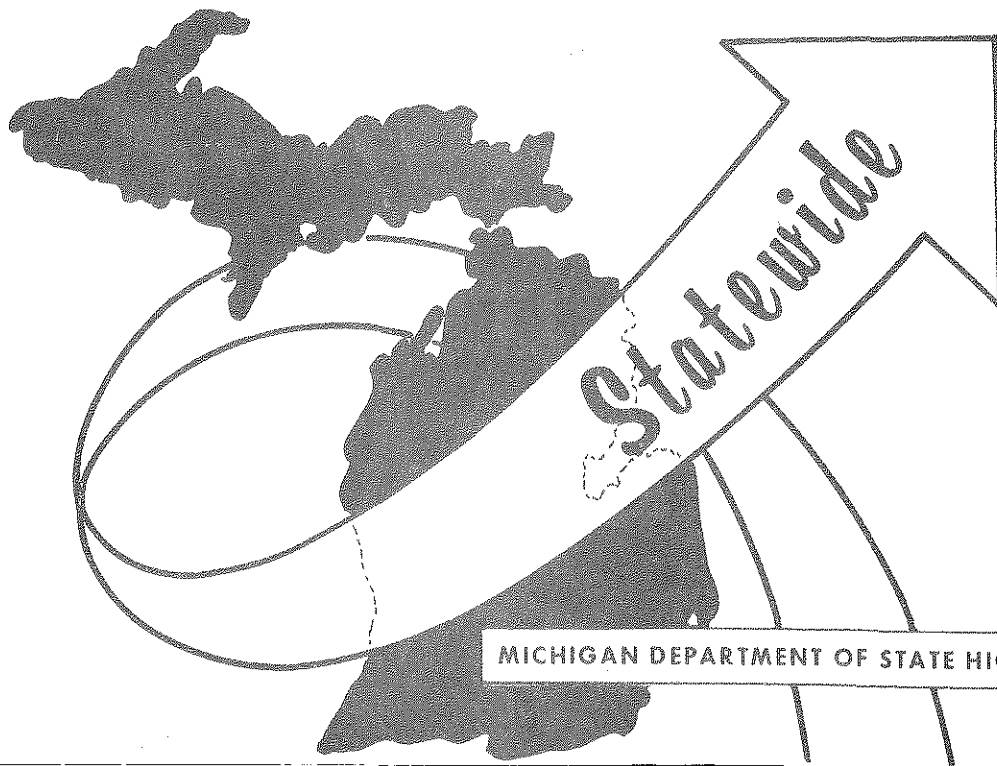# Statewide ★
Transportation
Analysis &
Research

STATEWIDE PROJECT
REPORT:

**REGIONAL PARK
PROXIMITY ANALYSIS**

STATEWIDE STUDIES
Report no. 6
FEBRUARY, 1973

Statewide

MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

MICHIGAN DEPARTMENT

OF

STATE HIGHWAYS AND TRANSPORTATION

BUREAU OF TRANSPORTATION PLANNING

STATEWIDE PROJECT
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STATE HIGHWAY COMMISSION

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JOHN P. WOODFORD, STATE HIGHWAY DIRECTOR

February 26, 1973

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

Dear Mr. Cryderman:

The Transportation Survey and Analysis Section of the Trans-
portation Planning Division is pleased to present a report
entitled "Regional Park Proximity Analysis." The report is an
example of the use of the Proximity Analysis process in
determining the social impacts of a highway system. It also
illustrates a possible means of increasing interdepartmental
participation in the transportation planning process by
demonstrating impacts upon facilities of other units of state
government.

This report shows the relation of population to the site of
a proposed Huron-Clinton Metropolitan Authority regional park
(Mill Creek), in Washtenaw County. The analysis was con-
ducted with the cooperation of Mr. William Colburn of the
Department of Natural Resources.

Sincerely,

Keith E. Bushnell
Engineer of Transportation
Survey and Analysis Section

NOTE

More detailed urban and regional modeling efforts, such
as that underway at SEMCOG (Southeast Michigan Council of
Governments), typically add "terminal times" to zone-to-zone
travel times. Terminal time is the average additional time
necessary to reach one's ultimate destination once the centroid
of a zone has been reached. For example, a shopper driving
to a city must spend time finding a parking place and walking
to a store. This is an important assumption, because in the
densely-populated southeast region of Michigan, the amount of
population contained within a given driving time is very
sensitive to the inclusion or deletion of terminal times.

No terminal times are used in this analysis. However, the
reader should be aware that the same process could have been
rerun with terminal times included with modest additional
effort.

