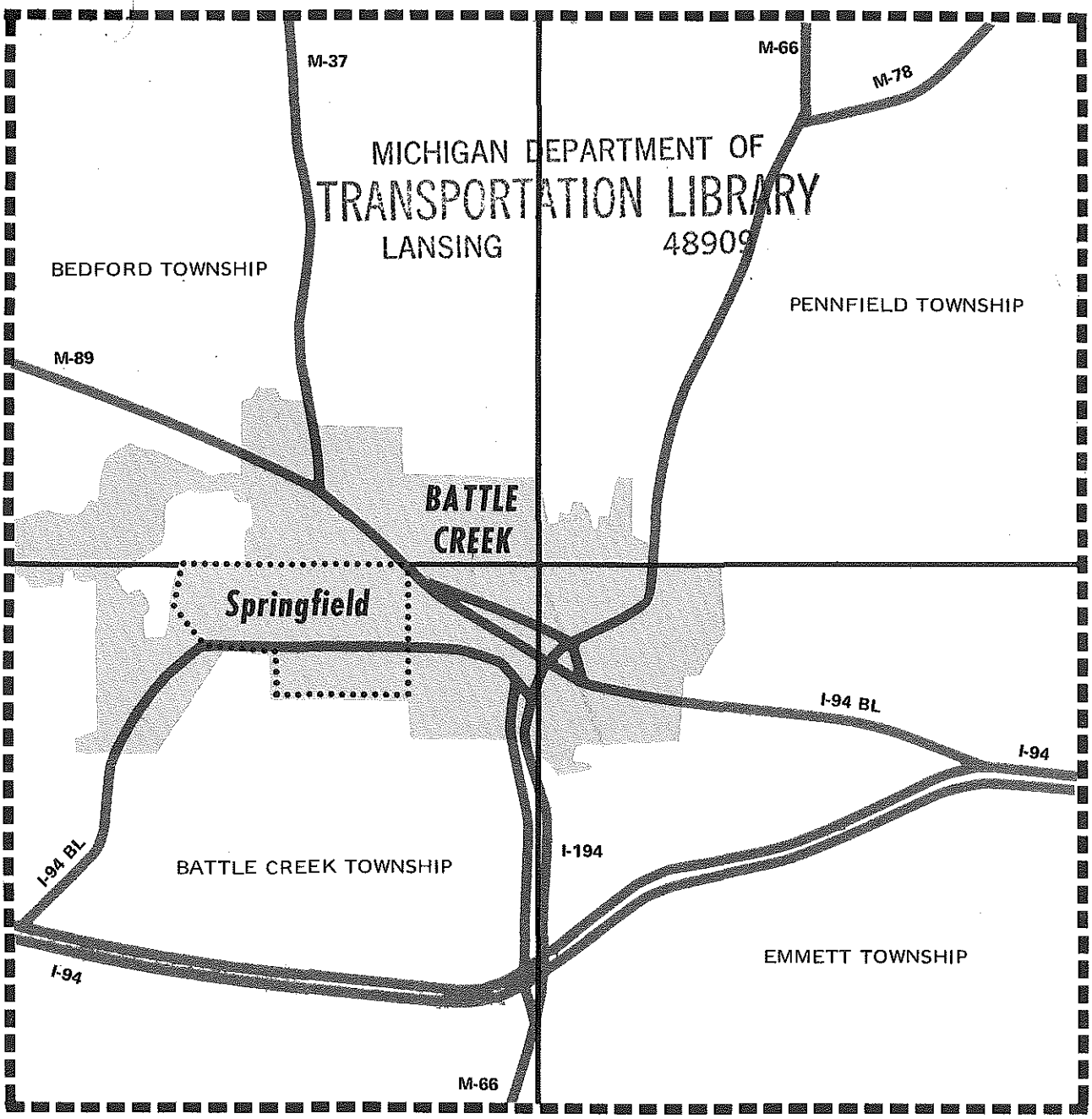
BATTLE CREEK AREA TRANSPORTATION STUDY

FACTUAL DATA REPORT



MAY 1980

MICHIGAN DEPARTMENT OF TRANSPORTATION

Bureau of Transportation Planning

MICHIGAN DEPARTMENT
OF
TRANSPORTATION

BATTLE CREEK AREA TRANSPORTATION STUDY

FACTUAL DATA REPORT

MAY 1980

This report represents the findings and/or professional opinions of the Michigan Department of Transportation and not an official opinion of the State Transportation Commission.

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OFFICE MEMORANDUM

DATE: April 9, 1980

TO: Sam F. Cryderman, Deputy Director
Bureau of Transportation Planning

FROM: R. J. Lilly, Administrator
Multi-Regional Planning Division

SUBJECT: BCATS Factural Data Report

The South Section of the Multi-Regional Planning Division is pleased to present the Factual Data Report for the Battle Creek Area Transportation Study.

This report documents the findings of the Origin-Destinations Survey conducted in 1976. It contains a brief description of data gathering procedures and accuracy checks, a summary of questions asked in the household interview, travel desire diagrams, a summary of adjusted occupied dwelling unit data, and passenger car occupancy data.

This report was prepared by Rodney J. Haan, Regional Coordinator, with assistance from Craig V. Iansiti, Transportation Planner, under the supervision of William C. Hartwig, South Section Manager.

R. J. Lilly

Administrator

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EXHIBITS

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INTRODUCTION

The Battle Creek area was designated by the Bureau of Census as an Urbanized Area in 1974. This designation made the Battle Creek area eligible for certain federal funds. However, this also resulted in requirements of Title 23 U.S. Code, Section 134 and Section 104 (f), which states that no federal transportation funds would be authorized for projects unless the projects were based on a "continuing, comprehensive transportation planning process carried on cooperatively by states and local communities" being applicable to the Battle Creek area.

In response to these requirements, the Battle Creek Area Transportation Study (BCATS) was organized. A major element in the transportation planning process is the study of travel patterns. This includes the study of existing travel patterns and the forecasts of future travel patterns. One method for studying existing travel patterns is an origin-destination survey which is designed to interview a representative sample of all kinds of travel that originates within or passes through an urban area. This information is then used to develop a computer model and trip generation equations which can be used to forecast future travel demands. Past studies have shown that this is a reliable technique for predicting future travel and that the information remains valid for many years.

One of the first actions of the BCATS Policy Committee was to request the Michigan Department of Transportation (MDOT) to conduct an Origin-Destination (O-D) Survey. This survey was conducted in the spring of 1976.

Three reports have been published to date relating to the Origin-Destination Survey. They are (1) O-D Prospectus for the Battle Creek Area Transportation Study, April 1975, (2) Field Procedures and Coding Manual for the Battle Creek Area Origin-Destination Study, February 1976, and (3) Origin-Destination Study Procedure for the Battle Creek Area Transportation Study, March 1976.

This report will briefly outline the procedures used in collecting, evaluating, and adjusting the data. The majority of this report will be comprised of presenting the data that was collected in the 1976 Battle Creek Origin-Destination Survey.

DEFINITIONS

The following terms will be mentioned in the context of this study. A brief definition of each should enable a better understanding of the processes and concepts involved in an Origin-Destination Study.

Origin-Destination Survey:
A comprehensive survey of travel habits within a selected study area, designed to collect detailed information pertaining to trip origins and destinations.

Study Area:
The geographical area selected for the origin and destination study.

Cordon Line:
The imaginary line enclosing the study area.

Screen Line:
A line bisecting the study area used to compare reported trips with actual classification counts.

External Survey:
One phase of the origin-destination survey. Interviews are conducted at the cordon line.

Internal Survey:
The phase of the origin-destination study in which residents of the study area are interviewed (on a sample basis) at their place of residence. Basic travel patterns and socio-economic data are obtained.

Station:
Point of interview and classification counts located on route crossing cordon line. Stations are also found on routes crossing the screen line for the purpose of classification.

Classification Counts:
Vehicles are counted and placed in catagories (passenger cars, single unit trucks, etc.) at screenline and cordon line stations.

External Trip:
A trip with one terminal outside the study area.

Through Trip:
A trip through an external station having both terminals outside the study area.

Internal Trip:
A trip with both terminals within the study area.

Zone:
The basic subdivision of the study area. Trip tables show the interchange of trips between zones.

Dwelling Unit:
Living quarters available for occupancy. The internal sample is selected on the basis of dwelling units. A dwelling unit may be a house, apartment, or an individual room, depending on the occupants.

Central Business District (CBD):
The main commercial area of a city.

Desire Line:
A straight imaginary line between stations and/or zones connecting a trip origin and destination. Actual routes of travel are not considered.

DATA GATHERING PROCEDURES

Study Area: The initial step in organizing the Battle Creek Area Transportation Study was to determine the limits of the study. This area should include all the areas where urban growth is anticipated in the next 20 years. It was determined that this objective would be met by including the Cities of Battle Creek and Springfield and Townships of Battle Creek, Bedford, Emmett, and Pennfield. This area encompassed 144 square miles and is shown in Exhibit 1.

Zones: The study area was subdivided into 133 O-D tracts. These tracts were further subdivided into blocks. Trip information (origin and destinations) was gathered on this "tract-block" basis. Traffic analysis zones were also created from the O-D tracts and blocks. The criteria for establishing these zones include existing land use, population distribution, natural or man-made boundaries (e.g. rivers, railroads), in addition to census tract boundaries. A zone map is shown in Exhibit 2.

External Survey: This phase of the origin-destination survey was designed to provide trip information, primarily pertaining to trips with at least one terminus outside the cordon line. Interviews were conducted at 30 external stations located on the major routes crossing the cordon line. These stations are shown in Exhibit 3. The eight stations on the state trunklines and a station on Michigan Avenue were operated for 14 hours, six stations on local roads whose traffic volumes were over 1,000 vehicles per day were operated for 12 hours, and stations where traffic volumes were less than 1,000 vehicles per day were operated for six hours. As many drivers were stopped as possible at the External Survey Stations, but because of traffic problems and other considerations, some drivers were not interviewed.

Drivers were asked to supply information concerning origin and destination of the trips, stops in the area (if any), purpose of the trip, and other pertinent information. A count was taken of all vehicles crossing the station points and the 37 percent interview sample was expanded to equal all vehicle totals. A total of 33,626 interviews were taken from the 92,024 vehicles crossing through the stations.

Internal Survey: This phase of the study was designed to collect trip information from residents of the study area. A sample of one out of every seven households was determined to be sufficient to give trip information of the accuracy desired. The sample was selected from Consumer Power Company electric meter records. Of the 4,521 addresses selected for sampling, complete interviews were obtained from 3,610 households.

The interview was conducted at each address by a trained interviewer. Basic socio-economic information was obtained at each household, in addition to a record of all trips made (by persons over four years of age) the previous day. Copies of the survey forms are shown in Exhibit 4.

