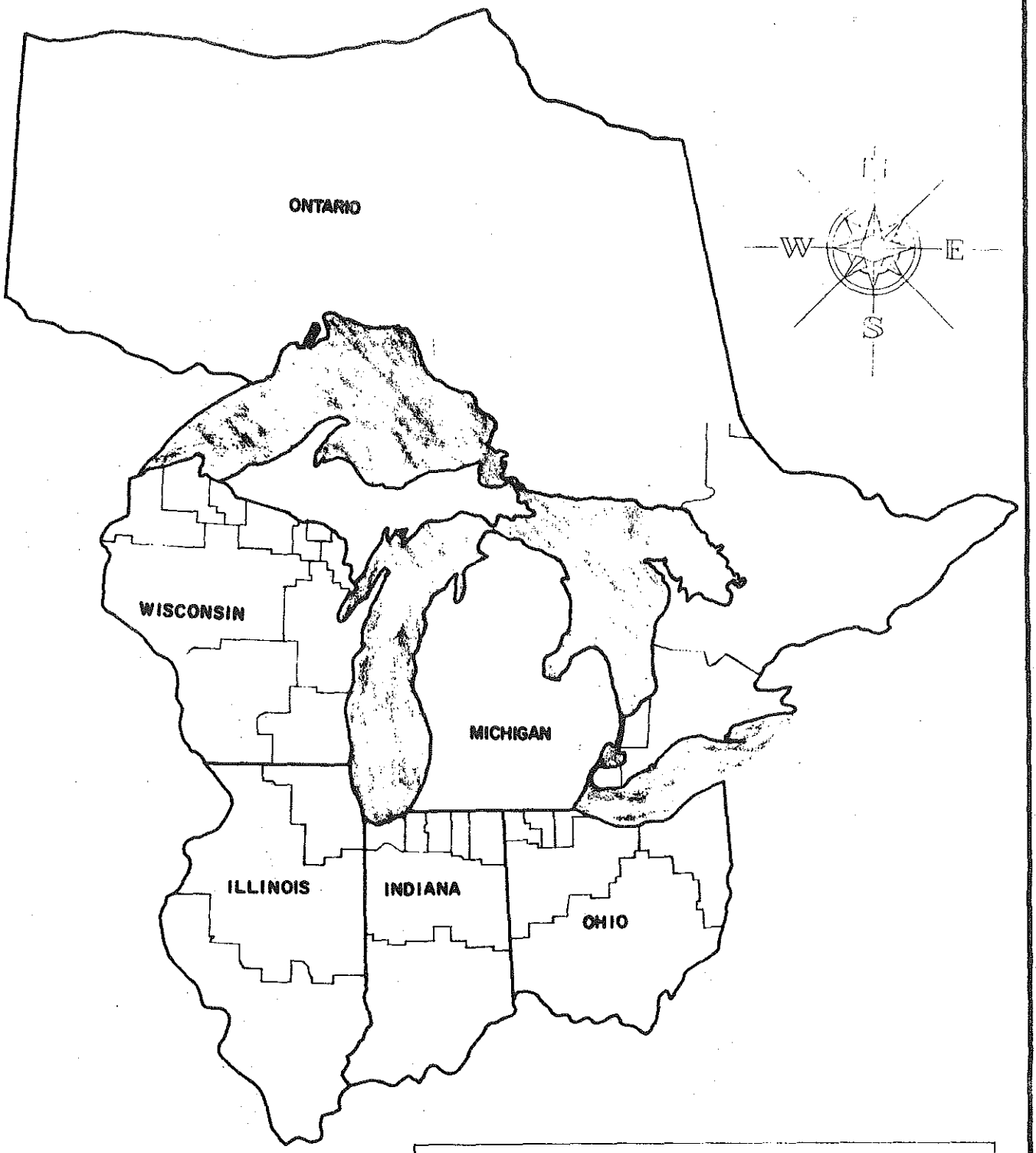

LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ST CLAIR
LAKE ERIE
CANADA
547 ZONE STATEWIDE MODEL
(INSTATE ZONES)
DECEMBER 1972
INDIANA
OHIO

