A TRAFFIC ACCIDENT ANALYSIS OF HIGH ACCIDENT LOCATIONS IN THE CITY OF ESCANABA

Report TSD-SS-197-72

TRAFFIC and SAFETY DIVISION

DEPARTMENT OF STATE HIGHWAYS
STATE OF MICHIGAN

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OF HIGH ACCIDENT LOCATIONS
IN THE CITY OF ESCANABA

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by

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INTRODUCTION

The Highway Safety Act of 1966 was enacted by the Congress of the United States in order to promote highway safety programs. Subsequently, various highway safety standards were developed to assure the orderly implementation of the Act.

Highway Safety Standard 4.4.9, Identification and Surveillance of Accident Locations, is one of those standards. The purpose of Standard 4.4.9 is to identify specific locations or sections of streets and highways which have high or potentially high accident experience as a basis for establishing priorities for improvement, selective enforcement or other operational practices that will eliminate or reduce the hazards at the location so identified.

The State of Michigan carries out a program of this type on the state trunkline system; however, many of the State's city and county agencies lack the financial and technical prerequisites necessary to pursue similar programs with similarly defined objectives. To insure that this additional Highway Safety Standard is met and to improve the overall evaluation of the accident picture in Michigan, the Michigan Department of State Highways requested and received through the Office of Highway Safety Planning in the Department of State Police a federally funded project entitled, "Traffic Accident Analysis for Cities and Counties". The intent of this new project is to provide a special traffic engineering field service for cities and counties. In cooperation with participating cities and counties, the proposed service under the direction of Department personnel will make a traffic engineering evaluation of the factors causing traffic accidents and will recommend corrections to those conditions which may be contributing to accidents.

SCOPE

The intent of this program is to improve traffic safety on all Michigan streets and roads by expanding the traffic engineering evaluation of factors causing accidents. This should be accomplished by conducting traffic accident analysis of locations which experience high accident frequencies, and summarizing recommendations for corrective action.

STUDY PROCEDURES

The study procedures for the subject project involve several distinct phases. They may be described as follows: basic data collection, identifying and locating high accident locations, an accident analysis of these high accident locations, technical evaluation of previously compiled facts and consequent remedial recommendations.

Since a portion of the data collection phase involves accident records and reports, and since the Michigan Department of State Police is responsible for keeping all accident records in Michigan, the task of identifying and locating high accident locations in the City of Escanaba (and providing an inventory of those locations) was designated as State Police responsibility. Since there is no automated system of locating accidents on the city street system, the high accident locations for the City of Escanaba were determined by manually extracting and compiling those locations with the highest number of accidents from the 1970 city accident reports. From this list the 15 highest accident locations were selected. Once the problem locations were identified, additional accident information for the years 1968 and 1969 was compiled in order to expand the accident base at each location. Upon completion of this portion of the data collection, the Department of State Police documented and transmitted to the Traffic & Safety Division of the Department of State Highways a list, along with the accident reports, of the high accident locations for the City of Escanaba.

The second portion of the data collection phase, which is the responsibility of the Department of State Highways, involves data collection utilizing the following basic steps: 1) preparation of collision diagrams, and if necessary, physical condition diagrams for each selected location, 2) obtaining traffic counts where necessary.

The accident analysis phase involves the analysis of the summarized facts and field data from the viewpoint of a highway traffic engineer with special attention focused on the effect which the highway environment may have had on the accident. Thus, at each high accident location, individual accident reports were reviewed in detail and the accident factors were tabulated and grouped in various tables. Collision diagrams were prepared for each location in order to identify accident patterns and to locate the accident in relation to the intersection or approaches to the intersection.

The traffic engineering analysis phase involves evaluating the summarized facts and field data and prescribing the proper remedial treatment.

STUDY AREA

The City of Escanaba, which is the county seat of Delta County, covers 11.5 square miles. It is located on the southern side of the Upper Peninsula on the shoreline of Lake Michigan at the mouth of Green Bay (See Figure 1).

Since 1920, Escanaba has had a steady increase in population as can be seen from the population projection shown in Figure 2. The City of Escanaba experienced its largest growth between 1920 and 1930, when the population increased 10.8%. It was during this period that Escanaba was at the

FIGURE 1

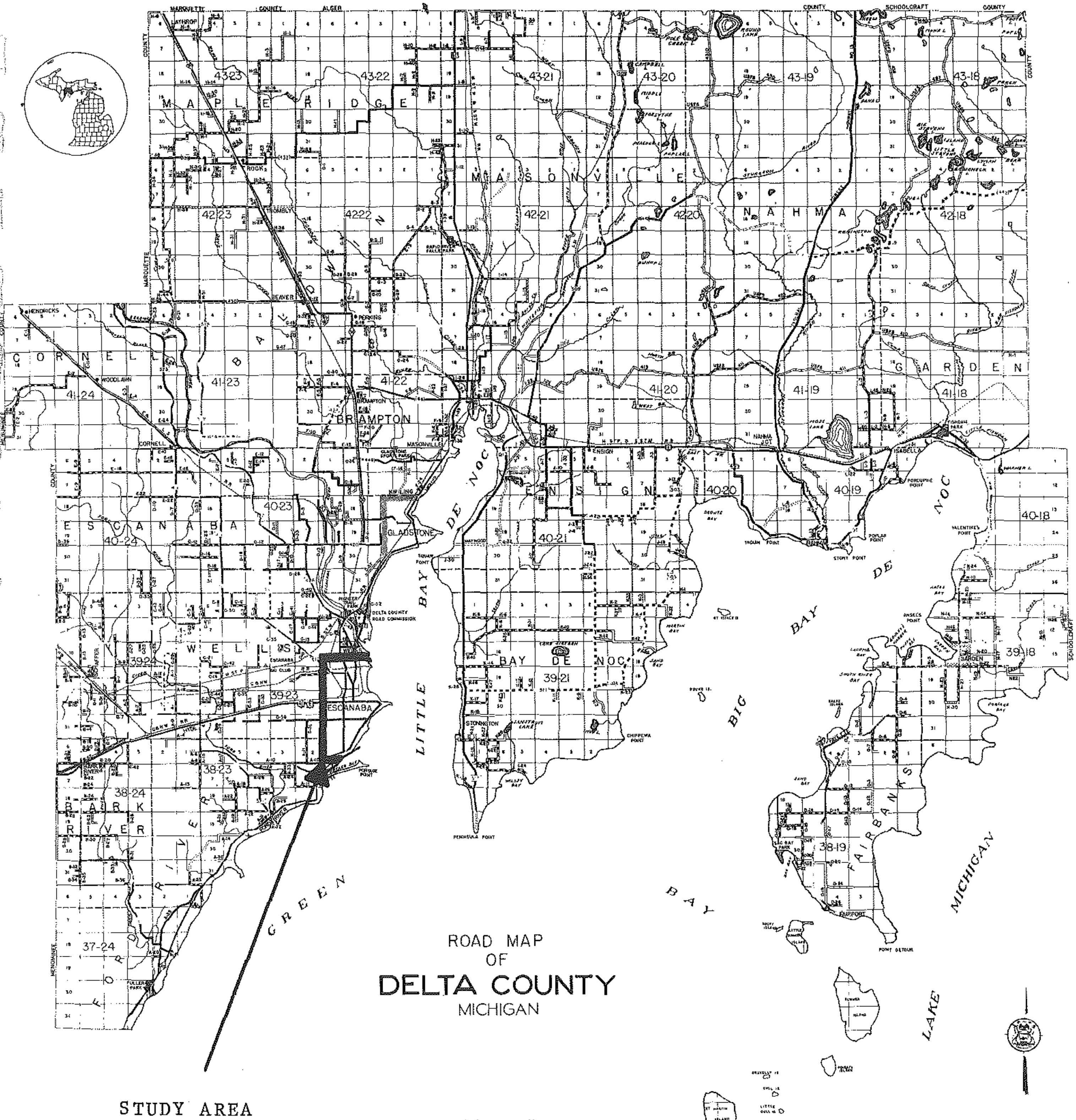
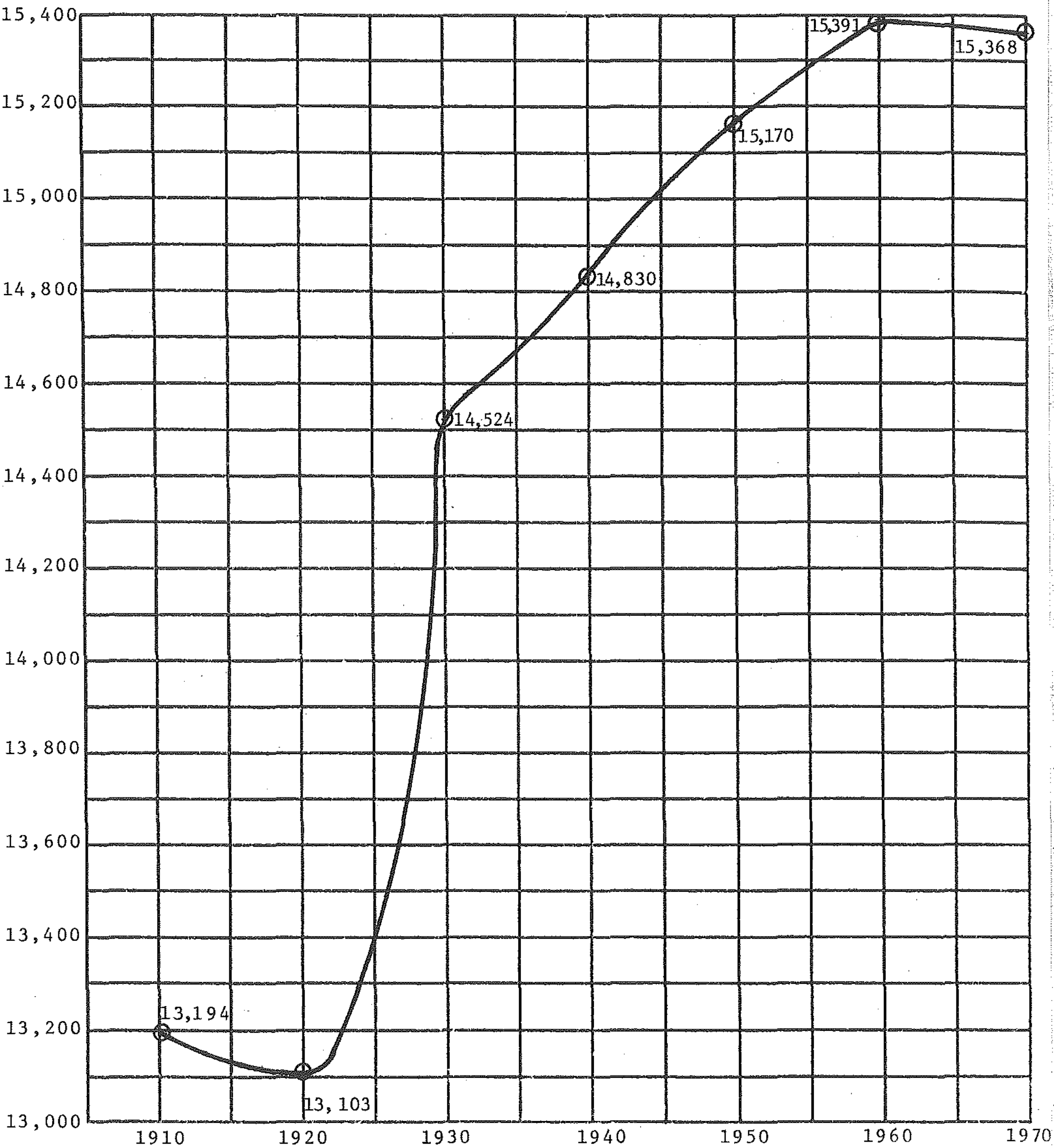