BATTLE CREEK TRANSPORTATION STUDY AREA

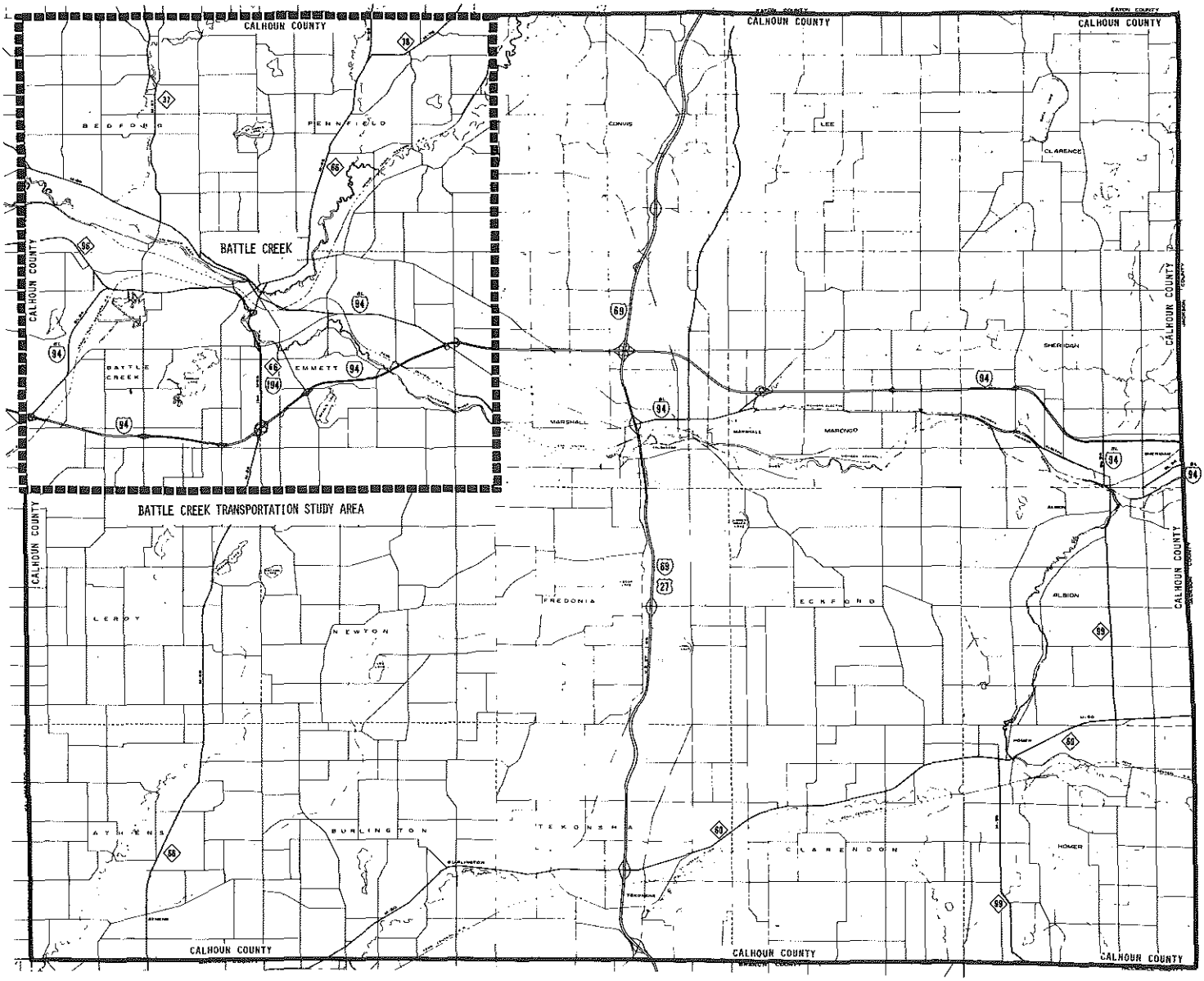


EXHIBIT 1

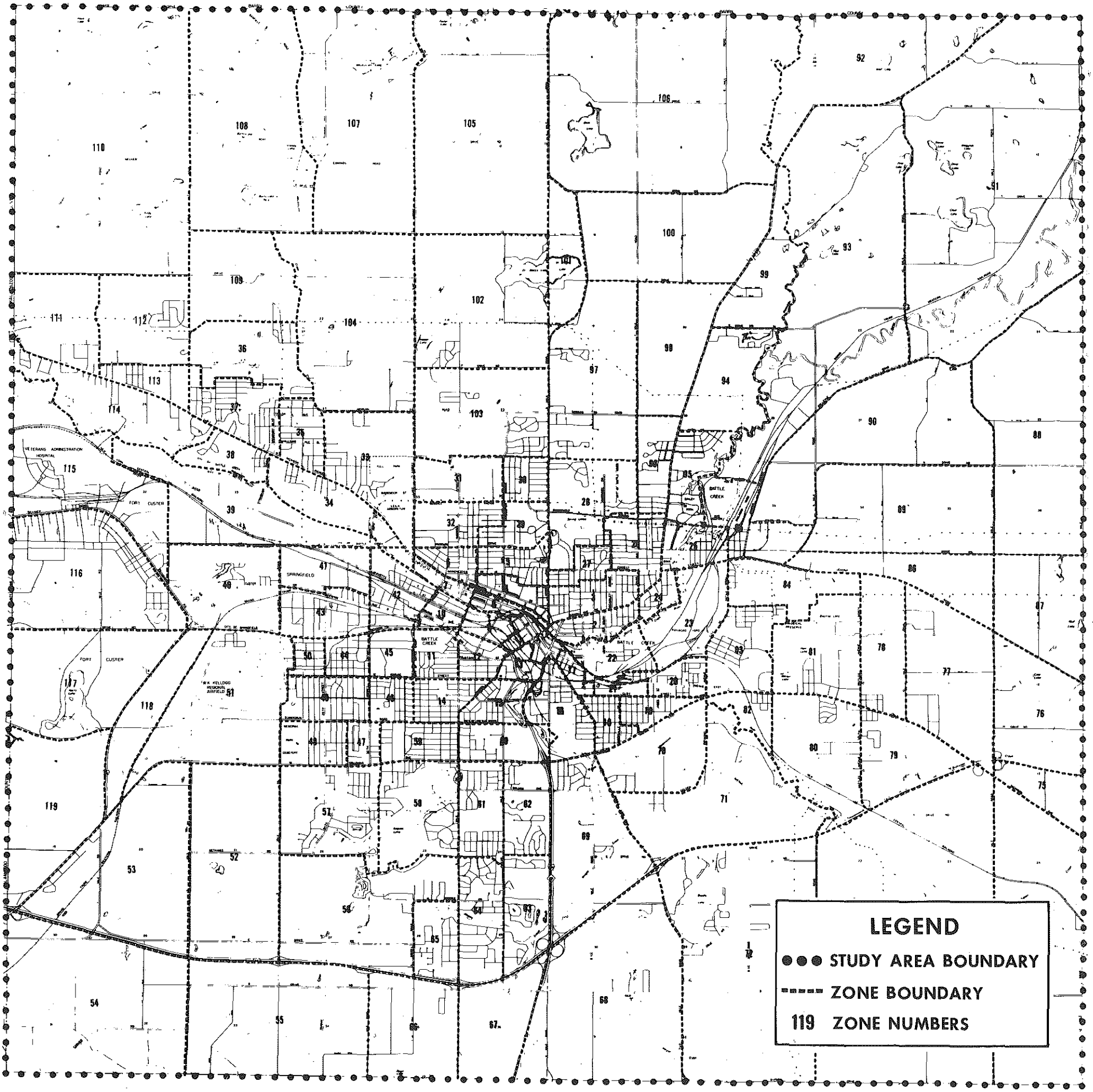
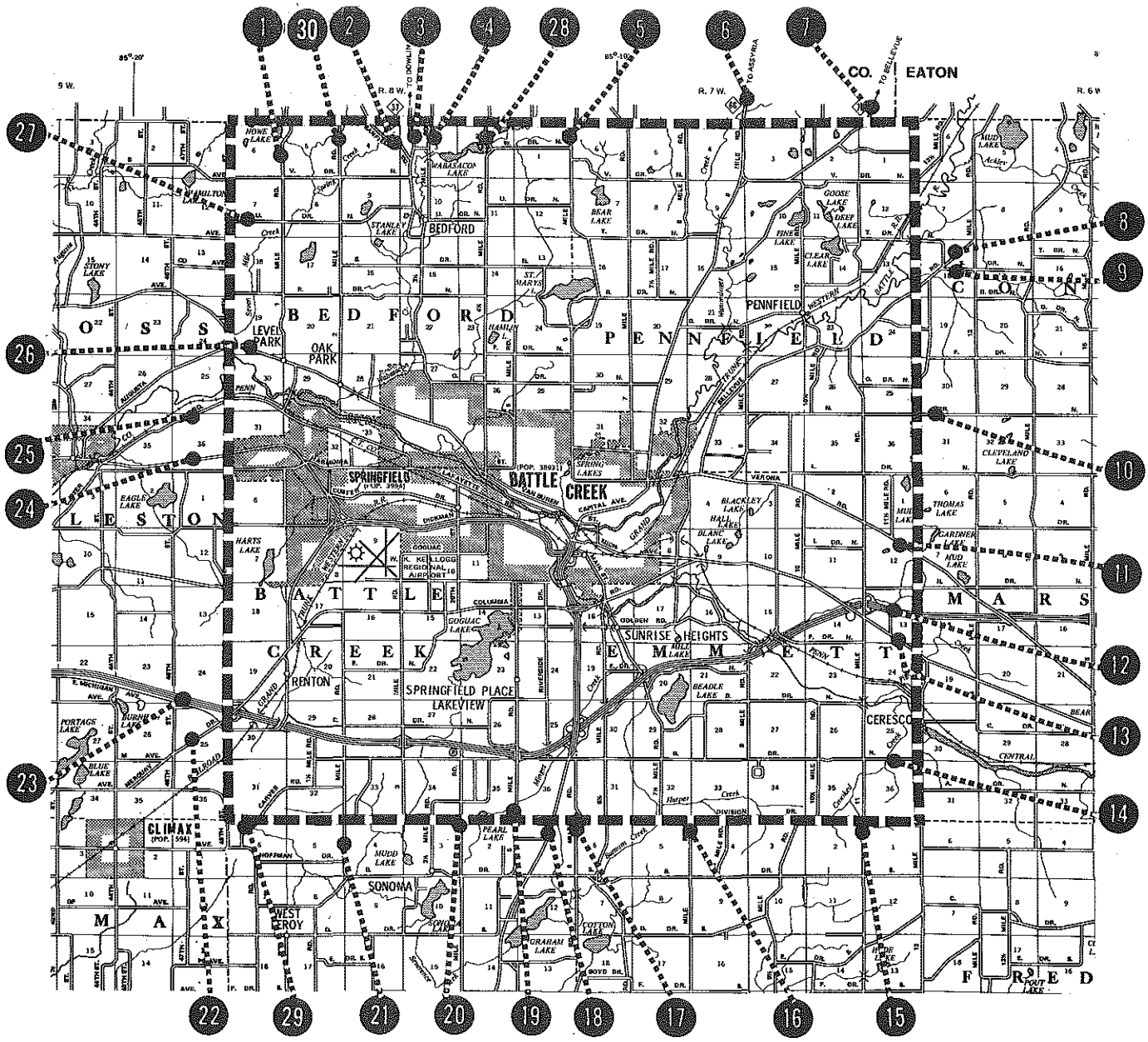

LEGEND
STUDY AREA BOUNDARY
ZONE BOUNDARY
119 ZONE NUMBERS
VETERANS ADMINISTRATION HOSPITAL
FORT CUSTER
SPRINGFIELD
BATTLE CREEK
W.K. KELLOGG REGIONAL AIRFIELD

EXHIBIT 2

BATTLE CREEK AREA TRANSPORTATION STUDY

CORDON LINE STATIONS



LEGEND

- Cordon Line
- External Interview Stations
- 29 External Interview Station Numbers

EXHIBIT 3

EXHIBIT 4

1769-C (9/75)

BATTLE CREEK AREA TRANSPORTATION STUDY HOUSEHOLD REPORT

CITY NO.	REC. NO.	INTERVIEW NUMBER	TRACT	BLOCK	DATE OF TRAVEL: DAY	DATE OF TRAVEL: MONTH	TYPE OF STRUCTURE
2 3	3						
1 2	3	4 5 6 7 8	9 10 11	12 13 14	*15	16 17	18**

X6015

Occupant

Battle Creek, MI 49015

1. How many cars at this address . . . . . ☐ 19
2. How many motorcycles at this address . . . . . ☐ 20
3. How many bicycles at this address . . . . . ☐ 21
4. How many persons live at this address . . . . . ☐☐ 22–23
5. How many are five or older . . . . . ☐☐ 24–25
6. How many persons in this household have a serious handicap that makes it difficult or impossible to drive an automobile or use conventional public transportation . . . . . ☐ 26
7. Would any elderly or handicapped member of this household make use of a door-to-door small bus service . . . . . ☐ 27
   Y = Yes N = No
8. How many members of this household have difficulty finding transportation for important and necessary kinds of trips. . . . . ☐ 28
9. How many blocks to the nearest bus line . . . . . ☐☐ 29–30
10. What is the total income for the household . . . . . ☐ 31
    1. 0 – 5,999
    2. 6,000 – 11,999
    3. 12,000 – 17,999
    4. 18,000 – 24,999

Administrative Code Only ☐ 32

* Code days of week as follows:
1 = Sunday
2 = Monday
3 = Tuesday
4 = Wednesday
5 = Thursday
6 = Friday
7 = Saturday

** SHOW TYPE OF STRUCTURE CODE IN NO. 18
1 = Single
2 = Multiple Housings
3 = Residential Hotels
4 = Mobile Homes
5 = Transient Lodgings
6 = Group Quarters
7 = Duplex
8 = Seasonal
9 = Town House

INTERVIEWER: _____

CALLS

DATE	TIME
(1) _____	_____
(2) _____	_____
(3) _____	_____
(4) _____	_____

REPORT SUBMITTED INCOMPLETE DATE _____

REASON _____

SUPERVISOR'S COMMENT _____

REMARKS _____

REPORT COMPLETED _____ (Initials)

INTERVIEW CHECKED _____ (Initials)

PHONE NUMBER _____

PERSON REPORT

1769 D (9/75)

BATTLE CREEK AREA TRANSPORTATION STUDY

Y = YES
N = NO

1 = MALE WHITE
2 = FEMALE WHITE
3 = MALE OTHER
4 = FEMALE OTHER

SEE CODING MANUAL

1 = FULL TIME
2 = PART TIME

HOW MANY TIMES HAVE YOU RIDDEN THE BATTLE CREEK TRANSIT AUTHORITY BUS IN THE PAST TWO WEEKS?

WHAT ARE THE TWO MOST IMPORTANT THINGS WHICH COULD BE DONE TO IMPROVE BUS SERVICE. (SEE CARD)

CITY NO. (2 3 / 1 2)

REC. NO. (4 / 3)

INTERVIEW NUMBER (4 5 6 7 8)

TRACT (9 10 11)

BLOCK (12 13 14)

PERSON NUMBER		DRIV. LIC.	RACE-SEX	AGE		OCCUPATION		WORK STATUS	NO. TRIPS		IMPR. SVC.		PLACE OF EMPLOYMENT																			
													L=LOCAL N=N-WIDE	UNUSED						PLACE NAME												
														HOUSE NO.						DIR.	STREET NAME								CIVIL DIVISION NAME			
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

13

The type of trip information gathered internally was basically the same as that obtained at the external stations. The primary information obtained was a listing of each trip made the previous day, including origin and destination; trip purpose, time of travel, and mode of travel for each family member.

Commercial Vehicles: Trip data from operators of trucks and taxicabs was not collected because of the insignificant amount of taxi trips and commercial truck trips in the area.

ACCURACY CHECK

The accuracy of the survey data was insured by an edit program designed to discover and correct coding and keypunch errors and a series of accuracy checks. These accuracy checks were documented in detail in the report "BCATS Accuracy Check and Screenline Adjustment," Benchmark Report #2. Exhibit 5 summarizes the comparisons of independent sources of socio-economic data and the data collected in the O-D survey. This comparison indicates that the data collected in the O-D survey accurately relects the socio-economic conditions as they existed in 1976.

EXHIBIT 5

INTERNAL ADDRESS SURVEY
ACCURACY CHECK SUMMARY

	O-D DATA	INDEPENDENT DATA	ACCURACY CHECK
Occupied Dwellings	31,647	32,234	98.2%
Population	91,192	98,142	92.9%
Automobiles	47,614	45,994	103.5%

The following questions and responses were part of the Household Report and Person Report and were asked by the interviewer in the home interviews. The responses have been expanded based on the sample rate.

Question: Number of automobiles (including light pick-ups and vans) per household.

NUMBER	HOUSEHOLDS RESPONDING	%
0	2,754	8.9%
1	12,973	41.9%
2	12,073	39.0%
3	2,516	8.1%
4	534	1.7%
5	92	0.3%
More than 5	52	0.1%

Question: Number of motorcycles per household.

NUMBER	HOUSEHOLDS RESPONDING	%
0	28,176	90.9%
1	2,117	6.8%
2	504	1.6%
More than 2	197	0.7%

Question: Number of bicycles per household.

NUMBER	HOUSEHOLDS RESPONDING	%
0	15,460	49.9%
1	5,201	16.8%
2	5,132	16.6%
3	2,288	7.4%
4	1,721	0.6%
More than 4	1,191	0.4%

Question: Number of persons per household.

NUMBER	HOUSEHOLDS RESPONDING	%
1	5,454	17.6%
2	10,344	33.4%
3	5,281	17.1%
4	4,754	15.4%
5	2,941	9.5%
6	1,313	4.2%
7	467	1.5%
More than 7	399	1.3%

Question: Number of persons 5 years old or older per household.

NUMBER	HOUSEHOLDS RESPONDING	%
1	5,807	18.8%
2	12,207	39.4%
3	4,992	16.1%
4	3,822	12.3%
5	2,471	8.0%
6	1,011	3.3%
More than 6	646	2.1%

Question: Number of handicapped persons per household who have difficulty driving or using public transportation.

NUMBER	HOUSEHOLDS RESPONDING	%
0	29,169	94.2%
1	1,533	5.0%
2	209	0.7%
More than 2	45	0.1%

Question: Would handicapped person in household use door to door small bus service?

1,763 (5.7%) of households responding said YES.
29,205 (94,3%) of households responding said NO.

Question: Number of persons per household who have difficulty finding transportation for important trips.

NUMBER	HOUSEHOLDS RESPONDING	%
0	29,642	95.6%
1	952	3.1%
2	297	1.0%
More than 2	102	0.3%

Question: Number of blocks to nearest bus stop.

BLOCKS	HOUSEHOLDS RESPONDING	%
0 – 2	16,611	54.3%
3 – 5	3,873	12.6%
6 – 10	1,915	6.3%
Over 10	8,220	26.8%

Question: Income per household.

INCOME	HOUSEHOLDS RESPONDING	%
$ 0 – 5,999	5,577	21.8%
$ 6,000 – 11,999	7,177	28.1%
$12,000 – 17,999	6,972	27.3%
$18,000 – 24,999	3,949	15.4%
$25,000 or more	1,894	7.4%

Question: Do you have a drivers license?

RESPONSE	NUMBER OF PERSONS RESPONDING	
Yes	55,589	67.0%
No	27,402	33.0%

Question: Race and sex of interviewee.

Male White	36,102	43.5%
Female White	38,022	45.8%
Male Other	4,146	5.0%
Female Other	4,721	5.7%

Question: What is your age?

AGE	NUMBER OF PERSONS RESPONDING	
5 – 9	7,496	9.1%
10 – 14	8,647	10.5%
15 – 19	9,494	11.5%
20 – 24	6,496	7.9%
25 – 29	7,232	8.8%
30 – 34	5,072	6.1%
35 – 44	9,661	11.7%
45 – 54	10,678	12.9%
55 – 64	8,381	10.1%
65 +	9,467	11.4%

Question: What is your occupation?

OCCUPATION		
Professionals and Semi-Professionals	5,458	6.6%
Proprietors, Managers, and Officials	2,867	3.5%
Store and Office Clerks, Salesman (excl. traveling)	5,957	7.2%
Traveling Salesmen, Agents, etc.	485	0.6%
Craftsmen, Foremen, Skilled Laborers, etc.	9,485	11.4%
Operatives and Semi-skilled workers	2,457	3.0%
Laborers and Unskilled Workers	1,820	2.2%
Protective Services	583	0.7%
Personal Services Workers	2,683	3.2%
Government Employees	1,031	1.2%
Other	693	0.8%
Unemployed, yet able to work	2,594	3.1%
Non-gainfully employed (housewives and other non-paid)	11,795	14.2%
Retired or Permanently Unemployable	10,461	12.6%
Students	23,081	27.8%
College Students	1,215	1.5%
Visitors	69	0.1%
Occupation Not Reported	225	0.3%

Question: What is your work status?

STATUS		
Full Time	30,738	86.5%
Part Time	4,809	13.5%

Question: How many times have you ridden the Battle Creek Transit Authority Bus in the past two weeks?

NUMBER OF TRIPS	NUMBER OF PERSONS RESPONDING	
0	67,215	93.4%
1 – 2	2,181	3.1%
3 – 6	1,195	1.7%
7 – 10	556	0.7%
Over 10	801	1.1%

Question: What are the most important things which could be done to improve bus service? (each respondent had two choices)

IMPROVEMENT		
Provide service closer to my home	5,728	19.6%
More service on evenings and weekends	5,327	18.2%
More frequent service	4,067	13.9%
Special service for elderly and handicapped	3,576	12.2%
More bus shelters	3,559	12.2%
Schedules which are easier to use and understand	2,610	8.9%
Reduce fare	2,151	7.4%
Reduced travel time by providing express service or direct routes	1,254	4.3%
More comfortable and reliable buses	924	3.2%
Satisfied	31	0.1%

SELECTED DATA

Study Area Size:
The Battle Creek study area included 144 square miles which comprises 20 percent of Calhoun County.

Dwelling Units and Population:
The survey data showed a total of 31,647 occupied dwelling units and 91,192 persons in the study area.

Car Ownership:
Residents of the area owned 47,614 autos during the survey in 1976.

Area Vehicle Travel:
Of the 360,596 total trips made in the area, 73.9 percent were movements from one zone to another while 5.5 percent were intrazonal trips.

There were 17,728 through trips in the area, which was 4.9 percent of all trips.

Resident drivers accounted for 87.4 percent of all auto driver trips in the area. This amounted to 8.8 trips per dwelling unit.

Area Person Travel:
There were 471,396 daily person trips made in vehicles in the study area during the survey in 1976.

Residents made 412,006 vehicle person trips in the study area. This amounted to 14.3 trips per dwelling unit.

Car Occupancy:
Resident drivers made trips within the area with an occupancy rate of 1.49 persons per car. They made trips across the cordon line with an occupancy rate of 1.61 persons per car.

TRAVEL DESIRE DIAGRAMS

The following diagrams graphically present travel data collected during the course of the Battle Creek Origin-Destination Study in 1976. These diagrams show, by means of weighted lines, the trip interchange between selected external stations, internal zones and external station, and internal zones. The trips are not assigned to an actual street system but represent travel desire based on total trips between selected zones and stations.

Exhibit 6 shows the trip movements of all vehicles in relation to zones and stations. The survey found that 5.5 percent of all trips are made within the zone, 73.9 percent are made between zones, 15.7 percent between zones and stations, and 4.9 percent between stations.

Exhibit 7 shows the through trip interchange between the eight state trunkline stations and the station on Michigan Avenue. Volumes under 50 are not shown.