FIGURE 1



540 ZONE TRAFFIC FORECASTING SYSTEM

OUTSTATE ANALYSIS ZONES

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRANSPORTATION PLANNING DIVISION
STATEWIDE STUDIES UNIT

FIGURE 1-A

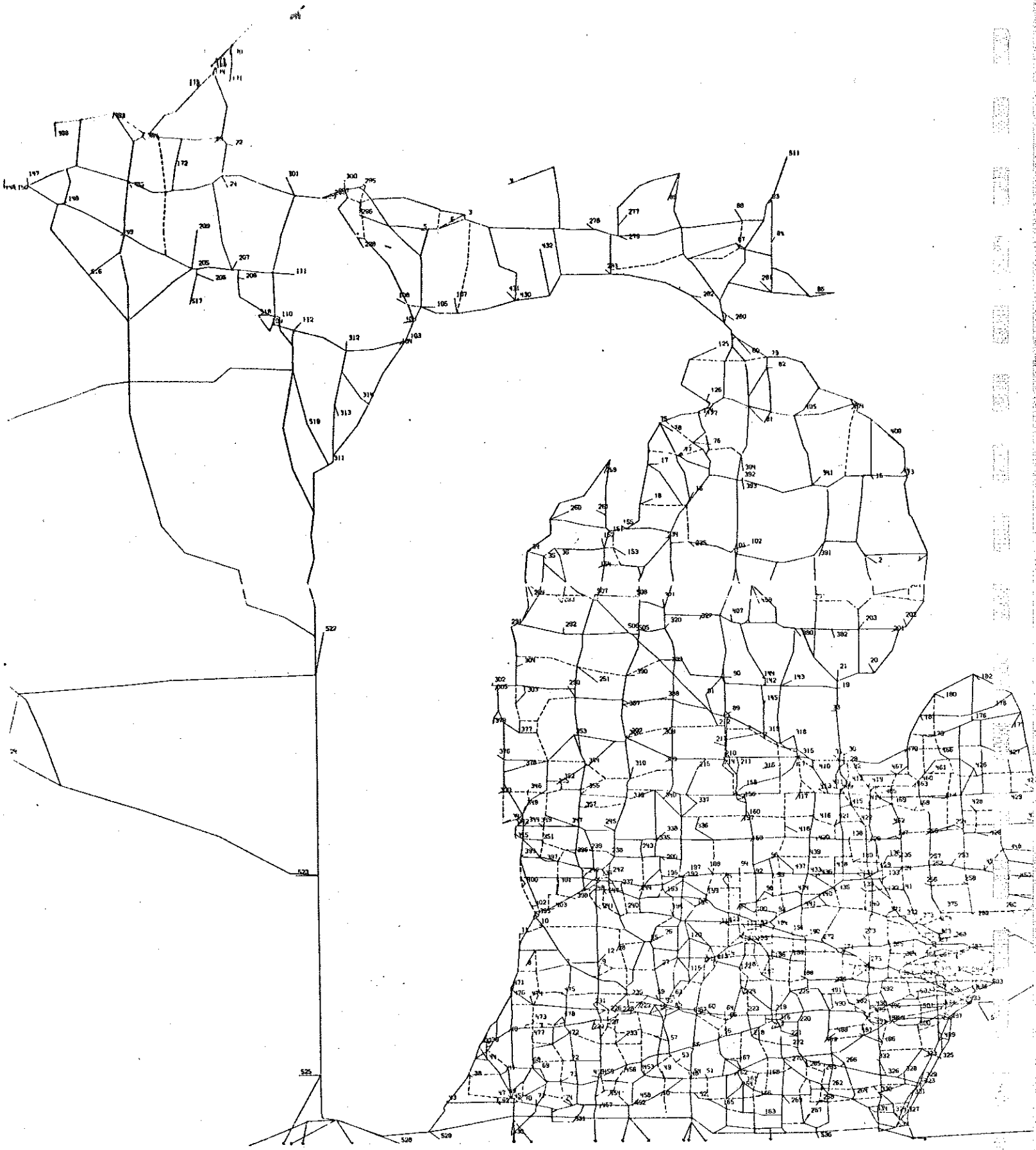


FIGURE 2

REPRESENTATIVE
547 ZONE TRAFFIC ASSIGNMENT SERIES

PROGRAM		DESCRIPTION	CPU TIME	
TP NET	Q01402	(Creates, updates and edits network)	5 Min 1 HR	(Update) (Print Net)
TP TREE	Q01403	(Determines and describes minimum network tree paths between zones)	3 HRS	
TP SKIM	Q01404	(Accumulates and describes cost paths between zones using tree output)	45 Min	
CAR	Q10105	(Generates car trip table based on socio-economic variables)	40 Min	
TRUCK	Q10105	(Generates truck trip table based on socio-economic variables).	40 Min	
VACATION	Q10103	(Generates vacation trip table based on socio-economic variables)	25 Min	
CAR MOD	Q01413	(Modifies trips between zones based on calibration factors)	15 Min	
TRK MOD	Q01413	(Modifies trips between zones based on calibration)	11 Min	
VAC MOD	Q01413	(Modifies trips between zones based on calibration factors)	13 Min	
MNIP	Q01412	(Adds car, truck and vacation trip tables together)	35 Min	

TP LOAD	Q01405	(Assigns trips to network)	75 Min
TP NAPS	Q01422	(Adjusts assignment from summer weekday to AADT using given factors)	5 Min
PREPLOT	Q01151	(Prepares tape to be used for plotting)	5 Min

The total state network system, for plotting purposes is broken into 4 regions.