Table Of Contents

INTRODUCTION
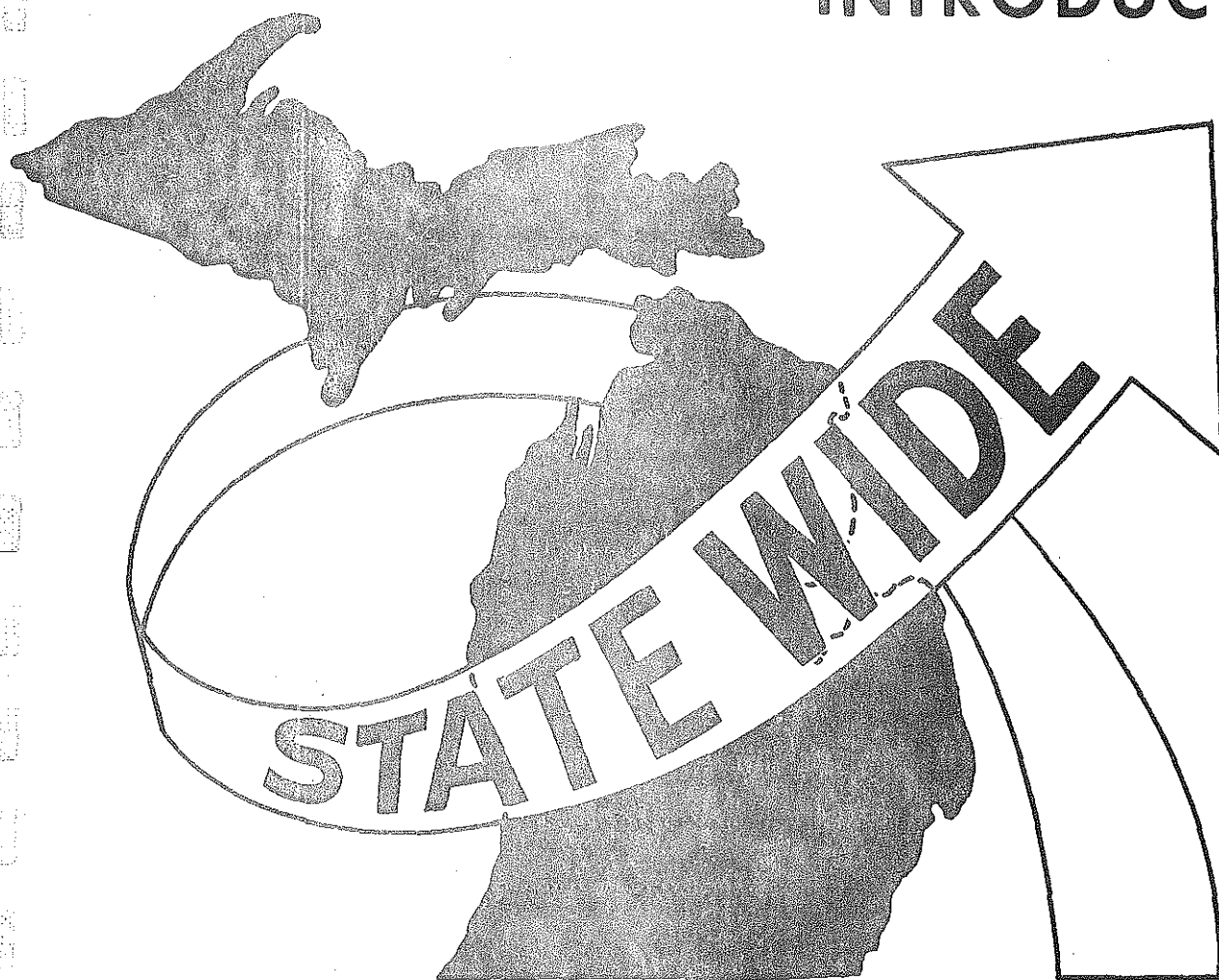
Introduction

In accordance with the Federal Aid Highway Act of 1970, highway agencies are required to monitor the social impacts of any proposed Federal aid transportation plans. To that end the Statewide Studies Unit has developed a process called Proximity Analysis which can measure the concentration of any socio-economic characteristic about a region of interest. This process could be used to facilitate greater interdepartmental cooperation in the planning process, resulting in decreased duplication of effort and consequent increased efficiency in allocating monetary and human resources.

As a test of this process, it was decided to consider a real situation: The possible location of a new regional (Huron-Clinton Metropolitan Authority) park in Washtenaw County. The analysis was done with the cooperation of Mr. William Colburn of the Department of Natural Resources.

The output of the analysis process takes two forms. First, the routes leading from the region of the state park are depicted in the form of a computer plot. This plot shows the shortest routes from the park to the other analysis subareas or "zones" into which Michigan has been divided (see Figure 1). Average driving times were accumulated on each link of each route and expressed in hundredths of a minute. Second, the population residing within 15, 30, 45, 60, 75, 90, and 120 minutes are summarized by the Proximity Analysis program. This second output serves as an indicator of the potential demand on the proposed park. The summary is done first for Michigan as a whole, then for only the people living in the counties composing the Huron-Clinton Metropolitan Authority (HCMA): Livingston, Macomb, Oakland, Washtenaw, and Wayne. All populations are 1970 data.