Exhibits 8–17 show the trips between the external stations and the zones which are the largest attractors of trips. The various stations are shown on the following exhibits:

Exhibit 8 = I-94 West
Exhibit 9 = I-94 East
Exhibit 10 = M-37
Exhibit 11 = M-66 North
Exhibit 12 = M-66 South
Exhibit 13 = M-78
Exhibit 14 = M-89
Exhibit 15 = M-96
Exhibit 16 = Capital Avenue South
Exhibit 17 = Michigan Avenue

TRIP MOVEMENTS OF ALL VEHICLES
360,596 TOTAL TRIPS

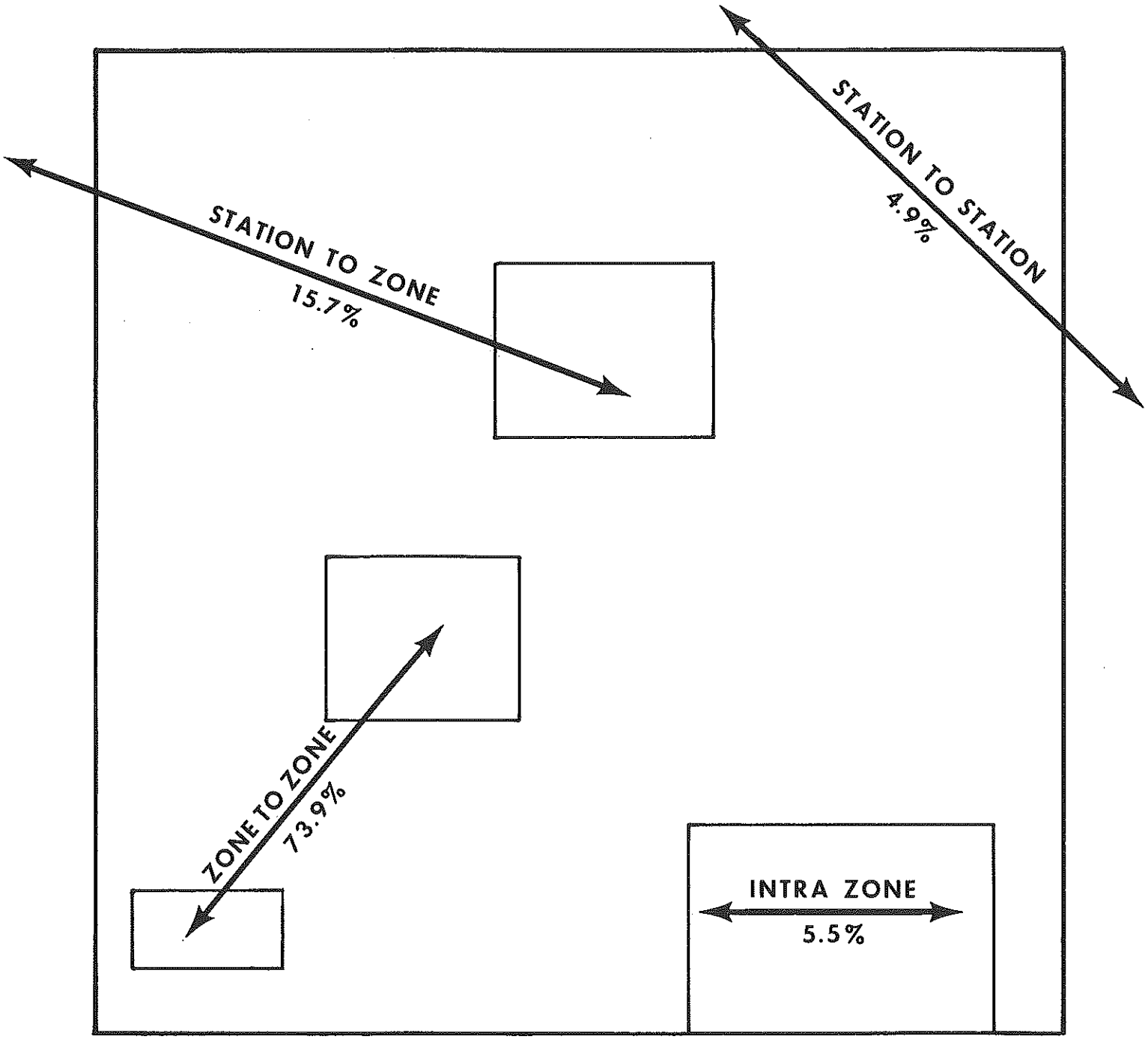


EXHIBIT 6

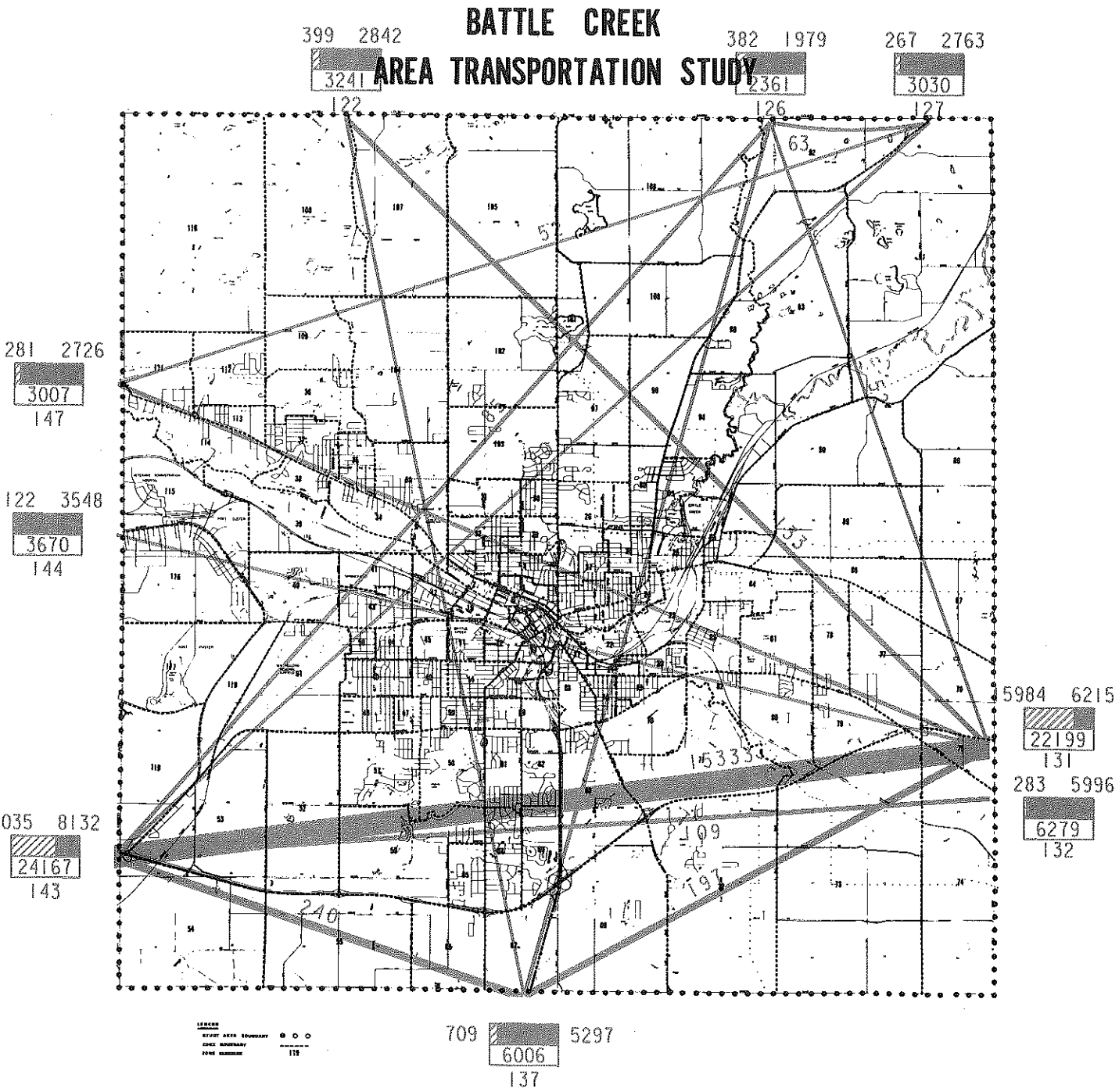
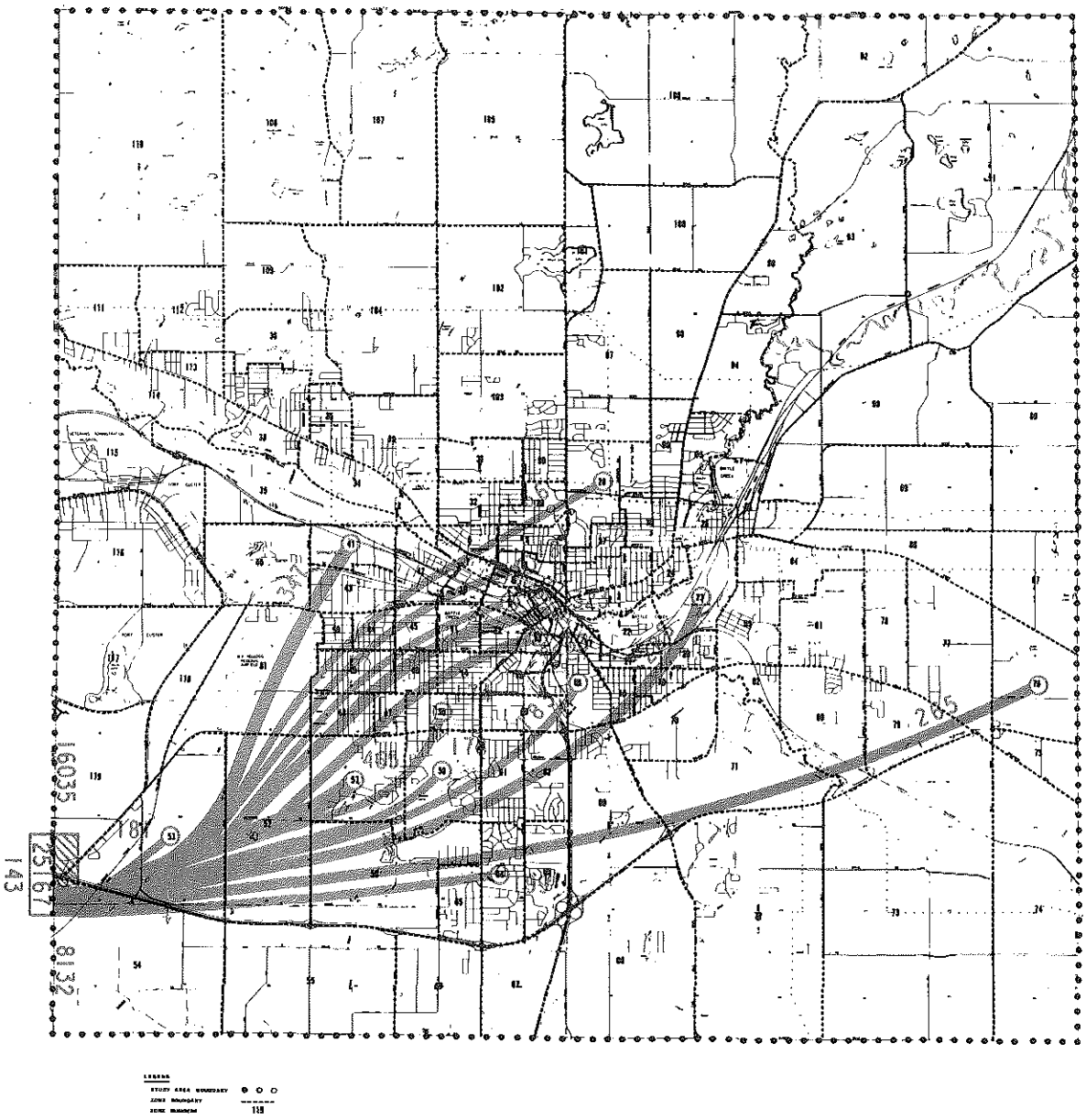

BATTLE CREEK
AREA TRANSPORTATION STUDY
399 2842
3241
122
382 1979
2361
126
267 2763
3030
127
281 2726
3007
147
122 3548
3670
144
5984 6215
22199
131
283 5996
6279
132
16035 8132
24167
143
709
6006
137
5297
TERMINAL TRAFFIC
THRU TRAFFIC
THROUGH TRIPS FOR 9 SELECTED EXTERNAL STATIONS. VOLUMES UNDER 50 NOT SHOWN.

EXHIBIT 7

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 66%

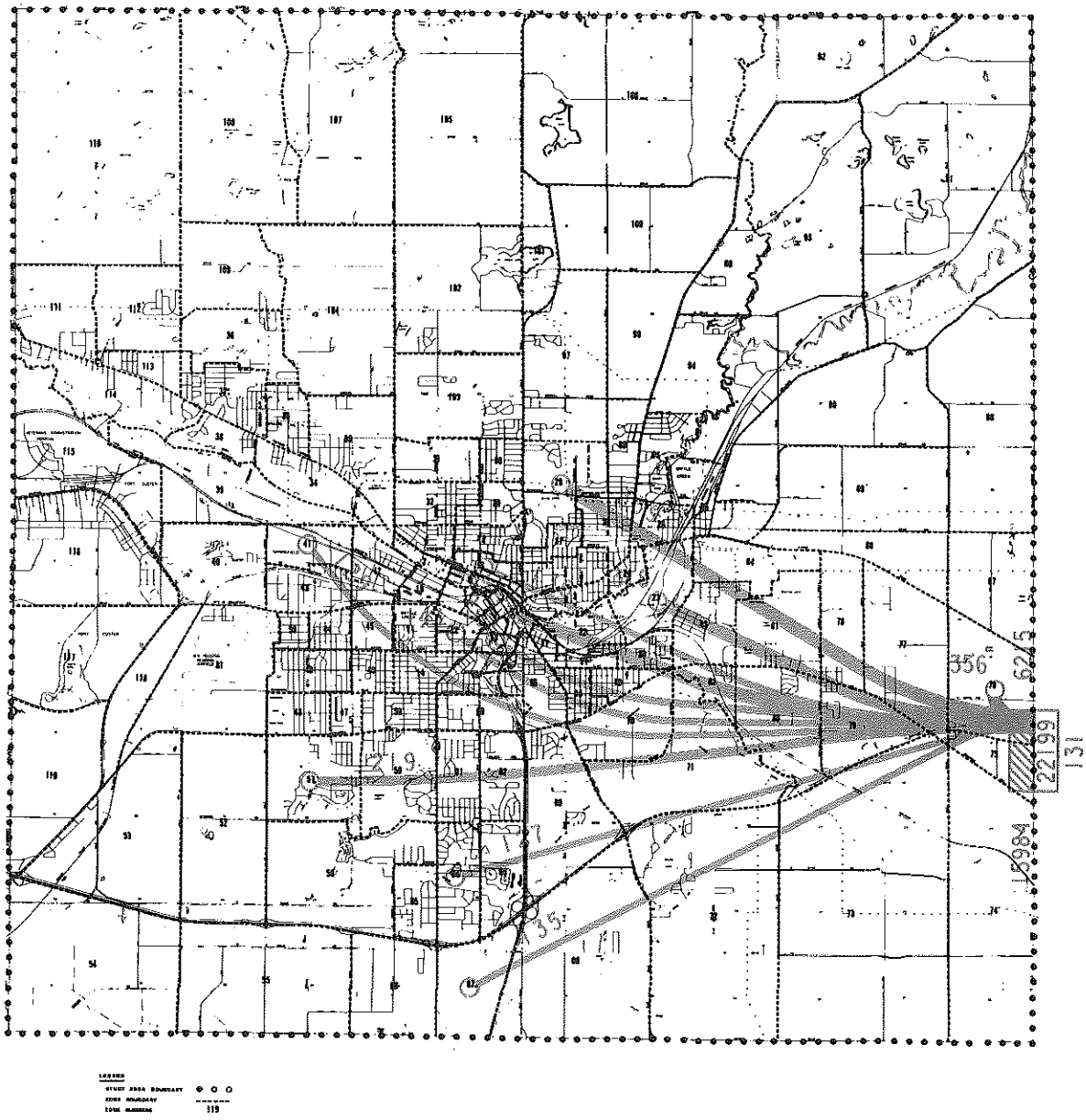
TERMINAL TRAFFIC 34%

STATION 143. THE 14 LARGEST INTERCHANGES ACCOUNT FOR 3379 TRIPS OR 42% OF ALL TERMINAL TRIPS.

I-94 WEST

EXHIBIT 8

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 72%

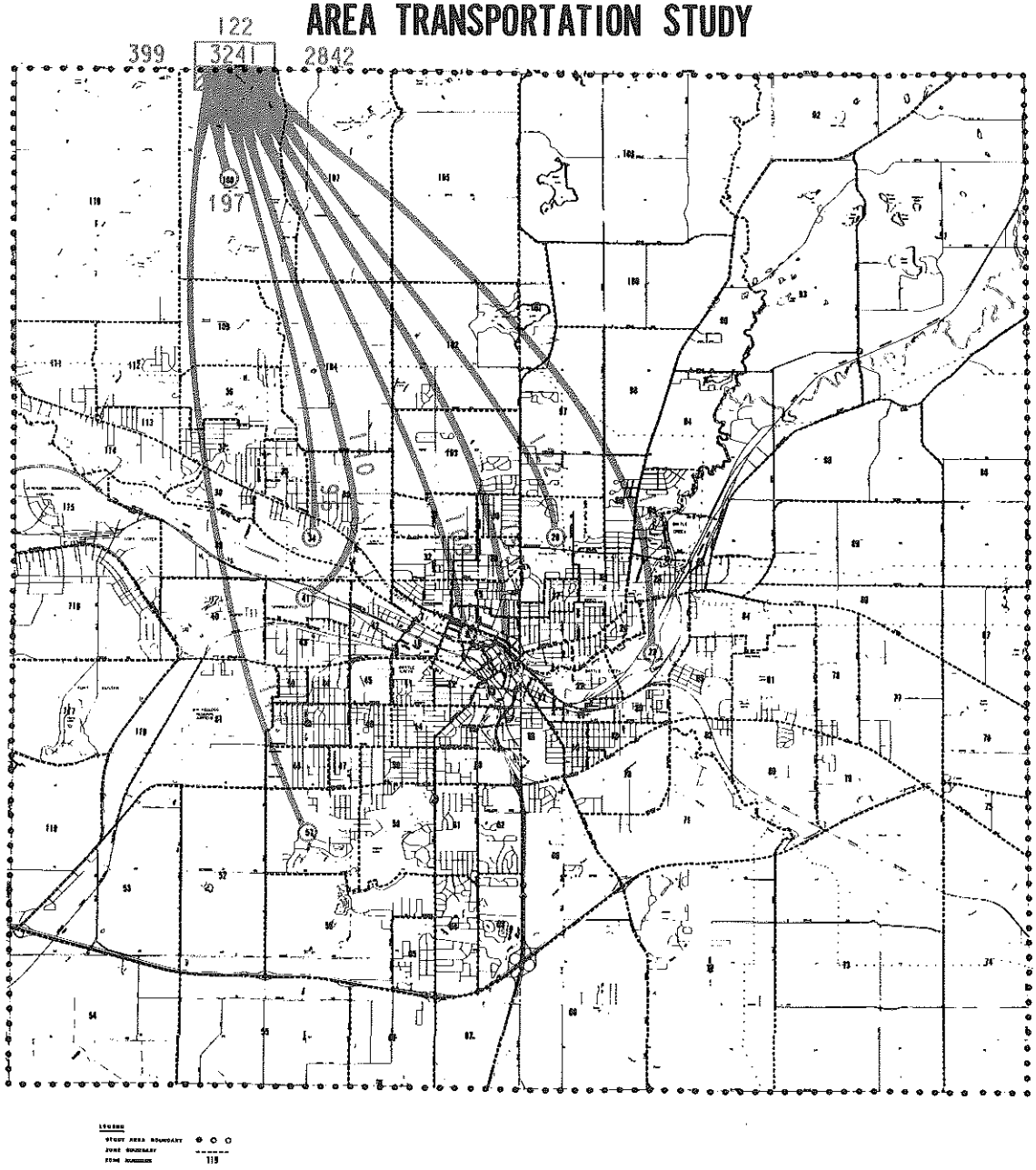
TERMINAL TRAFFIC 28%

STATION 131. THE 11 LARGEST INTERCHANGES ACCOUNT FOR 2396 TRIPS OR 39% OF ALL TERMINAL TRIPS.