PLOT*	Q01153	(REG 1)	12 Min
PLOT*	Q01153	(REG 2)	10 Min
PLOT*	Q01153	(REG 3)	5 Min
PLOT*	Q01153	(REG 4)	5 Min

*
Does not include physical plotting times.

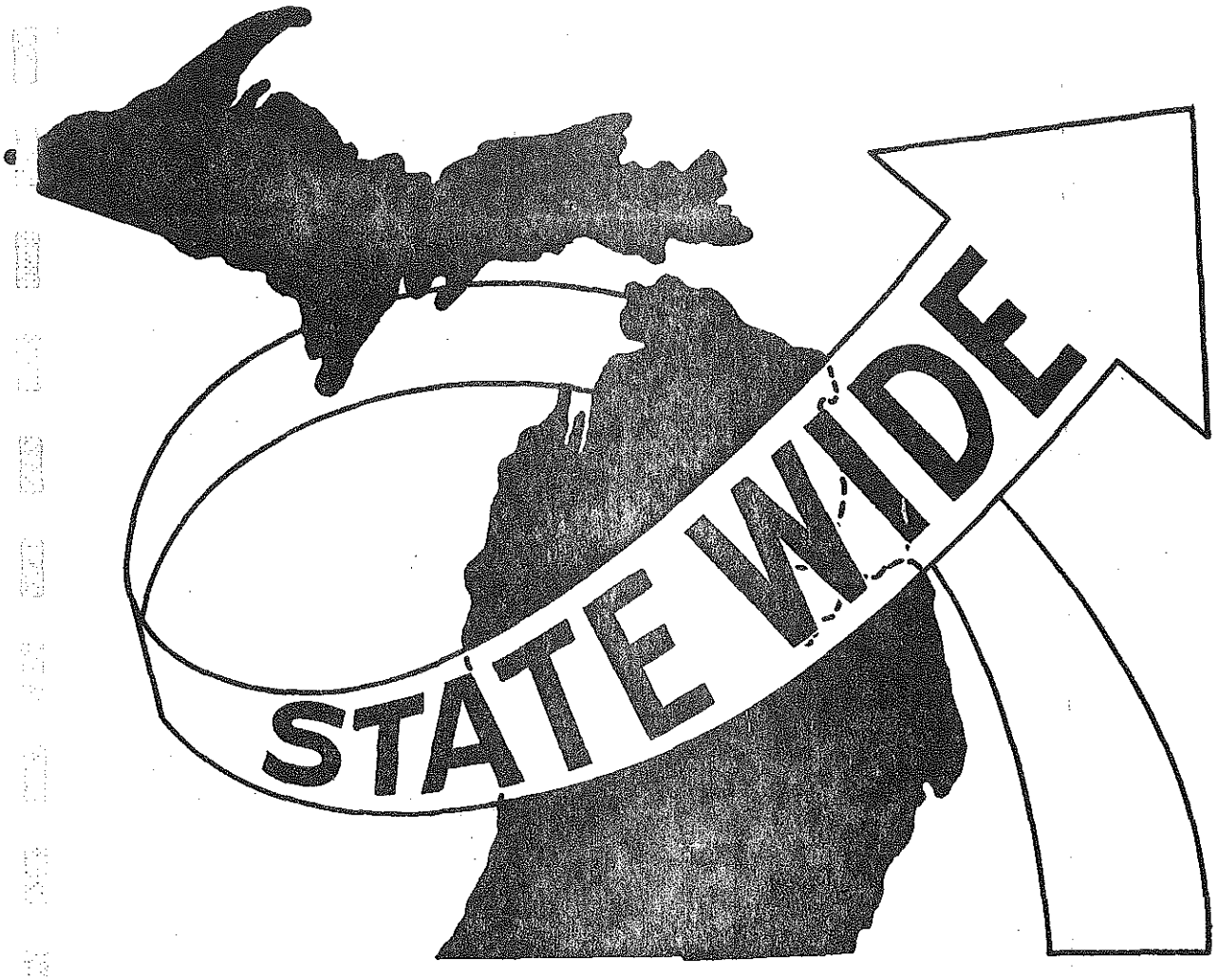
REPRESENTATIVE CPU TIMES FOR ONE RUN
OF PROGRAMS IN A NORMAL 547 ZONE CALIBRATION SERIES

