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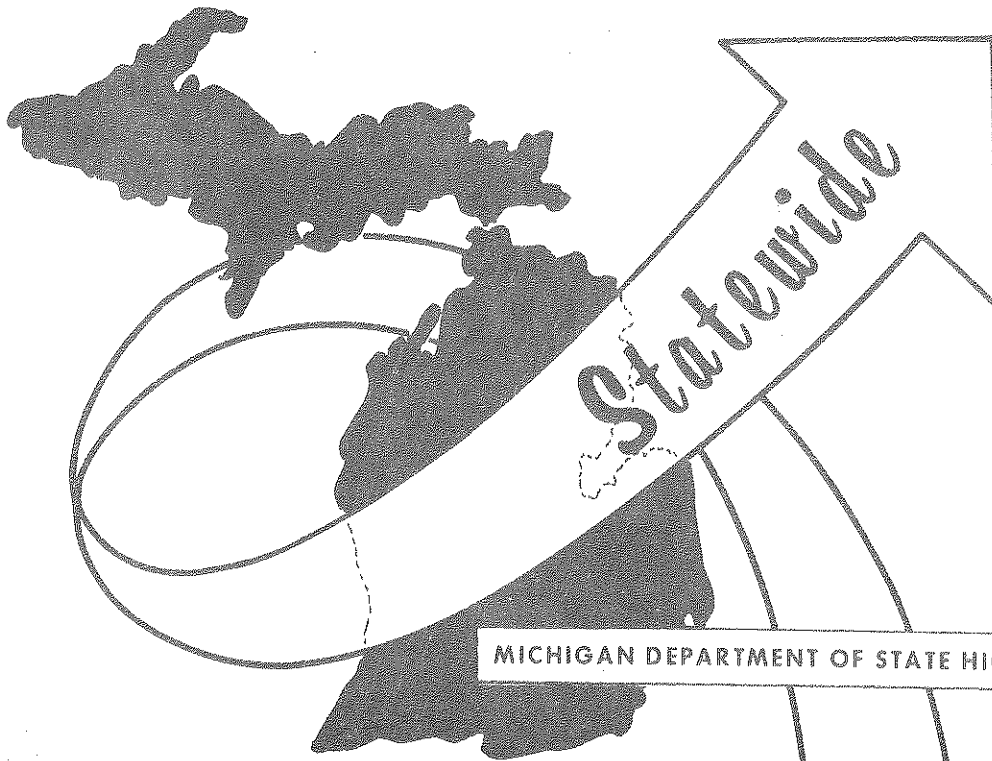
Statewide ★ Transportation Analysis & Research

MICHIGAN'S STATEWIDE
TRANSPORTATION MODELING
SYSTEM

ECONOMIC AND TRAVEL IMPACTS
OF SPEED LIMIT REDUCTION
USING A STATEWIDE TRANSPORTATION
MODELING SYSTEM

Report no. 14
Statewide Research and Development

September, 1974



MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

MICHIGAN DEPARTMENT

OF

STATE HIGHWAYS AND TRANSPORTATION

BUREAU OF TRANSPORTATION PLANNING

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JOHN P. WOODFORD, DIRECTOR
March 4, 1976

Mr. Sam F. Cryderman, Deputy Director
Bureau of Transportation Planning
Michigan Department of State Highways
and Transportation
State Highways Building
Post Office Drawer K
Lansing, Michigan 48904

Dear Mr. Cryderman:

The accompanying report, Economic and Travel Impacts of Speed Limit Reduction Using a Statewide Transportation Modeling System, was first brought out in September of 1974 as an in-house working paper. Because the subject of speed reduction impacts has received increasing attention in recent transportation literature, we feel that this would be a proper time to make this report public.

The report documents a process now being used in the Statewide Transportation Modeling System to predict three impacts of speed limit reduction which were previously difficult to address at the system level; the additional driving times necessitated by slower speeds, the value of the time lost, and a comparison of the probable number of trips made before and after speed limit reduction. Such calculations are particularly valuable in gauging the possible effects of a speed reduction before it is actually implemented.

Because this document has been published after the present 55 mile-per-hour speed limit was an accomplished fact, it should not be construed as a criticism of that decision. Moreover, any such judgment would be hasty because the report treats only a few of the issues which can be investigated when a deceleration program is proposed. We only hope that this is a demonstration of the manner in which statewide transportation modeling results could be used in formulating policy decisions.

Sincerely,

R. J. Lilly, Administrator
Highway Planning Division



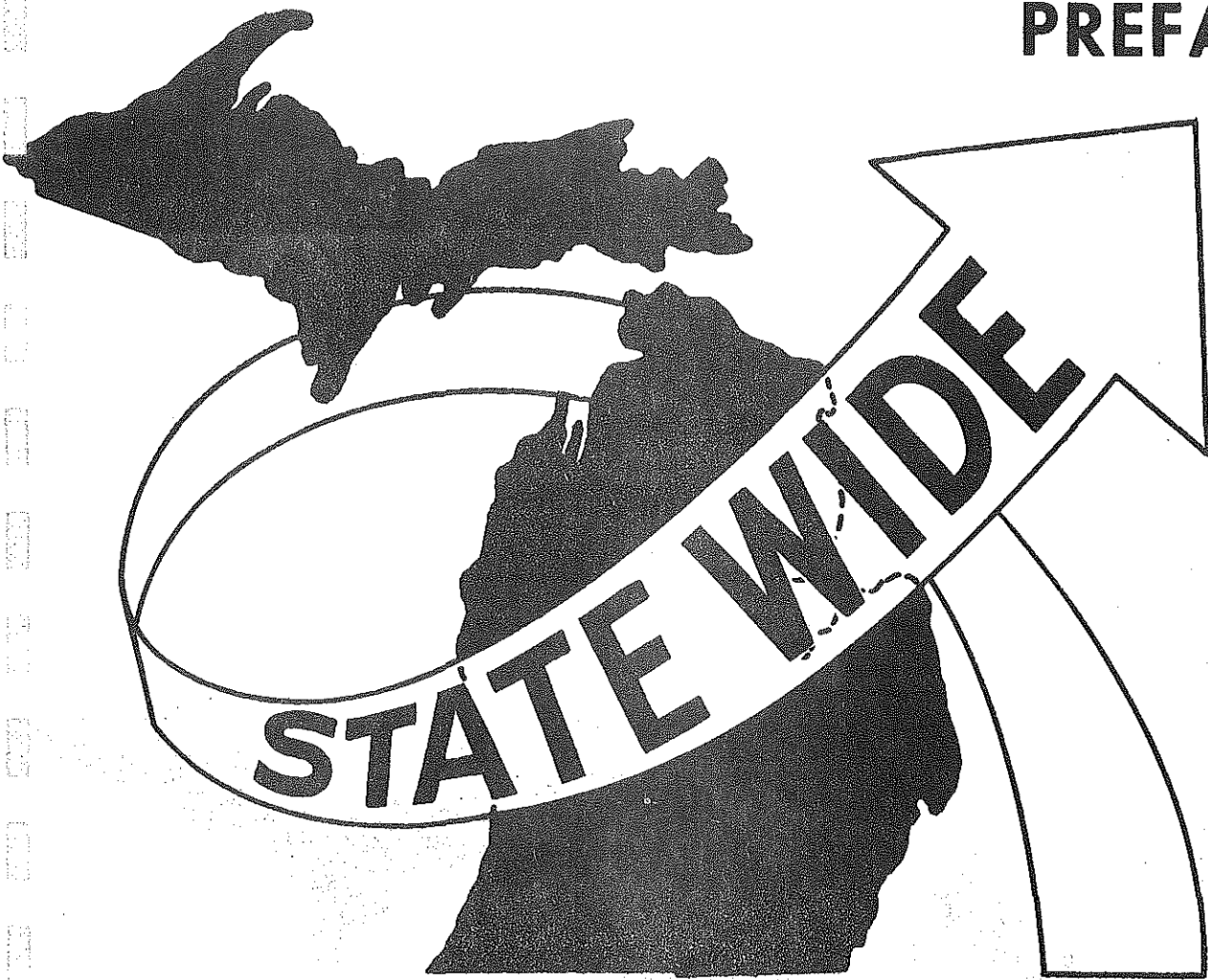
**ECONOMIC AND TRAVEL IMPACTS
OF
SPEED LIMIT REDUCTION
USING A
STATEWIDE TRANSPORTATION MODELING SYSTEM**

by

Randy Kaminsky

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PREFACE



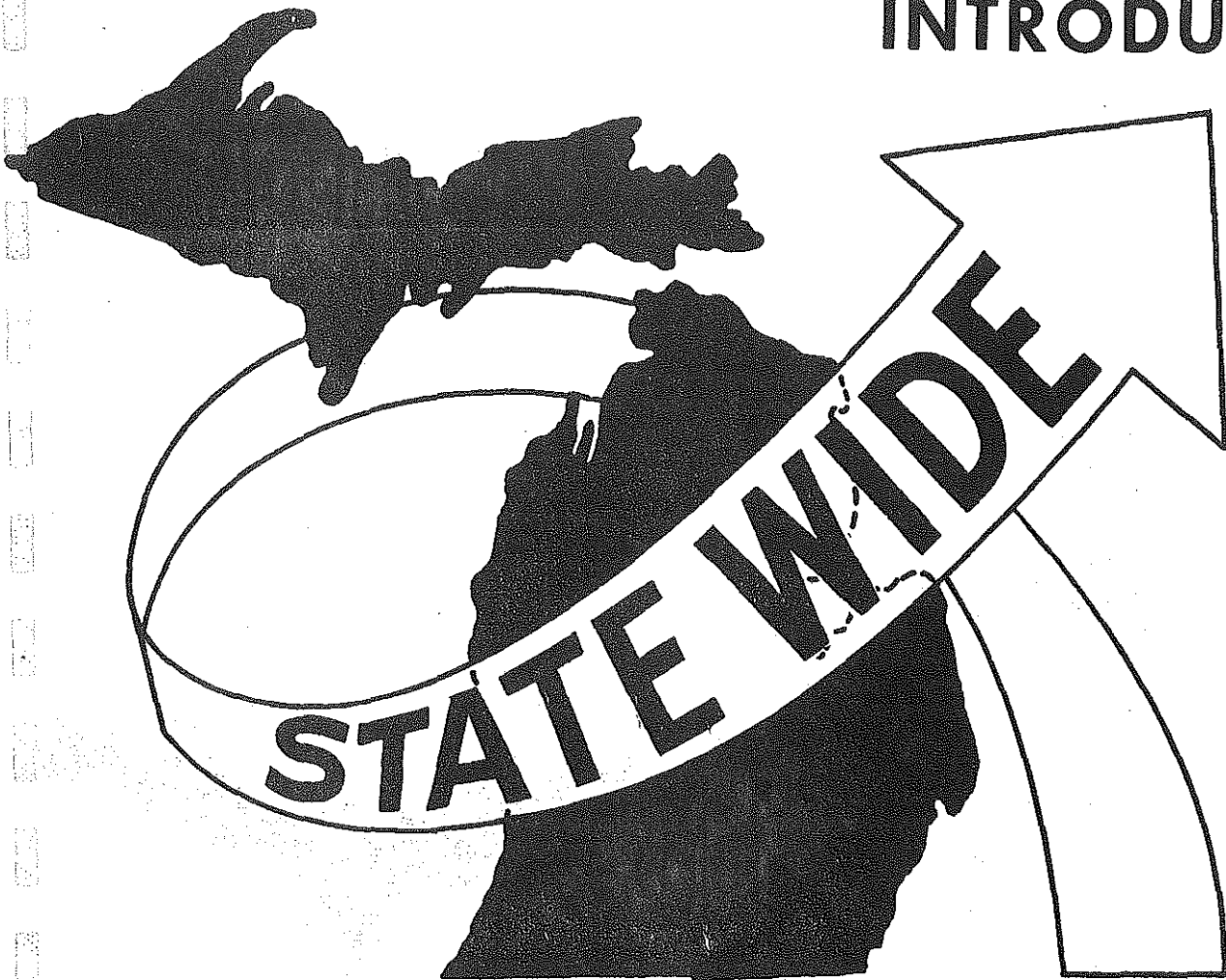
PREFACE

The statewide transportation modeling system has been applied in analysis of the impact of the 50 mph speed limit issue created as the result of the gasoline shortage during the fall of 1973 and the spring of 1974. The probable impact of this speed alteration, generated by a computerized statewide model, is documented in this report. Example and illustrations from the output of this model are included.

The accuracy and reliability of the results are indicated by these sample computer runs. The applicability of this method in the decision making process can be determined from this report. These travel impacts could be used, within the limits determined above, as a basis for administrative or legislative action.

This report has been completed "after the fact" as most energy crisis issues regarding speed limit change have been settled, but this document may still serve as a basis for future statewide transportation modeling applications.

INTRODUCTION



INTRODUCTION

The statewide highway network, shown in Figure 1, was used to generate the speed limit reduction travel impacts. This network consists of all state trunklines and selected county roads. Links--segments of these roads--are catalogued according to pairs of link node numbers. Nodes are reference points at each end of a link which define the link. The locations of nodes and a series of links are shown in Figure 2. Each of these sections has associated with it a set of parameters which describes the physical conditions of the link. These variables are listed in Figure 3.

The link-node technique is being used to store and access both physical and travel conditions of the actual road sections. This data is stored on magnetic tape. Corresponding parameters for all links are found in the same location or volume fields on the tape.

The computer programs in the Michigan transportation analysis battery are capable of reading up to fifty specific volume fields for each link in the network. This allows the user to complete many different types of analysis using the same network file. A test to select all links with a specific value of a given field can also be performed. Mathematical manipulation of any volume field can be performed on selected links, or the whole network.