I-94 EAST

EXHIBIT 9

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 12%

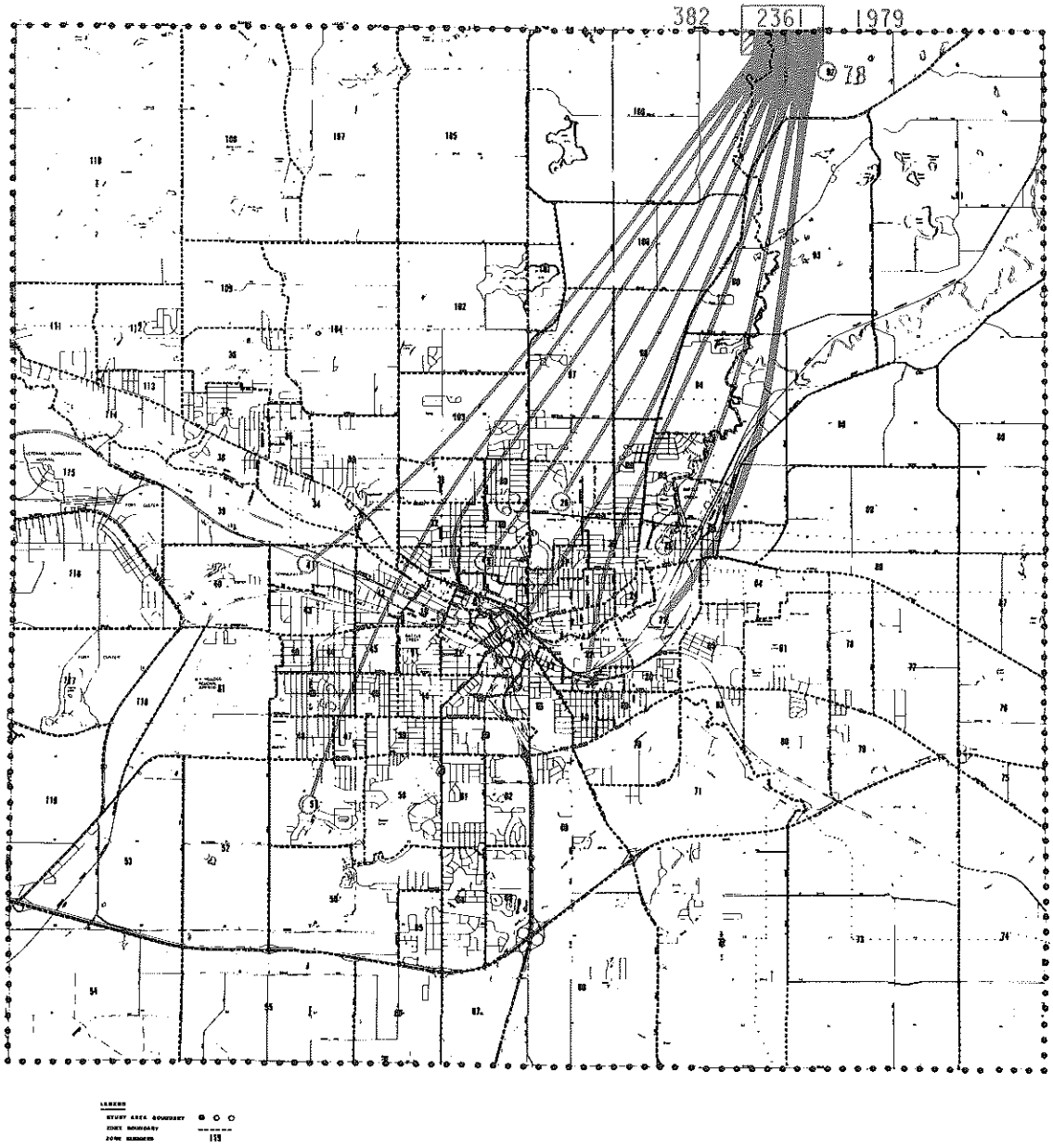
TERMINAL TRAFFIC 88%

STATION 122, THE 8 LARGEST INTERCHANGES ACCOUNT FOR 1074 TRIPS OR 38% OF ALL TERMINAL TRIPS.

M-37

EXHIBIT 10

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 16%

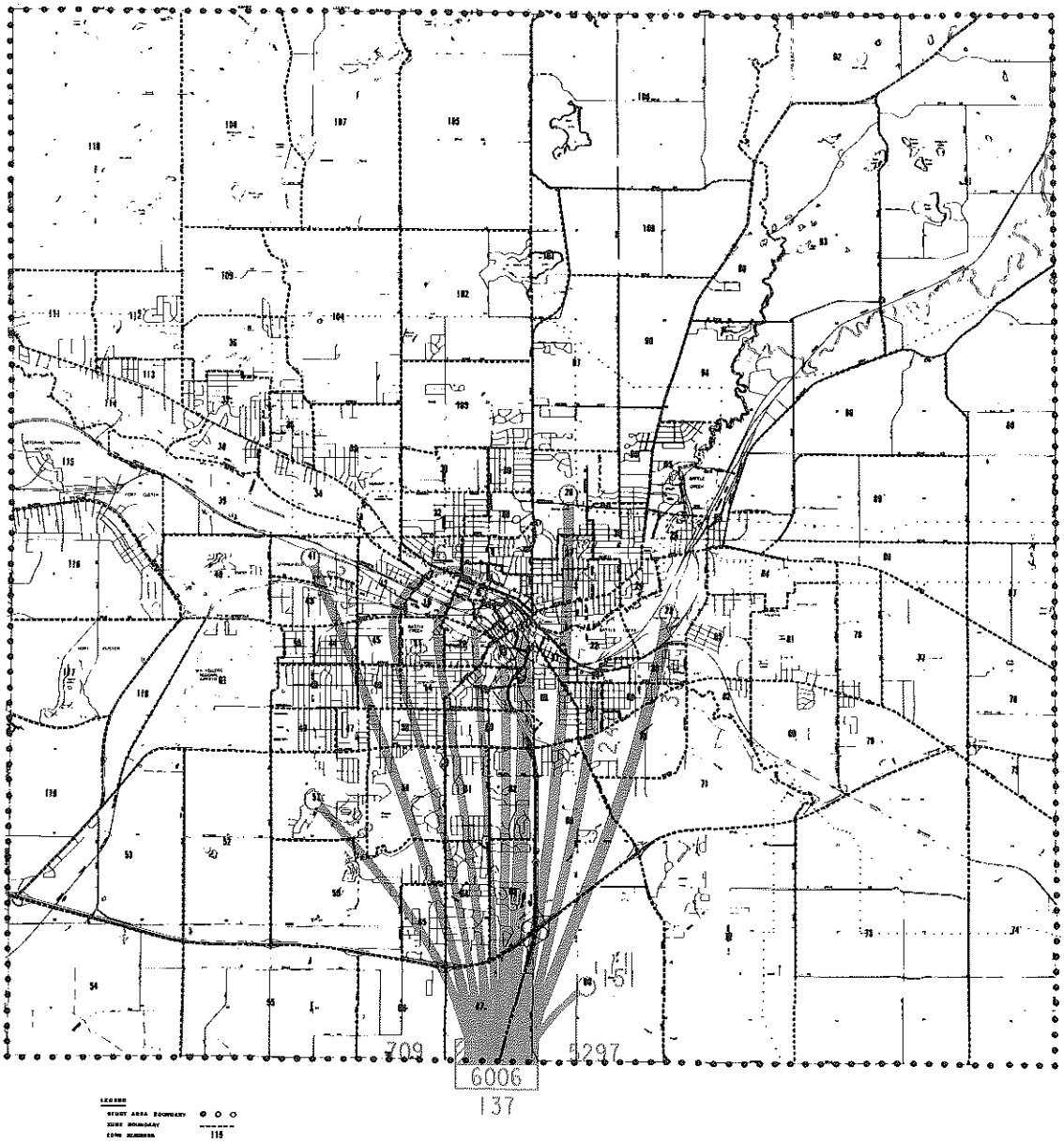
TERMINAL TRAFFIC 84%

STATION 126, THE 10 LARGEST INTERCHANGES ACCOUNT FOR 812 TRIPS OR 41% OF ALL TERMINAL TRIPS.

M-66 NORTH

EXHIBIT 11

BATTLE CREEK
AREA TRANSPORTATION STUDY



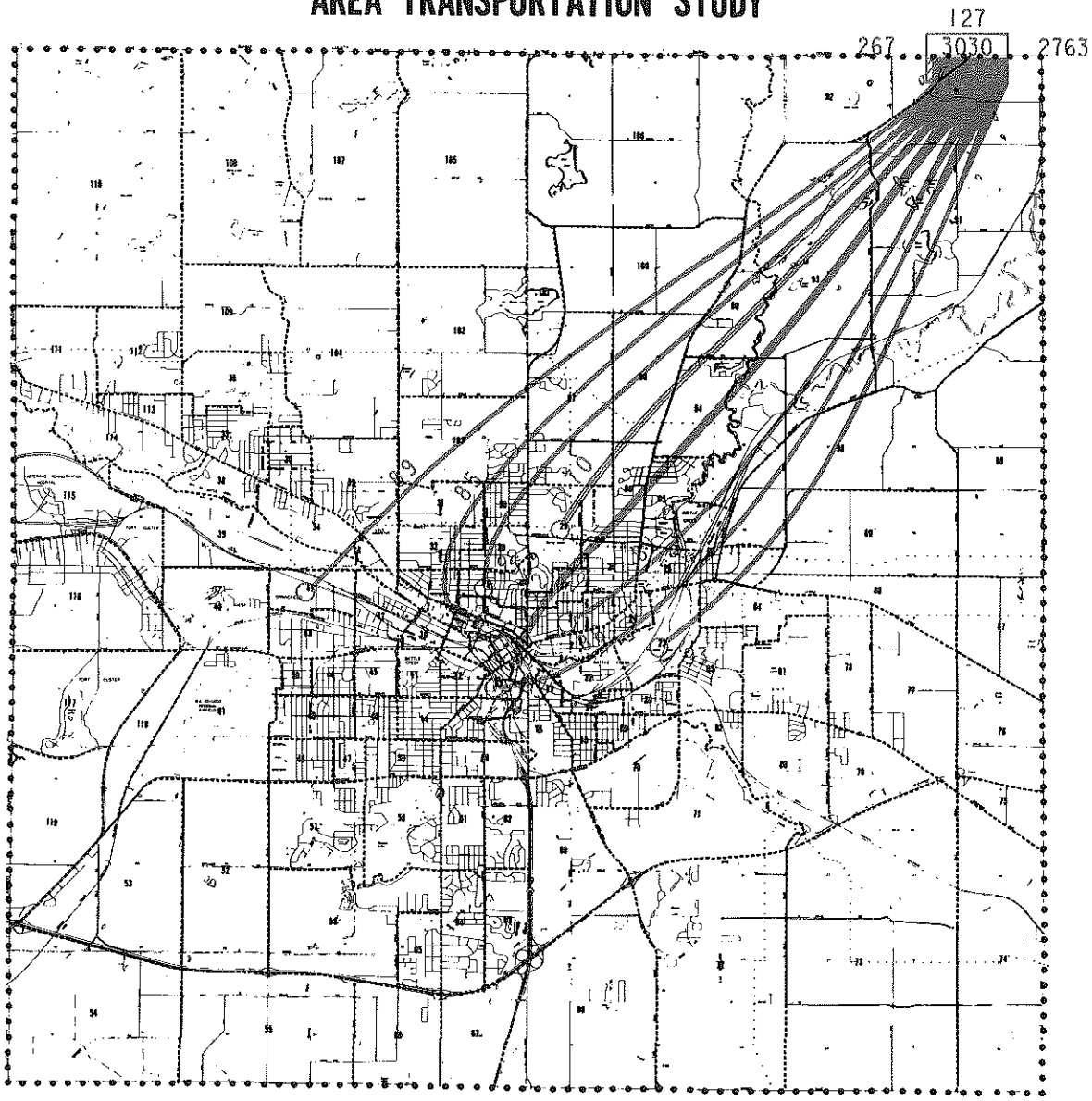
THRU TRAFFIC 12%

TERMINAL TRAFFIC 88%

STATION 137. THE 11 LARGEST INTERCHANGES ACCOUNT FOR 2524 TRIPS OR 48% OF ALL TERMINAL TRIPS.

EXHIBIT 12

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 9%

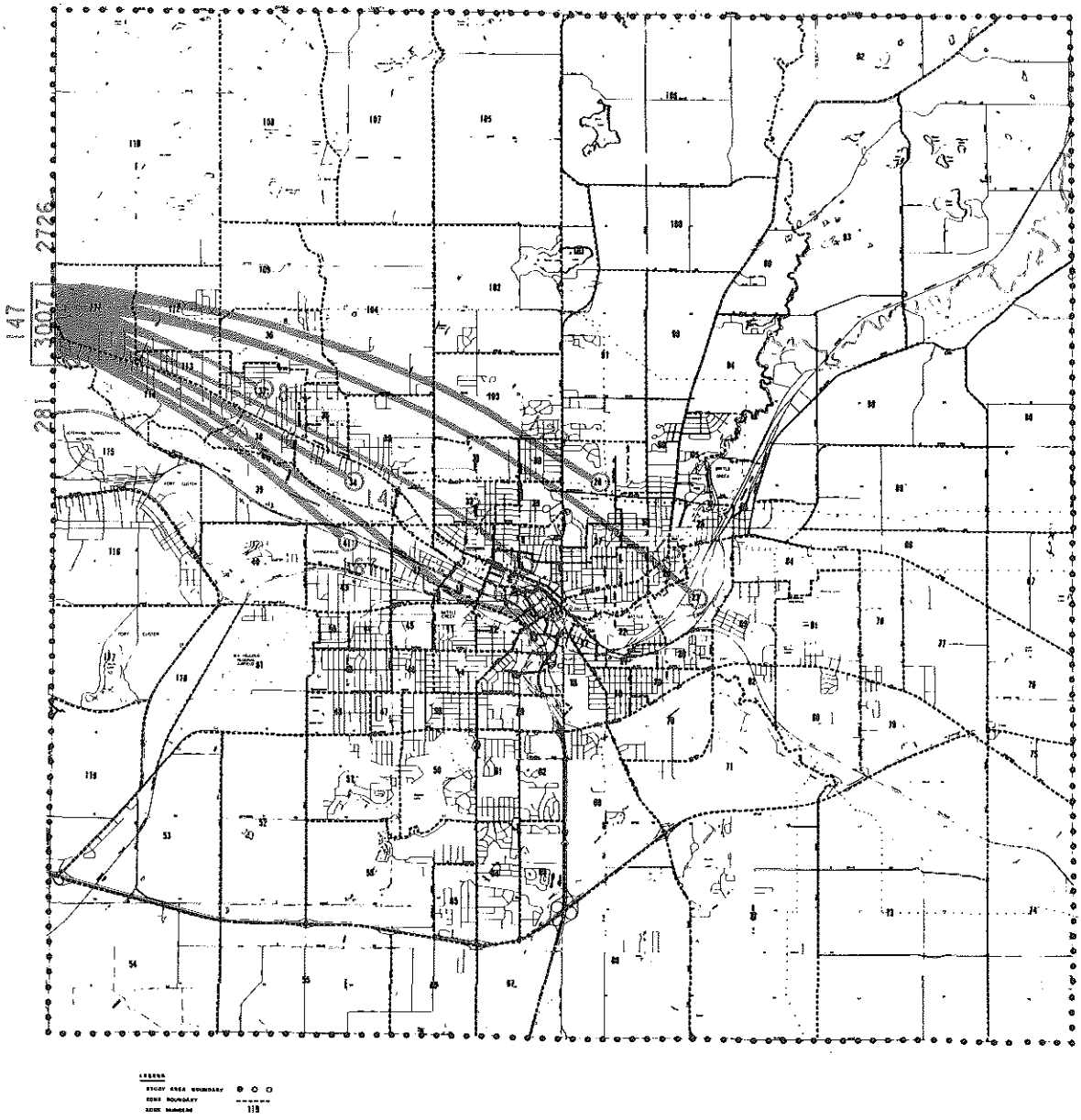
TERMINAL TRAFFIC 91%

STATION 127: THE 8 LARGEST INTERCHANGES ACCOUNT FOR 894 TRIPS OR 32% OF ALL TERMINAL TRIPS.