ANALYSIS ZONE SYSTEM

STATE WIDE
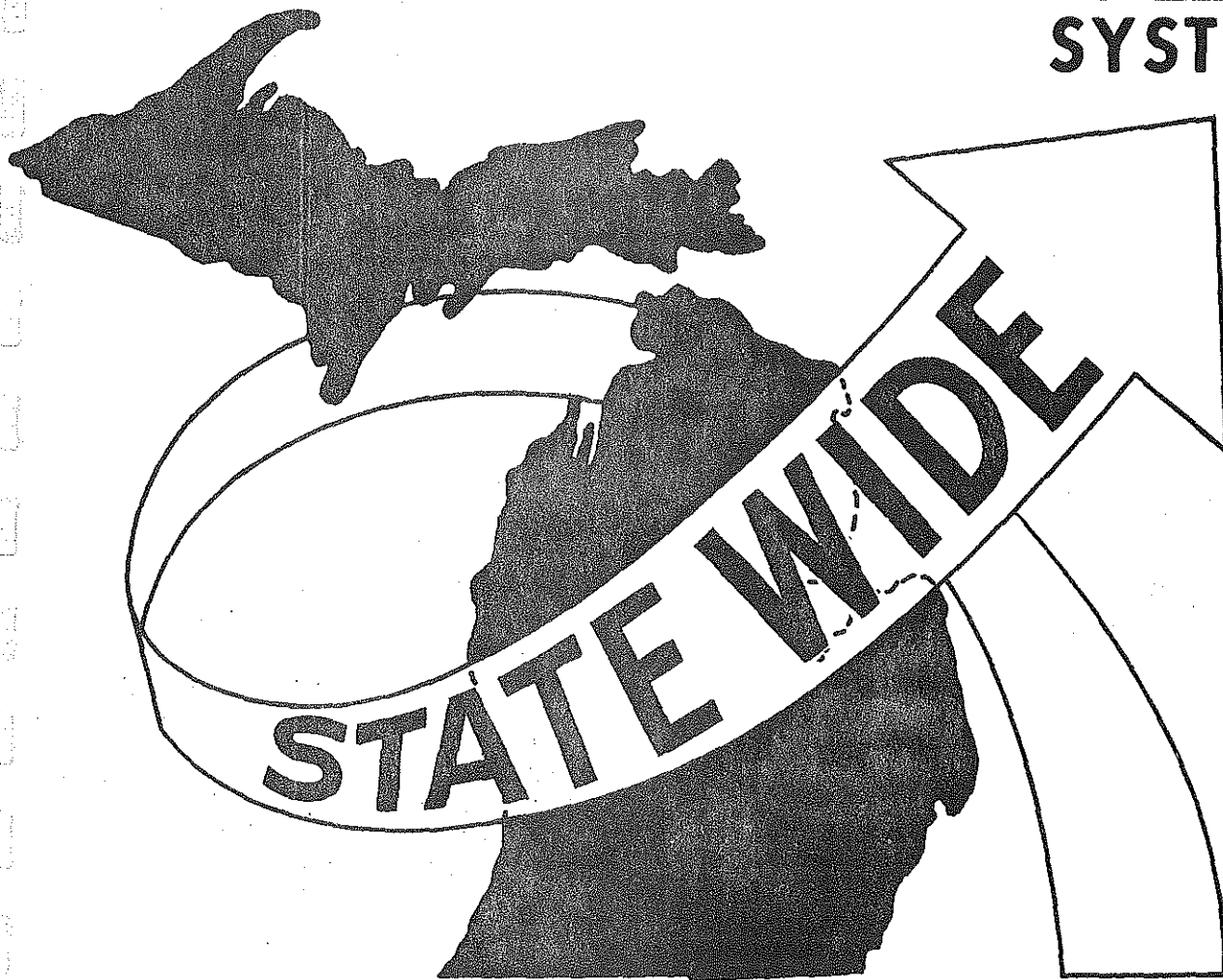
Analysis Zone System

Figure 1 shows the 508 instate zones of the 547-zone system. Only these zones were used in the analysis, because the outstate zones are very large (see Figure 2) and the shortest time path to Indiana, for instance, means little in this context. Figure 3 shows the proposed location of the park on a map of Washtenaw County.

The zone-to-zone travel times were calculated on the network shown in Figure 4. This is a plot of all links in the system, as contrasted with the plots in the next section of selected paths from the zone of the proposed park to all other zones.
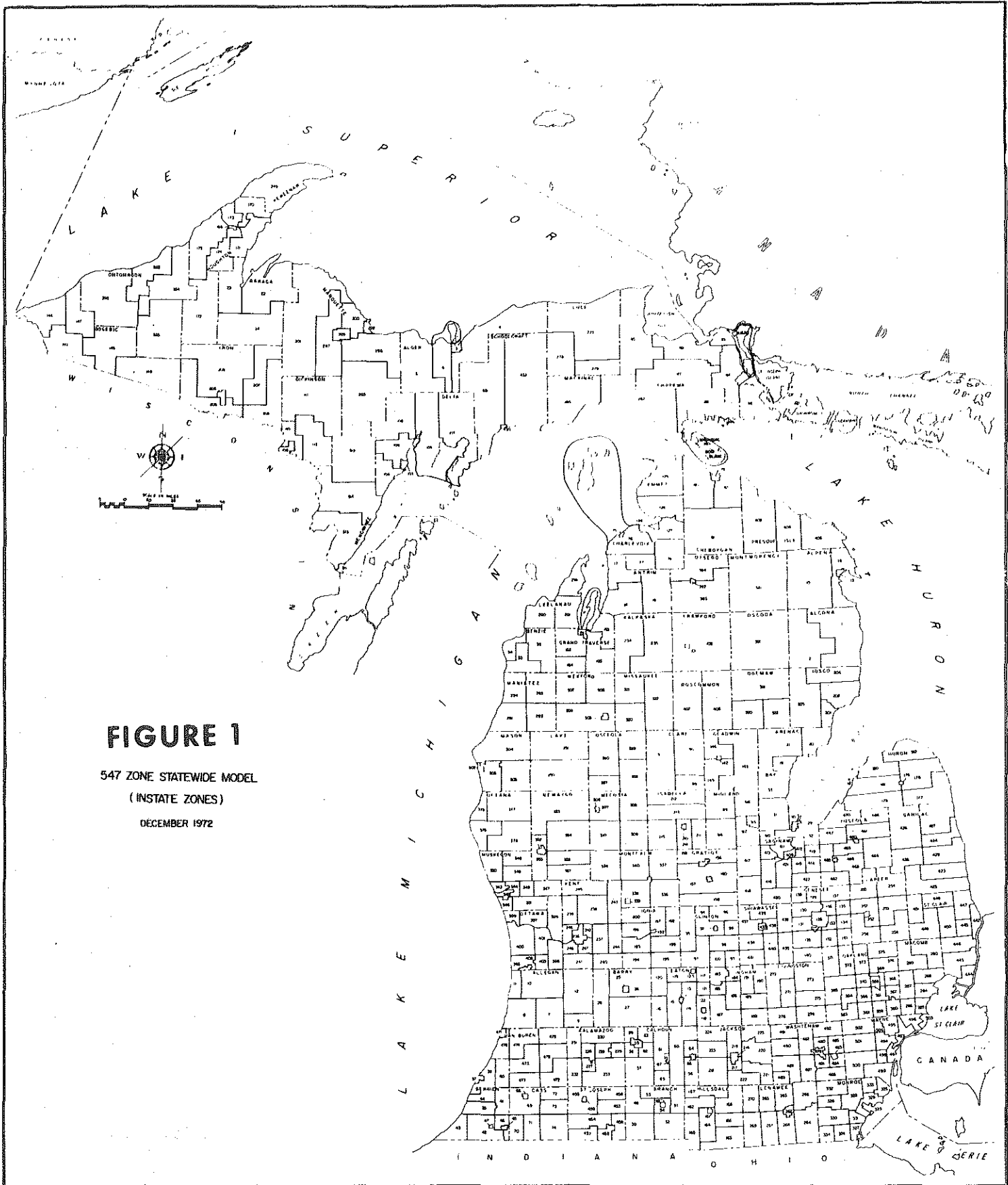
FIGURE 1

547 ZONE STATEWIDE MODEL

(INSTATE ZONES)