The trip generation and travel time calculations are two computer operations based on network files. Time calculation is dependent on the link speed and the total distance on the shortest time path between two zone pairs. Michigan's zone system appears

FIGURE 1: HIGHWAY NETWORK PLOT

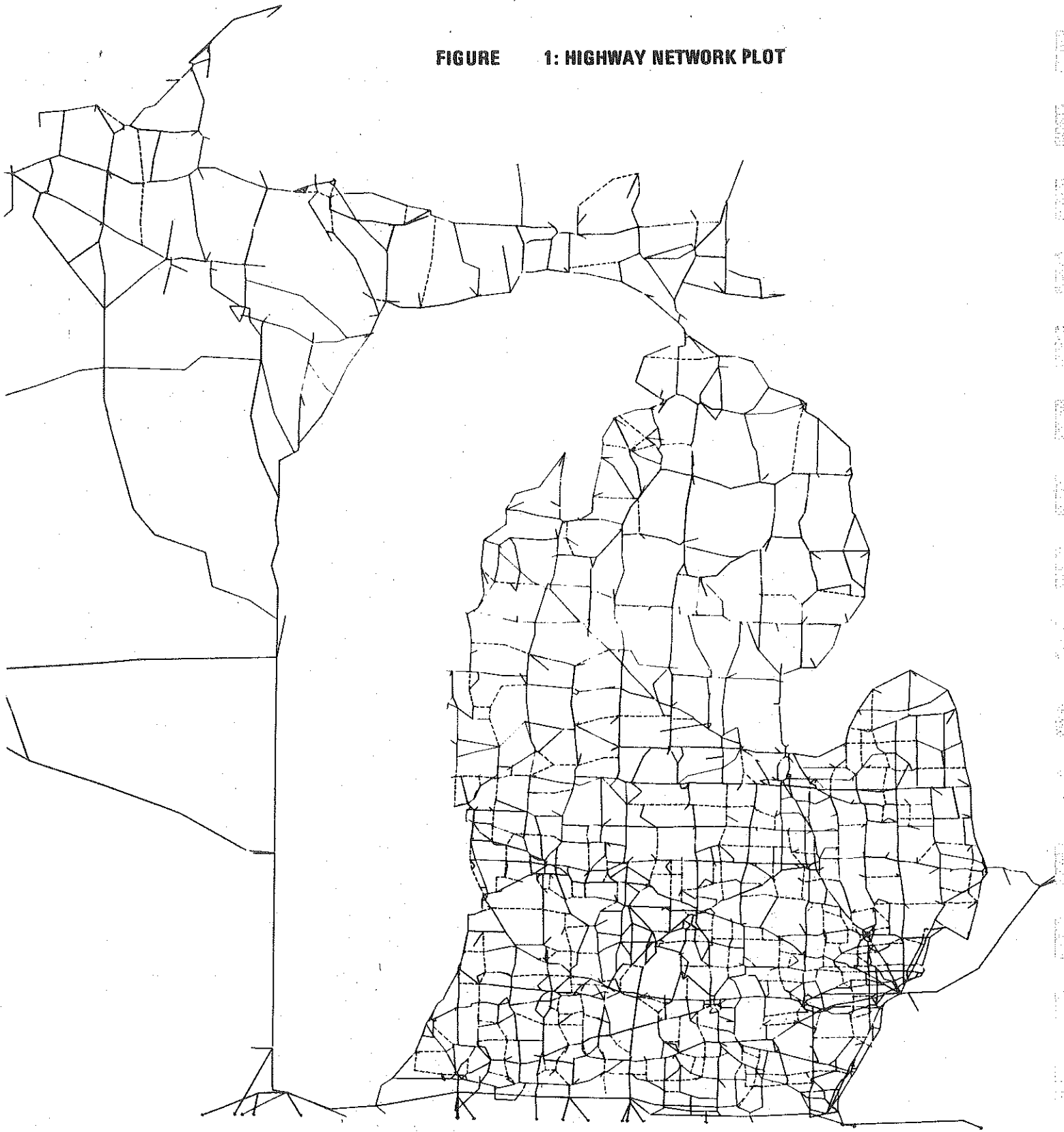
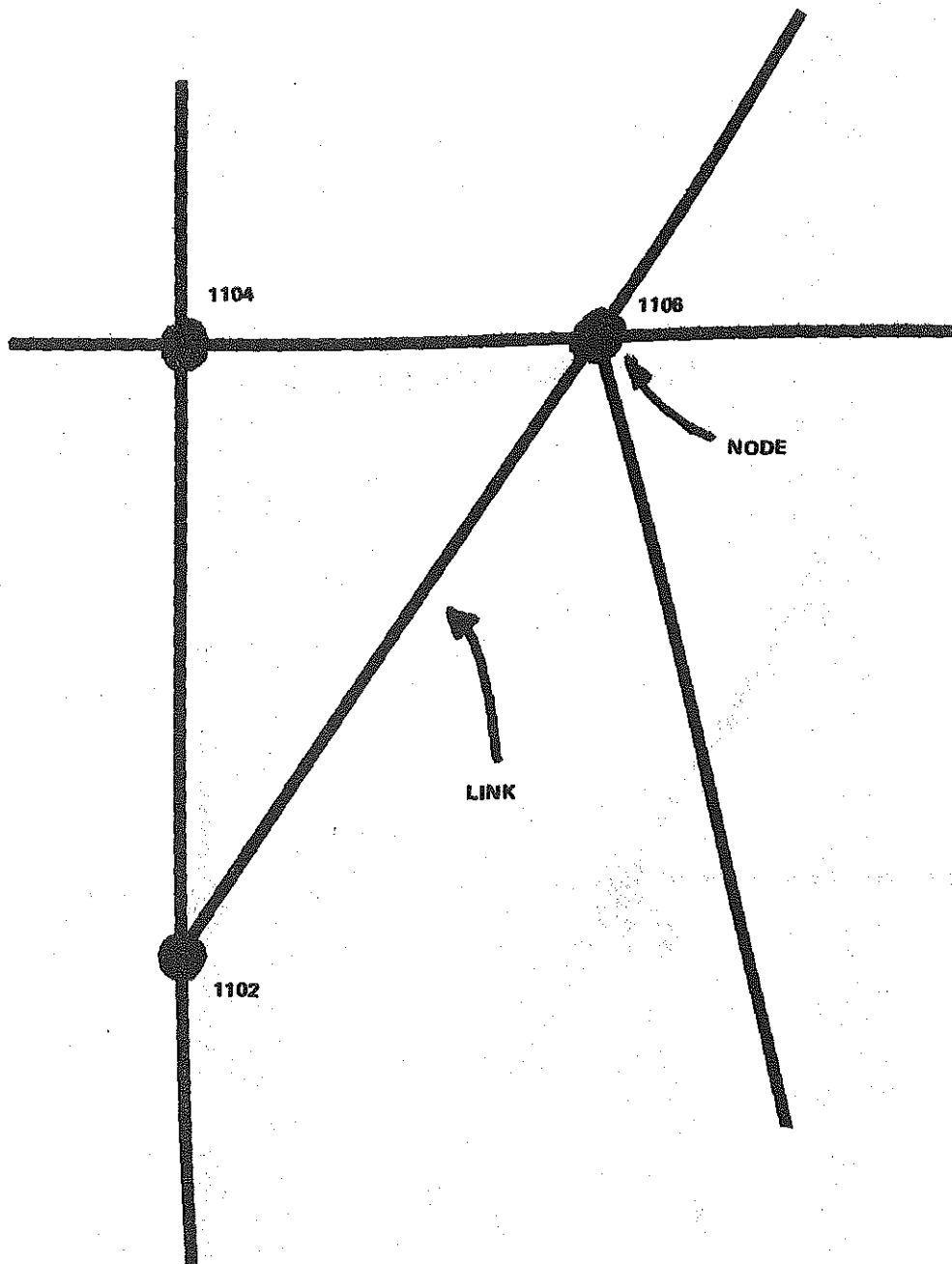


FIGURE 2: SAMPLE HIGHWAY NETWORK



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 3

in Figure 4 and is composed of 508 instate zones and 39 outstate zones. Variations in speed made over the whole network or only on selected links could have a striking effect on travel times between many zone pairs. The impact of these alterations will be discussed in the system impact analysis section. The speed limit change impacts affect driving time and also have a definite effect on trip generation. Driving time impacts can also be converted to dollar values as a possible measure of economic impact. The statewide transportation modeling system will be used to measure these impacts.

The next section of this document deals with a detailed explanation of the actual procedure followed and the computer programs used in this analysis. Tests of driving time and trip generation impacts are stepped through. The final sections are an explanation of the actual tests of the probable speed limit reduction impacts on the State of Michigan.

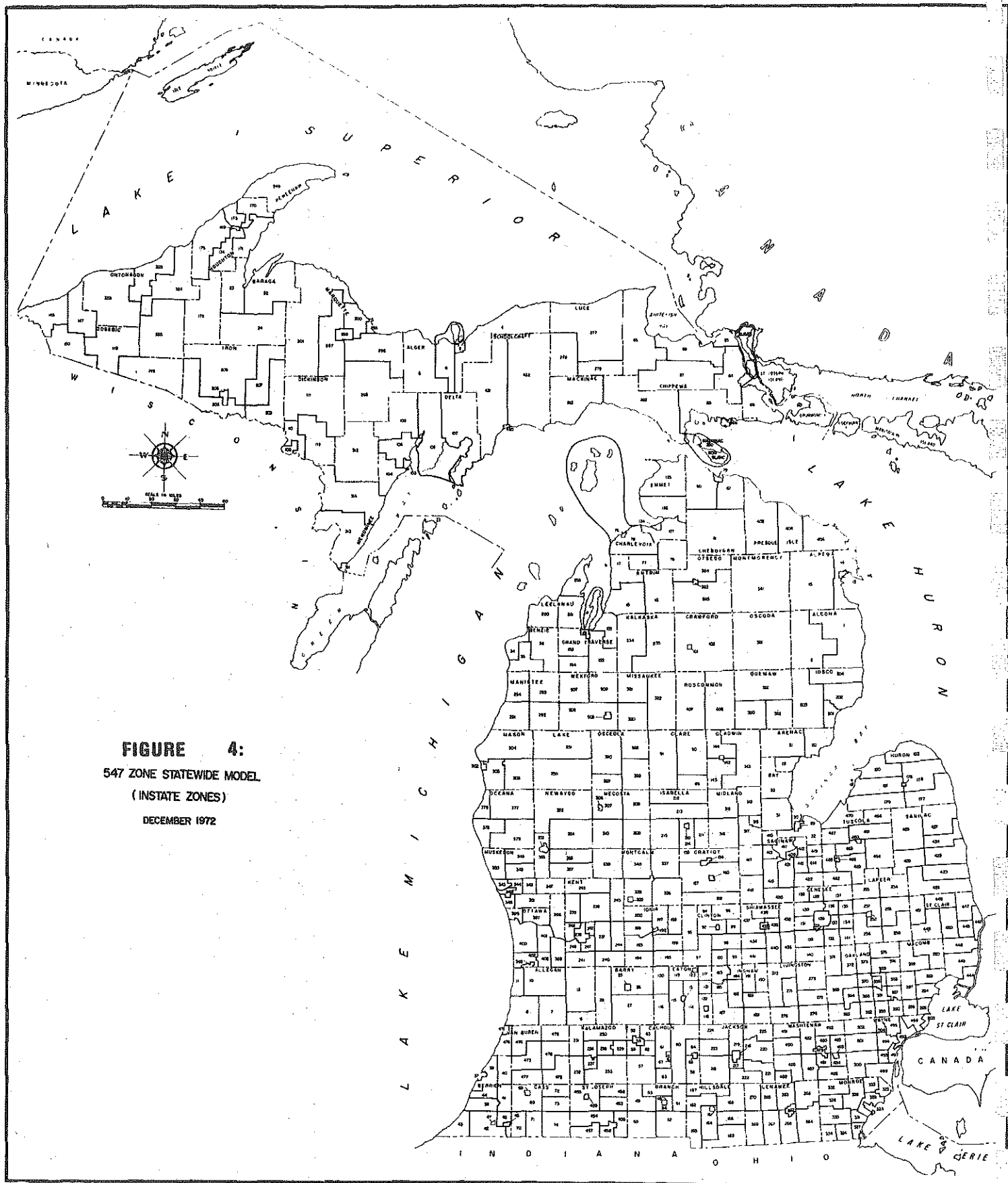
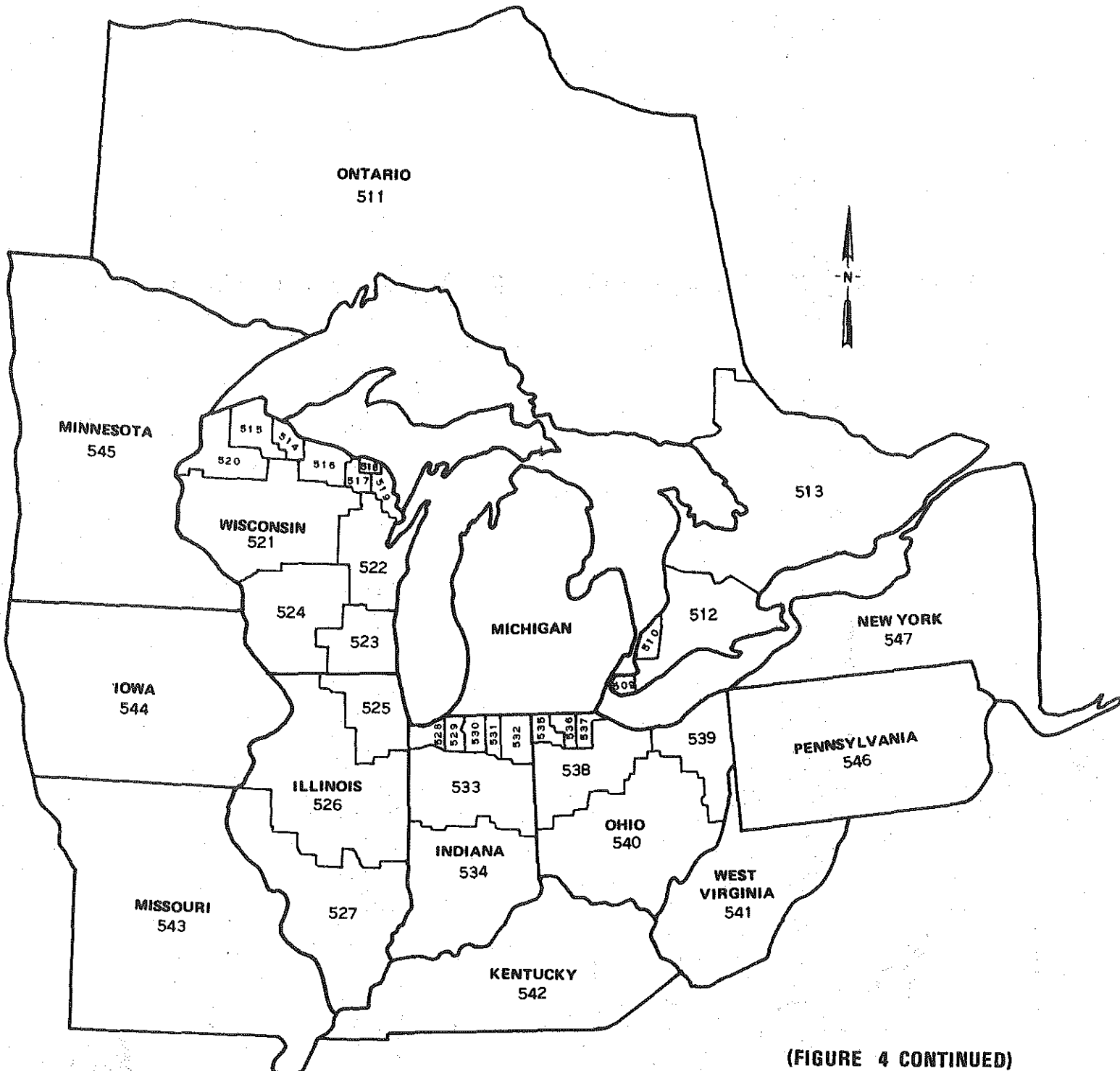