Program		CPU Time (to nearest min.)
TP NET	Q01402	4 Min.
TP TREE	Q01403/HY	3 Hours
TP SKIM	Q01404	45 Min.
CAR	Q10105	40 Min.
TRK	Q10105	40 Min.
VAC	Q10103	25 Min.
CAR MOD	Q01413	15 Min.
TRK MOD	Q01413	11 Min.
VAC MOD	Q01413	13 Min.
CAR LOAD	Q01405/HY	50 Min.
TRK LOAD	Q01405/HY	47 Min.
VAC LOAD	Q01405/HY	50 Min.
TP NAPS	Q01422	3 Min.
TP VOLA	Q01433	4 Min.
TP NAPS	Q01422	4 Min.
FACT ASSMT./ADT. and PAT. FACT. & UNFACT. ASSMT.		
PREPLOT	Q01151	4 Min.
PLOTS:	Q01153 Region 1	13 Min. *
	Q01153 Region 2	10 Min. *
	Q01153 Region 3 Factored $\frac{\text{Assignment}}{\text{ADT}}$	5 Min. *
	Q01153 Region 4	8 Min. *
TP NET	Q01402 (Network Report)	48 Min.
TP EVAL	Q01425	3 Min.

Program		CPU Time (to nearest min.)
TP PRIN	Q01410 (VAC TM)	29 Min.
TP PRIN	Q01410 (CAR TM)	31 Min.
PLOTS:	Q01153 Region 1	22 Min. *
	Q01153 Region 2	15 Min. *
	Q01153 Region 3	9 Min. *
	Q01153 Region 4	7 Min. *
	Q01153 Region 5	5 Min. *
TP EVAL	Q01425	3 Min.

* Does not include Actual Plotting Time on Cal Comp Plotter.

2262 ZONE SYSTEM



2262 ZONE SYSTEM

The 2262 zone system is comprised of 2223 instate zones (Figure 3) and 39 outstate zones (Figure 4). It contains 30,189 miles of trunkline and county roads (includes centroid distances). There are 10,491 links in the system, 2262 centroids and 4,930 nodes (Figure 5). The following figures will list the programs and corresponding CPU's for a total single traffic assignment.