DECEMBER 1972

ONTARIO
511

MINNESOTA
545

513

514

515
520
514
516
518
517 519

521
WISCONSIN

522

524

523

512

510

509

NEW YORK
547

MICHIGAN

IOWA
544

525

ILLINOIS
526

528 529 530 531 532 535 536 537

539

533

538

OHIO
540

PENNSYLVANIA
546

INDIANA

534

WEST
VIRGINIA
541

MISSOURI
543

527

KENTUCKY
542

FIGURE 2

647 *ZONE TRAFFIC FORECASTING SYSTEM*

OUTSTATE ANALYSIS ZONES

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRANSPORTATION PLANNING DIVISION
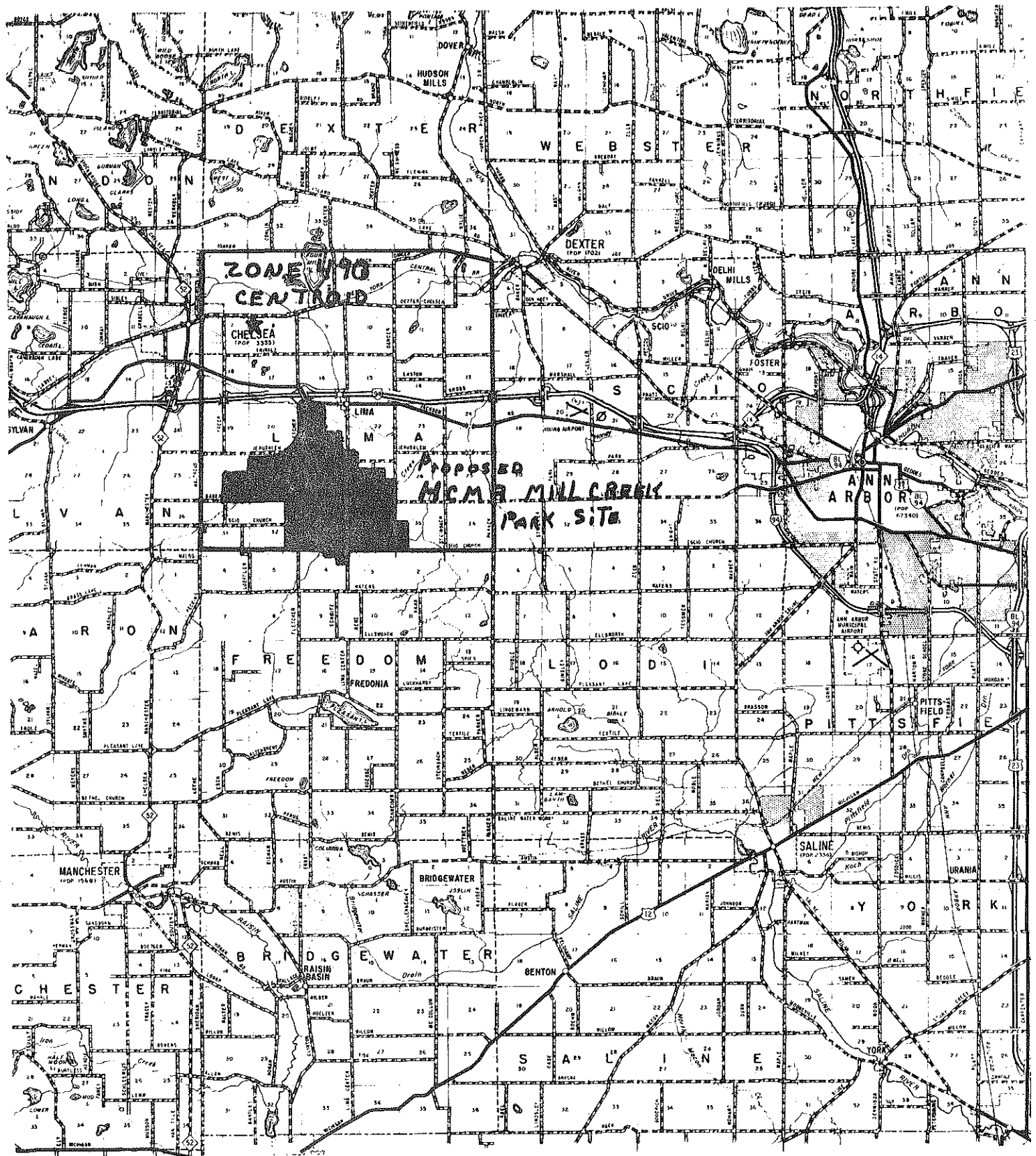STATEWIDE STUDIES UNIT