FIGURE 4:
547 ZONE STATEWIDE MODEL
(INSTATE ZONES)
DECEMBER 1972

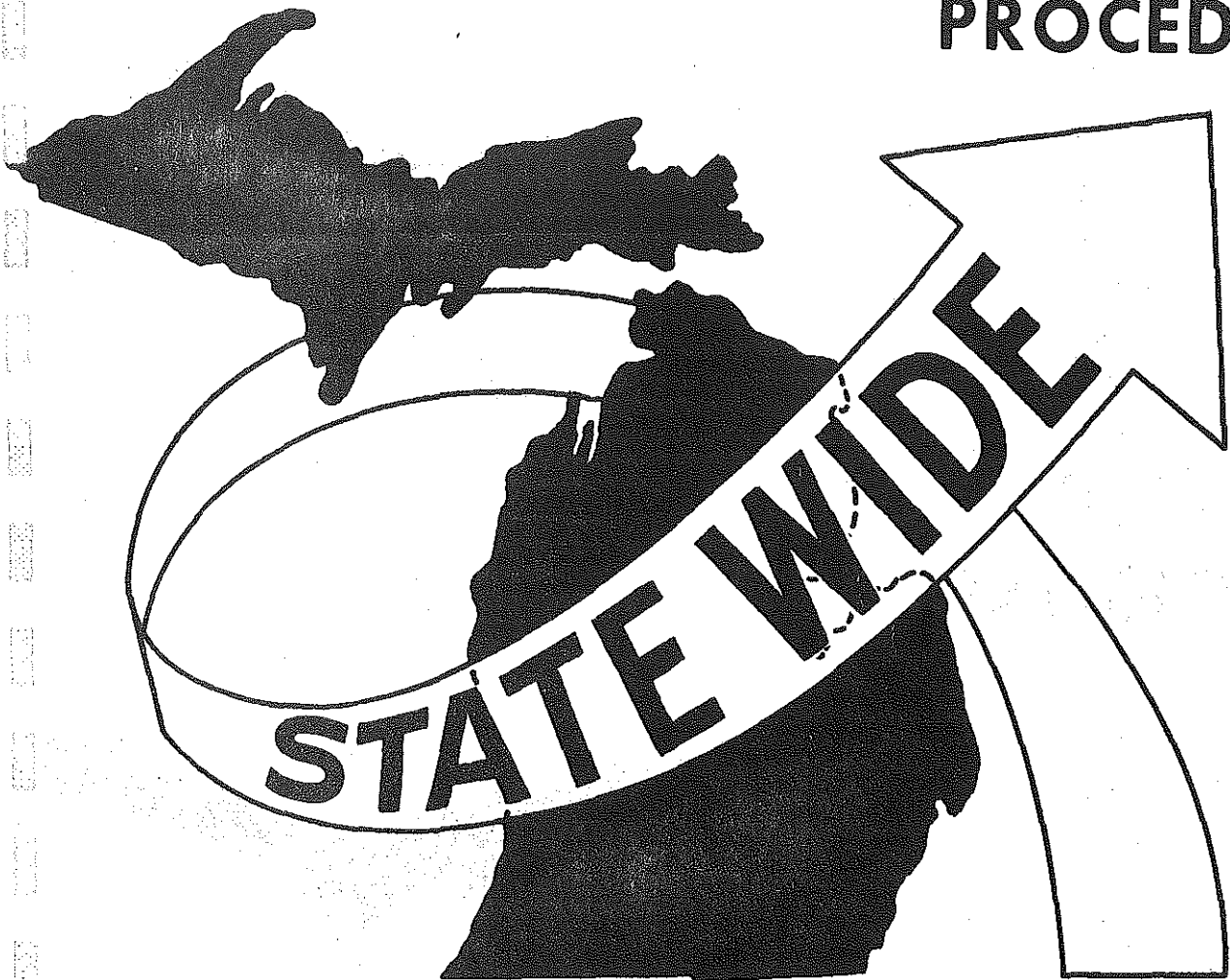
MICHIGAN'S TRANSPORTATION MODELING SYSTEM

547 ZONE OUTSTATE ANALYSIS ZONES



(FIGURE 4 CONTINUED)

**IMPACT ANALYSIS
PROCEDURES**



IMPACT ANALYSIS PROCEDURES

The task stated in the preface, measurement of the impacts caused by a speed reduction, was started with the plotting of the network shown in Figure 1. A flow chart of the other steps taken during this procedure is shown in Figure 5. Our highway network plotting program allowed us to print the velocity of each link. This initial plot contained speeds as high as the 62 mph avg. speed used on most rural freeways.

The network plotted in the previous step was then manipulated by a Cobol program. The program used in this network manipulation altered speed to conform with a 50 mph speed limit. All speeds on the original network that were originally greater than 50 were reduced to 50 mph. Once processed the network was ready to be ran with the programs of the transportation planning battery.

This altered network and the original net were input to the programs that create and plot trees. These program selected the shortest time routes and plotted them from specified zones. An example of the output of this process shown in Figure 6. This plotting was done after the differences between the two speeds were calculated.

Skim trees of time were then generated and printed. The tapes put out by these skim tree programs, for both the old and new networks, were manipulated by other programs of the transportation planning battery. This second processing gave the differences between the two time skims, which represent the additional driving times necessitated by reduced speeds.

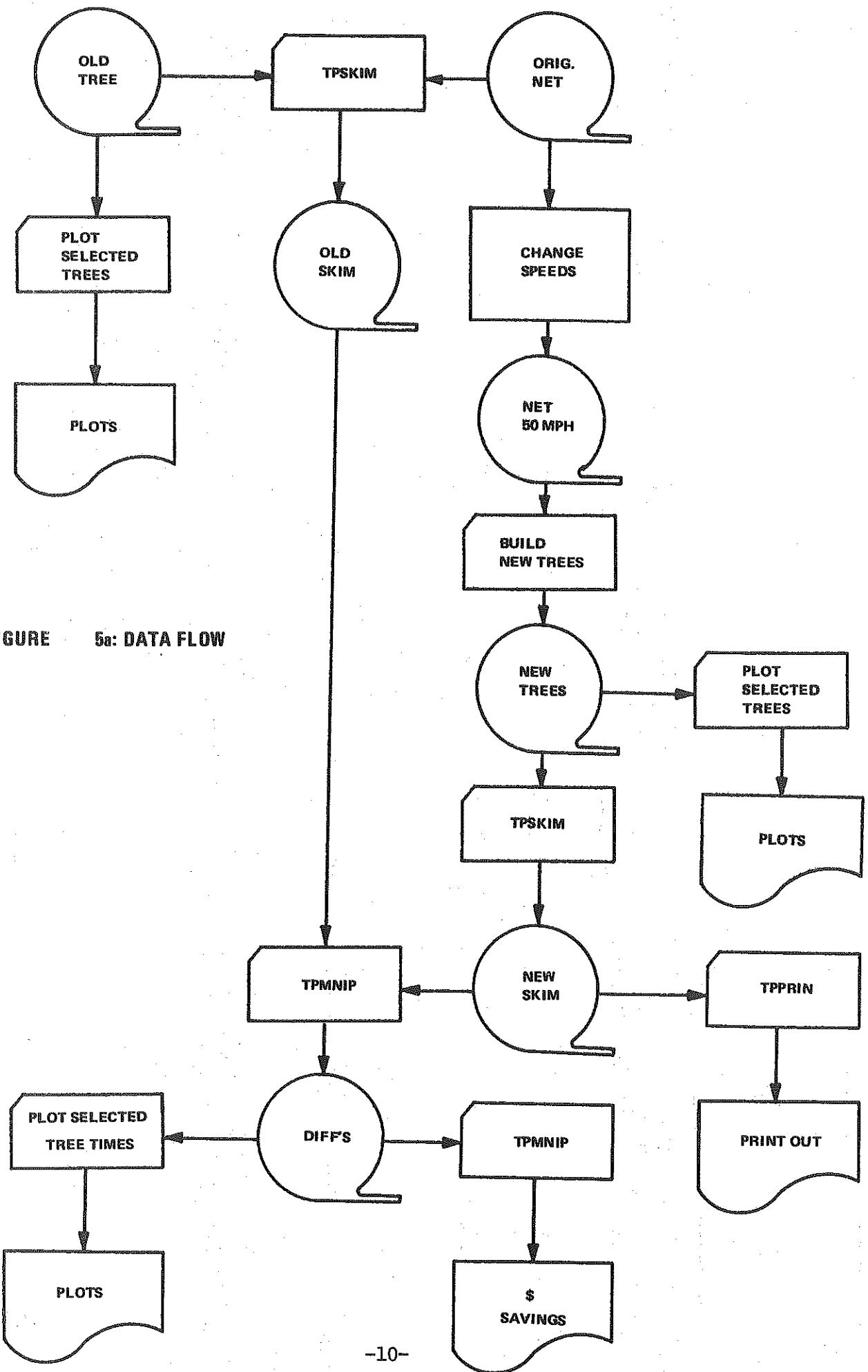
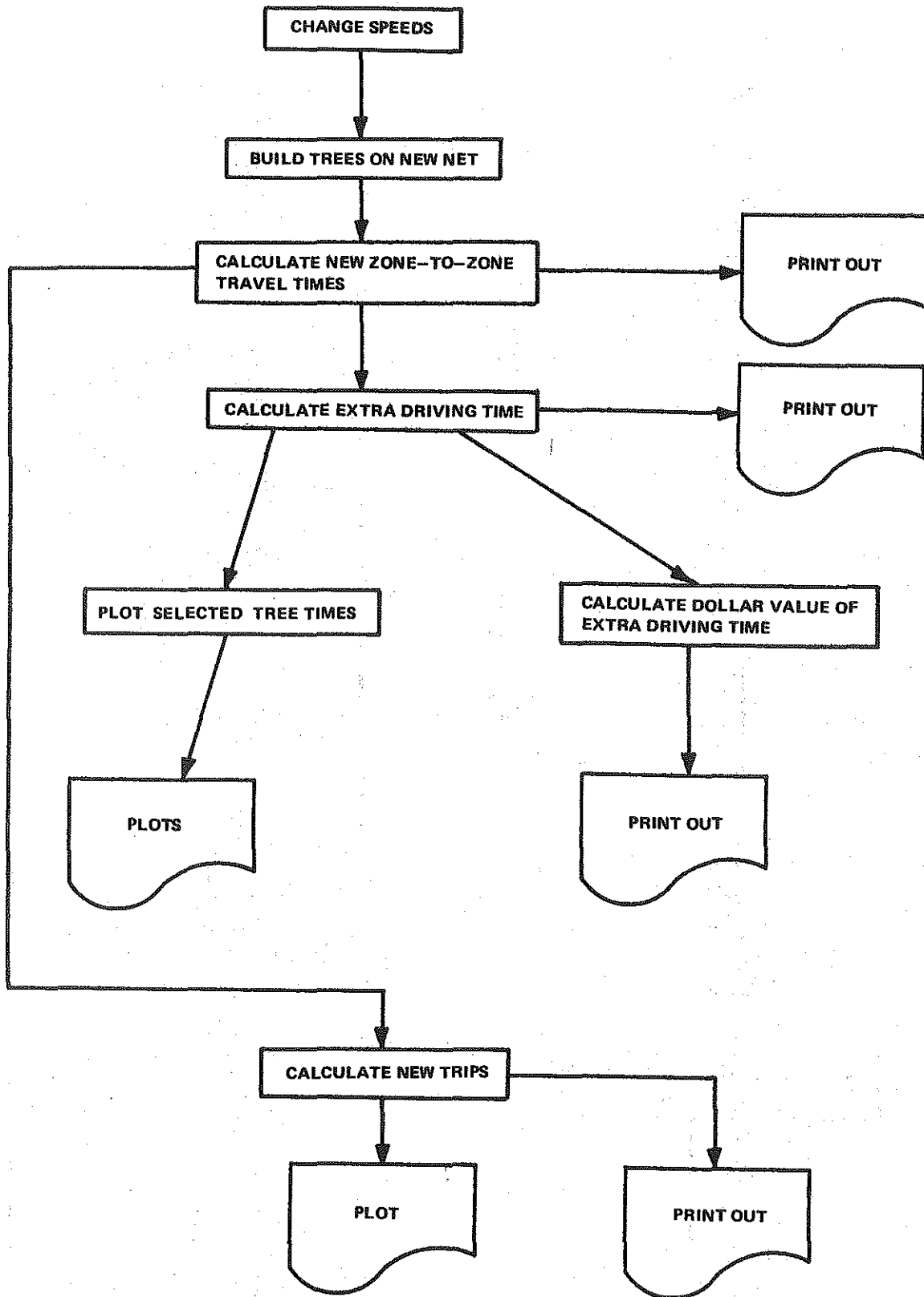
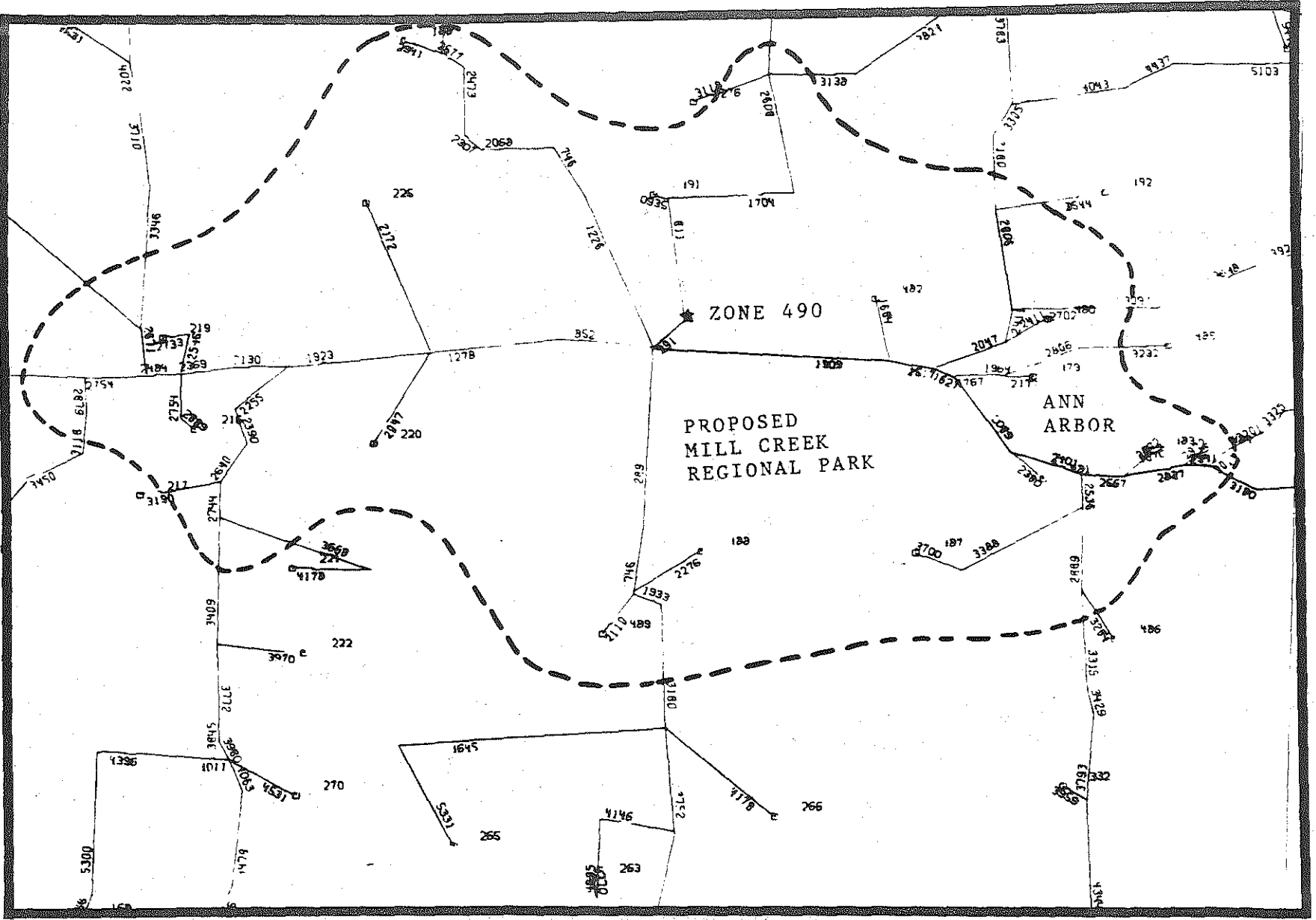