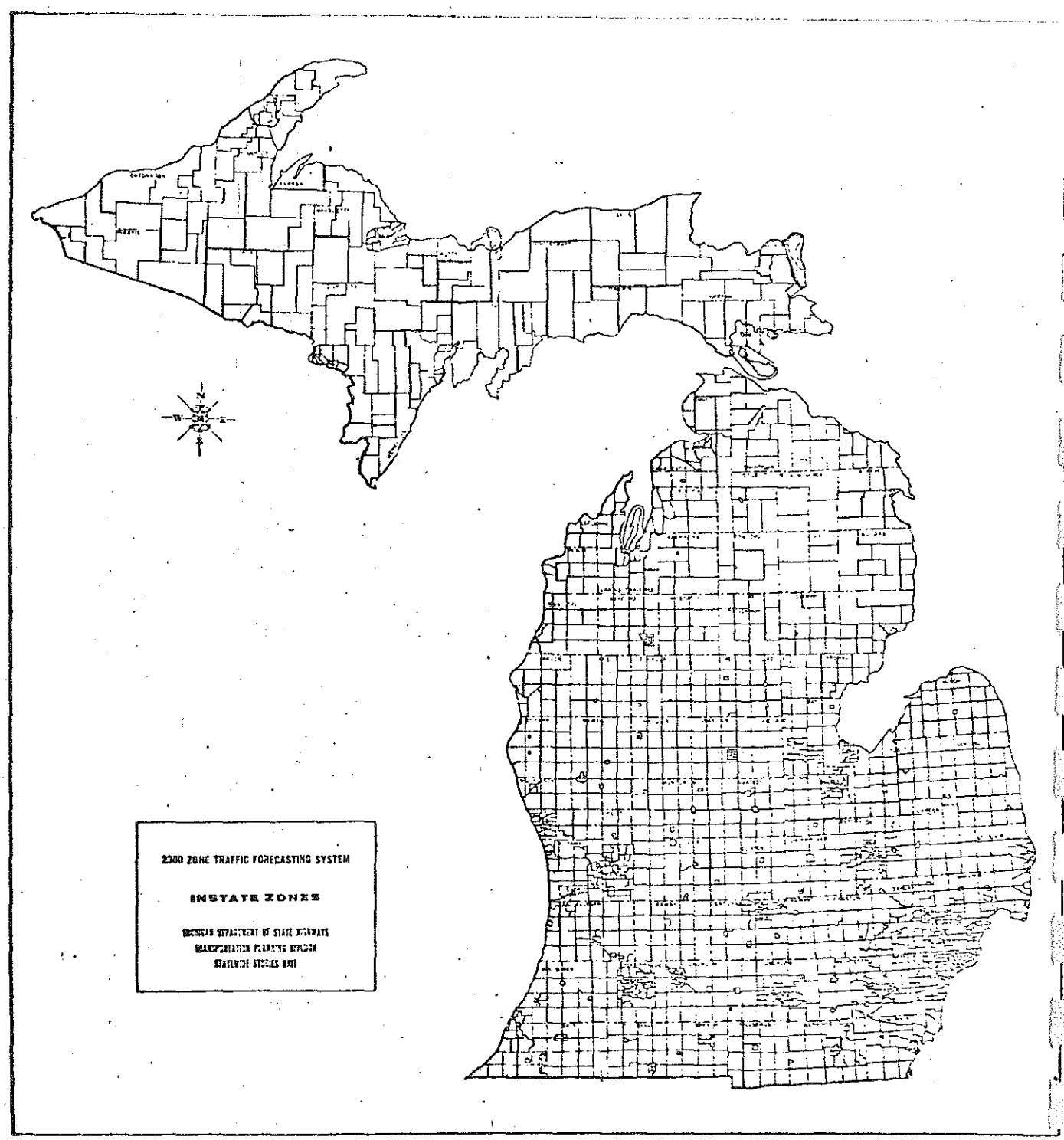


FIGURE 3


ONTARIO
W
E
S
MINNESOTA
WISCONSIN
MICHIGAN
NEW YORK
IOWA
PENNSYLVANIA
ILLINOIS
INDIANA
OHIO
WEST VIRGINIA
MISSOURI
KENTUCKY
2300 ZONE TRAFFIC FORECASTING SYSTEM
OUTSTATE ANALYSIS ZONES
MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRANSPORTATION PLANNING DIVISION
STATEWIDE STUDIES UNIT