ROAD MAP
OF
DELTA COUNTY
MICHIGAN
STUDY AREA
MAPLE RIDGE
MASONVILLE
NAHMA
CORNELL
BALDWIN
GARDEN
ESCANABA
ENSIGN
WELLS
BAY DE NOC
BARK RIVER
FORD RIVER
FAIRBANKS
BRAMPTON
GLADSTONE
ESCANABA
LITTLE BAY DE NOC
BIG BAY DE NOC
GREEN BAY
LAKE MICHIGAN

FIGURE 2

POPULATION PROJECTION

CITY OF ESCANABA: 1910 - 1970



SOURCE: U. S. BUREAU OF THE CENSUS

height of its iron ore shipping activities. Between 1930 and 1960, Escanaba had a 6% increase in population. During this period Escanaba was in the process of expanding both its economic activities which include iron ore shipments, forest products and general manufacturing, and its port facilities. Due to residential movement toward the suburban areas during the past decade, the city's population has followed the national trend by decreasing 0.1%. Due to present and future expansions and being the only port on the southern side of the Upper Peninsula, Escanaba and the surrounding vicinity can look forward to a prosperous growth.

Escanaba features many attractions for their own community and for tourists. The Escanaba Golf Club and Highland Golf Club offer their facilities for those who like to golf. Fishing enthusiasts can fish off the municipal dock, Sand Point or nearby lakes and streams. With an average snowfall of 56 inches, all the major winter sports can be enjoyed by those who wish to partake.

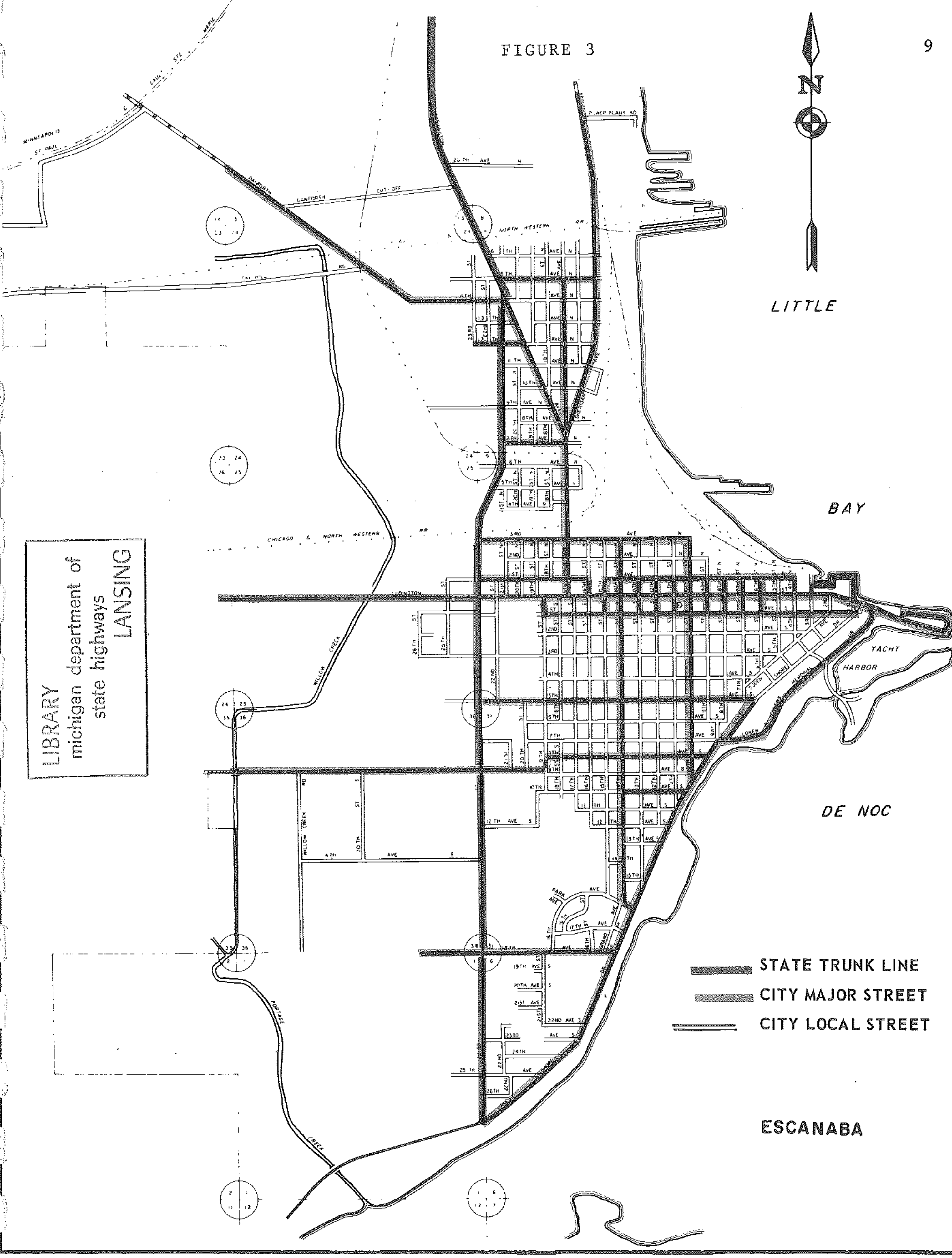
The first settlement in the immediate vicinity was upstream on the Escanaba River where sawmills were operating as early as 1836. Forestry continues through the present day to provide for paper manufacture, pulpwood products, lumber and precut houses.

During its first hundred years as a shipping port, Escanaba exported 325 million tons of iron ore. The amount of iron ore handled at Escanaba's shipping ports is influenced by several factors: the needs of the Chicago market, the productivity of the surrounding iron ranges and the improvements in the Soo Locks.

The Federal, State, and Local governments employ the most people in the city, while the single largest employer, the Harnischfeger Corporation, employs 1,125 persons. This firm has two plants in Escanaba with one manufacturing truck cranes and the other welding machines. The second largest employer is the Escanaba Paper Company, a Division of Mead Corporation, which employs 625 persons.

According to the Nineteenth Annual Progress Report, as compiled by the Local Government Division of the Michigan Department of State Highways, the City of Escanaba has 75.02 miles of streets. This figure includes 6.05 miles of state trunkline, 23.85 miles of major city streets and 45.12 miles of local city streets. A map showing these road types can be found on p. 9.

FIGURE 3



LITTLE
BAY
DE NOC
YACHT
HARBOR
STATE TRUNK LINE
CITY MAJOR STREET
CITY LOCAL STREET
ESCANABA
N
CHICAGO & NORTH WESTERN RR
LUDINGTON ST
WILLOW CREEK
PORTAGE CREEK
DANFORTH RD

TRAFFIC ENGINEERING ANALYSIS

The traffic engineering phase of any accident analysis study involves the evaluation of facts which are summarized from each accident report as well as data obtained from field investigations. From these sets of data recommendations are formulated for proper remedial treatment. One of the primary tools used in this type of analysis is a graphic representation of accidents on either a spot collision diagram or a strip map which is used to locate the accident and determine definite accident patterns. Another useful tool the traffic engineer uses in the analysis of accident data is the summarization of accidents by types, wet or dry pavement and dark or light conditions. These tools are the engineering techniques used in trying to eliminate the causes of accidents.