M-78

EXHIBIT 13

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 9%

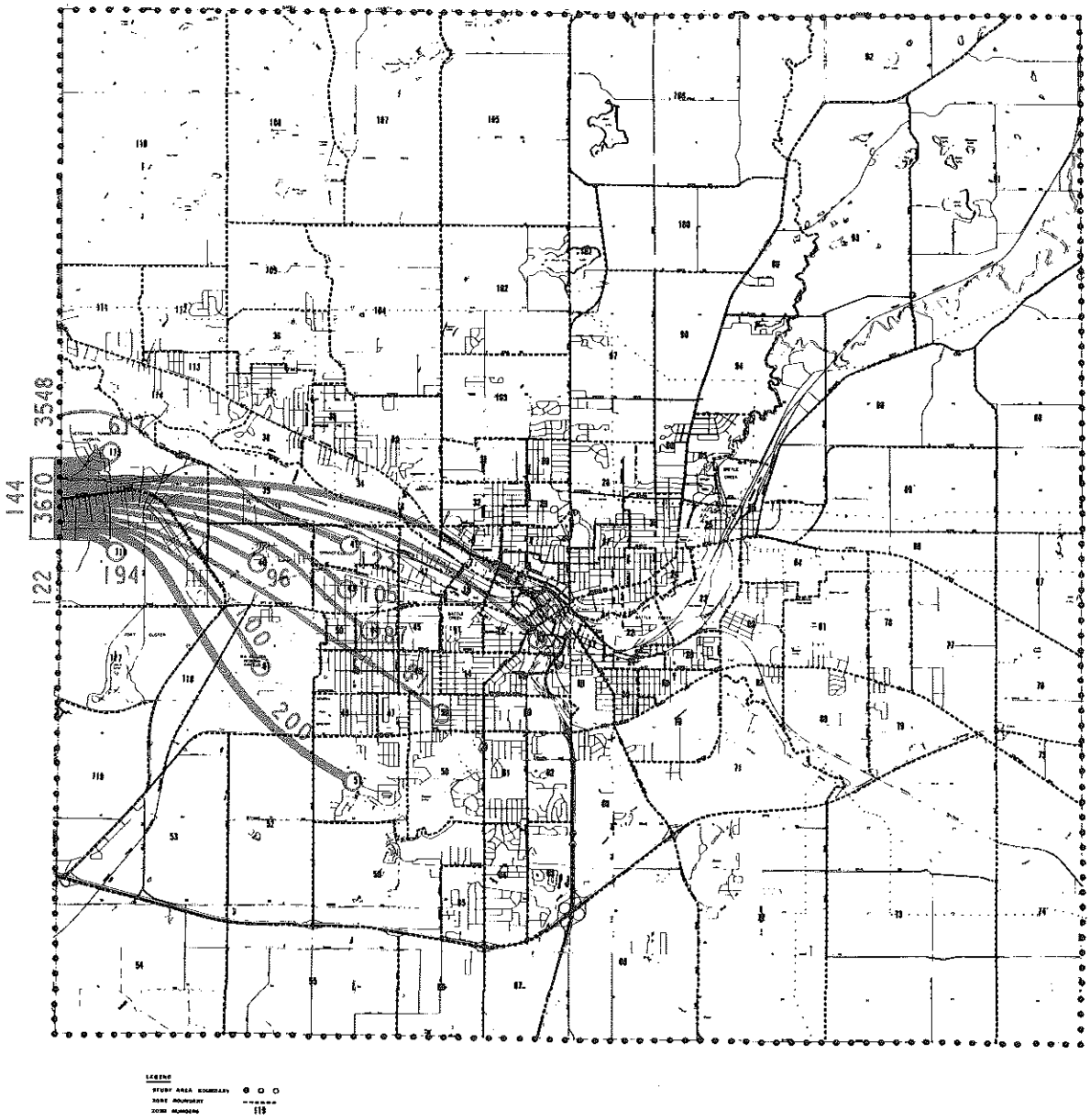
TERMINAL TRAFFIC 91%

STATION 147. THE 7 LARGEST INTERCHANGES ACCOUNT FOR 893 TRIPS OR 33% OF ALL TERMINAL TRIPS.

M-89

EXHIBIT 14

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 3%

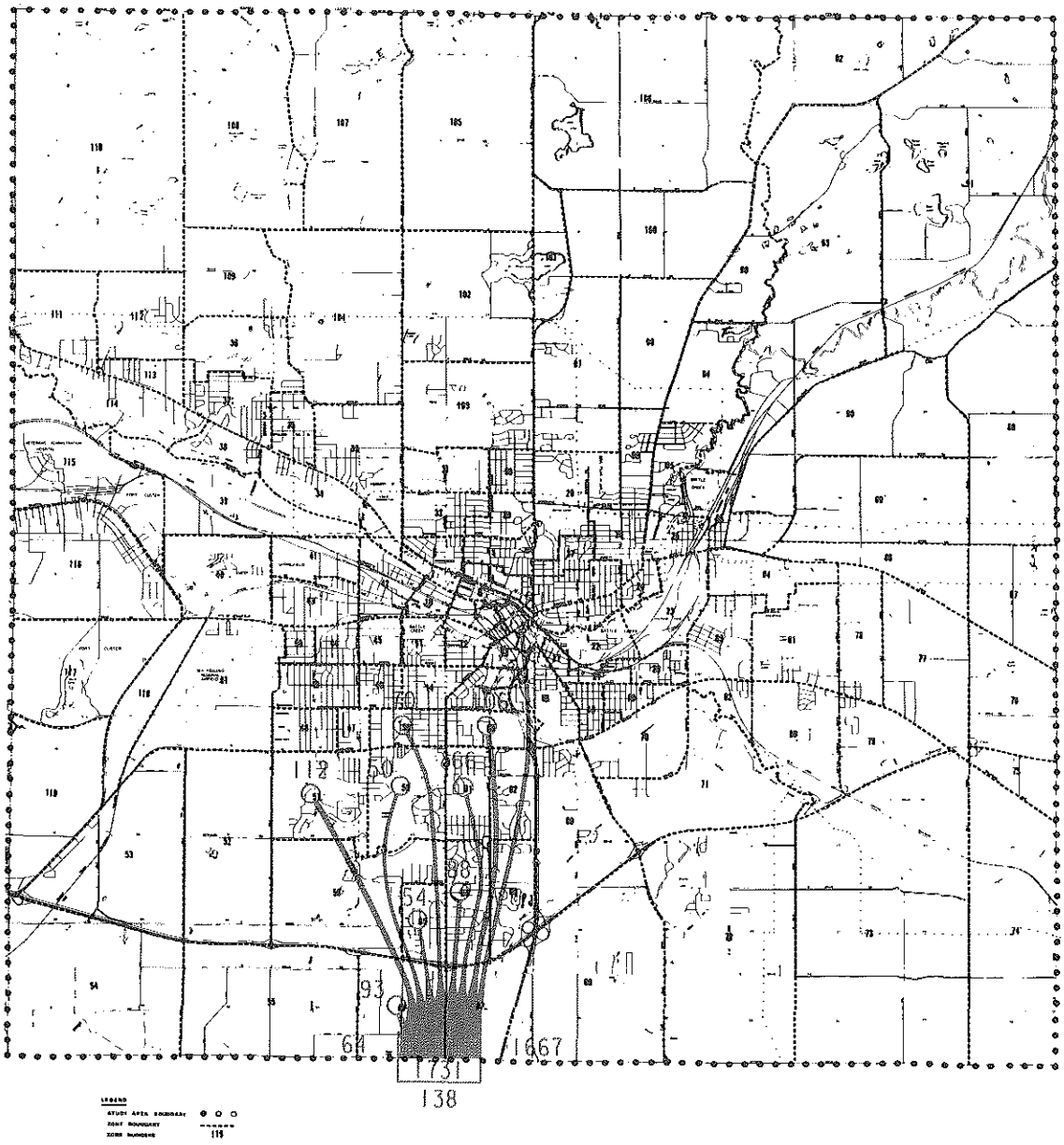
TERMINAL TRAFFIC 97%

STATION 144, THE 11 LARGEST INTERCHANGES ACCOUNT FOR 1835 TRIPS OR 52% OF ALL TERMINAL TRIPS.

M-96

EXHIBIT 15

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 4%

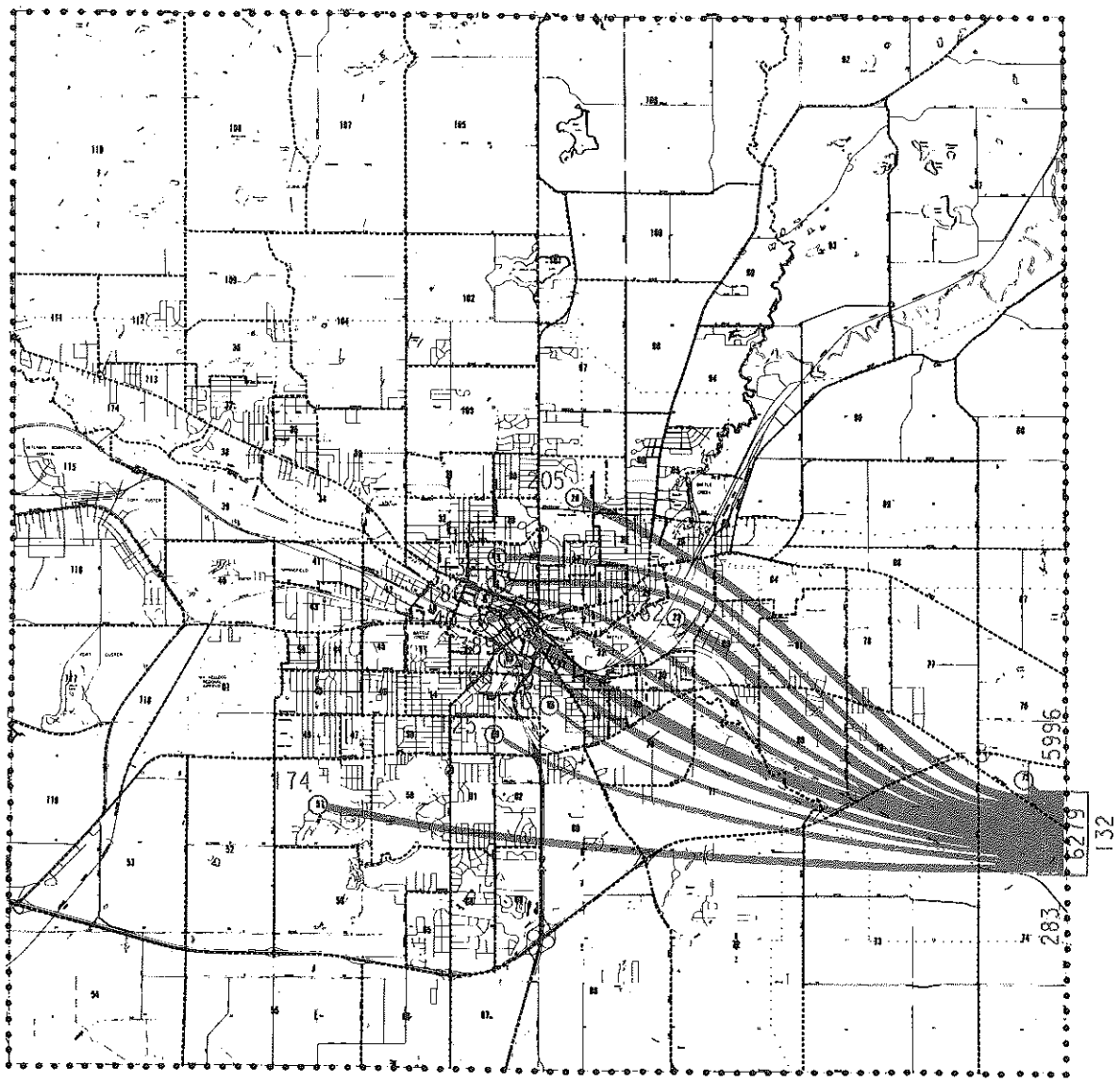
TERMINAL TRAFFIC 96%

STATION 138, THE 9 LARGEST INTERCHANGES ACCOUNT FOR 772 TRIPS OR 43% OF ALL TERMINAL TRIPS.

CAPTIAL AVENUE SOUTH

EXHIBIT 16

BATTLE CREEK
AREA TRANSPORTATION STUDY



THRU TRAFFIC 5%

TERMINAL TRAFFIC 95%

STATION 132: THE 12 LARGEST INTERCHANGES ACCOUNT FOR 2215 TRIPS OR 37% OF ALL TERMINAL TRIPS.

MICHIGAN AVENUE

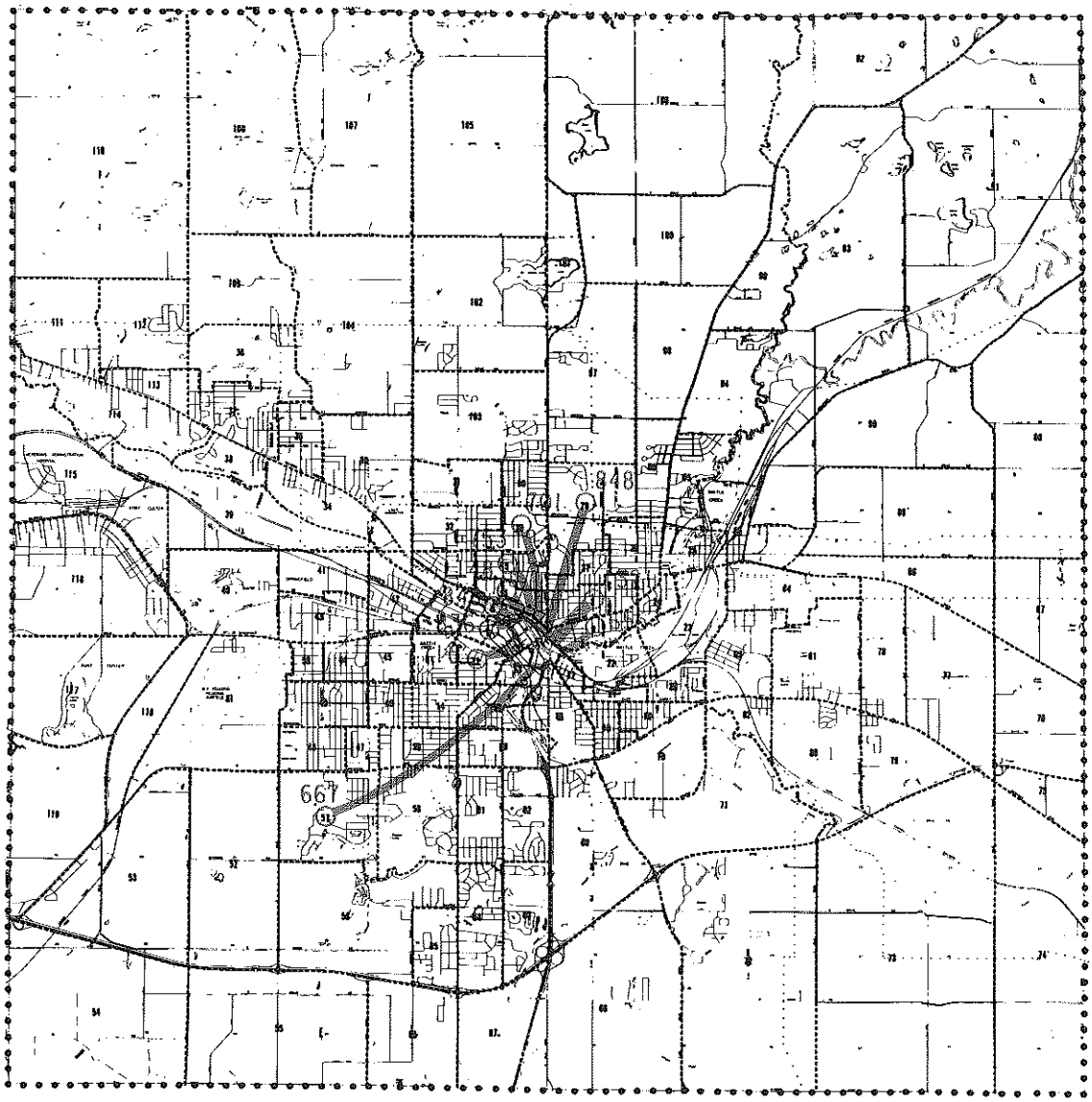
EXHIBIT 17

Exhibits 18–25 show the internal trips between eight selected zones and the zones which are the largest attractors of trips. The eight selected zones are shown on the following exhibits:

Exhibit 18 = Zone 1 (Central Business District)
Exhibit 19 = Zone 21 (Kellogg Company)
Exhibit 20 = Zone 28 (Kellogg Community and Leila Y. Post Hospitals)
Exhibit 21 = Zone 33 (Community of Urbandale)
Exhibit 22 = Zone 34 (Community of Urbandale)
Exhibit 23 = Zone 41 (Clark Equipment Company)
Exhibit 24 = Zone 57 (Meijers Thrifty Acres)
Exhibit 25 = Zone 116 (Ft. Custer Industrial Park)

The trip interchange between the study area and Michigan counties by order of importance are shown in Exhibit 26 for all trip purposes and Exhibit 27 for external work trips.