FIGURE 5a: DATA FLOW

FIGURE 5b: ANALYSIS PROCEDURE





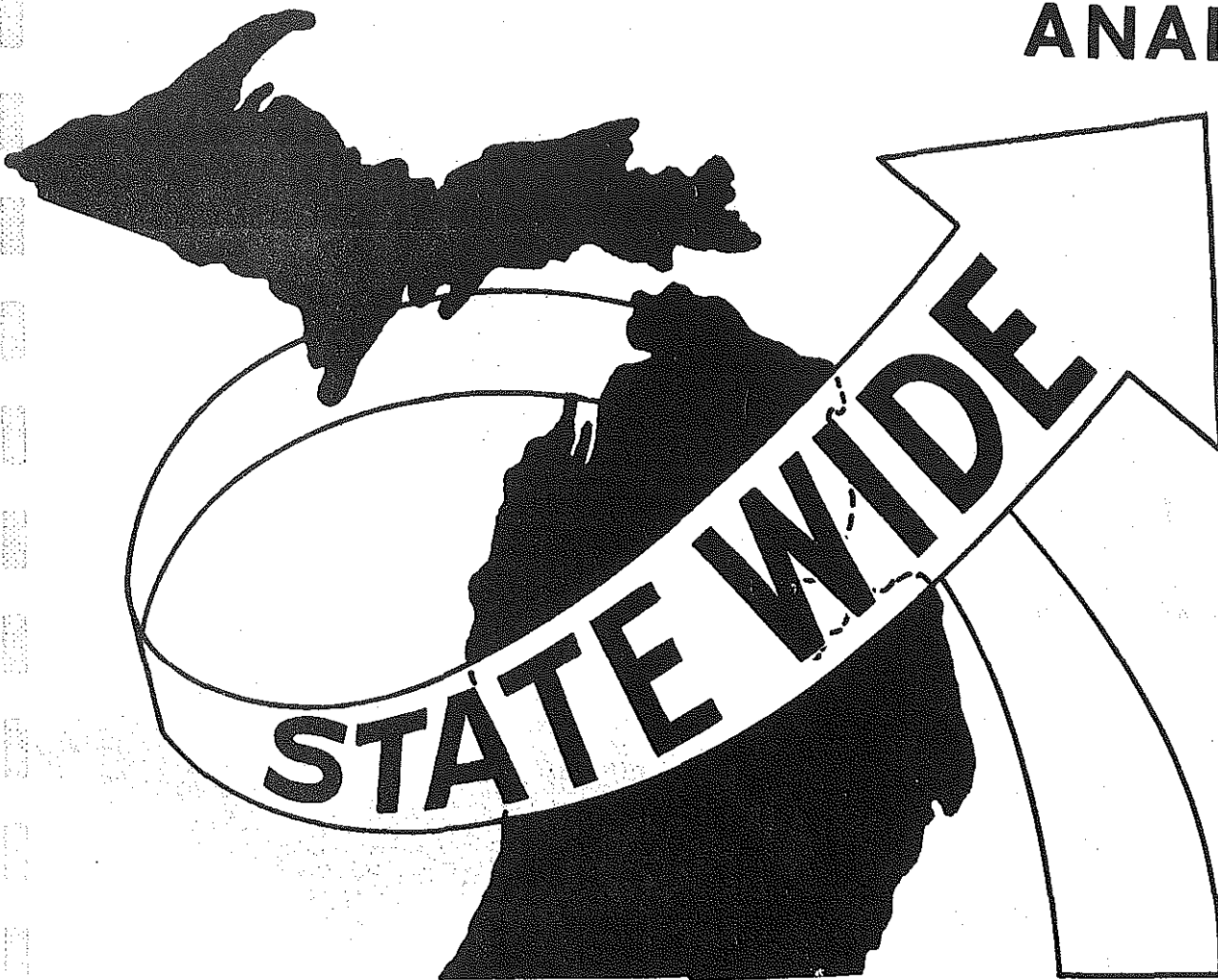
-12-
 FIGURE 8: EXAMPLE OF SELECTED TREE PLOT

Another program of the transportation planning battery, the trip generator, was also run during this analysis. The output, a printed computer listing, gave the number of trips generated by the network under existing conditions. Manipulation of the two matrices also gave the differences in the number of trips. This value of time was derived by inflating the value cited by SRI for auto VDT for auto VOT, \$2/hr. by using cost trends from Summary of National Travel Statistics, DOT, 1971.

Using the \$2.52/hr as the value of time and the two matrices, discussed in preceding paragraphs, another matrix was produced. This table gave the economic changes resulting from the speed reduction.

Additional analysis of these two networks before and after speed reduction, was performed. A ratio of the number of trips generated by each was calculated. This was plotted on the state highway network.

SYSTEM IMPACT ANALYSIS



SYSTEM IMPACT ANALYSIS

In analyzing the effects of the lowered speed limit three basic types of results should be examined:

- (1) additional driving time necessitated by slower speeds
 - (2) value of time lost
- and (3) a comparison of the number of trips which would probably be made at a maximum speed of 50 miles per hour with those which would be made under "normal" conditions

The amount of additional driving time required to go from one place to another is expressed in "trip-minutes", defined by the formula:

$$\left(\begin{array}{c} \text{trip-minutes} \\ \text{between zones } i \text{ and } j \end{array} \right) = \left(\begin{array}{c} \text{avg. driving time/trip} \\ \text{between } i \text{ and } j \end{array} \right) \times \left(\begin{array}{c} \text{no. of trips} \\ \text{between } i \text{ and } j \end{array} \right)$$

It is useful to examine the time lost in driving between selected origin-destination points, as is done in Figure 7. Also, one may be interested in the total trip-minutes lost by the residents of a particular area or region, regardless of their ultimate destination. An example of this sort of result is shown by Figure 8. The extra time spent driving can also be shown on the links of a "selected tree", or the highway paths from a selected zone to all other zones. A portion of such a plot is shown in Figure 9.

Moreover, this extra time spent driving can be costed, using a dollar value for each trip-minute lost or gained. This value is not what a person might earn during that minute, but what he might pay to save a minute's driving time which he could be using for something