There are, however, cases where an accident pattern does not exist, and often these collisions are caused by one or more driving hazards such as inclement weather, drinking drivers, defective equipment or excessive speed. In these cases the accident causes lie outside the jurisdiction of the traffic engineer and fall within the area of enforcement. In this instance the traffic engineer can offer specific information to the enforcing agency and request their cooperation in increasing the safety of problem areas.

The traffic engineering analysis began when the Michigan Department of State Police, after compiling the accident data for the city streets in Escanaba, transmitted to the Michigan Department of State Highways 15 high accident locations (See Spot Map, p. 12). A review of these locations shows that six of the locations were signalized and the remaining nine were controlled by stop signs.

All of the signalized locations have only one signal head. The MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES states that a minimum of one overhead vehicular signal face per approach is required at any signalized location. However, it is strongly recommended that at least two vehicular signal faces be provided per approach for the following reasons:

1) Two (or more) properly located overhead faces will in almost all cases provide drivers with a signal indication even though trucks or buses may momentarily obscure one signal face.
2) Multiple faces provide a safety factor where the signals must compete with a brilliant background such as advertising signs or the sun.
3) The occasional lamp failure in one face will not leave an approach without any signal indication.

(See Part IV, Section B, pp. 326-327 of the MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES, Appendix II, pp. 89-90).

The cost of extra signal heads may not be economically feasible at this time, but it would be advantageous to employ dual signal heads as funds become available.

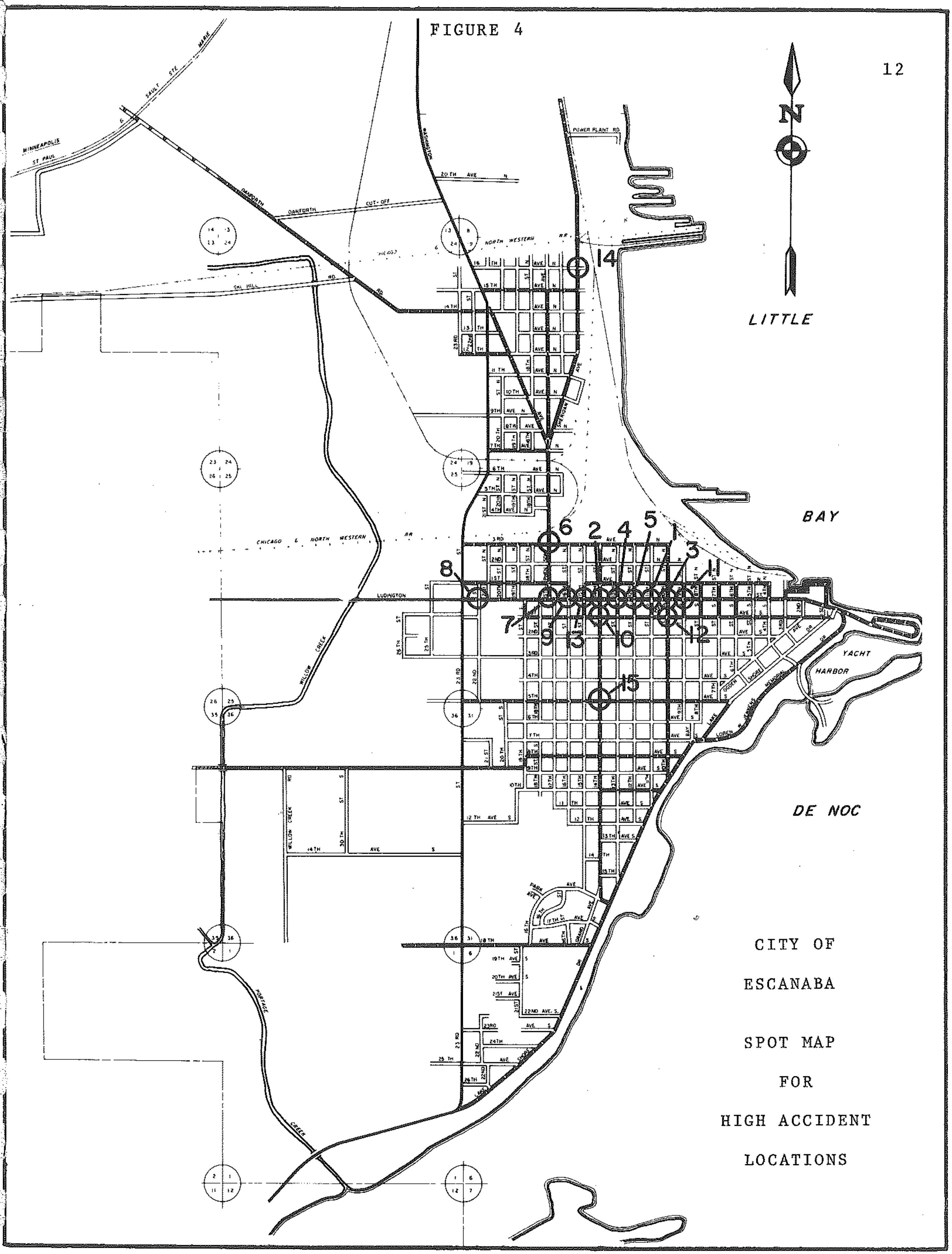


FIGURE 4

CITY OF ESCANABA

SPOT MAP FOR HIGH ACCIDENT LOCATIONS

The high accident location Spot Map (Figure 4) shows that 10 of the 15 high accident locations are on Ludington Street in the Central Business District. These intersections run consecutively from 9th Street to Stephenson Street, except for 22nd Street.

An initial review of the total accident experience at the 15 high accident locations shows that parking accidents constituted 44.5% of the total accidents (263 of 591 accidents). The 10 accident locations on Ludington Street, where angle parking is prevalent, had 233 parking accidents, or 49.2% of a total 474 accidents at these locations. (See Figure 5).

With these facts in mind, it is recommended that all angle parking in the City of Escanaba, especially Ludington Street, be phased out and replaced by parallel parking.

The City of Lansing had a similar problem prior to 1958. The angle parking was removed in favor of parallel parking on Washington Avenue and Michigan Avenue in the Central Business District; the results of which are found in Figure 6. If these figures are applied to the City of Escanaba, a reduction of from 80-90% in parking accidents could be expected. On Ludington Street alone this would be between 185 and 210 accidents, or from $75,000 to $85,000 savings in property damage costs alone.

Angle parking at 30° with 8ft. lanes, as is the case here, yields 6.2 parking spaces per 100ft. Parallel parking yields 4.6 parking spaces per 100ft. Since the city has two large parking lots, with free parking in the Central Business District, it is felt that the reduction in the

PARKING ACCIDENTS

Figure 5

Fifteen High Accident Locations In The City of Escanaba

Location Number	Total Accidents	Parking Accidents	% Parking Accidents
*1	85	58	68.2%
*2	83	32	38.6%
*3	66	27	40.9%
*4	46	25	55.6%
*5	46	35	76.1%
6	40	12	30.0%
*7	38	5	13.2%
*8	37	18	48.7%
*9	32	14	42.4%
10	31	3	9.8%
*11	23	12	52.2%
12	21	2	9.3%
*13	18	7	38.9%
14	15	12	80.0%
15	10	1	10.0%
Total	591	263	44.5%

*Intersections on Ludington Street

Total	474	233	49.2%

number of parking spaces would not create a critical shortage of parking in the downtown area.

In addition to the increase in safety for the motorist with the removal of angle parking, there is also an increase in capacity on the street system. Allowing 8 feet for parallel parking on either side of Ludington Street, which is 68 feet wide for the study section, there would be 52 feet of pavement remaining to facilitate through and turning movements on Ludington Street. All cross streets, where angle parking would be removed, should be marked with two approach lanes as has been done on other intersections on Ludington Street.

The new MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES has revised pavement markings as shown in Appendix II, pp. 95 and 96. To comply with these changes the city should, on the next application of pavement markings, follow the guidelines set forth in the new MANUAL and illustrated in Appendix II.

Since parking accidents constituted the only problem at several of the locations on Ludington Street, they will not be discussed in further detail. The collision diagrams and pictures for these locations will be found in Appendix I. The locations which may require additional corrective engineering will be discussed in detail, with the collision diagram and pictures following the discussion.

Location 15 had no accident patterns or potential driving hazards and will also be found in Appendix I.

Additional statistical information was collected on traffic accidents in the City of Escanaba for the period 1968-70.

This information, which may be a valuable tool in selective enforcement, is contained in Tables 1 through 8 (See pp. 18 through 23).

Table 1 shows that there was a total of 2,765 accidents in the city during the three-year study period. City streets accounted for 2,274 of the accidents; while the 15 study locations had 591 accidents during the three-year study period.

The information summarized in Table 2 shows that the peak accident month was December at the 15 study locations. Table 2 also shows that the peak accident day was Saturday and that approximately 51% of the accidents occurred during the weekend period Friday through Sunday.