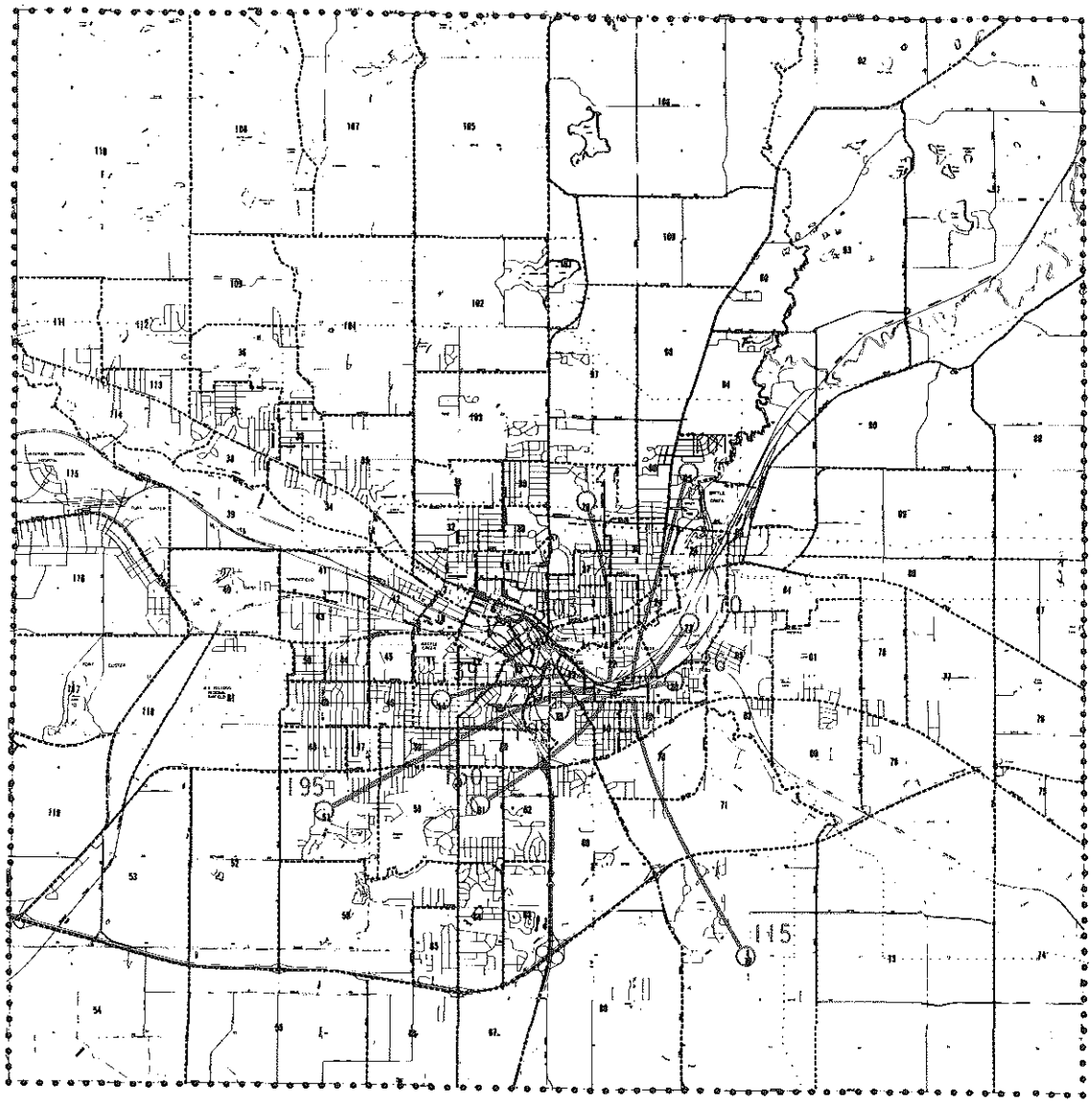
BATTLE CREEK
AREA TRANSPORTATION STUDY



OUT OF 28,951 INTERNAL TRIPS WITH A TERMINAL IN ZONE 7, 10 ZONES ACCOUNTED FOR 8,487 TRIPS OR 29%. ZONE 1 HAD 1,816 INTRAZONAL TRIPS .

EXHIBIT 18

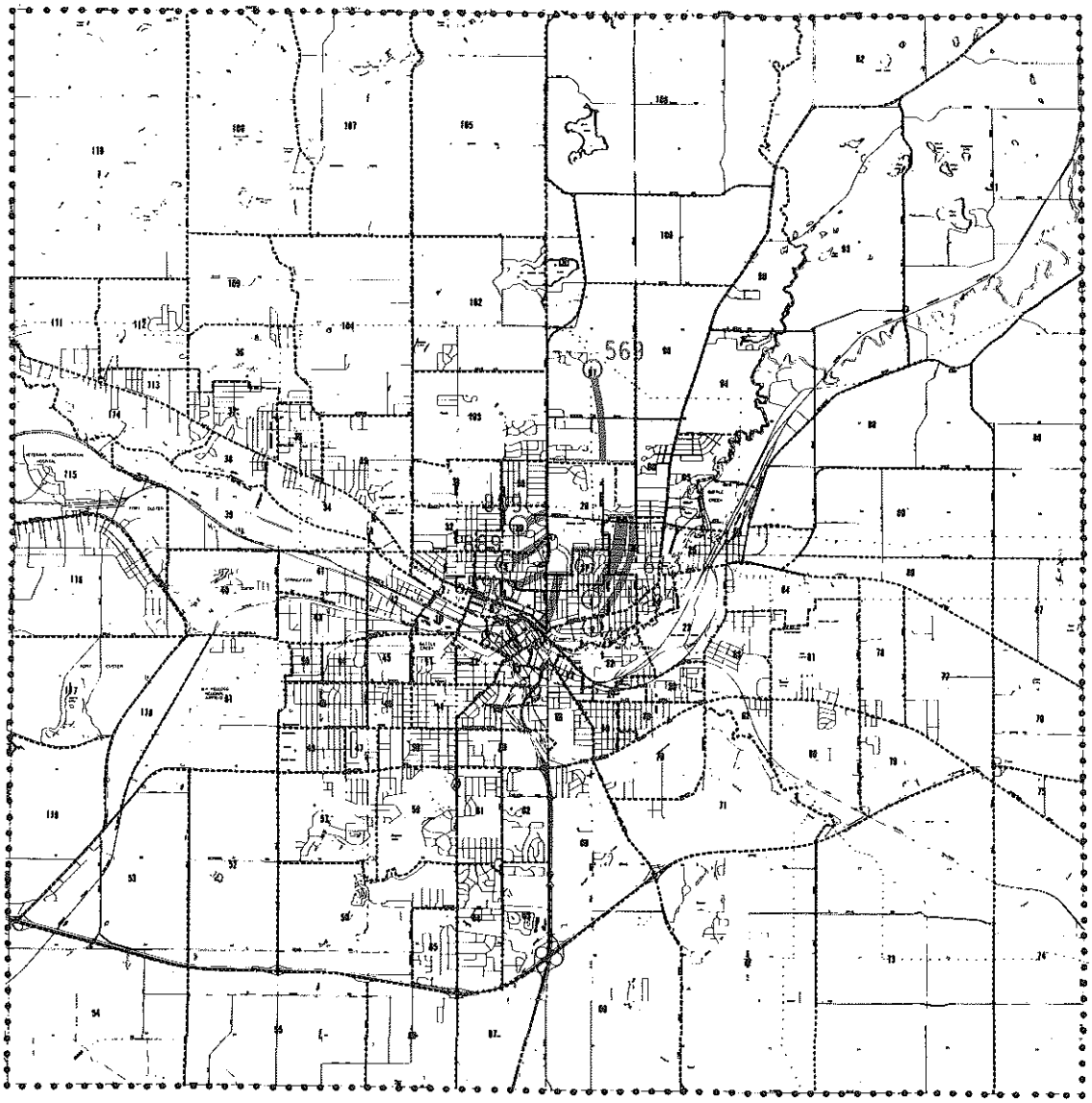
BATTLE CREEK
AREA TRANSPORTATION STUDY



OUT OF 4,329 INTERNAL TRIPS WITH A TERMINAL IN ZONE 21, 10 ZONES ACCOUNTED FOR 1,425 TRIPS OR 33%. ZONE 21 HAD 0 INTRAZONAL TRIPS .

EXHIBIT 19

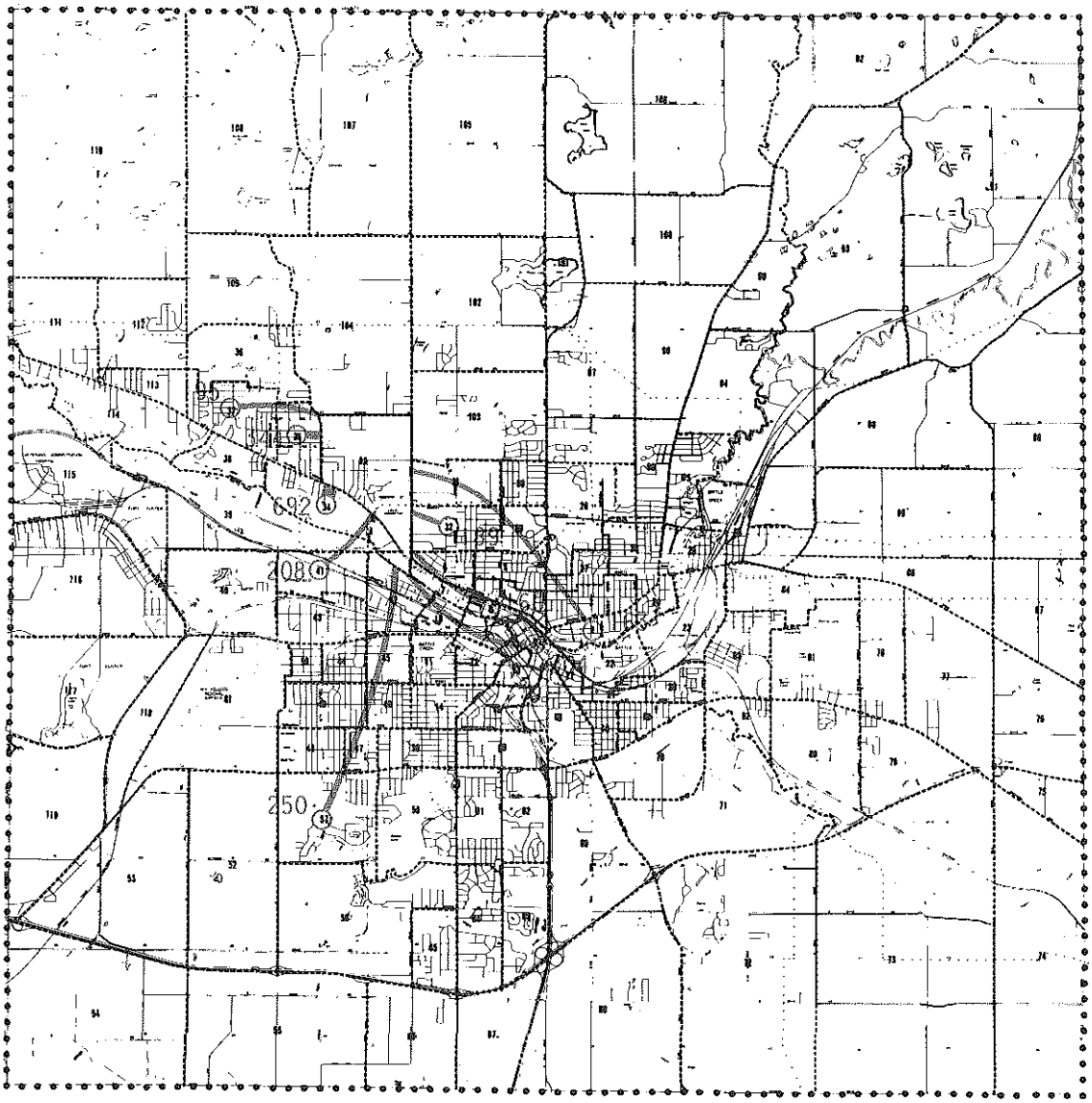
BATTLE CREEK
AREA TRANSPORTATION STUDY



OUT OF 16,967 INTERNAL TRIPS WITH A TERMINAL IN ZONE 28, 8 ZONES ACCOUNTED FOR 6,224 TRIPS OR 37%. ZONE 28 HAD 1,098 INTRAZONAL TRIPS .

EXHIBIT 20

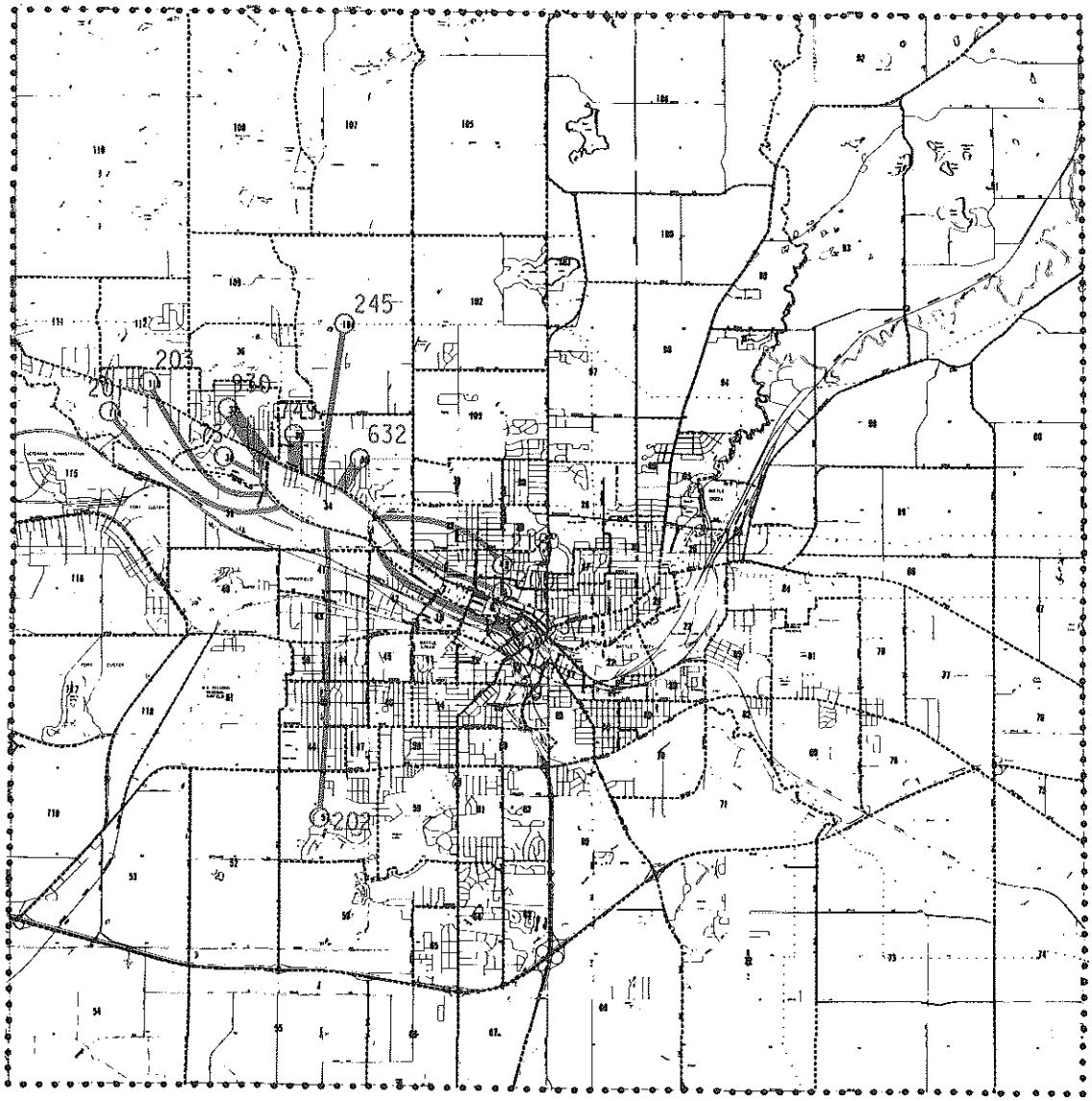
BATTLE CREEK
AREA TRANSPORTATION STUDY



OUT OF 6,244 INTERNAL TRIPS WITH A TERMINAL IN ZONE 33, 9 ZONES ACCOUNTED FOR 2,345 TRIPS OR 38%. ZONE 33 HAD 338 INTRAZONAL TRIPS .

EXHIBIT 21

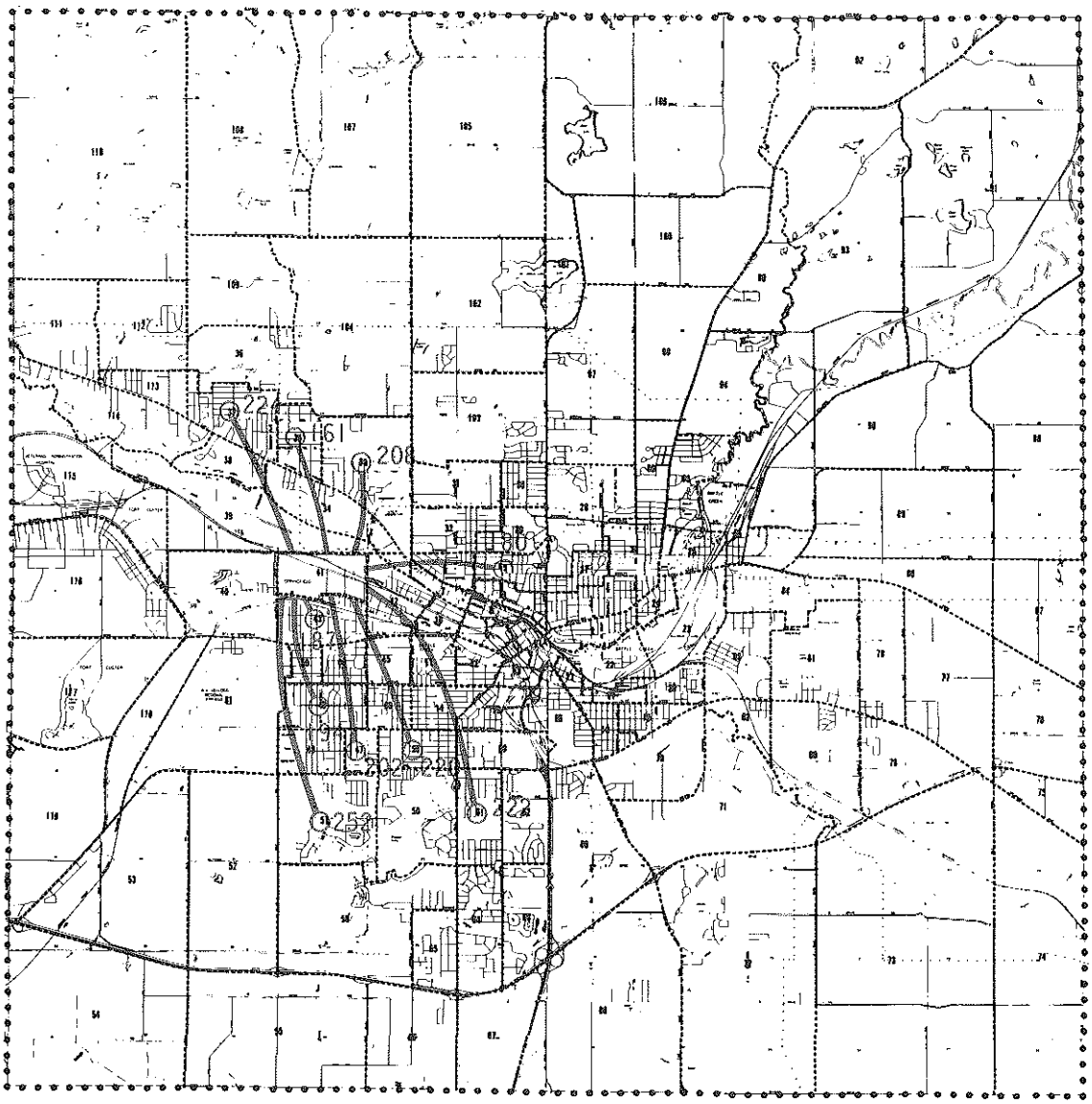
BATTLE CREEK
AREA TRANSPORTATION STUDY



OUT OF 8,763 INTERNAL TRIPS WITH A TERMINAL IN ZONE 34, 11 ZONES ACCOUNTED FOR 4,090 TRIPS OR 47%. ZONE 34 HAD 910 INTRAZONAL TRIPS .