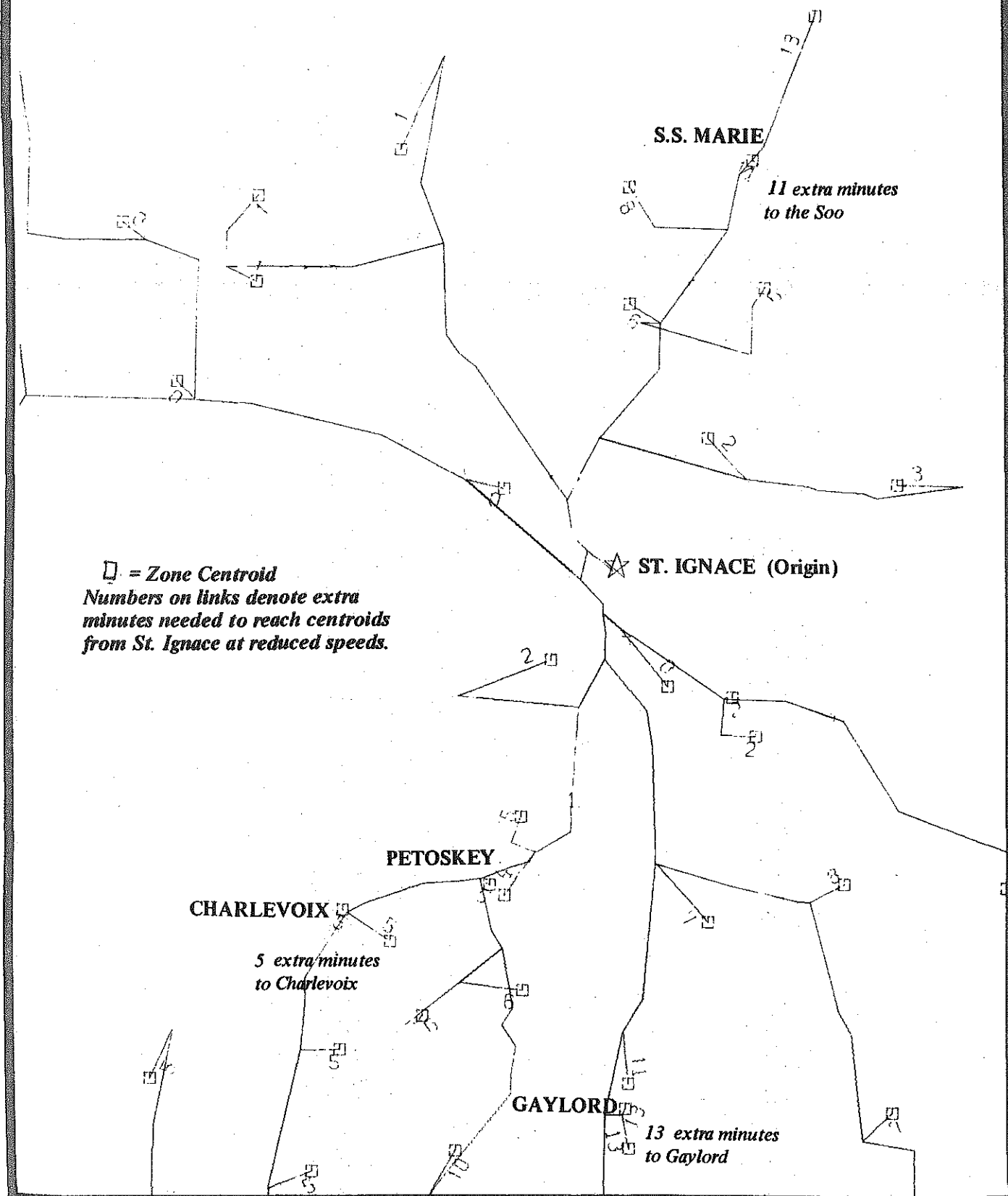
FIGURE 7: ZONE-TO-ZONE TIME LOSS FOR SELECTED ZONE PAIRS

ZONE NUMBERS	TRIP-TIME	PLACES
013 - 394	12.380	Alpena -- Gaylord
083 - 183	472.059	Sault Ste. Marie -- Lansing
073 - 280	6,352.170	Sault Ste. Marie -- St. Ignace
103 - 280	4.385	Escanaba -- St. Ignace
126 - 315	33.635	Harbor Springs -- Midland
126 - 493	98.748	Harbor Springs -- Detroit
128 - 409	3,226.489	Flint -- Saginaw
151 - 216	24.112	Traverse City -- Jackson
183 - 394	46.990	Lansing -- Gaylord
226 - 479	272.202	Kalamazoo -- Ann Arbor
280 - 493	107.416	St. Ignace -- Detroit
295 - 299	0.000	Marquette -- Negaunee
386 - 493	59.920	Porcupine Mts -- Detroit

FIGURE 8: TOTAL TIME LOST FOR SELECTED ZONES

ZONE NUMBER	NAME	TOTAL ADDITIONAL MINUTES REQUIRED
013	Alpena	17,075
083	Sault Ste. Marie	24,047
103	Escanaba	20,827
126	Harbor Springs	16,303
128	Flint	12,132
151	Traverse City	9,971
183	Lansing	11,905
216	Jackson	13,731
226	Kalamazoo	12,275
280	St. Ignace	18,834
295	Marquette	18,398
299	Negaumee	18,487
315	Midland	10,335
003	Munising	18,370
342	Muskegon	11,173
236	Grand Rapids	10,424
147	Wakefield Twp.	26,730
178	Bloomfield Twp.	8,561

FIGURE 9: EXTRA DRIVING TIMES



else. At a rate of \$2.52 per hour per trip, Figures 10 and 11 show the value of the extra driving times given in Figures 7 and 8. The above tables are shown for all zones in Appendix A.

The final result is possibly the most interesting. It is well-known that if a given trip is made to take longer, some people will simply refuse to go, or refuse to go as often. This deals with the whole notion of "induced" travel, that as two places become relatively more accessible to one another, the travel between them increases. This has another, even more complicated, sidelight: if a city which is the main travel attractor for a region is suddenly made less accessible relative to neighboring cities, some of the travel which had gone to the city previously will go to its neighbors. This could happen, for example, if one city in a county lay on the crossroads of two freeways, and other cities of comparable size lay on slower two-lane roads; if the speed limit on the expressways were suddenly dropped, that first city's share of the trips in the county would be diminished. Figure 12 presents a table comparing the number of forecasted trips into and out of certain areas before and after a speed limit reduction to 50 mph. Figures 13a-b-c show this phenomenon graphically. The two areas outlined in Figure 13-a are blown up in Figures 13b and 13c, and the number on each link is the ratio of the number of trips using that link if the speed limit were 50 mph. to the number of trips using the link with "normal" speed limits. A comparison of "before" and "after" trips for all zones is given in Appendix B.

FIGURE 10: VALUE OF ZONE-TO-ZONE EXCESS TIME

<u>ZONE NUMBERS</u>	<u>\$ COST OF ADD'L TIME</u>	<u>PLACES</u>
013-394	\$ 0.51	Alpena-Gaylord
083-183	19.83	Sault Ste. Marie-Lansing
073-280	.03	Sault Ste. Marie-St. Ignace
103-280	.18	Escanaba-St. Ignace
126-315	1.41	Harbor Springs-Midland
123-493	4.15	Harbor Springs-Detroit
128-409	135.51	Flint-Saginaw
151-216	1.01	Traverse City-Jackson
183-394	1.97	Lansing-Gaylord
226-479	11.43	Kalamazoo-Ann Arbor
280-493	4.51	St. Ignace-Detroit
386-493	2.47	Porcupine Mts.-Detroit

FIGURE 11: VALUE OF TOTAL EXCESS TIME

<u>ZONE NUMBERS</u>	<u>NAME</u>	<u>\$ VALUE OF EXCESS DRIVING TIME</u>
13	Alpena	\$ 653.31
83	Sault Ste. Marie	1985.33
103	Escanaba	308.30
126	Harbor Springs	391.42
128	Flint	5850.07
151	Traverse City	495.31
183	Lansing	5334.88
216	Jackson	1619.18
226	Kalamazoo	3004.99
280	St. Ignace	748.62
295	Marquette	386.90
299	Negaunee	177.44
315	Midland	927.44
342	Muskegon	1603.54

FIGURE 12: COMPARISON OF GENERATED TRIPS BEFORE AND AFTER SPEED CHANGE

ZONE NUMBER	TRIPS @ 70 MPH	TRIPS @ 50 MPH	
5	2308	2350	*
10	6388	6046	
15	4034	3838	
20	5664	5290	
25	14464	14870	*
50	7684	7338	
75	12078	12202	*
100	14658	14888	*
150	6150	6176	*
165	4476	4488	*
170	6440	6440	
175	3042	3068	*
180	3610	3524	
185	19052	19586	*
190	5150	4758	
191	10510	9762	
192	11086	10934	
193	2570	2200	
194	5740	5702	
195	3822	3518	
196	7734	7708	
197	6818	6774	
198	5576	5666	
199	5518	4618	
200	6140	6200	*
205	3405	3438	*
210	18016	17580	
215	5328	5390	*
220	21004	20438	
225	9666	9046	
250	4118	4178	
275	12138	9630	
300	6272	6352	*
325	12676	11494	
350	11470	11062	
375	14586	13776	
400	9954	9784	
425	3912	3924	
450	5308	4712	
475	6530	6728	*
500	50744	47010	

NOTE: Zones marked with a (*) gained in total trips after speed reduction.

FIGURE 13a: DETAIL REGIONS

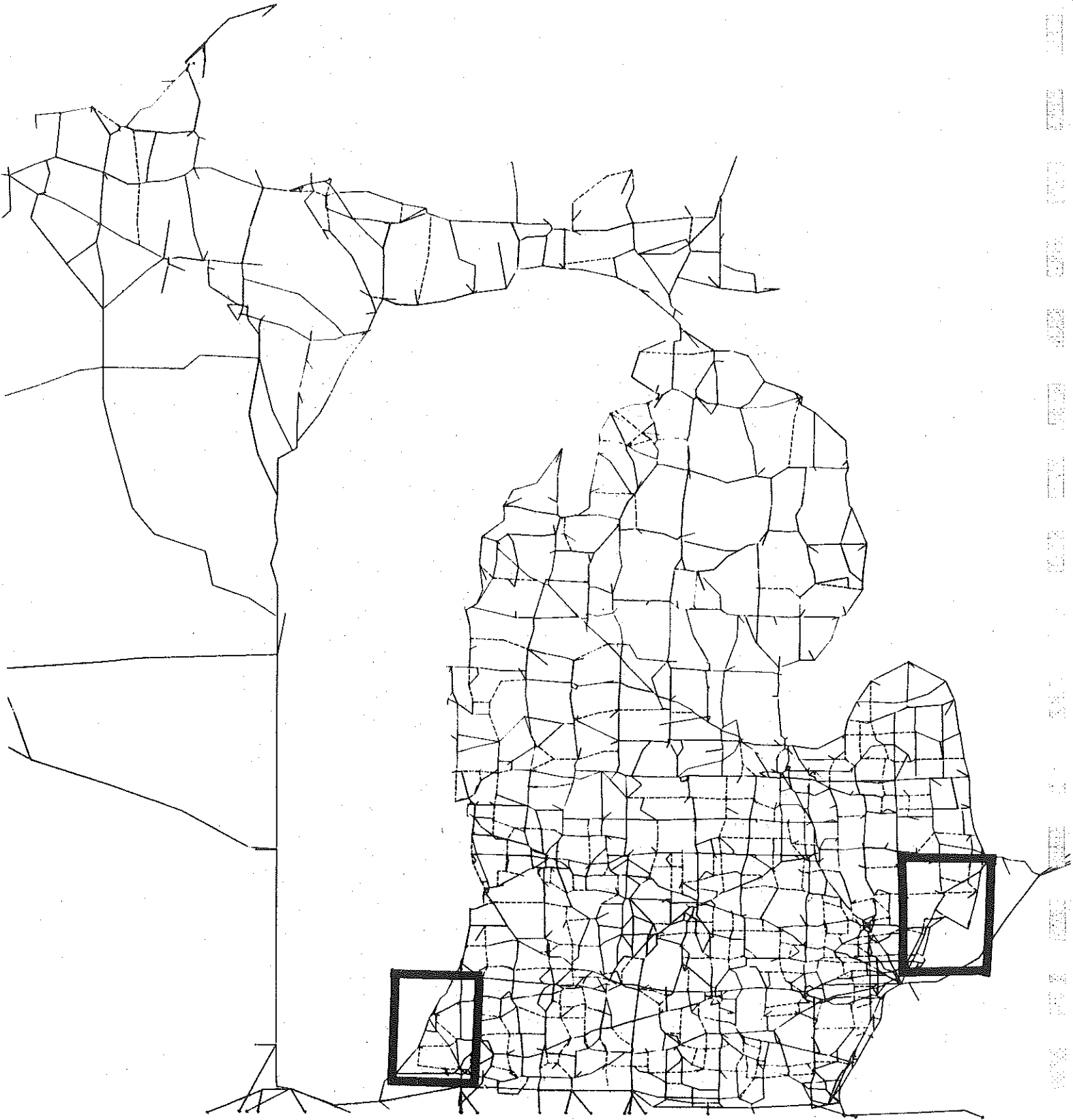
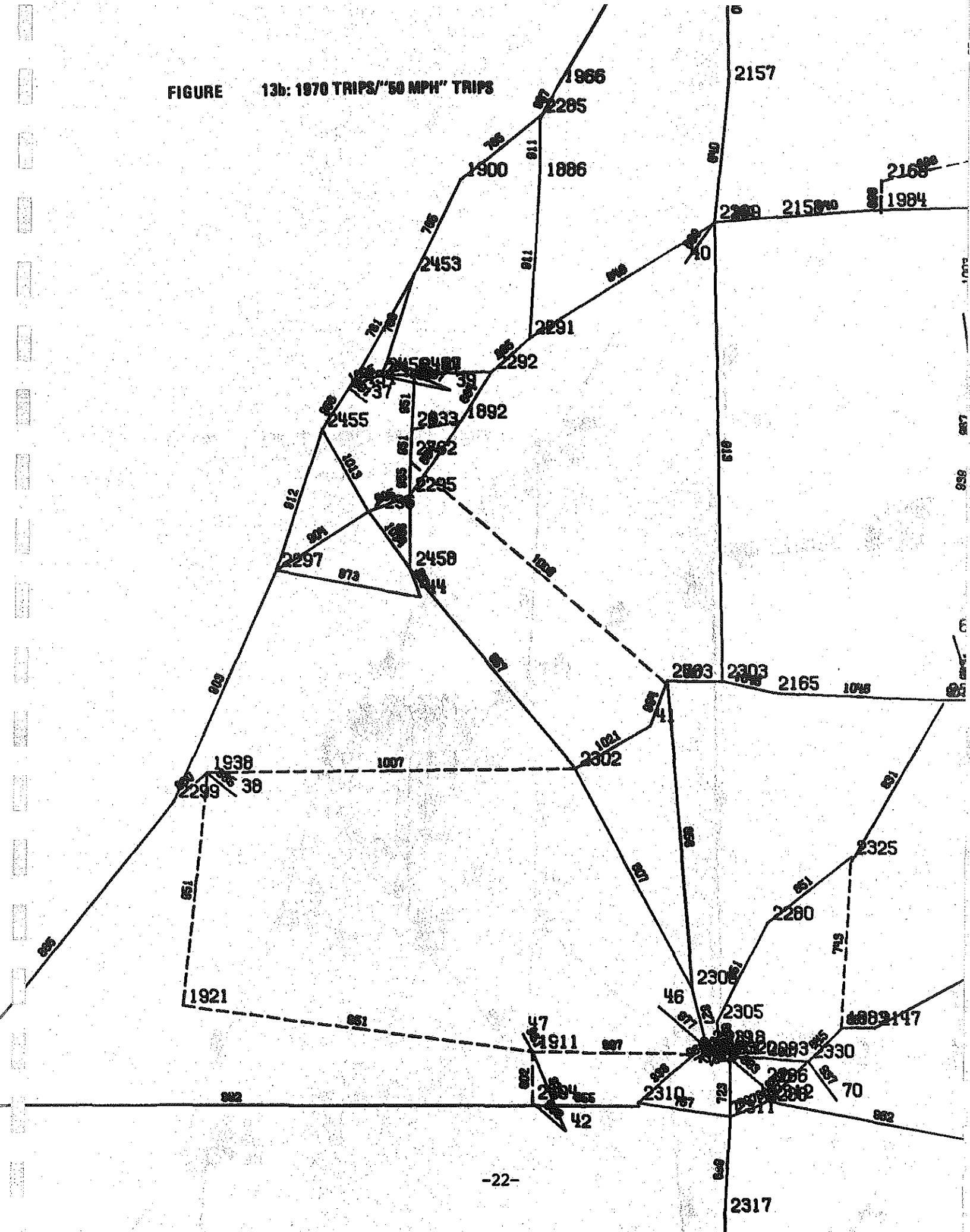
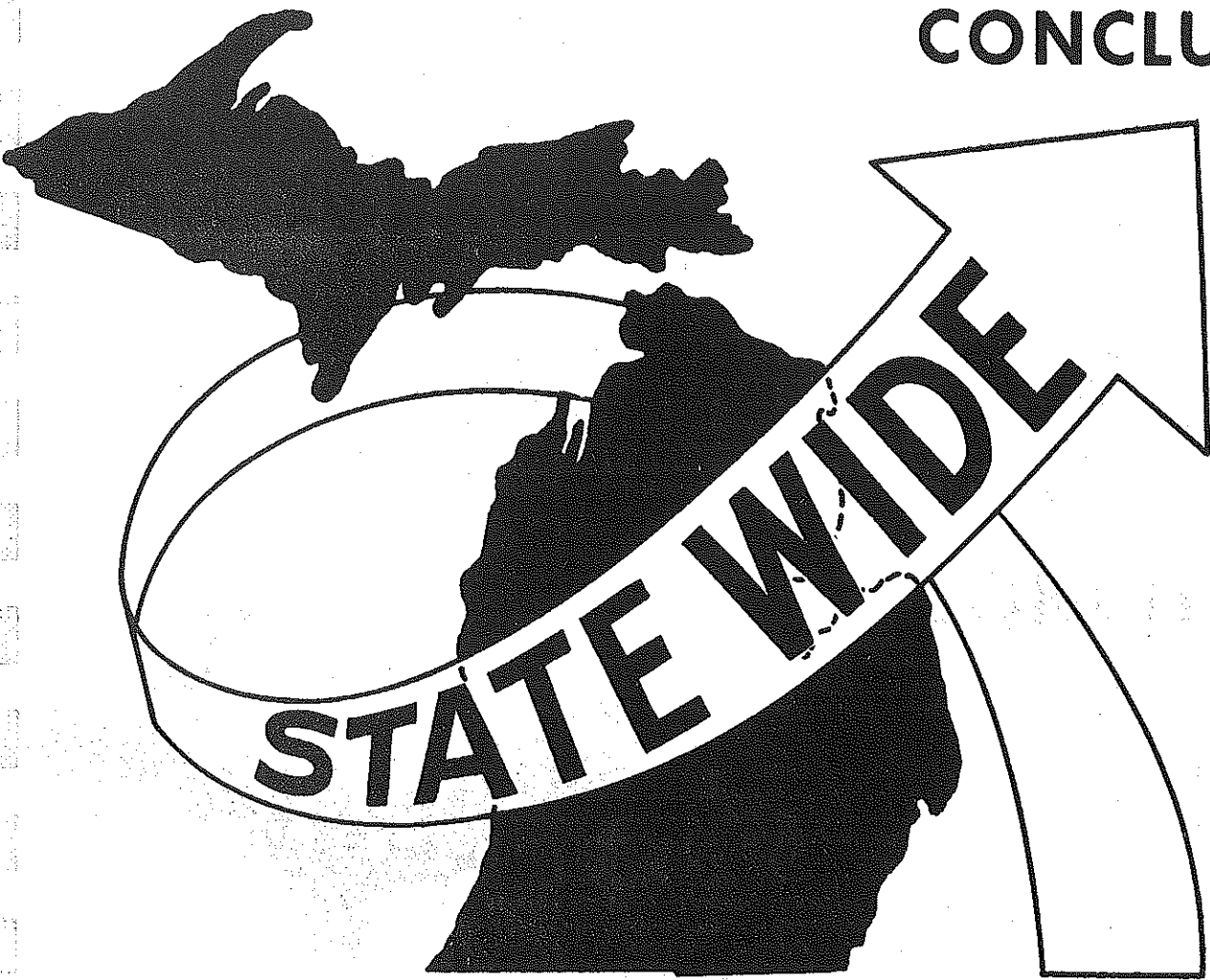