Table 3 indicates that there were only 69 personal injury accidents and 522 property damage accidents, during the three-year study period, at the 15 study locations. This reflects on the high incidence of parking accidents, since the majority of parking accidents involve slow moving vehicles. It also shows that 39.1% (231) of the accidents occurred at night.

Table 4 shows that the peak accident hours were 3:00 to 4:00 p.m. (8.1%) and 4:00 to 5:00 p.m. (8.1%). Tables 5 and 6 show the age and residence of drivers; while Tables 7 and 8 show the weather conditions and pavement conditions at the 15 study locations.

FIGURE 6

CITY OF LANSING

TRAFFIC DEPARTMENT

ACCIDENT COMPARISON - ANGLE PARKING AND PARALLEL PARKING

WASHINGTON AVENUE - NINE BLOCKS - GENESEE TO LENAWEE

	ALL MID-BLOCK ACCIDENTS				
	ANGLE PARKING				PARALLEL PARKING
WASHINGTON AVENUE	1954	1955	1956	1957	1958
JUNE	22	10	21	18	2
JULY	9	17	17	15	3
AUGUST	25	16	23	10	1
3 MONTH TOTALS	56	43	61	43	6

	ALL MID-BLOCK ACCIDENTS				
	ANGLE PARKING				PARALLEL PARKING
EAST MICHIGAN AVENUE	1954	1955	1956	1957	1958
MAY	3	6	9	10	1
JUNE	8	5	7	5	0
JULY	7	3	3	7	1
AUGUST	6	5	5	4	2
4 MONTH TOTALS	24	19	24	26	4

COMPILED BY: ALLEN T. HAYES, CITY TRAFFIC ENGINEER

From

Official Lansing Police Department Accident Reports

TABLE 1

REPORTED TRAFFIC ACCIDENTS IN THE CITY OF ESCANABA

Year	Total	City Street	Property Damage	Injury	Fatal	Persons Injured	Persons Killed
1966	798	702	638	159	1	248	1
1967	693	612	554	134	5	199	5
1968	815	682	670	145	0	213	0
1969	983	811	805	177	1	262	1
1970	967	781	778	185	4	276	4

COMPARISON OF ACCIDENT FREQUENCY

Year	Escanaba City Streets	Delta County Roads	Total Accidents State of Mich.
1966	702	194	302,880
1967	612	196	299,004
1968	682	237	305,495
1969	811	303	331,223
1970	781	266	313,715

PERCENTAGE CHANGE FOR ABOVE TOTALS

1966 - 67	-12.8	1.0	-1.3
1967 - 68	11.4	20.9	2.2
1968 - 69	18.9	27.8	8.4
1969 - 70	- 3.7	-12.2	-5.6

ACCIDENT ANALYSIS

Table 2

MONTHLY AND DAILY ACCIDENT OCCURRENCE

FIFTEEN HIGH ACCIDENT LOCATIONS IN THE CITY OF ESCANABA

Period Studied: 1968 through 1970

Month	Day of the Week							Monthly Total	Of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
January	3	4	9	7	7	15	6	51	8.6
February	4	3	8	2	7	12	3	39	6.7
March	4	5	5	7	4	17	5	47	8.0
April	4	8	7	2	7	11	5	44	7.4
May	4	8	4	3	13	9	7	48	8.1
June	8	8	3	7	8	6	1	41	6.9
July	4	7	11	4	13	6	7	52	8.8
August	9	9	5	2	17	10	2	54	9.1
September	5	5	7	7	9	13	9	55	9.3
October	2	11	12	4	11	10	1	51	8.6
November	4	1	6	7	13	10	5	46	7.8
December	13	9	8	11	9	7	6	63	10.7
Day Total	64	78	85	63	118	126	57	591	100.0
% of Total	10.8	13.2	14.4	10.7	20.0	21.3	9.6	100.0	100.0

Peak Accident Day: Saturday

Peak Accident Month: December

ACCIDENT ANALYSIS

Table 3

ANNUAL ACCIDENT SUMMARY

FIFTEEN HIGH ACCIDENT LOCATIONS IN THE CITY OF ESCANABA

Period Studied: 1968 through 1970

Accident Type	Day	Night	Total
Fatal Accident			
Personal Injury Acc.	41	28	69
Property Damage Acc.	319	203	522
Total	360	231	591

* * * * * * * *

Month	Fatal		Injury		Prop. Damage		Sub. Total		Total
	Day	Night	Day	Night	Day	Night	Day	Night	
January			4		22	25	26	25	51
February			3	2	19	15	22	17	39
March			3	2	17	25	20	27	47
April			4	1	29	10	33	11	44
May			6	1	32	9	38	10	48
June			1	2	25	13	26	15	41
July			4	5	30	13	34	18	52
August			2	2	35	15	37	17	54
September			4	2	32	17	36	19	55
October			4	4	25	18	29	22	51
November			5	4	18	19	23	23	46
December			1	3	35	24	36	27	63
S. Total			41	28	319	203	360	231	591
Total			69		522		591		591

ACCIDENT ANALYSIS

Table 4

DAILY AND HOURLY ACCIDENT OCCURRENCE

FIFTEEN HIGH ACCIDENT LOCATIONS IN THE CITY OF ESCANABA

Period Studied: 1968 through 1970

Hour	Day of the Week							Hour Total	% of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
12-1 a.m.		1	2	1		8	7	19	3.2
1-2 a.m.		1	2	1		1		5	0.8
2-3 a.m.		2	2			7	7	18	3.0
3-4 a.m.		1	2	1	1	3	3	11	1.9
4-5 a.m.		1						1	0.2
5-6 a.m.							2	2	0.3
6-7 a.m.	1					1		2	0.3
7-8 a.m.		3		1				4	0.7
8-9 a.m.	1	5	3	2		3	1	15	2.5
9-10 a.m.	3	3	5	3	2	2		18	3.0
10-11 a.m.	4	7	2	1	10	4		28	4.8
11-12 a.m.	2	6	7	5	3	11	4	38	6.4
12-1 p.m.	5	4	6	5	5	5	2	32	5.4
1-2 p.m.	8	4	3	7	3	9	1	35	5.9
2-3 p.m.	5	3	8	6	8	11	1	42	7.1
3-4 p.m.	4	4	10	4	13	7	6	48	8.1
4-5 p.m.	7	9	9	5	11	7		48	8.1
5-6 p.m.	3	4	6	5	10	8	3	39	6.7
6-7 p.m.	3	2	1	3	5		5	19	3.2
7-8 p.m.	3	5	5	3	11	2	1	30	5.1
8-9 p.m.	5	7	4	1	14	8	4	43	7.3
9-10 p.m.	7	1	6		8	6	5	33	5.6
10-11 p.m.	1	5	2	3	7	9	1	28	4.8
11-12 p.m.	2			5	7	12	4	30	5.1
Not Stated				1		2		3	0.5
Day Total	64	78	85	63	118	126	57	591	100.0
% of Total	10.8	13.2	14.4	10.7	20.0	21.3	9.6	100.0	100.0

Peak Accident Hour: 3 - 4 p.m. / 4 - 5 p.m.

Peak Accident Day: Saturday

ACCIDENT ANALYSIS

Table 5

AGE OF DRIVERS INVOLVED IN ACCIDENTS

FIFTEEN HIGH ACCIDENT LOCATIONS IN THE CITY OF ESCANABA

Period Studied: 1968 through 1970

Age Group	Number of Drivers Involved in				Percent
	Fatal	Injury	Property Damage	Total	
Under 16			2	2	0.2
16 - 19		38	210	248	24.3
20 - 24		24	142	166	16.2
25 - 34		14	113	127	12.4
35 - 44		13	113	126	12.3
45 - 54		16	118	134	13.1
55 - 64		11	93	104	10.2
65 - 74		9	55	64	6.3
75 & Over		2	23	25	2.4
Not Stated		1	26	27	2.6
TOTAL		128	895	1023	100.0

Table 6

RESIDENCE OF DRIVERS INVOLVED IN ACCIDENTS

Residence	Number of Drivers Involved in				Percent
	Fatal	Injury	Property Damage	Total	
City		68	465	533	52.1
County		36	296	332	32.5
Michigan		18	67	85	8.3
Out of State		5	42	47	4.6
Not Stated		1	25	26	2.5
TOTAL		128	895	1023	100.0

ACCIDENT ANALYSIS

Table 7

WEATHER CONDITIONS AT SCENE OF ACCIDENTS

FIFTEEN HIGH ACCIDENT LOCATIONS IN THE CITY OF ESCANABA

Period Studied: 1968 through 1970

Weather	Severity of Accident				Percent
	Fatal	Injury	Property Damage	Total	
Clear or Cloudy		59	440	499	84.4
Rain		7	43	50	8.5
Fog		1	1	2	0.3
Snow or Sleet		2	38	40	6.8
Not Stated					
TOTAL		69	522	591	100.0

TABLE 8

PAVEMENT CONDITIONS AT SCENE OF ACCIDENTS

Pavement	Severity of Accident				Percent
	Fatal	Injury	Property Damage	Total	
Dry		50	323	373	63.1
Wet		11	80	91	15.4
Snowy/Icy		7	108	115	19.5
Icy		1	11	12	2.0
Not Stated					
TOTAL		69	522	591	100.0

LOCATION 1 LUDINGTON STREET AT 11TH STREET

(For Recommendations see TRAFFIC ENGINEERING ANALYSIS and Appendix I, p. 61)

Total	P.D.	Inj.	Fatal
85	80	5	0

LOCATION 2 LUDINGTON STREET AT 14TH STREET

Ludington Street and 14th Street form a right-angle intersection in the Central Business District of the city. Ludington Street has a 68ft. bituminous pavement, with curb and gutter, and 14th Street has a 56ft. bituminous pavement, with curb and gutter. Angle parking is permitted on both sides of Ludington, as indicated in the TRAFFIC ENGINEERING ANALYSIS. However, it is restricted on both sides of Ludington Street, west of the intersection, for approximately 100 feet. North of the intersection, on 14th Street, parallel parking is permitted on both sides except for 100 feet from the intersection on the west side. The south leg of the intersection has parallel parking on the west side and angle parking on the east side.