FIGURE 4

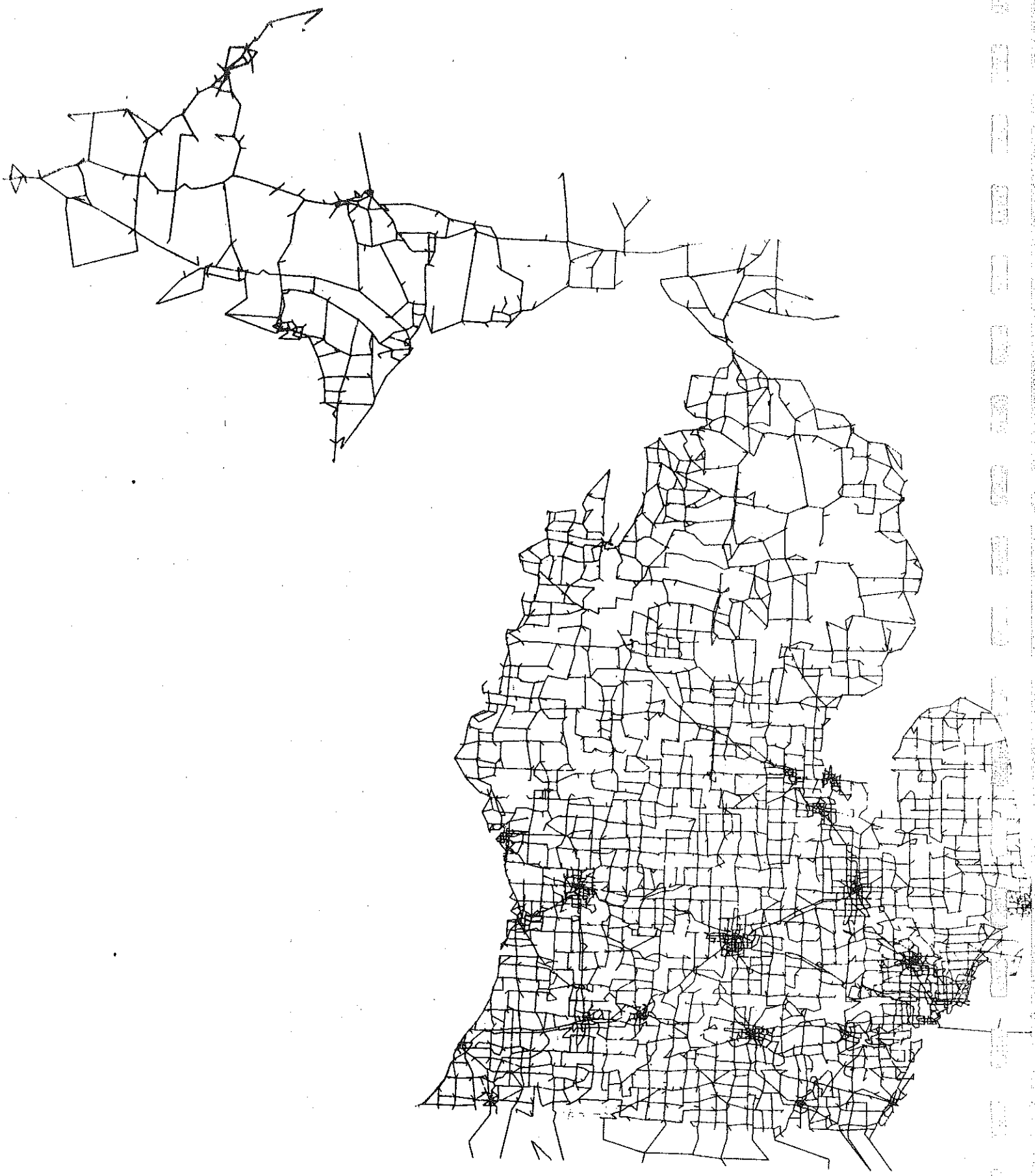


FIGURE 5

For processing purposes with the larger system, "block" runs were necessary to make the corresponding CPU times reasonable. By blocking, we mean that the total zones within the 2262 system were stratified and only predetermined groups were processed within each unit. To illustrate, the 2262 system was broken down as follows:

1	Zones	1 - 377
2	Zones	378- 754
3	Zones	755-1131
4	Zones	1132-1508
5	Zones	1509-1885
6	Zones	1866-2262

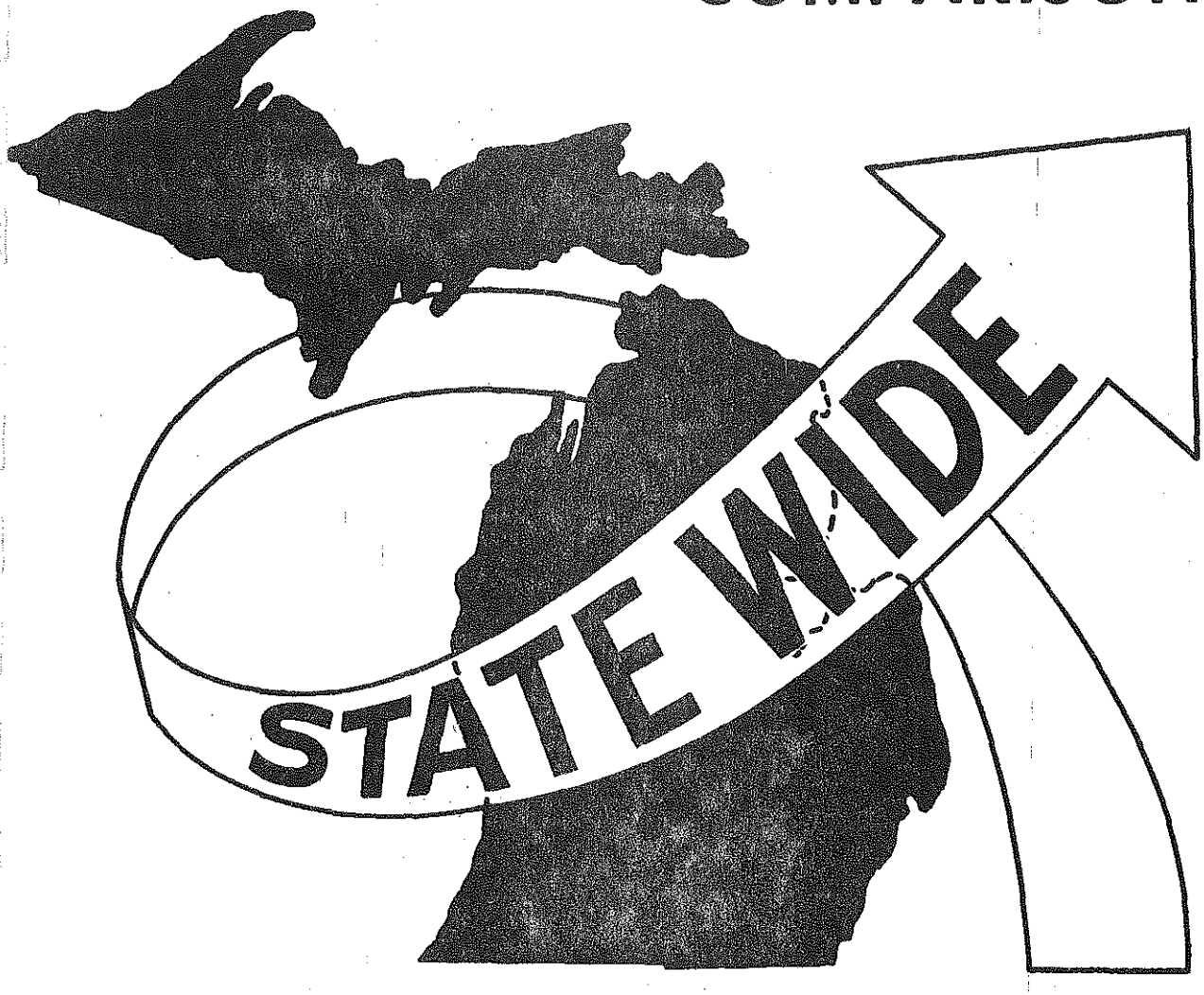
Trees were built for the above zone segments as were they skimmed and loaded and then combined to form a total assignment. Each "tree build" segment took approximately 4 hours for a total of 24 hours and each load segment took four hours for a total of 24 hours. The trip builder programs (Q10105, Q10103) and the other specified programs were run continuously until they were completed. For purposes of clarity a designation of "C" for continuous and "S" for segmented will be used in the following figure to define the types of run times associated with each program.