FIGURE 3

WASHTENAW COUNTY

FIGURE 4
547 ZONE NETWORK PLOT
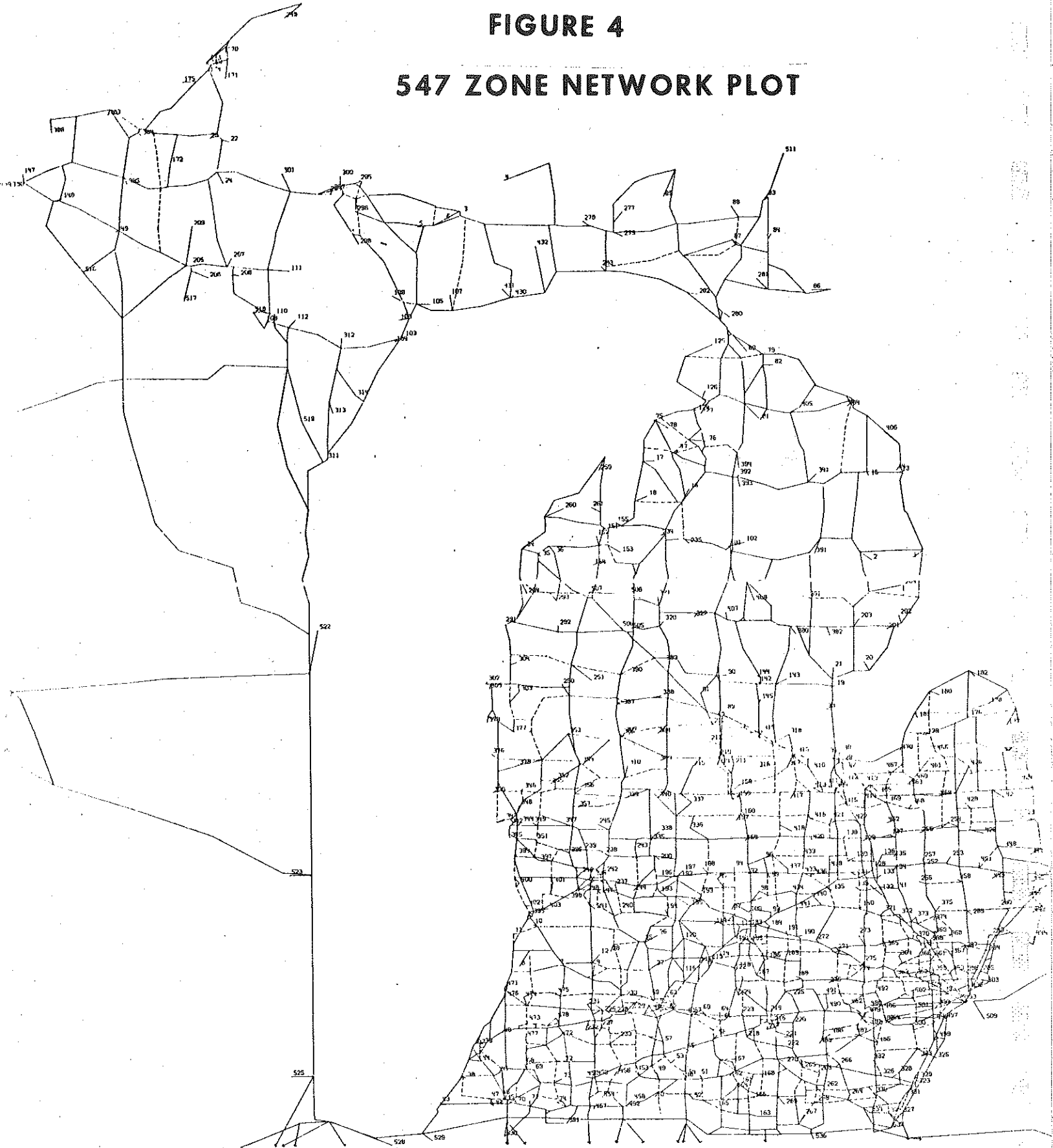
CONSIDERATIONS
AND ASSUMPTIONS
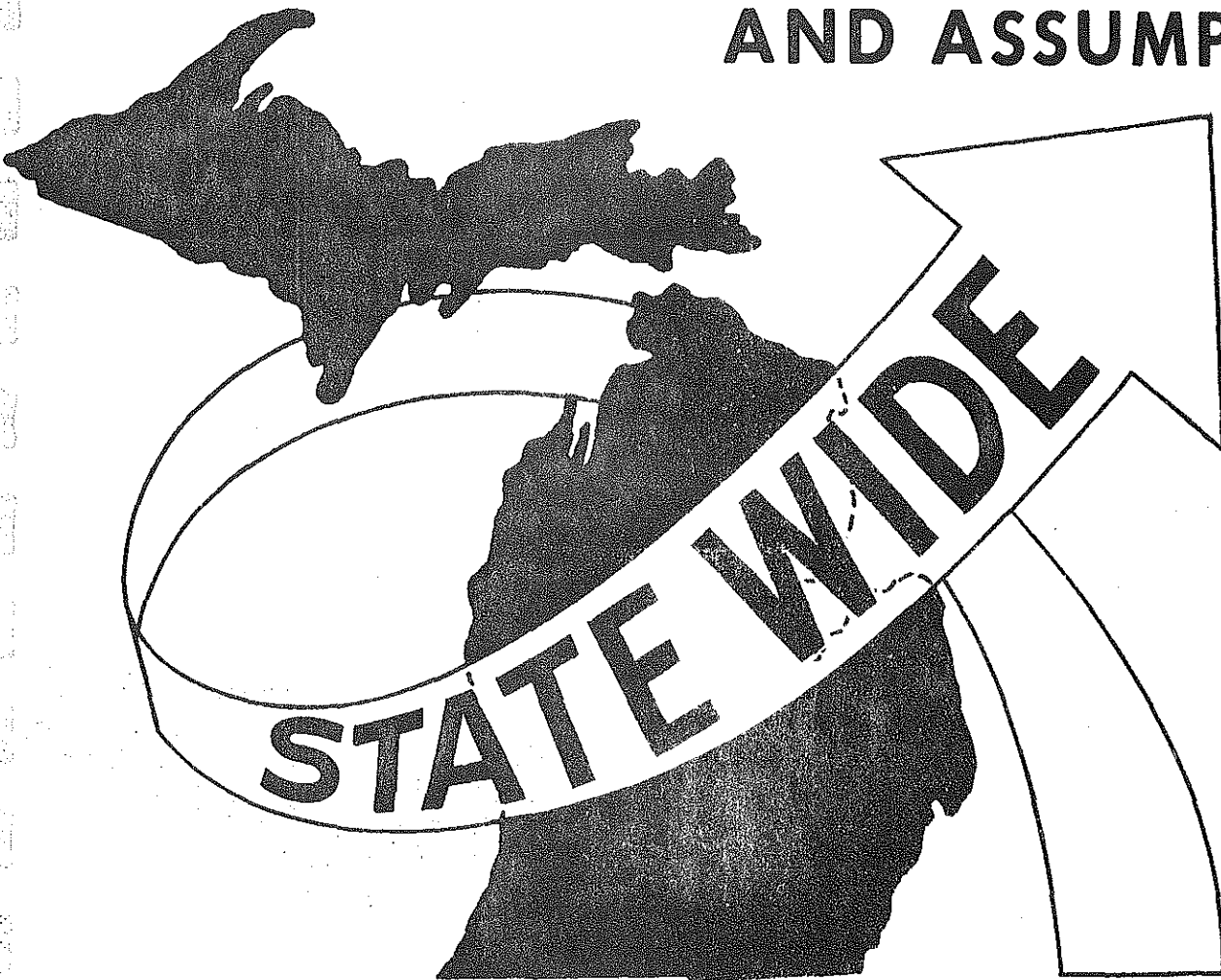
STATE WIDE

Considerations And Assumptions

Using the 547-zone Statewide Traffic Forecasting Model network, "trees", or minimum-time paths, were created from the proposed park site to every other zone in the system. These paths were than plotted using a CALCOMP plotter. Before reading the plots, however, a user unacquainted with the model should familiarize himself with certain assumptions of the process.

First, the network used includes only the state trunkline system and certain selected secondary roads, because the level of detail of the 547 zone system is not sufficient to support a richer highway system.

Second, the time needed to traverse a given link is derived from the length of the link and the average driving time on the link as determined by MDSH speed studies. It cannot be emphasized too strongly that the speed on a link is not the speed limit on that link; rather, it is the effective speed for all traffic on that link.

Third, all travel times are computed utilizing a given point within each zone, referred to as a centroid. The proposed Mill Creek park lies within zone 490, the centroid for which is north of, and 2.91 minutes from, I-94. The proposed park site is about two miles southeast of this centroid, south of I-94. Thus, travel times calculated are not those from the precise location of the park.

However, any difference between travel times shown and the true travel times from the park site is roughly of the order of two minutes (see Figure 3).