Traffic is controlled by a pre-timed single head signal with eight inch lenses. It operates on a 60 second cycle with a 60%-40% split, Ludington to 14th. The amber time is 5% of the cycle length.

The approaches on all four legs of the intersection have two lanes into the intersection and one lane out of the intersection (See Figure 7a and 7b).

During the three-year study period, 1968-1970, this location was the scene of 83 accidents. Parking accidents constituted the most significant type of accident with 32 (38.6%). Rear end accidents with 24 (28.9%), sideswipe accidents with 9 (10.8%) and angle accidents with 9 (10.8%), formed the remaining patterns.

Recommendations

Parking removal has been discussed in the TRAFFIC ENGINEERING ANALYSIS part of the report. It is also recommended that the amber time be changed from 5% to 6%. This change should help reduce the incidence of right-angle accidents and possibly some rear end accidents by increasing the clearance interval. Rear end accidents will also be reduced if the angle parking is changed to parallel parking.

Finally, it is recommended that vehicles be prohibited from angle parking on the east side of 14th Street, south of the intersection. The pavement is marked to show two approach lanes (See Figure 7b) but the parked vehicles are restricting the use of the outer lane.

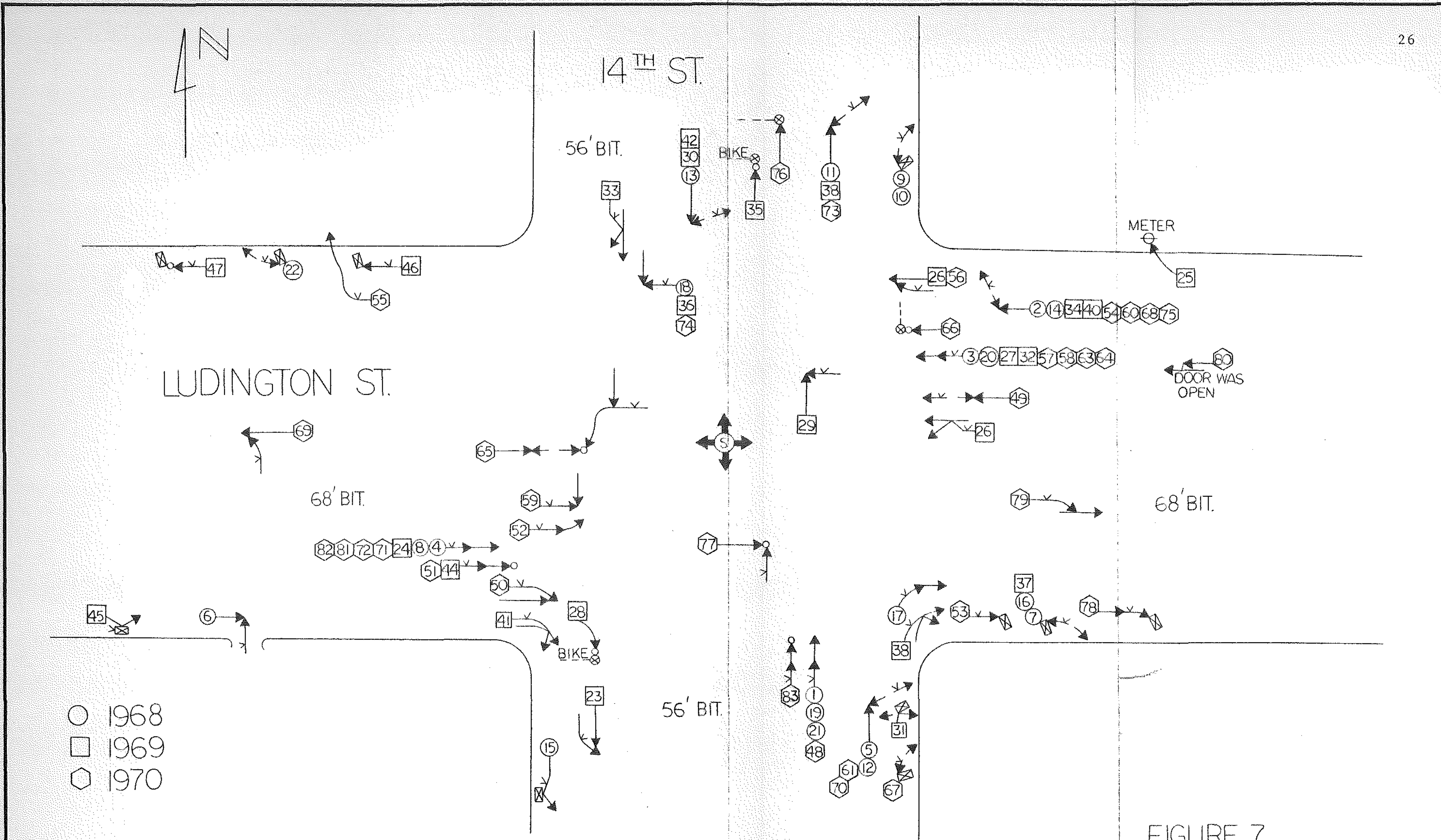


FIGURE 7

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970

Accidents – Total 83 P.D. 74

Injury 9 (10) Fatal 0 ( )

C.S. ______ Miles ______ Drawn DJM

Plan No. LOCATION 2 Date 8-3-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at 14th ST.
CITY OF ESCANABA
DELTA CO.

EASTBOUND
LUDINGTON STREET

WESTBOUND
LUDINGTON STREET

Figure 7a

SOUTHBOUND
14TH STREET

NORTHBOUND
14TH STREET

Figure 7b

LOCATION 3 <u>LUDINGTON STREET AT 10TH STREET</u>

(For Recommendations see TRAFFIC ENGINEERING ANALYSIS and Appendix I, p.64)

Total	P. D.	Inj.	Fatal
66	59	7	0

LOCATION 4 <u>LUDINGTON STREET AT 12TH STREET</u>

(For Recommendations see TRAFFIC ENGINEERING ANALYSIS and Appendix I, p.66)

Total	P. D.	Inj.	Fatal
46	43	3	0

LOCATION 5 <u>LUDINGTON STREET AT 13TH STREET</u>

This location had no existing or potential hazards other than the previously discussed parking problem. Field investigation did however reveal that the existing 24in. stop sign (R1-1-24, Appendix II, p.76), north of the intersection was in poor condition. It is, therefore, recommended that this sign be replaced by a new 24in. stop sign.