FIGURE 13b: 1970 TRIPS/"60 MPH" TRIPS



CONCLUSION



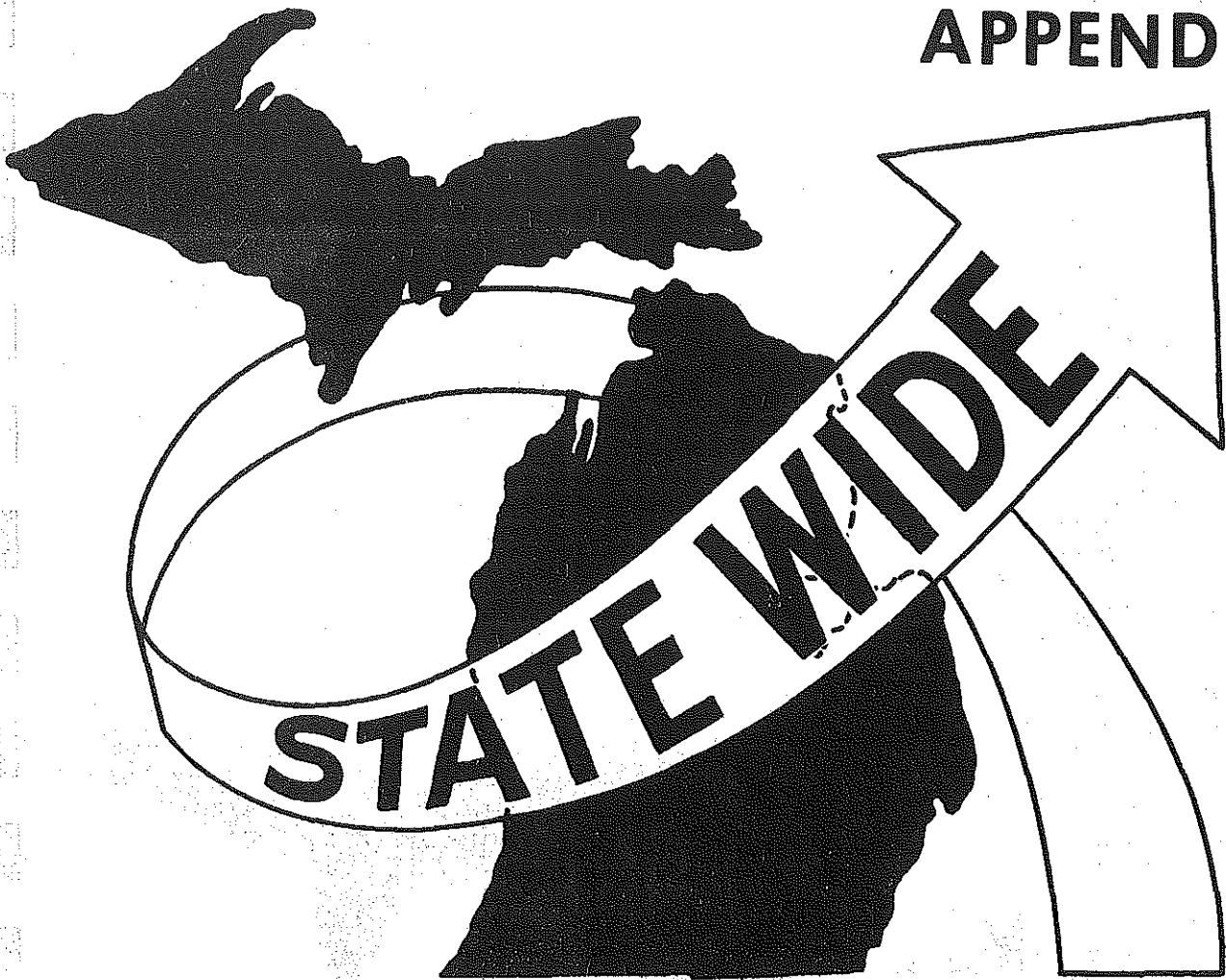
CONCLUSION

In the past, it has generally been necessary to wait for the effects of a statewide policy decision such as a reduced speed limit to occur before they can be evaluated. Using a Statewide Transportation Modeling System, some of the probable impacts of a speed reduction can be examined before the actual decision is made.

Using techniques described in this report, three impacts which until now have been very difficult to evaluate can be considered: the additional driving time necessitated, the cost of that time, and the fluctuations in number of trips which are made from each region. The results presented should be taken as representative of the type of results possible with this method. Hopefully, it may serve as a basis for similar future modeling applications.

Work is now in progress on updated trip-generation-distribution equations, reflecting recent study data. It is expected that the conclusions of this report will be solidified further when the new model is operational.

APPENDIX A



ORIGIN ZONETOTAL DRIVING TIME LOST

1	15959
2	12140
3	18370
4	18470
5	18395
6	18408
7	11999
8	11691
9	12218
10	10705
11	11053
12	12583
13	17075
14	17108
15	12479
16	12021
17	11456
18	11694
19	13127
20	13723
21	13129
22	18863
23	18829
24	18849
25	9781
26	9764
27	10370
28	8565
29	11160
30	11867
31	11964
32	11295
33	11519
34	10937
35	10919
36	10507
37	15540
38	17362
39	15664
40	15189
41	14353
42	13791
43	18166
45	16295
46	13839
47	13823
48	14020
49	12457
50	13264
51	13797
52	14228
53	12944
54	13975
55	12638
56	11443
57	12487
58	13111

ORIGIN ZONETOTAL DRIVING TIME LOST

59	11484
60	13196
61	12907
62	12612
63	11723
64	13011
65	13345
66	12481
67	13099
68	14033
69	13702
70	14084
71	13450
72	12939
73	13026
74	13242
75	13000
76	13872
77	13126
78	12983
79	18158
80	18751
81	18017
82	18012
83	24047
84	21961
85	19467
86	20503
87	22032
88	23092
89	12143
90	13008
91	11296
92	10346
93	11835
94	10296
95	10847
96	9673
97	11338
98	10770
99	9781
100	11754
101	13573
102	13552
103	20827
104	20808
105	20705
106	20711
107	20374
108	20631
109	23288
110	23255
111	23045
112	23227
113	11582
114	11593
115	11750

ORIGIN ZONETOTAL DRIVING TIME LOST

116	11500
117	11951
118	11791
119	11534
120	10784
121	11980
122	11721
123	11831
124	14409
125	17291
126	16303
127	16406
128	12132
129	11526
130	10697
131	10921
132	12347
133	11861
134	10995
135	10847
136	11336
137	11101
138	9960
139	12427
140	11937
141	11133
142	11848
143	11666
144	11878
145	12241
146	26728
147	26730
148	26094
149	25643
150	26719
151	9971
152	9914
153	9846
154	10310
155	11792
156	9988
157	10424
158	10152
159	10223
160	10456
161	12253
162	12246
163	14473
164	12190
165	13733
166	13867
167	12298
168	13747
169	18856
170	18867
171	18867
172	18916
173	18794

ORIGIN_ZONETOTAL DRIVING TIME LOST

174	18862
175	18514
176	8598
177	9441
178	8561
179	10202
180	10301
181	10378
182	9846
183	11905
184	11794
185	11835
186	12580
187	12665
188	12089
189	11523
190	11952
191	12130
192	9753
193	11645
194	10051
195	10846
196	9768
197	9700
198	10423
199	12168
200	9460
201	14944
202	14486
203	12863
204	11551
205	24285
206	24300
207	24314
208	24312
209	24355
210	10382
211	10364
212	11503
213	11826
214	10122
215	9732
216	13731
217	13481
218	13252
219	13438
220	13883
221	13793
222	13864
223	14225
224	11895
225	12764
226	12275
227	13013
228	13431
229	12078
230	12526

ORIGIN_ZONETOTAL DRIVING TIME LOST

231	12979
232	13342
233	13042
234	11814
235	12037
236	10424
237	9696
238	9246
239	9726
240	11865
241	11243
242	9642
243	9452
244	10662
245	9668
246	10390
247	10835
248	10501
249	19242
250	9402
251	9164
252	10949
253	10952
254	9617
255	9637
256	10939
257	10957
258	10507
259	9961
260	11159
261	9974
262	13965
263	12879
264	15374
265	12902
266	12901
267	13847
268	13956
269	14361
270	13846
271	13327
272	13223
273	13637
274	13310
275	14672
276	12728
277	19393
278	18462
279	19343
280	18834
281	20436
282	18849
283	18689
284	14894
285	16924
286	16043
287	14474