EXHIBIT 22

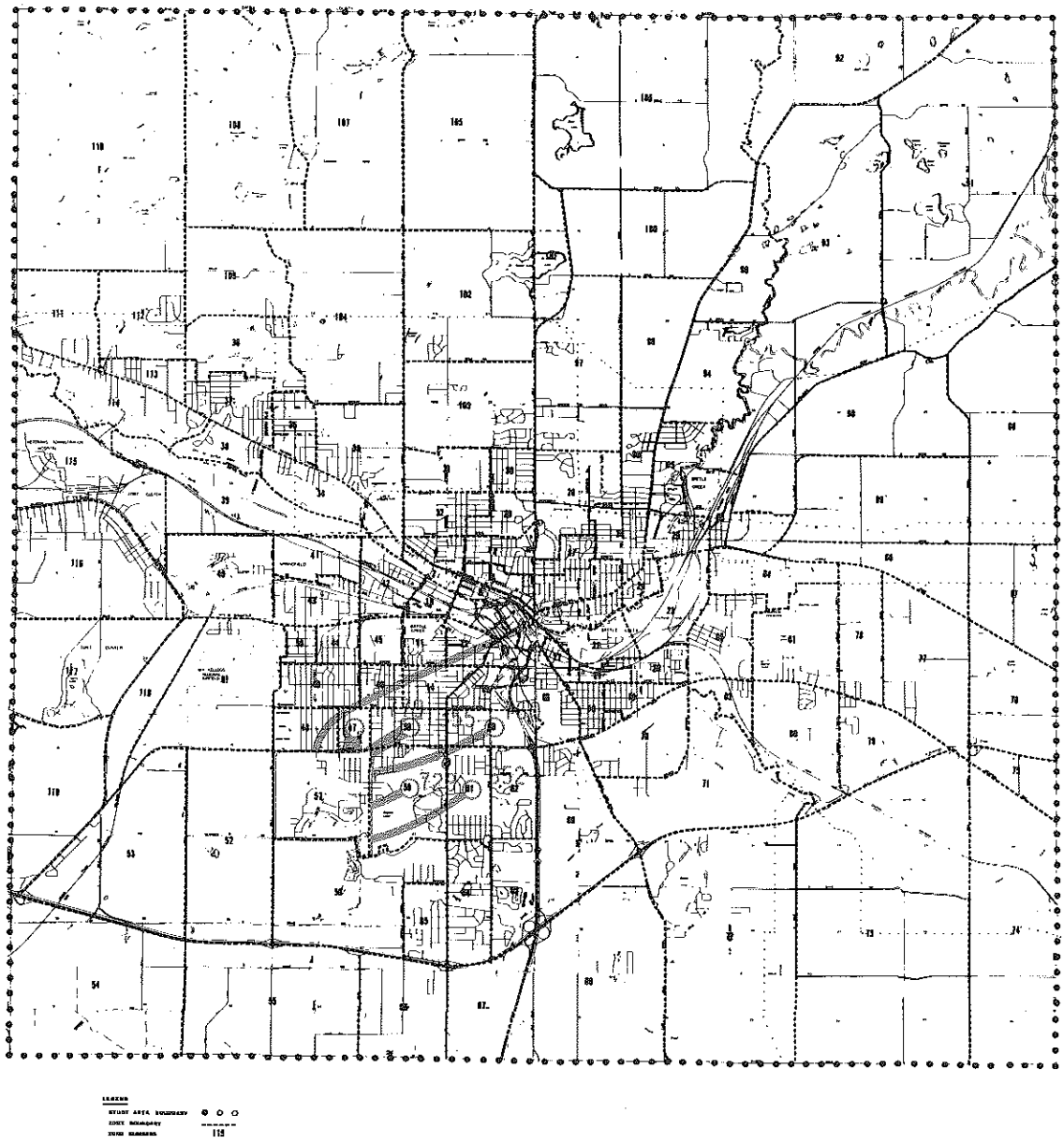
BATTLE CREEK
AREA TRANSPORTATION STUDY



OUT OF 5,652 INTERNAL TRIPS WITH A TERMINAL IN ZONE 41, 10 ZONES ACCOUNTED FOR 2,050 TRIPS OR 36%. ZONE 41 HAD 90 INTRAZONAL TRIPS .

EXHIBIT 23

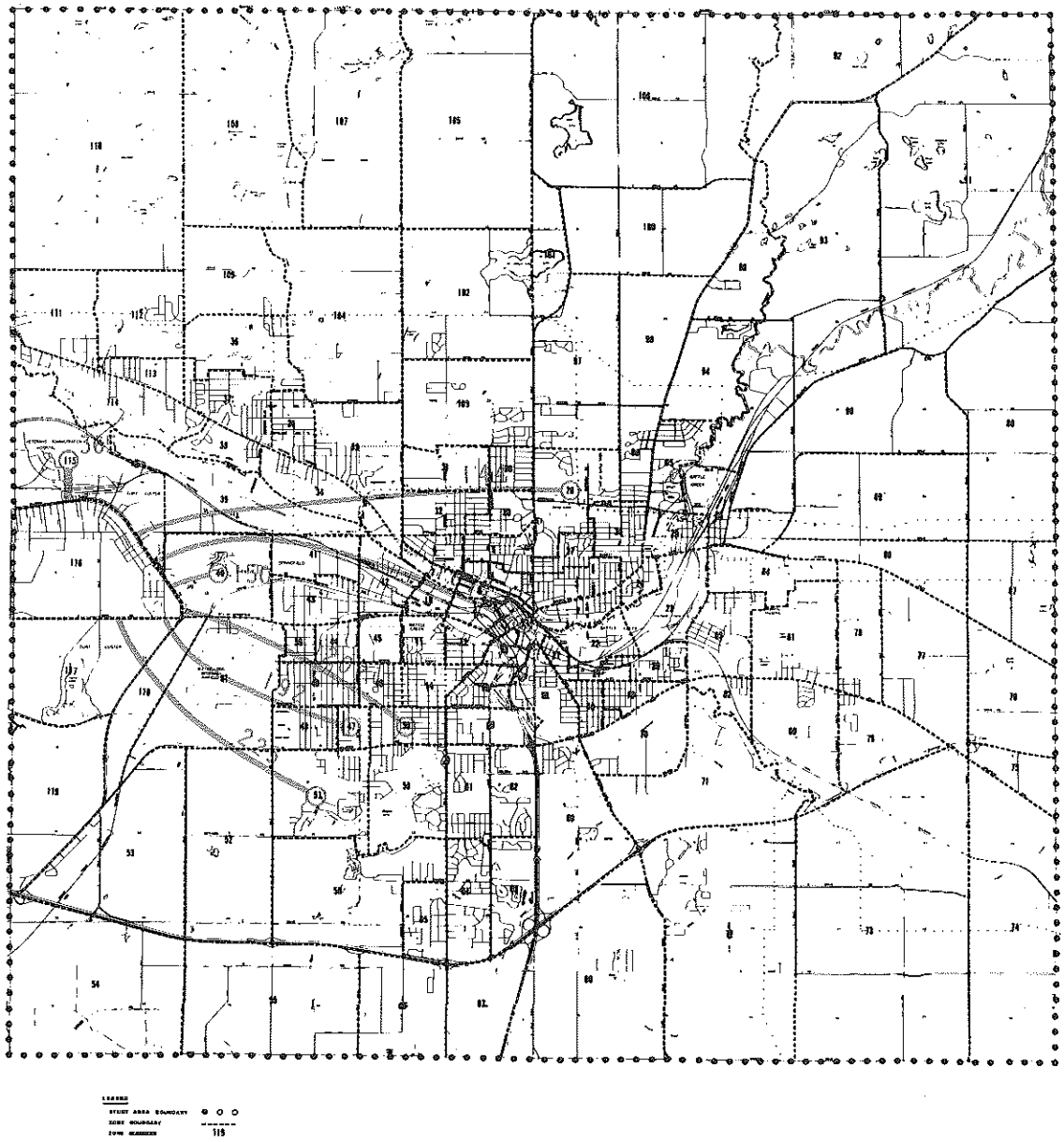
BATTLE CREEK
AREA TRANSPORTATION STUDY



OUT OF 23,856 INTERNAL TRIPS WITH A TERMINAL IN ZONE 57, 9 ZONES ACCOUNTED FOR 8,014 TRIPS OR 34%. ZONE 57 HAD 2,442 INTRAZONAL TRIPS .

EXHIBIT 24

BATTLE CREEK
AREA TRANSPORTATION STUDY

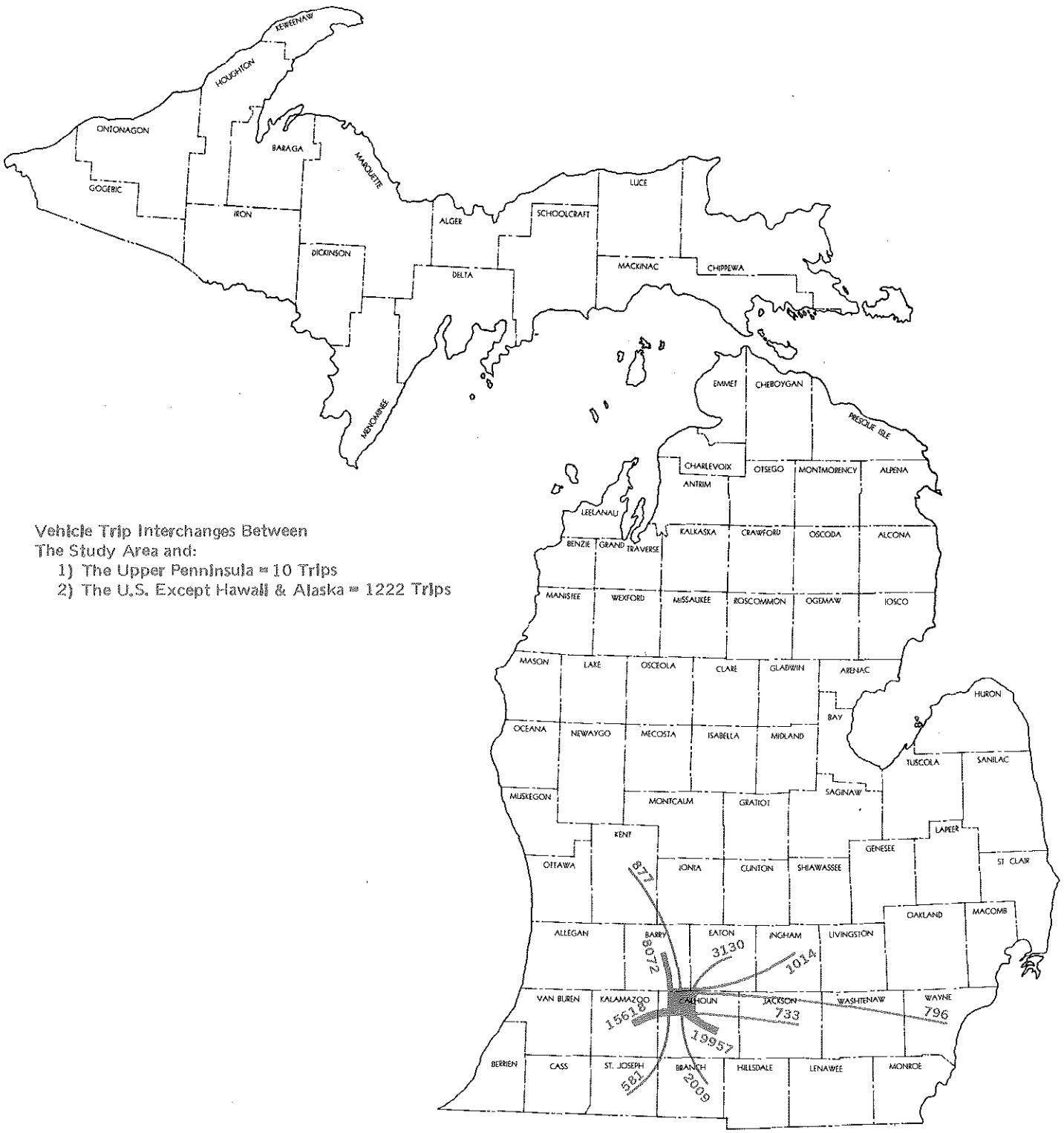


OUT OF 3,426 INTERNAL TRIPS WITH A TERMINAL
IN ZONE 116, 7 ZONES ACCOUNTED
FOR 1,450 TRIPS OR 42%. ZONE 116 HAD
406 INTRAZONAL TRIPS .

EXHIBIT 25

ALL VEHICLE EXTERNAL TRIPS

All Trip Purposes



Vehicle Trip Interchanges Between
The Study Area and:

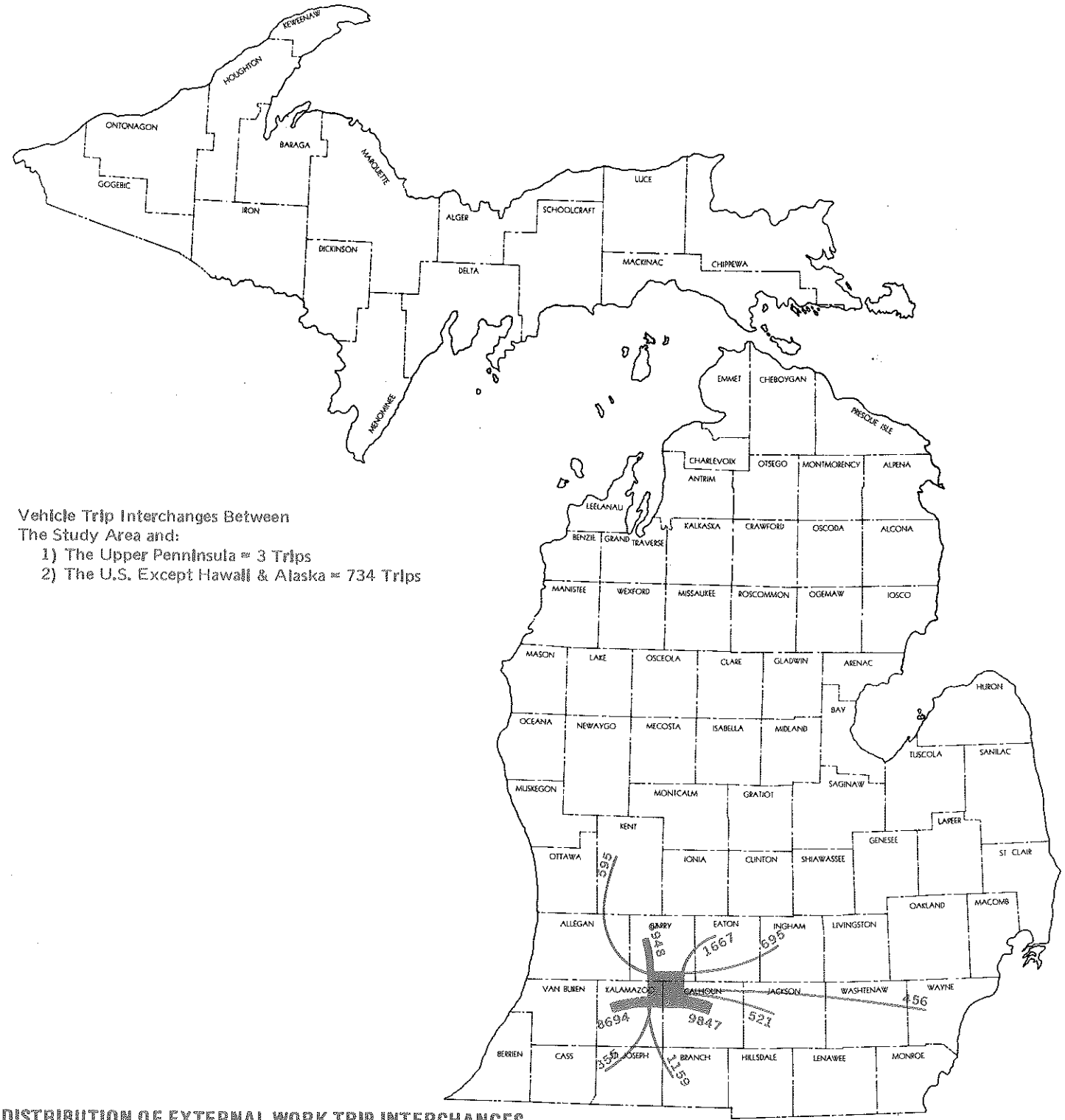
1) The Upper Penninsula = 10 Trips
2) The U.S. Except Hawaii & Alaska = 1222 Trips

DISTRIBUTION OF EXTERNAL TRIP INTERCHANGES BETWEEN THE STUDY AREA AND MICHIGAN COUNTIES BY ORDER OF IMPORTANCE. EXCLUDING THROUGH TRIPS

OUT OF 56,507 TOTAL EXTERNAL TRIPS, 10 COUNTIES ACCOUNTED FOR 93 PERCENT OR 52,787 TRIPS.