2262 ZONE CPU TIMES

	PROGRAM		TIME		REMARKS
(c)	TP NET	Q01402	1 HR	15 Min	PRINT (2 VOL FLDS)
				15 Min	UPDATE
(s)	TP TREE	Q01403			
	SEGMENT	1	4 HRS		BUILD
	SEGMENT	2	4 HRS		
	SEGMENT	3	4 HRS		
	SEGMENT	4	4 HRS		
	SEGMENT	5	4 HRS		
	SEGMENT	6	4 HRS		
			24 HRS		
(s)	TP SKIM	Q01404			
	SEGMENT	1	1 HR		
	SEGMENT	2	1 HR		
	SEGMENT	3	1 HR		
	SEGMENT	4	1 HR		
	SEGMENT	5	1 HR		
	SEGMENT	6	1 HR		
			6 HRS		
(c)	UTILITY PROGRAM				
	TO COMBINE SKIMS		10 Min		
	TRIP TABLE BUILDERS:				
(c)	CAR	Q10105	15 HRS		
(c)	TRUCK	Q10105	15 HRS		
(c)	VAC	Q10103	7 HRS	15 Min.	

	PROGRAM		TIME	REMARKS
(c)	TRMNIP	Q01412	11 HRS	COMBINES TRIP TABLES
(s)	TPLOAD	Q01405		
	SEGMENT	1	4 HRS	
	SEGMENT	2	4 HRS	
	SEGMENT	3	4 HRS	
	SEGMENT	4	4 HRS	
	SEGMENT	5	4 HRS	
	SEGMENT	6	4 HRS	
			24 HRS TOTAL	
(c)	TPNAPS	Q01422	20 Min.	ADDS SEGMENTAL LOADS TOGETHER TO FORM TOTAL
(c)	PREPLOT	Q01151	15 Min	
	*PLOT	Q01153 Region 1	21 Min	
	PLOT	Q01153 Region 2	43 Min	* Does not include physical plotting times
	PLOT	Q01153 Region 3	30 Min	
	PLOT	Q01153 Region 4	17 Min	
	PLOT	Q01153 Region 5	13 Min	
	PLOT	Q01153 Region 6	11 Min	
	PLOT	Q01153 Region 7	11 Min	
	PLOT	Q01153 Region 8	6 Min	

COMPUTER RUN TIME COMPARISONS



ZONE SYSTEM
COMPARISON DATA

	(547)	(2262)
INSTATE ZONES	508	2223
OUTSTATE ZONES	39	39
TOTAL MILAGE IN SYSTEM	20,623	30,189
NUMBER OF LINKS	3,377	10,491
NUMBER OF CENTROIDS	547	2262
NUMBER OF NODES	2,008	4,930