SELECTED TREE
PLOT

STATE WIDE
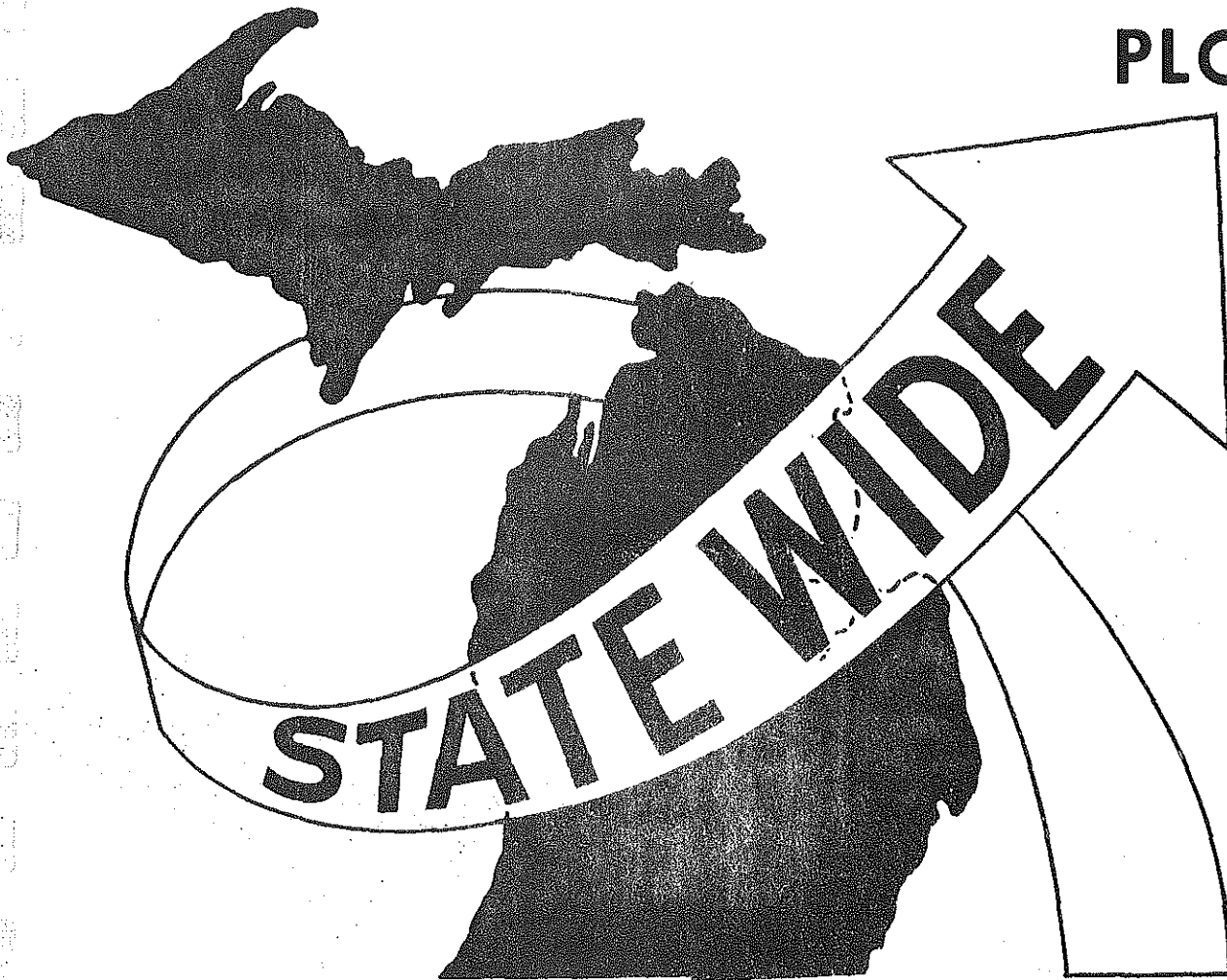
Selected Tree Plot

Figure 5 is a plot of the shortest time paths from the proposed park site, indicated by a star, to every other zone in the system. The number along a link is the cumulative time in hundredths of a minute, needed to travel from the zone of origin (the park site) to the end of that link farthest from the proposed park. For example, consider the following blow-up of a portion of the tree for zone 490:
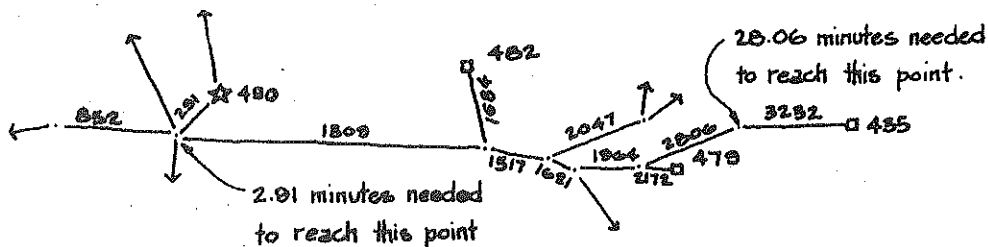
KEY

☆ – Beginning point for "Tree"