EXHIBIT 26

ALL VEHICLE EXTERNAL WORK TRIPS



Vehicle Trip Interchanges Between
The Study Area and:

1) The Upper Penninsula = 3 Trips
2) The U.S. Except Hawaii & Alaska = 734 Trips

DISTRIBUTION OF EXTERNAL WORK TRIP INTERCHANGES BETWEEN THE STUDY AREA AND MICHIGAN COUNTIES BY ORDER OF IMPORTANCE. EXCLUDING THROUGH TRIPS

OUT OF 30,231 TOTAL EXTERNAL TRIPS, 10 COUNTIES ACCOUNTED FOR 91 PERCENT OR 27,481 TRIPS.

EXHIBIT 27

SUMMARY OF ADJUSTED OCCUPIED DWELLING UNIT DATA

The following table, Exhibit 28 presents data gathered during the home interview portion of the 1976 Origin-Destination Study. This dwelling unit data is used as a base for projections to future years, and as a check on the completeness and accuracy of the internal survey.

The basic data items collected were dwelling units, total persons, passenger car trips, passenger trips, and passenger cars available. Relationships among these, which are also included in the table, are passenger cars per dwelling unit, persons per dwelling unit, persons per car, vehicle trips per dwelling unit, and trips per dwelling unit. These ten data items are summariezed for each traffic zone and for the total study area.

This data indicates that the 1976 population of the study area was 91,189. This amounted to 2.94 persons per dwelling unit. There were 47,612 passenger cars in the study area and 1.54 passenger cars per dwelling unit and 1.92 persons per car. There was an average of 8.77 vehicle trips per dwelling unit and 14.27 trips per dwelling unit.

EXHIBIT 28

SUMMARY OF ADJUSTED OCCUPIED DWELLING UNIT DATA

ZONE	OCCUPIED DWELLING UNIT	PASSENGER CARS	TOTAL PERSONS	PASS CARS PER D.U.	PERSONS PER D.U.	PERSONS PER CAR	PASSENGER CAR TRIPS	PASSENGER TRIPS	VEHICLE TRIPS/D.U.	TRIPS PER D.U.
1	41	41	41	1.00	1.00	1.00	253.10	0.00	6.17	6.17
2	708	763	2006	1.08	2.83	2.63	4706.98	3854.48	6.64	12.08
3	1359	1899	3885	1.40	2.86	2.05	10064.90	6549.42	7.40	12.22
4	401	323	1513	0.81	3.77	4.68	2177.85	2720.98	5.43	12.22
5	674	863	2076	1.28	3.08	2.41	4974.28	4919.40	7.38	14.68
6	477	607	1613	1.27	3.38	2.66	2664.01	2371.98	5.59	10.56
7	195	143	549	0.73	2.82	3.85	1071.83	1215.98	5.50	11.74
8	87	70	191	0.80	2.20	2.75	260.29	204.77	2.99	5.35
9	14	14	28	1.00	2.00	2.00	30.79	0.00	2.20	2.20
10	112	92	438	0.82	3.91	4.78	386.80	959.20	3.45	12.02
11	458	525	1540	1.15	3.36	2.93	3629.47	2732.11	7.92	13.88
12	413	464	1179	1.12	2.85	2.54	1946.37	1709.58	4.71	8.85
13	86	120	224	1.40	2.60	1.86	1167.88	521.08	13.58	19.64
14	829	1134	2354	1.37	2.84	2.08	6424.87	4600.50	7.75	13.30
15	568	753	1531	1.33	2.70	2.03	3131.22	1847.41	5.51	8.76
16	760	760	1962	1.00	2.58	2.58	4069.10	3580.90	5.35	10.07
17	365	425	835	1.17	2.29	1.96	1956.02	1018.80	5.37	8.16
18	664	833	1825	1.25	2.75	2.19	7110.59	3870.74	10.70	16.53
19	531	750	1492	1.41	2.81	1.99	4088.63	2106.92	7.70	11.67
20	465	623	1214	1.34	2.61	1.95	3302.15	1355.01	7.09	10.01
21	57	71	86	1.25	1.50	1.20	228.15	43.00	4.00	4.76
22	95	89	291	0.93	3.07	3.29	445.39	732.63	4.69	12.41
23	54	54	216	1.00	4.00	4.00	232.78	575.44	4.31	14.97
24	278	376	691	1.35	2.49	1.84	2638.72	1296.54	9.50	14.16
25	137	169	321	1.24	2.35	1.90	1246.59	1139.46	9.13	17.48
26	845	1090	2121	1.29	2.51	1.95	6072.47	4653.29	7.19	12.69
27	425	718	1249	1.69	2.94	1.74	4286.60	2278.03	10.08	15.44
28	433	745	1121	1.72	2.59	1.50	5064.29	2292.13	11.69	16.98
29	276	302	753	1.10	2.73	2.49	1599.88	1140.14	5.81	9.94
30	325	468	869	1.44	2.68	1.86	2776.78	1349.44	8.55	12.71

ZONE	OCCUPIED DWELLING UNIT	PASSENGER CARS	TOTAL PERSONS	PASS CARS PER D.U.	PERSONS PER D.U.	PERSONS PER CAR	PASSENGER CAR TRIPS	PASSENGER TRIPS	VEHICLE TRIPS/D.U.	TRIPS PER D.U.
31	115	193	329	1.67	2.86	1.71	895.41	493.70	7.76	12.04
32	418	497	1266	1.19	3.03	2.55	2951.47	2598.52	7.06	13.27
33	424	651	1132	1.53	2.67	1.74	4014.52	2235.43	9.46	14.73
34	188	194	482	1.03	2.57	2.48	1343.41	1321.78	7.15	14.19
35	457	742	1407	1.62	3.08	1.90	4632.35	2698.46	10.13	16.03
36	130	185	326	1.42	2.50	1.76	801.68	301.68	6.15	8.46
37	727	1212	2274	1.67	3.13	1.88	6611.24	3490.40	9.09	13.90
38	144	221	355	1.53	2.47	1.61	1215.12	631.72	8.45	12.84
39	42	53	118	1.27	2.82	2.21	362.50	205.81	8.63	13.52
40	443	770	1245	1.74	2.81	1.62	3740.21	2135.55	8.43	13.25
41	5	10	20	2.00	4.00	2.00	60.32	15.08	12.06	15.08
42	277	306	727	1.10	2.62	2.38	1648.84	1307.26	5.95	10.67
43	314	583	1007	1.86	3.21	1.73	3196.06	2478.79	10.18	18.07
44	248	433	721	1.74	2.90	1.67	2185.27	985.03	8.80	12.77
45	89	126	257	1.42	2.90	2.04	710.98	412.15	8.02	12.67
46	449	672	1326	1.50	2.95	1.97	3529.34	1918.72	7.86	12.13
47	259	331	751	1.28	2.90	2.27	1600.48	1240.22	6.17	10.96
48	275	431	815	1.57	2.97	1.89	2160.32	1270.39	7.86	12.48
49	753	1242	2123	1.65	2.82	1.71	6539.73	3455.23	8.69	13.27
50	10	17	37	1.67	3.67	2.20	143.94	6.66	14.41	15.08
51	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
52	33	75	109	2.25	3.25	1.44	210.62	232.14	6.30	13.24
53	108	188	296	1.75	2.75	1.57	941.62	583.20	8.74	14.16
54	24	36	66	1.50	2.75	1.83	204.32	258.82	8.51	19.30
55	63	117	235	1.86	3.72	2.00	891.62	407.52	14.15	20.62
56	268	648	931	2.42	3.47	1.44	3583.43	1759.66	13.38	19.95
57	567	1199	1831	2.11	3.23	1.53	6678.95	4040.73	11.78	18.91
58	449	742	1200	1.65	2.67	1.62	3970.33	1786.73	8.84	12.82
59	537	919	1534	1.71	2.85	1.67	5191.70	2813.21	9.66	14.90
60	157	242	356	1.55	2.27	1.47	1140.27	921.81	7.27	13.15

ZONE	OCCUPIED DWELLING UNIT	PASSENGER CARS	TOTAL PERSONS	PASS CARS PER D.U.	PERSONS PER D.U.	PERSONS PER CAR	PASSENGER CAR TRIPS	PASSENGER TRIPS	VEHICLE TRIPS/D.U.	TRIPS PER D.U
61	701	1148	1841	1.64	2.63	1.60	6917.19	2569.88	9.86	13.53
62	427	781	1462	1.83	3.43	1.87	4590.84	2359.64	10.76	16.29
63	380	834	1355	2.20	3.57	1.62	5209.31	3718.94	13.71	23.50
64	449	929	1543	2.07	3.43	1.66	5763.50	3431.37	12.82	20.46
65	295	565	1012	1.91	3.43	1.79	3068.55	2449.87	10.40	18.70
66	234	442	709	1.89	3.04	1.60	1621.70	1281.14	6.94	12.43
67	186	337	512	1.81	2.75	1.52	1510.83	1052.61	8.12	13.78
68	163	296	519	1.82	3.18	1.75	1745.81	963.06	10.71	16.62
69	236	413	792	1.75	3.36	1.92	2326.03	1914.53	9.85	17.97
70	202	272	491	1.35	2.43	1.81	1405.93	604.82	6.97	9.97
71	97	148	274	1.53	2.83	1.85	1319.55	832.07	13.62	22.22
72	563	982	1835	1.74	3.26	1.87	6380.22	4673.79	11.32	19.62
73	73	131	219	1.80	3.00	1.67	355.19	196.48	4.86	7.55
74	80	160	192	2.00	2.40	1.20	512.88	330.24	6.41	10.54
75	38	101	120	2.67	3.17	1.19	474.13	110.34	12.46	15.36
76	28	84	126	3.00	4.50	1.50	649.29	280.90	23.19	33.22
77	199	369	671	1.85	3.37	1.82	2381.33	1495.97	11.97	19.48
78	142	241	369	1.70	2.60	1.53	2018.00	1148.35	14.21	22.30
79	133	248	461	1.87	3.47	1.86	1714.16	1105.78	12.90	21.22
80	150	300	488	2.00	3.25	1.63	1615.10	910.14	10.77	16.83
81	266	540	863	2.03	3.25	1.60	4044.32	1802.69	15.23	22.01
82	34	68	136	2.00	4.00	2.00	79.52	68.40	2.34	4.35
83	449	549	1148	1.22	2.56	2.09	4111.72	2177.46	9.15	14.00
84	71	97	200	1.36	2.82	2.07	1211.70	502.46	17.08	24.16
85	83	145	270	1.75	3.25	1.86	889.80	720.75	10.72	19.39
86	46	74	148	1.60	3.20	2.00	481.61	303.69	10.38	16.92
87	23	52	48	2.25	2.50	1.11	226.46	88.58	9.85	13.70
88	46	55	110	1.20	2.40	2.00	269.34	276.80	5.87	11.91
89	66	132	205	2.00	3.11	1.56	633.32	546.45	9.60	17.88
90	115	86	310	1.62	2.69	1.67	1104.62	723.19	9.60	15.89

ZONE	OCCUPIED DWELLING UNIT	PASSENGER CARS	TOTAL PERSONS	PASS CARS PER D.U.	PERSONS PER D.U.	PERSONS PER CAR	PASSENGER CAR TRIPS	PASSENGER TRIPS	VEHICLE TRIPS/D.U.	TRIPS PER D.U.
91	164	320	597	1.95	3.63	1.86	1781.60	1350.30	10.84	19.06
92	73	146	206	2.00	2.82	1.41	907.04	585.45	12.44	20.46
93	205	379	797	1.85	3.89	2.10	2210.41	1945.02	10.79	20.28
94	96	220	324	2.29	3.38	1.47	1356.69	644.15	14.13	20.84
95	255	499	705	1.96	2.77	1.41	3031.24	1266.66	11.91	16.88
96	476	680	1118	1.43	2.35	1.64	4286.89	1842.16	9.00	12.87
97	396	740	1369	1.87	3.46	1.85	4280.91	2970.56	10.81	18.31
98	46	77	84	1.67	1.83	1.10	654.85	133.42	14.23	17.13
99	68	125	204	1.83	3.00	1.64	477.43	302.59	7.02	11.47
100	79	168	237	2.13	3.00	1.41	794.56	389.37	10.06	14.99
101	70	117	163	1.67	2.33	1.40	832.77	400.58	11.89	17.61
102	245	590	881	2.41	3.59	1.49	1877.55	871.66	7.66	11.21
103	545	829	1837	1.52	3.37	2.22	5061.28	3381.22	9.29	15.49
104	324	551	823	1.70	2.54	1.49	2856.44	2066.40	8.82	15.19
105	91	127	317	1.39	3.47	2.49	276.72	377.52	3.03	7.16
106	152	304	622	2.00	4.09	2.05	2117.61	1202.07	13.92	21.82
107	124	189	496	1.53	4.00	2.62	745.92	810.97	6.02	12.57
108	92	134	283	1.46	3.08	2.11	752.35	417.08	8.19	12.72
109	19	29	67	1.50	3.50	2.33	166.66	114.72	8.77	14.81
110	128	246	352	1.92	2.75	1.43	839.67	211.03	6.55	8.20
111	138	284	499	2.06	3.61	1.76	1247.64	904.88	9.04	15.59
112	146	292	576	2.00	3.95	1.97	1316.40	1028.67	9.02	16.07
113	160	278	472	1.74	2.95	1.70	1580.73	806.15	9.87	14.90
114	254	466	728	1.83	2.87	1.56	2141.20	1187.70	8.43	13.10
115	154	270	770	1.75	5.00	2.86	2814.15	2422.39	18.27	33.99
116	409	556	736	1.36	1.80	1.32	3540.21	748.45	8.66	10.49
117	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
119	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	30993	47612	91189	1.54	2.94	1.92	271745.70	170667.42	8.77	14.27

PASSENGER CAR OCCUPANCY

The passenger car occupancy tables, which show the average number of persons per vehicle, are presented on the following pages in four groups:

1. Cars owned by residents of the study area that made trips to any place whatsoever.

2. Cars owned or garaged in the study area that made trips which crossed the cordon line.

3. Cars garaged outside the area that made trips which crossed the cordon line.

4. All cars owned by residents and non-residents that made trips which crossed the cordon line.

Within these four groups passenger car occupancy is sub-divided into purpose categories. The driver of each vehicle is included in the count of the occupants, and the trip purpose of the driver is used for tabulation.

The tables show number of vehicle trips, percent of vehicle trips, number of occupants and average occupancy for each trip purpose. The trip purpose is the destination purpose or to-purpose of the trip in the internal records. Otherwise, purposes from and to are combined.

The residents of the area made 275,407 trips with an average occupancy of 1.50 persons per car. 261,737 of these trips were to destinations within the cordon line with an average occupancy of 1.49 persons per car. Residents made 13,670 cordon trips with an average occupancy of 1.61 persons per car.

Cars owned by non-residents accounted for 36,825 trips across the cordon line with an average occupancy of 1.61 persons per car. There were a total of 50,495 cordon trips by all cars with an average occupancy of 1.61 persons per car.

It can be seen that the highest occupancy rate among trips by residents is found in the Serve Passenger purpose. The lowest average occupancy is found in the Work purpose category for all car trips by residents.

Work trips for all residents of vehicles garaged and who worked inside the study area has a lower occupancy rate (1.11) than those cordon work trips of residents of vehicles garaged in the study area who worked outside the study area whose occupancy rate was 1.26 or those cordon work trips of non-residents of vehicles garaged outside the study area who worked inside the study area whose occupancy rate was 1.26.

PASSENGER CAR OCCUPANCY BY PURPOSE OF TRIPS

INTERNAL RECORDS
CAR TRIPS BY RESIDENTS

To-Purpose of Trip	Number of Vehicle Trips	Percent of Vehicles	Number of Occupants	Average Occupants
Work	42,094	16.1	46,516	1.11
Business	30,604	11.7	43,119	1.41
Shopping	38,764	14.8	60,208	1.55
School	4,335	1.7	5,311	1.23
Social-Rec.	29,602	11.3	48,281	1.63
Change Mode	502	.2	694	1.38
Serve Passenger	28,808	11.0	60,448	2.10
Subtotal	174,702	66.7	264,577	1.51
Home	87,035	33.3	125,482	1.44
ALL PURPOSES	261,737	100.0	390,059	1.49

EXTERNAL RECORDS
VEHICLES GARAGE INSIDE THE AREA

Purpose From and To	Number of Vehicle Trips	Percent of Vehicles	Number of Occupants	Average Occupants
Work	5,591	43.5	7,499	1.26
Business	1,746	12.8	3,160	1.81
Shopping	1,238	9.1	2,467	1.99
Vacation	467	3.4	696	1.49
Social-Rec.	3,851	28.2	7,405	1.92
Other	417	3.1	720	1.73
TOTAL	13,670	100.0	21,947	1.61

EXTERNAL RECORDS
VEHICLES GARAGE OUTSIDE THE AREA

Work	17,713	48.1	22,235	1.26
Business	4,244	11.5	7,471	1.76
Shopping	3,970	10.8	7,424	1.87
Vacation	1,618	4.4	2,382	1.47
Social-Rec.	7,701	20.9	16,934	2.20
Other	1,579	4.3	2,944	1.86
TOTAL	36,825	100.0	59,390	1.61

EXTERNAL RECORDS
ALL VEHICLES CROSSING CORDON LINE

Purpose From and To	Number of Vehicle Trips	Percent of Vehicles	Number of Occupants	Average Occupants
Work	23,664	46.9	29,734	1.26
Business	5,990	11.9	10,631	1.77
Shopping	5,208	10.3	9,891	1.90
Vacation	2,085	4.1	3,078	1.48
Social-Rec.	11,552	22.9	24,339	2.11
Other	1,996	3.9	3,664	1.84
TOTAL	50,495	100.0	81,337	1.61