ASSIGNMENT RUN TIMES COMPARISON

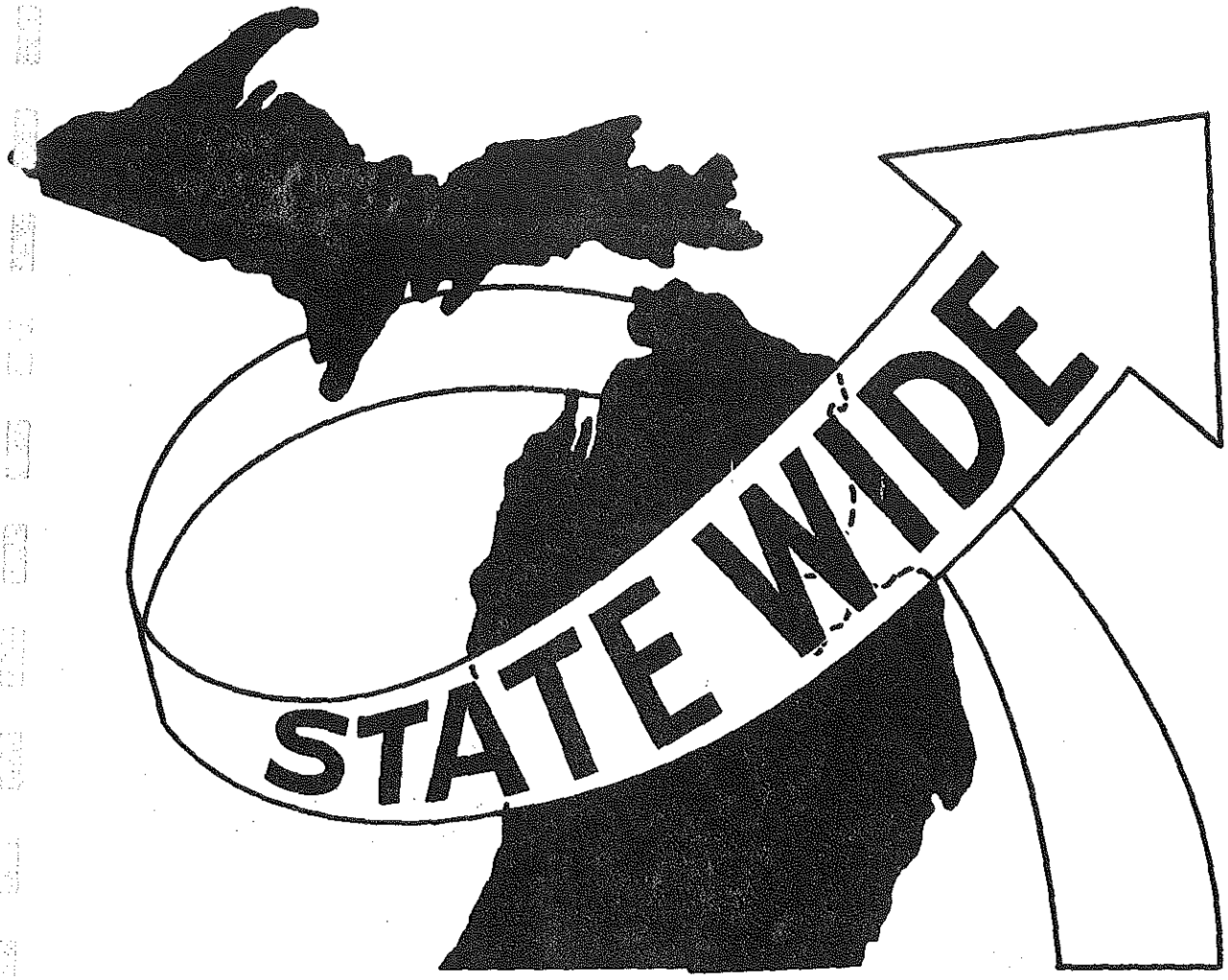
		(547)	(2262)
TPNET Q01402	(UPDATE)	5 Min	15 Min
	(PRINT)	1 HR	1 HR 15 Min
TPTREE Q01403		3 HR	24 HRS
TP SKIM Q01404		45 Min	6 HRS
CARQ10105		40 Min	15 HRS
TK Q10105		40 Min	15 HRS
VAC Q10103		25 Min	7 HRS
CAR MOD Q01413		15 Min	
TK MOD Q01413		11 Min	
VAC MOD Q01413		13 Min	
MNIP Q01412		35 Min	11 HRS
LOAD Q01405		75 Min	24 HRS
TPNAPS Q01422		5 Min	20 Min
PREPLOT Q01151		5 Min	15 Min
PLOTS Q01153		32 Min	2 1/2 HR

PLOTTING CAPABILITY NOTE

It is extremely important that any initial modeling effort be accompanied by a basic computer plotting capability. The initial building and operation of even minimal modeling efforts without a plotter would be extremely difficult if not fruitless.

The Michigan Department of State Highways and Transportation has used a digital incremental plotter for this type of work and has on order for future efforts a modular automatic drafting system with a 40 i.p.s. capability. The choice of plotting systems is definitely up to each individual user but the fact of its definite need cannot be over-emphasized.

CONCLUSION



CONCLUSION

The purpose of the report has been accomplished if other agencies now have a better idea of the processing times involved in model application. Future computer technology may alter the concepts and times involved here but at least a groundwork for comparison has been laid.

The Statewide Studies Unit would be glad to assist anyone with future inquires regarding model system size and related processing times: Please contact . . .

Mr. Richard E. Esch
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