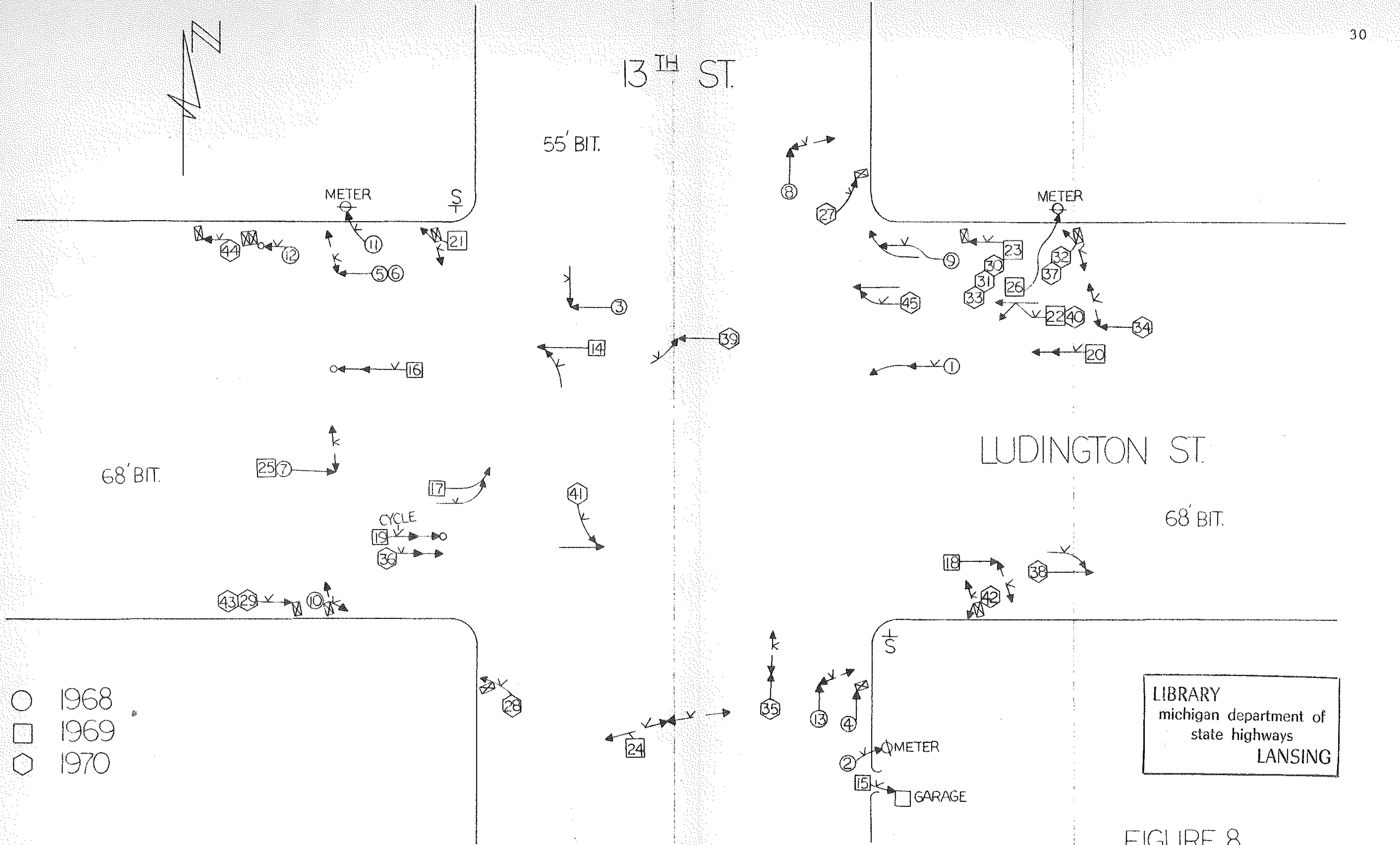


FIGURE 8

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970
Accidents – Total 45 P.D. 42
Injury 3 (4) Fatal 0 ( )
C.S. ______ Miles ______ Drawn DVW
Plan No. LOCATION 5 Date 8-3-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at 13th ST.
CITY OF ESCANABA
DELTA CO.

FORM NO. 1547 REV. 5-71

EASTBOUND
LUDINGTON STREET

SOUTHBOUND
13TH STREET

WESTBOUND
LUDINGTON STREET

Figure 8a

LOCATION 6 STEPHENSON AVENUE AT 3RD AVENUE NORTH

Located three blocks north of the Central Business District, Stephenson Avenue and 3rd Avenue North form a right-angle intersection. There is a single track railroad grade crossing 151 feet to the north of the intersection. Both Stephenson Avenue and 3rd Avenue North have 56ft. bituminous pavements with curb and gutter.

Parallel parking is permitted on both sides of all legs of the intersection. Each approach has a solid white center-line, with two-10ft. inbound lanes and one-20ft. outbound lane. There is a no parking zone, approximately 30 feet long, from each curb line on all corners of the intersection.

Traffic is controlled by a pre-timed single head signal, with eight inch lenses, operating on a 60 second cycle. The cycle split is 60%-40%, Stephenson to 3rd Avenue North, and the amber time is 5% of the cycle length. There is also a red flashing arrow for southbound to westbound traffic. North of the grade crossing there is also a single face signal stopping southbound traffic at the grade crossing. This signal head prevents a backup at the intersection to the grade crossing.

The signal goes to a green phase on 3rd Avenue North and a red phase on Stephenson Avenue when a train is crossing Stephenson Avenue.

The protection at the railroad grade crossing consists of a Railroad Crossing sign (W10-2, Appendix II, p.79) and cantilevered flashing lights.

This location was the scene of 40 accidents during the three-year study period, 1968-1970. The most significant accident patterns were formed by 12 parking accidents (30%), 9 rear end accidents (22.5%), and 7 right-angle accidents (17.5%). The 12 remaining accidents formed no significant patterns.

Recommendations

Eight of the parking accidents were attributable to the angle parking which existed at this location during the first year of the study. Since the parking has been changed to parallel, this type of accident will be reduced.

The only recommendation at this location involves changing the amber time to 6% of the total cycle length. This change should reduce the incidence of right-angle accidents at the intersection.

EDCO• 196M 6-71 46430•

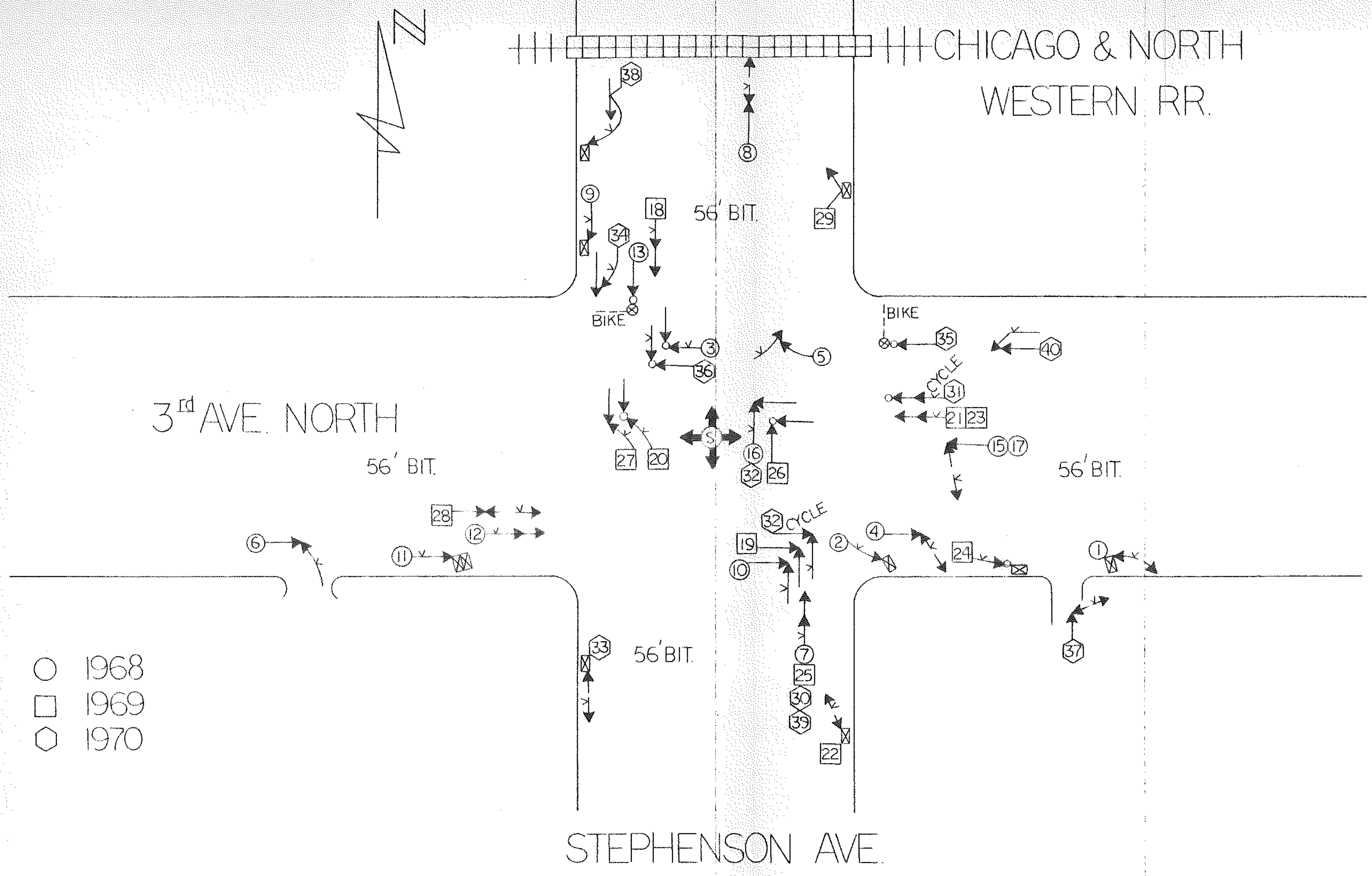


FIGURE 9

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970

Accidents – Total 40 P.D. 32

Injury 8 (11) Fatal 0 ( )

C.S. ______ Miles ______ Drawn DJM

Plan No. LOCATION 6 Date 8-4-71

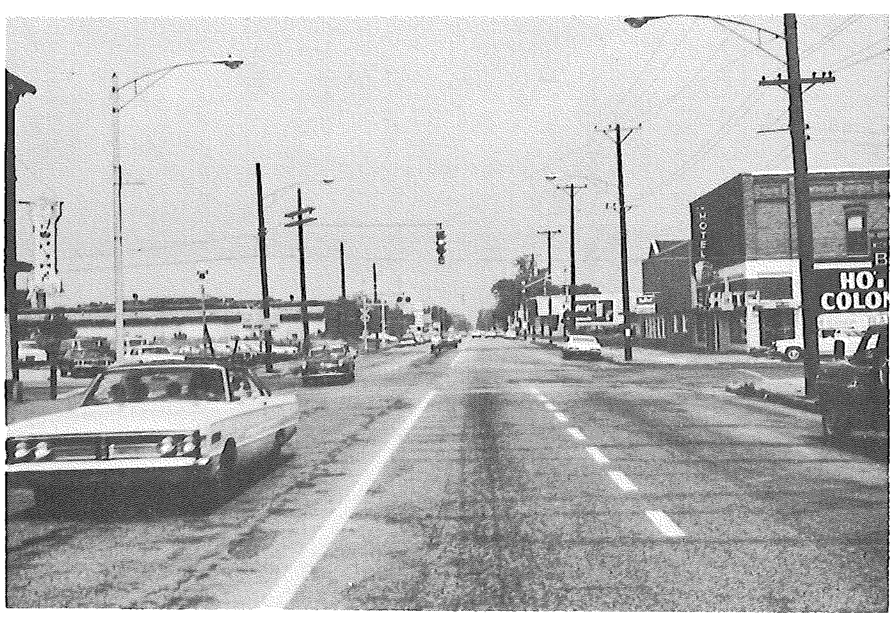
MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location STEPHENSON AVE. at 3rd AVE NORTH
CITY OF ESCANABA
DELTA CO.