• – Node

482 ◻ – Centroid and zone number

FIGURE 5

ZONE 490 TREE PLOT

ZONE 490

PROPOSED
MILL CREEK
REGIONAL PARK

ANN
ARBOR
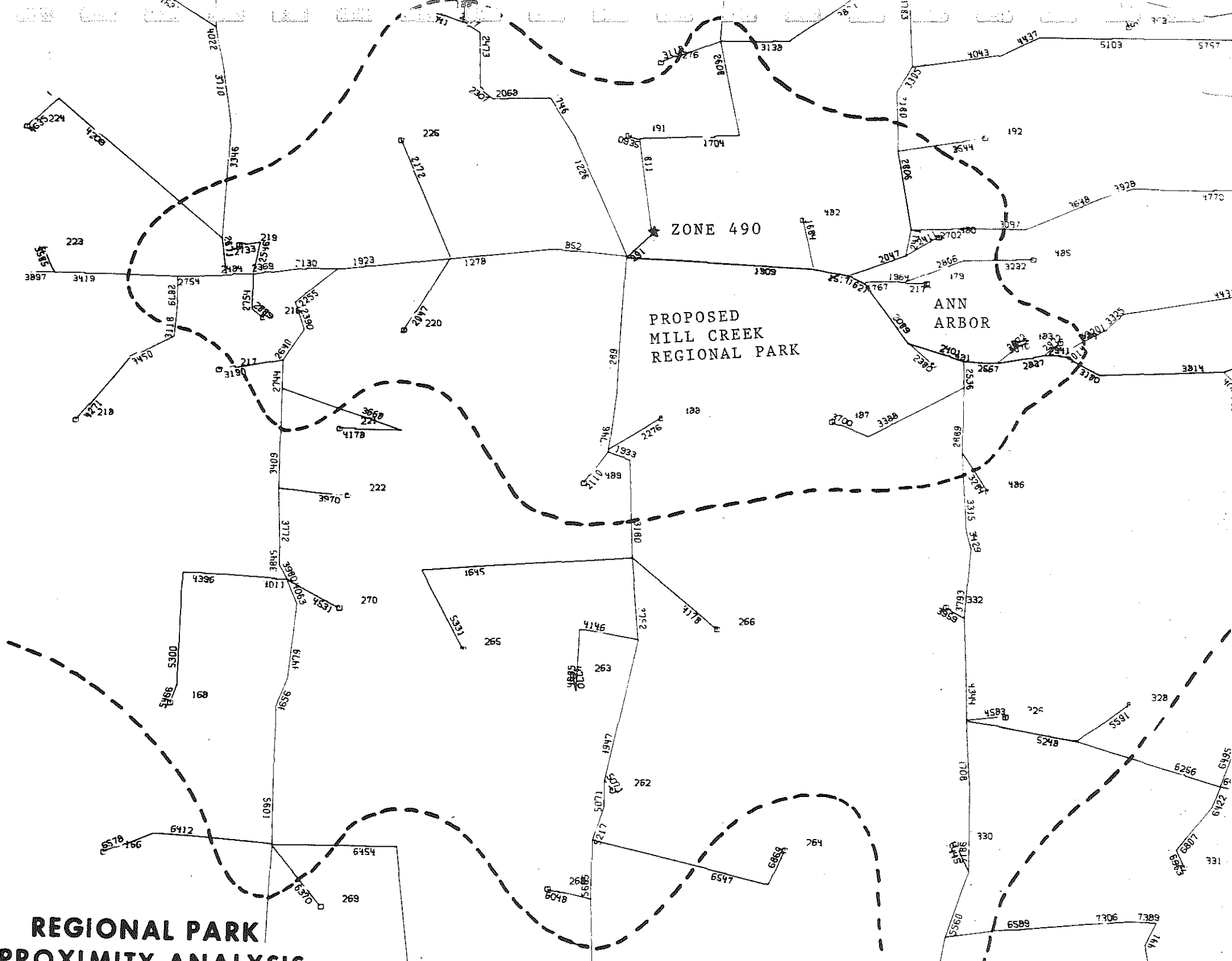
REGIONAL PARK
PROXIMITY ANALYSIS

PROXIMITY ANALYSIS

STATE WIDE

Proximity Analysis

Considering the proposed park site as a reference point, the program uses the skimmed tree for zone 490 to determine the accumulated 1970 population of all zones having their centroids within 0-15, 15-30, 30-45, 45-60, 60-75, 75-90, and 90-120 minutes driving time away. It also specified cumulative bands: 0-15, 0-30, 0-45, and so on. In addition, the program subdivided the total population in each band into "urban", "suburban", and "rural" subtotals.

In the state-wide analysis (Figure 6), the population in each band is expressed as a percentage of the total population of the state. The numbers of the zones in each band are also listed, together with their driving time from the park site.

For the HCMA area analysis (Figure 7), the population in each band is expressed as a percent of the total population of the HCMA district. The zone list is ommitted here, since it would duplicate the information given in Figure 6.

In considering the program output following, three things must be kept in mind. First, as has been stated above, driving times between zones are calculated using average speeds (derived from speed studies) on all links. Second, the process does not subdivide zones: A zone is included in a given band if, and only if, its centroid lies within that time band.

For further information on the proximity analysis routine, the reader is referred to Statewide Transportation Analysis and Research report volume I-D titled "Proximity Analysis". This report also details other options available to the user in the program. Any other inquiries regarding the

proximity analysis procedure may be directed to the Statewide Studies Unit, Transportation Survey and Analysis Section, Transportation Planning Division, Michigan Department of State Highways.

POPULATION PROXIMITY

DATA FOR ZONE 490
POPULATION =   6781
NUMBER OF SERVERS =   1
TOTAL CAPACITY =   1

                    TIME BAND   0- 15 MINUTES
                    POPULATION WITHIN BAND =   10392 , URBAN =   0 , SUBURBAN =   0 , RURAL = 10392
                                           =   0.117 PERCENT OF TOTAL POPULATION

                    NUMBER OF SERVERS IN BAND =   1
                    POPULATION PER SERVER IN BAND =   10392.00
WITHIN 0- 15 MIN., POPULATION =   10392
      NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   10392.00

                        ZONE   TIME AWAY
                        490   0
                        491   9

                    TIME BAND 15- 30 MINUTES
                    POPULATION WITHIN BAND =   251618 , URBAN = 145281 , SUBURBAN = 64673 , RURAL = 41664
                                           =   2.835 PERCENT OF TOTAL POPULATION

                    NUMBER OF SERVERS IN BAND =   0
                    POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 30 MIN., POPULATION = 262010
      NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   262010.00

                        ZONE   TIME AWAY
                        188   29
                        216   29
                        219   27
                        220   21
                        225   22
                        479   22
                        480   24
                        481   24
                        482   17
                        484   30
                        488   23
                        489   21

                    TIME BAND 30- 45 MINUTES
                    POPULATION WITHIN BAND =   232286 , URBAN = 32007 , SUBURBAN = 99473 , RURAL = 100806
                                           =   2.617 PERCENT OF TOTAL POPULATION

                    NUMBER OF SERVERS IN BAND =   0
                    POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 45 MIN., POPULATION = 494296
      NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   494296.00

                        ZONE   TIME AWAY

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FIGURE 6   STATE-WIDE PROXIMITY ANALYSIS

```
            64              44
           187              45
           217              32
           218              43
           221              42
           222              40
           223              36
           266              42
           270              45
           274              38
           275              42
           276              31
           332              40
           483              31
           485              32
           486              33
           487              37
           492              35
           500              45
```

TIME BAND   45- 60 MINUTES
POPULATION WITHIN BAND =   1463993   , URBAN = 525237   , SUBURBAN = 791821   , RURAL = 146935
                       = 16.496 PERCENT OF TOTAL POPULATION

NUMBER OF SERVERS IN BAND =   0
POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 60 MIN., POPULATION = 1958289
        NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   1958289.00

```
            ZONE          TIME AWAY
            58              59
            60              56
            61              59
            66              46
            67              57
           118              56
           122              56
           148              55
           186              52
           189              47
           190              51
           191              54
           224              46
           262              51
           263              48
           265              53
           268              60
           271              47
           272              54
           273              55
           326              46
           328              56
           330              54
```

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334	59
363	54
365	57
494	54
497	55
498	53
499	59
501	49
502	51
504	60

TIME BAND   60- 75 MINUTES
POPULATION WITHIN BAND =   2105113   , URBAN = 402216   , SUBURBAN =1489951   , RURAL = 212946
                         = 23.719 PERCENT OF TOTAL POPULATION