ORIGIN_ZONETOTAL DRIVING TIME LOST

288	15244
289	13632
290	12903
291	11870
292	10856
293	10436
294	10674
295	18398
296	18335
297	18575
298	20361
299	18487
300	18436
301	18689
302	11758
303	10755
304	11180
305	11769
306	10132
307	10207
308	9935
309	9575
310	9458
311	21106
312	21846
313	21977
314	20838
315	10335
316	9590
317	9858
318	11056
319	11706
320	10904
321	11941
322	13318
323	16479
324	17852
325	16573
326	17277
327	18008
328	16682
329	16447
330	18097
331	16821
332	17177
333	15638
334	18066
335	9508
336	9645
337	9804
338	9529
339	9731
340	9520
341	13030
342	11173
343	11442
344	11463

ORIGIN ZONETOTAL DRIVING TIME LOST

345	11606
346	11389
347	9426
348	11480
349	10691
350	12343
351	10820
352	8748
353	8711
354	8732
355	8743
356	8822
357	9197
358	13311
359	14627
360	16205
361	15691
362	15235
363	15452
364	14246
365	14060
366	14155
367	15299
368	14666
369	14578
370	13268
371	13287
372	13270
373	13388
374	14399
375	14401
376	12765
377	12019
378	12284
379	12349
380	13178
381	13093
382	13632
383	18718
384	18727
385	18712
386	19736
387	9868
388	11010
389	10810
390	9869
391	11923
392	15715
393	15732
394	16427
395	10184
396	10864
397	11818
398	10440
399	12453
400	10896

ORIGIN ZONETOTAL DRIVING TIME LOST

401	10859
402	10429
403	10214
404	14846
405	15339
406	17811
407	13554
408	12892
409	9488
410	9726
411	9417
412	11430
413	9686
414	11212
415	10372
416	9159
4174	9661
418	9143
419	10611
420	9500
421	9795
422	11624
423	12313
424	11703
425	9245
426	8541
427	8878
428	9460
429	9496
430	19894
431	19949
432	19296
433	9985
434	10966
435	11485
436	10079
437	9757
438	10264
439	9347
440	11415
441	11272
442	14240
443	17258
444	15642
445	14316
446	13618
447	12985
448	10524
449	11897
450	13441
451	10785
452	13618
453	13133
454	13361
455	13055

ORIGIN ZONETOTAL DRIVING TIME LOST

456	13167
457	12652
458	13621
459	12115
460	10021
461	10057
462	10321
463	9994
464	9969
465	10533
466	9476
467	9620
468	9992
469	10063
470	10320
471	12768
472	14030
473	15096
474	13876
475	12287
476	13068
477	14342
478	14244
479	15258
480	15035
481	16191
482	15026
483	15472
484	16114
485	15372
486	16257
487	15570
488	14229
489	14273
490	14820
491	13158
492	14813
493	17033
494	15090
495	15188
496	16756
497	15602
498	16097
499	16331
500	16885
501	15081
502	14120
503	17184
504	15467
505	10503
506	10460
507	10315
508	10355
509	17041
510	15188
511	25336
512	27156

ORIGIN ZONETOTAL DRIVING TIME LOST

513	27156
514	26729
515	28423
516	24233
517	24277
518	23258
519	24304
520	37151
521	44258
522	34923
523	29275
524	36592
525	26504
526	22444
527	25985
528	22445
529	22135
530	15826
531	13684
532	16295
533	26540
534	38644
535	15850
536	17231
537	18261
538	25145
539	23114
540	25145
541	64884
542	75385
543	106803
544	86867
545	70145
546	73636
547	73315

ZONE	\$ VALUE OF EXCESS DRIVING TIME
1	909.12
2	140.66
3	118.84
4	145.07
5	93.58
6	267.62
7	688.41
8	485.35
9	1095.67
10	533.00
11	233.60
12	1215.36
13	643.31
14	450.33
15	318.89
16	202.41
17	237.66
18	328.62
19	508.67
20	556.38
21	474.33
22	73.02
23	65.75
24	34.09
25	231.00
26	366.73
27	280.61
28	497.32
29	1413.02
30	506.74
31	1352.32
32	464.84
33	717.95
34	186.45
35	324.02
36	215.89
37	1631.84
38	1640.14
39	1144.92
40	1319.62
41	368.17
42	705.25
43	2353.27
44	1297.20
45	1530.23
46	684.53
47	369.32
48	643.18
49	162.47

ZONE

\$ VALUE OF EXCESS DRIVING TIME

50	449.29
51	322.06
52	794.78
53	440.09
54	401.49
55	1427.67
56	210.82
57	382.06
58	1330.20
59	474.88
60	705.12
61	532.73
62	517.36
63	571.64
64	511.58
65	165.65
66	726.24
67	502.86
68	278.34
69	516.72
70	600.36
71	601.74
72	196.37
73	198.20
74	511.85
75	186.14
76	133.86
77	270.89
78	362.44
79	940.82
80	619.00
81	564.68
82	661.03
83	1985.33
84	181.34
85	406.42
86	209.64
87	1044.50
88	266.11
89	465.00
90	549.94
91	337.16
92	422.51
93	270.79
94	133.71
95	277.31
96	212.44
97	317.89
98	269.54
99	148.14
100	571.77
101	250.65
102	242.51
103	308.30
104	65.33
105	63.77
106	281.51
107	58.82

ZONE

\$ VALUE OF EXCESS DRIVING TIME

108	82.57
109	299.37
110	90.37
111	72.10
112	122.28
113	308.01
114	310.90
115	273.12
116	358.86
117	1106.55
118	132.96
119	283.14
120	189.11
121	227.51
122	179.07
123	450.37
124	608.43
125	553.64
126	391.42
127	360.85
128	5850.07
129	1206.70
130	1490.01
131	976.29
132	1211.84
133	1158.15
134	316.18
135	89.23
136	680.65
137	247.92
138	414.77
139	967.09
140	2114.86
141	196.98
142	155.36
143	388.30
144	152.30
145	284.20
146	392.88
147	147.44
148	74.41
149	34.00
150	170.27
151	495.31
152	328.88
153	194.64
154	39.60
155	144.18
156	660.61
157	462.49
158	359.06
159	397.84
160	211.61
161	219.70
162	195.77
163	275.62
164	148.03
165	240.57

ZONE

\$ VALUE OF EXCESS DRIVING TIME

166	193.10
167	179.73
168	250.97
169	93.00
170	159.31
171	65.63
172	53.48
173	22.35
174	30.61
175	63.11
176	161.62
177	337.64
178	147.84
179	196.45
180	198.98
181	354.76
182	286.42
183	5334.88
184	971.33
185	554.35
186	1085.27
187	697.44
188	217.99
189	221.05
190	324.05
191	670.09
192	325.65
193	151.85
194	237.07
195	154.77
196	247.55
197	206.52
198	199.35
199	486.10
200	208.52
201	478.07
202	773.83
203	383.95
204	1163.63
205	144.36
206	125.14
207	153.30
208	54.75
209	91.33
210	684.42
211	396.18
212	210.83
213	362.83
214	147.67
215	207.84
216	1619.18
217	928.83
218	636.30
219	1265.19
220	1075.97
221	422.87
222	257.11
223	448.69
224	254.77

ZONE

\$ VALUE OF EXCESS DRIVING TIME

225	642.63
226	3004.99
227	1674.02
228	462.46
229	152.46
230	695.22
231	430.54
232	204.65
233	692.38
234	183.68
235	98.56
236	4215.64
237	445.51
238	1283.13
239	524.48
240	297.64
241	1576.83
242	429.84
243	202.79
244	412.28
245	771.67
246	601.31
247	893.05
248	2751.56
249	801.28
250	234.55
251	89.21
252	91.37
253	207.04
254	81.67
255	128.26
256	226.03
257	111.14
258	137.06
259	347.54
260	320.54
261	359.19
262	704.14
263	211.11
264	539.55
265	144.21
266	573.24
267	343.99
268	350.59
269	379.65
270	341.11
271	1068.75
272	871.30
273	655.31
274	854.87
275	1210.70
276	327.96
277	240.41
278	77.36
279	150.56
280	748.62
281	218.38
282	135.93
283	121.45

ZONE

\$ VALUE OF EXCESS DRIVING TIME

284	2267.10
285	6197.69
286	2471.67
287	1256.75
288	945.65
289	299.11
290	594.69
291	668.20
292	150.73
293	169.62
294	226.72
295	386.90
296	144.64
297	97.57
298	199.35
299	177.44
300	74.64
301	92.87
302	579.69
303	259.73
304	316.99
305	346.56
306	353.25
307	175.29
308	132.78
309	161.85
310	262.53
311	809.83
312	180.78
313	254.70
314	111.96
315	927.44
316	348.21
317	281.23
318	422.15
319	300.97
320	220.27
321	89.36
322	186.80
323	187.44
324	642.99
325	778.35
326	397.96
327	2577.55
328	584.41
329	835.34
330	630.97
331	159.75
332	425.52
333	618.54
334	260.87
335	238.06
336	365.18
337	290.80
338	194.25
339	358.03
340	228.64
341	556.40

ZONE

\$ VALUE OF EXCESS DRIVING TIME

342	1603.54
343	465.57
344	605.08
345	1097.07
346	239.57
347	178.20
348	684.43
349	335.18
350	936.54
351	725.95
352	158.70
353	170.33
354	236.63
355	147.49
356	204.79
357	246.58
358	3002.09
359	2597.22
360	5477.16
361	2233.91
362	4071.29
363	2572.76
364	1221.46
365	1436.08
366	984.64
367	1007.35
368	987.79
369	959.81
370	1638.70
371	692.65
372	394.20
373	1416.18
374	1243.84
375	603.67
376	708.57
377	666.64
378	616.18
379	213.37
380	586.35
381	208.11
382	291.39
383	158.36
384	79.11
385	185.60
386	306.30
387	169.82
388	190.60
389	166.21
390	106.47
391	489.71
392	196.26
393	235.24
394	333.84
395	534.78
396	677.87
397	398.21
398	701.60
399	1334.81

ZONE

\$ VALUE OF EXCESS DRIVING TIME

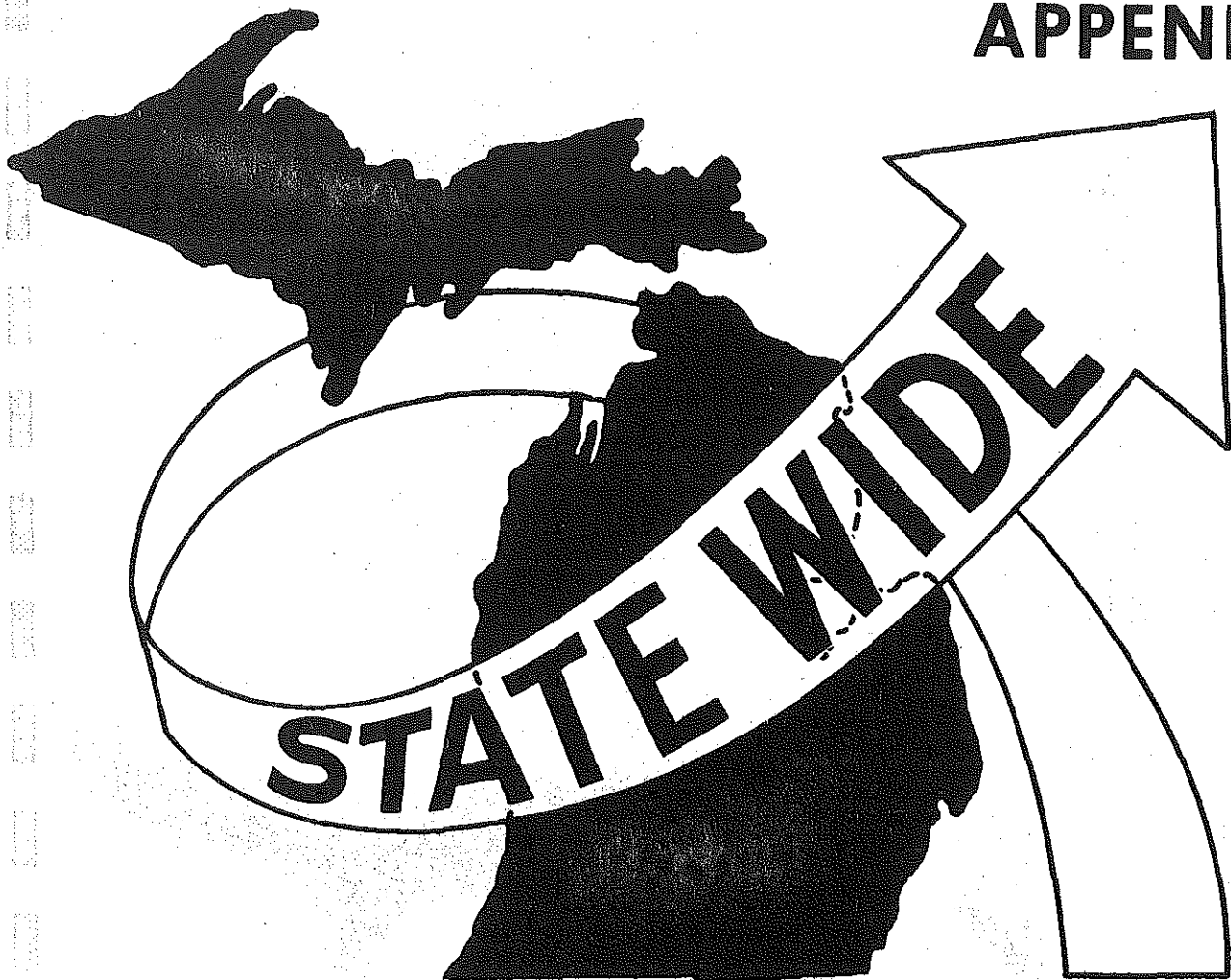
400	484.87
401	472.18
402	573.98
403	331.17
404	641.37
405	244.79
406	421.56
407	1340.66
408	793.76
409	1428.04
410	213.40
411	617.21
412	542.89
413	240.63
414	285.99
415	614.47
416	146.84
417	300.94
418	148.28
419	98.87
420	221.32
421	247.49
422	517.46
423	306.89
424	254.19
425	165.41
426	143.76
427	120.04
428	170.20
429	183.46
430	254.01
431	82.97
432	230.56
433	464.20
434	157.06
435	502.61
436	225.92
437	180.38
438	93.93
439	55.17
440	161.50
441	213.44
442	2862.35
443	767.94
444	695.63
445	321.42
446	355.02
447	342.51
448	205.65
449	242.30
450	341.16
451	139.53
452	1055.14
453	346.60
454	430.80
455	358.66
456	364.71
457	723.54