FORM NO. 1547 REV. 5-71

SOUTHBOUND
STEPHENSON AVENUE

EASTBOUND
3RD AVENUE NORTH



NORTHBOUND
STEPHENSON AVENUE

Figure 9a

LOCATION 7 LUDINGTON STREET AT STEPHENSON AVENUE

Ludington Street and Stephenson Avenue form a "T" intersection at the west end of the Central Business District. Ludington Street has a 68ft. bituminous pavement, with curb and gutter, east of the intersection and a 58ft. bituminous pavement, with curb and gutter, west of the intersection. Parallel parking is permitted on both sides of Stephenson Avenue and opposite Stephenson Avenue on the south side of Ludington Street. There is a no parking zone on the north side of Ludington Street, west of the intersection; while angle parking is permitted on the north side of Ludington Street, east of the intersection. Each approach to the intersection has two inbound lanes and one outbound lane.

Traffic is controlled at the intersection by a pre-timed single head signal with eight inch lenses. It operates on a 60 second cycle with a 60%-40% split, Ludington Street to Stephenson Avenue. The amber time is 5% of the cycle length. There is also a steady green arrow for westbound to northbound vehicles.

During the three-year study period there were 38 accidents at this location. Rear end accidents were the most significant type accounting for 20, or 52.6% of the total accidents. The remaining 18 accidents formed no significant patterns.

Recommendations

Eight of the 20 rear end accidents occurred on snowy or icy pavement; therefore, the incidence of rear-end accidents cannot be considered critical. It is recommended, however, that the amber time be increased to 6% of the cycle time. This change will coincide with the changes made at Locations 2 and 6.

EDCO• 196M 6-71 46430•

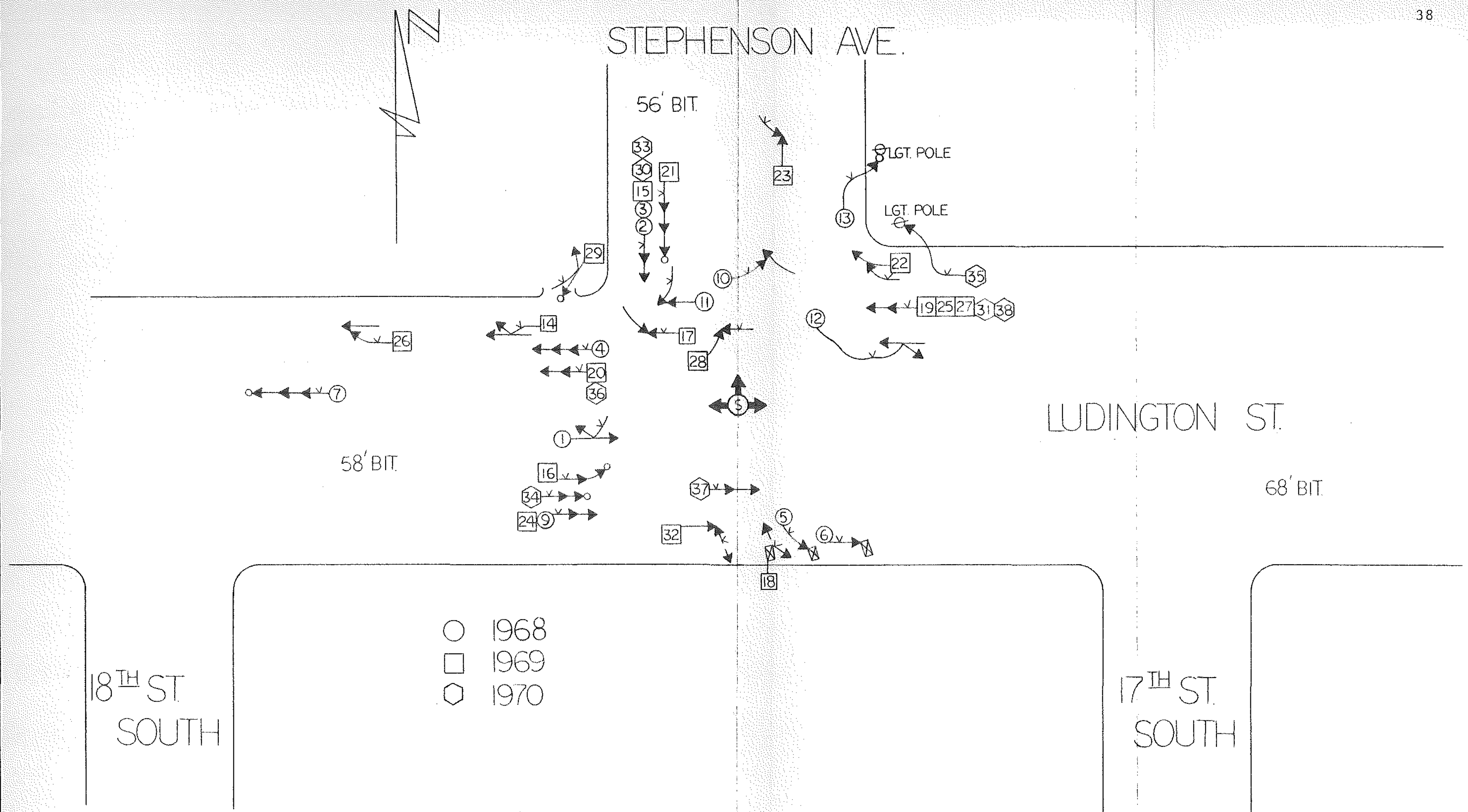


FIGURE 10

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970

Accidents – Total 38 P.D. 32

Injury 6 (9) Fatal 0 ( )

C.S. ______ Miles ______ Drawn DVW

Plan No. LOCATION 7 Date 8-4-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at STEPHENSON AVE.
CITY OF ESCANABA
DELTA CO.

FORM NO. 1547 REV. 5-71

EASTBOUND
LUDINGTON STREET

SOUTHBOUND
STEPHENSON AVENUE

WESTBOUND
LUDINGTON STREET

Figure 10a

LOCATION 8 <u>LUDINGTON STREET AT 22ND STREET</u>

Ludington Street and 22nd Street form a right-angle intersection on the western end of the Central Business District. Ludington Street has a 68ft. bituminous pavement, with curb and gutter, and 22nd Street has a 37ft. bituminous pavement, with curb and gutter. Ludington Street has angle parking on all legs of the intersection except for the south side east of the intersection. South of the intersection, 22nd Street has parallel parking, and north of the intersection there is parallel parking on the east side and angle parking on the west side. Ludington Street has a solid white centerline.

Traffic is controlled by two 24in. stop signs (R1-1-24, Appendix II, p.76) on 22nd Street. These stop signs are in poor condition.

This location was the scene of 37 accidents during the three-year study period and parking accidents formed the most significant pattern. There were 18 parking accidents or 48.7% of the total. The remaining accidents formed no significant patterns.

Recommendations

Review of the collision diagram shows that 12 of the 18 parking accidents involved vehicles backing from the angle parking slots adjacent to a restaurant in the northeast quadrant of the intersection. It is, therefore, recommended that the angle parking adjacent to the restaurant be changed to parallel.

Finally, it is recommended that the stop signs on 22nd Street be replaced, as they are in poor condition.