NUMBER OF SERVERS IN BAND =   0
POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 75 MIN., POPULATION = 4063402
     NUMBER OF SERVERS =   1
POPULATION PER SERVER =   4063402.00

ZONE	TIME AWAY
55	71
58	71
62	73
63	72
65	69
113	72
114	74
117	71
121	69
139	75
140	65
161	72
162	68
164	75
166	65
167	69
183	67
184	62
185	64
264	69
269	63
323	68
324	69
325	68
329	68
331	70
333	67
359	70
361	74
362	63
364	62
366	69

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371	72
434	74
440	74
441	63
493	70
495	61
496	68

TIME BAND   75- 90 MINUTES
POPULATION WITHIN BAND =   1447731   , URBAN = 278596   , SUBURBAN =1055248   , RURAL = 113887
                         = 16.312 PERCENT OF TOTAL POPULATION

NUMBER OF SERVERS IN BAND =   0
POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 90 MIN., POPULATION = 5511133
       NUMBER OF SERVERS =   1
   POPULATION PER SERVER = 5511133.00

ZONE	TIME AWAY
48	84
51	81
53	89
54	86
57	83
59	80
93	77
97	88
98	88
100	86
115	77
116	79
119	86
123	81
128	79
131	83
132	78
133	81
136	89
163	76
228	88
229	88
267	87
285	78
286	79
327	79
358	81
360	77
367	82
369	87
370	78
372	81
373	85
433	82
435	81

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```
                436              87
                437              90
                503              76


         TIME BAND   90-120 MINUTES
         POPULATION WITHIN BAND =      952294    , URBAN = 233230   , SUBURBAN = 394193   , RURAL = 324871
                                = 10.730 PERCENT OF TOTAL POPULATION

         NUMBER OF SERVERS IN BAND =       0
         POPULATION PER SERVER IN BAND =          0.00
WITHIN 0- 120 MTN., POPULATION = 6463427
      NUMBER OF SERVERS =       1
  POPULATION PER SERVER =  6463427.00
```

ZONE	TIME AWAY
9	117
25	108
26	116
27	98
49	101
50	102
52	91
92	93
94	104
95	100
96	106
99	101
120	92
129	93
130	93
134	97
135	103
137	104
138	98
141	94
159	116
165	91
192	110
193	108
194	106
195	100
196	119
197	115
198	113
199	94
226	95
227	95
230	94
231	99
232	100
233	99
252	109
256	114
257	111

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284	91
287	93
288	98
289	110
290	114
368	95
374	99
375	99
409	113
412	111
414	110
415	103
416	114
420	106
421	114
422	97
438	91
439	91
446	119
452	117
453	97
455	116
456	104
459	115
462	119
475	119
478	112

POPULATION PROXIMITY

DATA FOR ZONE 490
POPULATION =   6781
NUMBER OF SERVERS =   1
TOTAL CAPACITY =   1

            TIME BAND   0- 15 MINUTES
            POPULATION WITHIN BAND =   10392   , URBAN =   0   , SUBURBAN =   0   , RURAL =   10392
                          =   0.231 PERCENT OF TOTAL POPULATION

            NUMBER OF SERVERS IN BAND =   1
            POPULATION PER SERVER IN BAND =   10392.00
WITHIN 0- 15 MIN., POPULATION =   10392
       NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   10392.00

            TIME BAND 15- 30 MINUTES
            POPULATION WITHIN BAND =   160134   , URBAN = 99797   , SUBURBAN =   44968   , RURAL =   15369
                          =   3.564 PERCENT OF TOTAL POPULATION

            NUMBER OF SERVERS IN BAND =   0
            POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 30 MIN., POPULATION =   170526
       NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   170526.00

            TIME BAND 30- 45 MINUTES
            POPULATION WITHIN BAND =   141480   , URBAN = 29538   , SUBURBAN =   59617   , RURAL =   52325
                          =   3.149 PERCENT OF TOTAL POPULATION

            NUMBER OF SERVERS IN BAND =   0
            POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 45 MIN., POPULATION =   312006
       NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   312006.00

            TIME BAND 45- 60 MINUTES
            POPULATION WITHIN BAND =   1328446   , URBAN = 487934   , SUBURBAN = 763579   , RURAL =   76933
                          = 29.567 PERCENT OF TOTAL POPULATION

            NUMBER OF SERVERS IN BAND =   0
            POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 60 MIN., POPULATION = 1640452
       NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   1640452.00

            TIME BAND 60- 75 MINUTES
            POPULATION WITHIN BAND =   1582823   , URBAN = 203566   , SUBURBAN =1344733   , RURAL =   34524
                          = 35.229 PERCENT OF TOTAL POPULATION

            NUMBER OF SERVERS IN BAND =   0
            POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 75 MIN., POPULATION = 3223275

FIGURE 7

HCMA PROXIMITY ANALYSIS

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TIME BAND   75- 90 MINUTES
POPULATION WITHIN BAND =   975830   , URBAN =   85279   , SUBURBAN = 863433   , RURAL =   27113
                         =   21.719 PERCENT OF TOTAL POPULATION

NUMBER OF SERVERS IN BAND =   0
POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 90 MIN., POPULATION = 4199105
        NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   4199105.00

TIME BAND   90-120 MINUTES
POPULATION WITHIN BAND =   293893   , URBAN =   0   , SUBURBAN = 232754   , RURAL =   61139
                         =   6.541 PERCENT OF TOTAL POPULATION

NUMBER OF SERVERS IN BAND =   0
POPULATION PER SERVER IN BAND =   0.00
WITHIN 0- 120 MIN., POPULATION = 4492998
        NUMBER OF SERVERS =   1
   POPULATION PER SERVER =   4492998.00

FIGURE 8
SUMMARY

MINUTES FROM SITE	STATE			HCMA REGION	
	NO. OF PEOPLE* WITHIN	% OF TOTAL*		NO. OF PEOPLE WITHIN	% OF TOTAL**
0-15	10,392	.117		10,392	0.231
0-30	251,618	2.952		170,526	3.795
0-45	494,296	5.569		312,006	6.944
0-60	1,958,289	22.065		1,640,452	36.511
0-75	4,063,402	45.784		3,223,275	71.740
0-90	5,511,133	62.096		4,199,105	93.459
0-120	6,463,427	72.826		4,492,998	100.000

*Michigan people only   **In HCMA region