ZONE

\$ VALUE OF EXCESS DRIVING TIME

458	326.74
459	463.02
460	92.78
461	110.38
462	193.55
463	118.61
464	82.78
465	241.96
466	159.83
467	101.86
468	163.96
469	125.62
470	73.57
471	402.74
472	738.48
473	834.08
474	537.67
475	314.42
476	546.77
477	218.83
478	1166.58
479	3615.87
480	401.76
481	1121.88
482	904.75
483	1361.38
484	1829.85
485	378.50
486	902.20
487	581.31
488	219.90
489	178.83
490	802.75
491	287.77
492	488.36
493	12692.27
494	7101.47
495	13339.10
496	11444.04
497	5792.51
498	2201.26
499	2603.77
500	2791.19
501	2100.89
502	1672.78
503	2597.48
504	1627.76
505	404.76
506	177.48
507	99.77
508	130.93

APPENDIX B



ZONE	<u>TRIPS AT 70 M.P.H SPEED LIMIT</u>	<u>TRIPS AT 50 M.P.H SPEED LIMIT</u>
1	6032	5357
2	1802	1940
3	4420	4510
4	1106	1144
5	2308	2350
6	2477	2468
7	12094	12266
8	5050	5018
9	10280	9430
10	6388	6046
11	3424	3466
12	10127	8974
13	16874	16304
14	15610	15388
15	4034	3838
16	4338	4478
17	5862	6006
18	7530	7746
19	9406	9358
20	5664	5290
21	7658	7752
22	2564	2576
23	3334	3368
24	1526	1560
25	14464	14870
26	13646	13951
27	6868	6986
28	11346	11361
29	47487	47205
30	23458	24092
31	29488	27698
32	12348	12258
33	10176	9612
34	6164	6758
35	8950	8882
36	4887	4647
37	33174	32876
38	17722	15680
39	25282	25520
40	15498	13926

ZONE

TRIPS AT 70 M.P.H.
SPEED LIMITTRIPS AT 50 M.P.H.
SPEED LIMIT

41	8898	8954
42	19122	17205
43	18152	13656
44	18884	17390
45	42171	36374
46	19748	19286
47	12554	11938
48	13546	13254
49	2876	2782
50	7684	7338
51	7854	7870
52	9860	9374
53	7760	7594
54	8486	8464
55	33156	31826
56	3752	3614
57	8899	8824
58	24388	22588
59	20840	21352
60	12092	11036
61	11036	10218
62	14176	13882
63	14406	13588
64	9026	8494
65	2028	1760
66	14148	13578
67	9372	8556
68	9620	9694
69	12756	12410
70	13954	13072
71	8176	6936
72	3298	3176
73	3898	3822
74	7076	6722
75	12078	12202
76	2164	2178
77	6428	6416
78	12012	12156
79	13660	13786
80	3944	3892
81	3722	3616
82	11808	11910
83	19586	16926
84	2710	2857
85	1860	1970
86	1002	1036
87	6622	5698
88	3410	3294
89	5752	5276
90	5876	5808
91	5582	5716
92	14680	14394
93	7232	7336

ZONE

TRIPS AT 70 M.P.H.
SPEED LIMITTRIPS AT 50 M.P.H.
SPEED LIMIT

94	4706	4770
95	6032	5892
96	8672	8042
97	9888	10122
98	7276	7308
99	6540	6511
100	11758	14888
101	5360	5338
102	4462	4518
103	15680	15596
104	9094	9084
105	2324	2326
106	10164	10092
107	612	594
108	3146	3158
109	13084	12792
110	6698	6652
111	1472	1482
112	4138	4056
113	9362	9144
114	7458	7162
115	5784	5500
116	6642	6352
117	32310	33152
118	3872	3896
119	5790	5536
120	5798	5388
121	6882	6856
122	5484	5504
123	12670	12332
124	16196	16252
125	2600	2701
126	7720	7844
127	9218	9296
128	10118	96906
129	17834	15594
130	24744	23686
131	19598	19318
132	28066	28404
133	40730	42516
134	18940	19574
135	6420	6617
136	31416	33150
137	6252	6040
138	8104	7707
139	17244	16849
140	27702	25562
141	9404	9622
142	4984	4920
143	4784	4390
144	4072	4047
145	4820	4548
146	15268	15340

ZONE

TRIPS AT 70 M.P.H.
SPEED LIMITTRIPS AT 50 M.P.H.
SPEED LIMIT

147	4514	4464
148	1236	1166
149	1604	1648
150	6150	6176
151	30924	31322
152	11146	11024
153	10694	10842
154	1502	1510
155	9050	9122
156	15256	15212
157	7194	6958
158	9752	10030
159	5716	5426
160	5228	5286
161	10322	10426
162	8378	8534
163	4406	4284
164	7742	7836
165	4476	4488
166	5828	5828
167	4434	7500
168	5512	5400
169	23578	23616
170	6440	6440
171	6080	6088
172	1736	1788
173	9042	9046
174	13206	13212
175	3042	3068
176	7876	7601
177	3664	3701
178	5528	5415
179	6278	6354
180	3610	3524
181	5378	5036
182	4828	4904
183	103568	100957
184	32852	33869
185	19052	19586
186	19522	17466
187	11564	10931
188	4626	4722
189	4598	4394
190	5150	4758
191	10510	9762
192	11086	10934
193	2570	2200
194	5740	5702
195	3822	3518
196	7734	7708
197	6818	6774
198	5576	5666
199	5518	4718

ZONE

TRIPS AT 70 M.P.H.
SPEED LIMITTRIPS AT 50 M.P.H.
SPEED LIMIT

200	6140	6200
201	8274	8226
202	13630	13418
203	3850	4012
204	11658	11374
205	3450	3438
206	1288	1278
207	2110	1998
208	1114	1032
209	2002	2026
210	18016	17580
211	7120	6622
212	4274	4224
213	5496	5230
214	7468	7694
215	5328	5390
216	39386	40380
217	25000	25972
218	12368	12400
219	28306	27236
220	21004	20438
221	10174	10270
222	5722	5694
223	5894	5220
224	4826	4526
225	9666	9046
226	54644	54455
227	32750	32392
228	13348	13870
229	4852	4958
230	21506	22146
231	9378	9266
232	3542	3314
233	14258	14464
234	3482	3372
235	1820	1824
236	94608	92526
237	16142	16654
238	27530	27284
239	16102	16444
240	7186	7294
241	28332	26758
242	12142	12004
243	7648	7696
244	9970	9980
245	11834	11386
246	17420	17216
247	28786	29703
248	69980	68168
249	1596	1590

ZONE	TRIPS @ 70 M.P.H. SPEED LIMIT	TRIPS @ 50 M.P.H. SPEED LIMIT
250	4118	4178
251	1526	1518
252	4730	4744
253	7444	7570
254	3920	3990
255	5404	5472
256	6000	5852
257	4556	4612
258	4820	4818
259	3840	3974
260	4094	4056
261	15606	15808
262	19268	19380
263	8572	8846
264	9300	9056
265	4300	4352
266	16428	16824
267	3826	3758
268	9394	9476
269	5886	5514
270	5324	5086
271	10330	9001
272	8006	7030
273	5982	4826
274	9904	8904
275	12138	9630
276	4850	4768
277	3798	3910
278	1660	1692
279	3026	3092
280	4854	3832
281	2564	2696
282	852	874
283	1766	1806
284	58286	56576
285	137898	126256
286	141550	146643
287	57412	57955
288	20182	19652
289	11598	11780
290	11594	11484
291	8930	9192
292	2124	1982
293	3946	3992
294	5538	5710
295	21362	21404
296	14058	14168
297	4388	4416
298	6490	6546
299	9344	9446

<u>ZONE</u>	<u>TRIPS @ 70 M.P.H. SPEED LIMIT</u>	<u>TRIPS @ 50 M.P.H. SPEED LIMIT</u>
300	6272	6352
301	2162	2184
302	12136	12592
303	5330	5394
304	4076	4166
305	10448	10626
306	16030	15976
307	12586	12768
308	3660	3780
309	5147	5184
310	4302	4028
311	9738	9262
312	2284	2162
313	4328	4866
314	3440	3814
315	34950	35160
316	9328	9560
317	16116	16523
318	8649	8516
319	4846	4832
320	3160	3180
321	1652	1702
322	2742	2800
323	37316	35330
324	19538	18641
325	12676	11075
326	5260	4514
327	28894	20560
328	12092	11722
329	22696	22650
330	7148	5952
331	8894	9208
332	4472	3756
333	16522	15960
334	3134	2766
335	23626	24160
336	6803	6880
337	7558	7726
338	19948	20418
339	6974	6884
340	6526	6732
341	3776	3866
342	41082	41818
343	8036	8378
344	16584	16678
345	27818	27638
346	5730	5838
347	5358	5536
348	12038	11648
349	9208	9246
350	11470	11062

<u>ZONE</u>	<u>TRIPS @ 70 M.P.H. SPEED LIMIT</u>	<u>TRIPS @ 50 M.P.H. SPEED LIMIT</u>
351	14650	13756
352	6304	6338
353	3878	3966
354	6094	6206
355	4928	4732
356	5862	6036
357	5978	6160
358	94839	89976
359	87820	86298
360	153766	147716
361	77788	75353
362	94418	87750
363	44754	40178
364	32690	31932
365	23914	21010
366	43980	44530
367	31032	29527
368	30056	28665
369	23730	21357
370	66364	66535
371	10274	9061
372	8238	7606
373	23730	21533
374	24950	22923
375	14586	13776
376	6400	6090
377	6930	7114
378	4828	4716
379	3216	3318
380	6568	6254
381	2114	2192
382	2354	2312
383	2834	2862
384	2704	2746
385	3418	3428
386	3676	3622
387	6034	6128
388	3434	3503
389	3522	3554
390	2380	2336
391	3272	3386
392	4956	4772
393	4868	4750
394	2924	2572
395	12536	11886
396	10648	10158
397	6068	5504
398	12134	12048
399	16348	14512
400	9954	9784

<u>ZONE</u>	<u>TRIPS @ 70 M.P.H. SPEED LIMIT</u>	<u>TRIPS @ 50 M.P.H. SPEED LIMIT</u>
401	9992	9732
402	12108	11220
403	7342	7240
404	4856	4680
405	3370	3562
406	4248	3830
407	8674	8746
408	5826	5890
409	69012	69640
410	5094	4882
411	49096	50239
412	16764	16330
413	13634	13910
414	5944	5444
415	12216	11444
416	5630	5748
417	9080	9226
418	3250	3276
419	4652	4650
420	6640	6709
421	7770	7860
422	6752	5922
423	7016	7367
424	7026	7317
425	3912	3924
426	5646	5711
427	3824	3894
428	5322	5373
429	5270	5359
430	2044	2014
431	854	860
432	1070	1056
433	21186	21326
434	3620	3578
435	8194	7821
436	12226	12380
437	8824	8400
438	3328	3446
439	2662	2703
440	2002	1760
441	3342	3114
442	46440	46286
443	15368	16773
444	11334	11920
445	8594	9019
446	8618	8448
447	7910	8548
448	4640	4516
449	5676	5412
450	5308	4712

<u>ZONE</u>	<u>TRIPS @ 70 M.P.H. SPEED LIMIT</u>	<u>TRIPS @ 50 M.P.H. SPEED LIMIT</u>
451	5094	5190
452	16798	15342
453	5644	5364
454	7402	7134
455	7146	7050
456	6336	5970
457	10018	9438
458	7294	7152
459	8526	8382
460	7908	7938
461	7032	7088
462	7098	7141
463	4862	4878
464	3648	3692
465	7448	7434
466	8724	8818
467	3732	3808
468	6826	6888
469	7796	7875
470	3112	3163
471	9314	9264
472	10494	9768
473	15028	14698
474	12600	12154
475	6530	6728
476	9332	8720
477	4588	4540
478	14476	13490
479	56118	52542
480	11989	11796
481	18442	17046
482	12802	11722
483	40642	40804
484	39398	36990
485	14096	14170
486	15748	11372
487	11226	10848
488	4048	4040
489	3570	3556
490	9418	8320
491	5674	5660
492	11544	10978
493	268882	260970
494	160000	251353
495	435810	424592
496	361776	357904
497	149264	144508
498	75452	75881
499	66234	62582
500	50744	47010

ZONETRIPS @ 70 M.P.H.
SPEED LIMITTRIPS @ 50 M.P.H.
SPEED LIMIT

501	108070	110054
502	113978	118456
503	92458	92167
504	138194	142766
505	9806	9782
506	4840	4836
507	2514	2436
508	4762	4870