EDCO• 196M 6-71 46430•

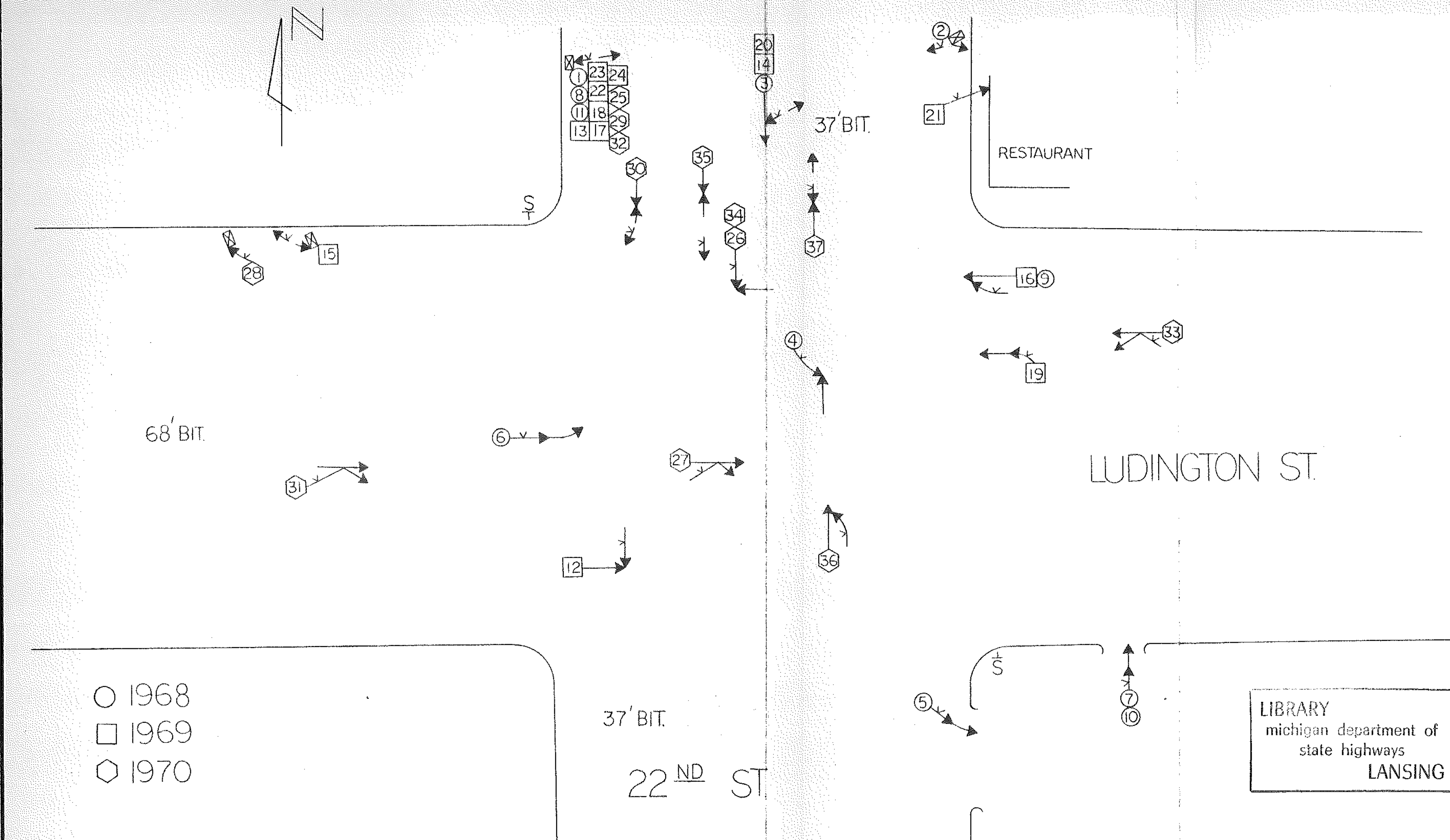


FIGURE 11

LEGEND

Fatal		Out of Control		Pedestrain		Tree	
Injury		Driver Intent		Stop & Go Signal		Stop Sign	S
Skidding		Deer		Flashing Beacon		Yield Sign	Y
Jackknife		Violator					
Overturned		Backing					

Period: 1968 THRU 1970

Accidents – Total 37 P.D. 37

Injury 0 ( ) Fatal 0 ( )

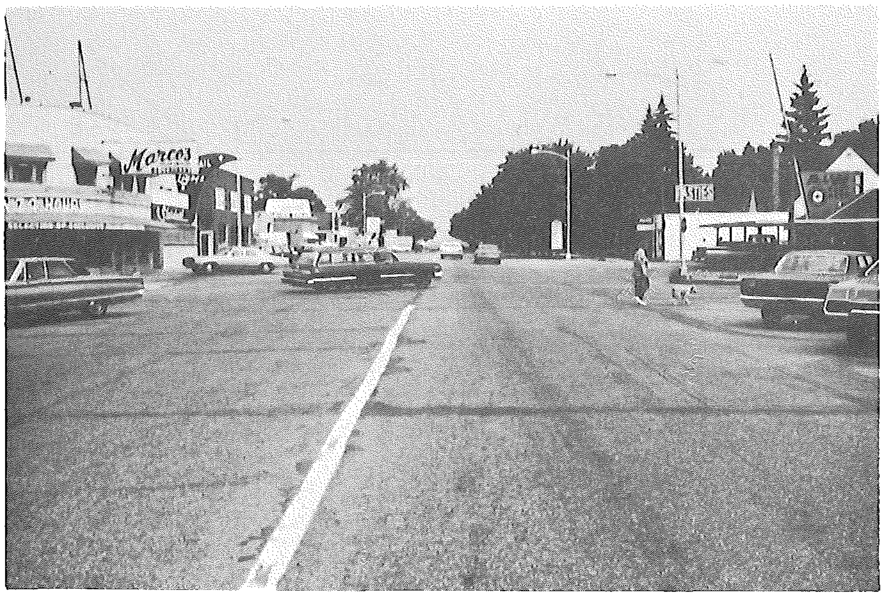
C.S. ______ Miles ______ Drawn DJM

Plan No. LOCATION 8 Date 8-4-71

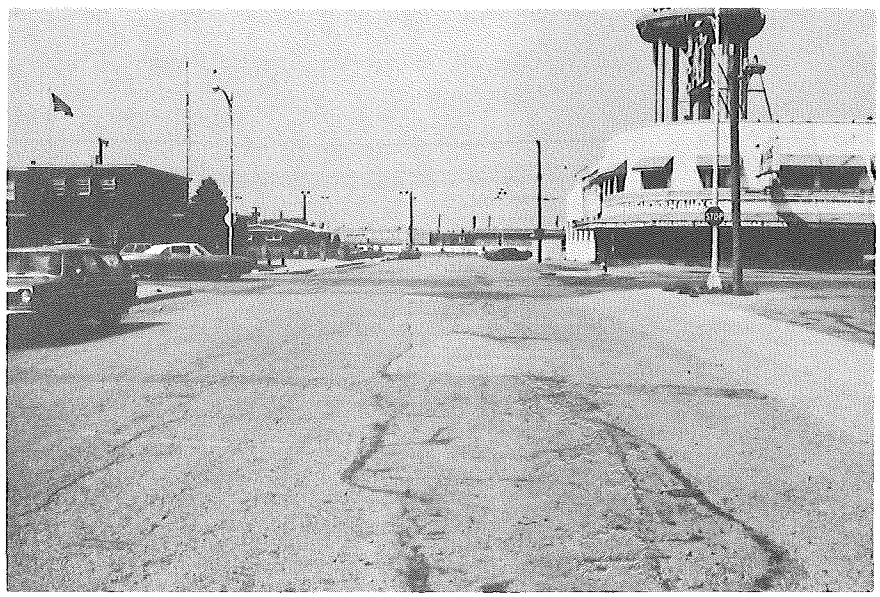
MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at 22nd ST.
CITY OF ESCNABA
DELTA CO.

FORM NO. 1547 REV. 5-71



EASTBOUND
LUDINGTON STREET



NORTHBOUND
22ND STREET

WESTBOUND
LUDINGTON STREET

Figure 11a

LOCATION 9 LUDINGTON STREET AT 16TH STREET

(For Recommendations see TRAFFIC ENGINEERING ANALYSIS and Appendix I, p.68)

Total	P. D.	Inj.	Fatal
33	25	8	0

LOCATION 10 SOUTH 14TH STREET AT 1ST AVENUE SOUTH

Located in the central part of the city, one block south of the Central Business District, South 14th Street and 1st Avenue South form a right-angle intersection. South 14th Street has a 35ft. bituminous pavement, with curb and gutter, and 1st Avenue South has a 40ft. bituminous pavement, with curb and gutter. Parallel parking is permitted on both sides of all legs of the intersection, except for the east side of South 14th Street, north of the intersection.

South 14th Street has a solid white centerline, north of the intersection, and south of the intersection it has a broken white centerline. Traffic is controlled by two 24in. stop signs (R1-1-24, Appendix II, p.76) on 1st Avenue South.

This intersection was the scene of 31 accidents during the three-year study period. Right-angle accidents were the predominant type, with 24, or 77.4% of the total. The remaining accidents formed no significant accident patterns.

Recommendations

The MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES lists six possible warrants for the installation of pre-timed signals (See Appendix II, pp. 81-88). A signal can be installed and operated only when one or more of the warrants are met.

Warrant 5, Accident Experience, is satisfied when there are five or more accidents of the type (right-angle) susceptible of correction by a traffic signal, occurring during a 12-month period, and there is a volume of vehicular traffic not less than 80% of the requirements stated in Warrant 1. Since there were 24 angle accidents, or an average of eight per year, Warrant 5, Accident Experience, is satisfied.

Figures obtained from the 1968 Highway Needs Study show that South 14th Street had an estimated daily bi-directional volume of 8,200 vehicles. West of the intersection, 1st Avenue South had an estimated daily bi-directional volume of 2,990 vehicles, and east of the intersection the volume was estimated to be 5,430 vehicles per day. (See Appendix II, p. 92, for volume warrants.) Since the figures obtained from the Highway Needs Study are greater than the figures indicated in Appendix II, Warrant 1 is satisfied.

It is, therefore, recommended that a pre-timed dual head signal be installed at the intersection. It should operate on a 60 second cycle split 60%-40%, 1st Avenue South to South 14th Street, with a 6% amber. Since there is a signal one block (400 feet) to the north (See Location 2, p. 24), these signals should be interconnected to provide progression between the two locations.

Parking should also be removed for 150 feet on both sides of all legs of the intersection. This is necessary to provide separation at the approaches for left turning vehicles from through and right turning vehicles.

EDCO• 196M 6-71 46430•

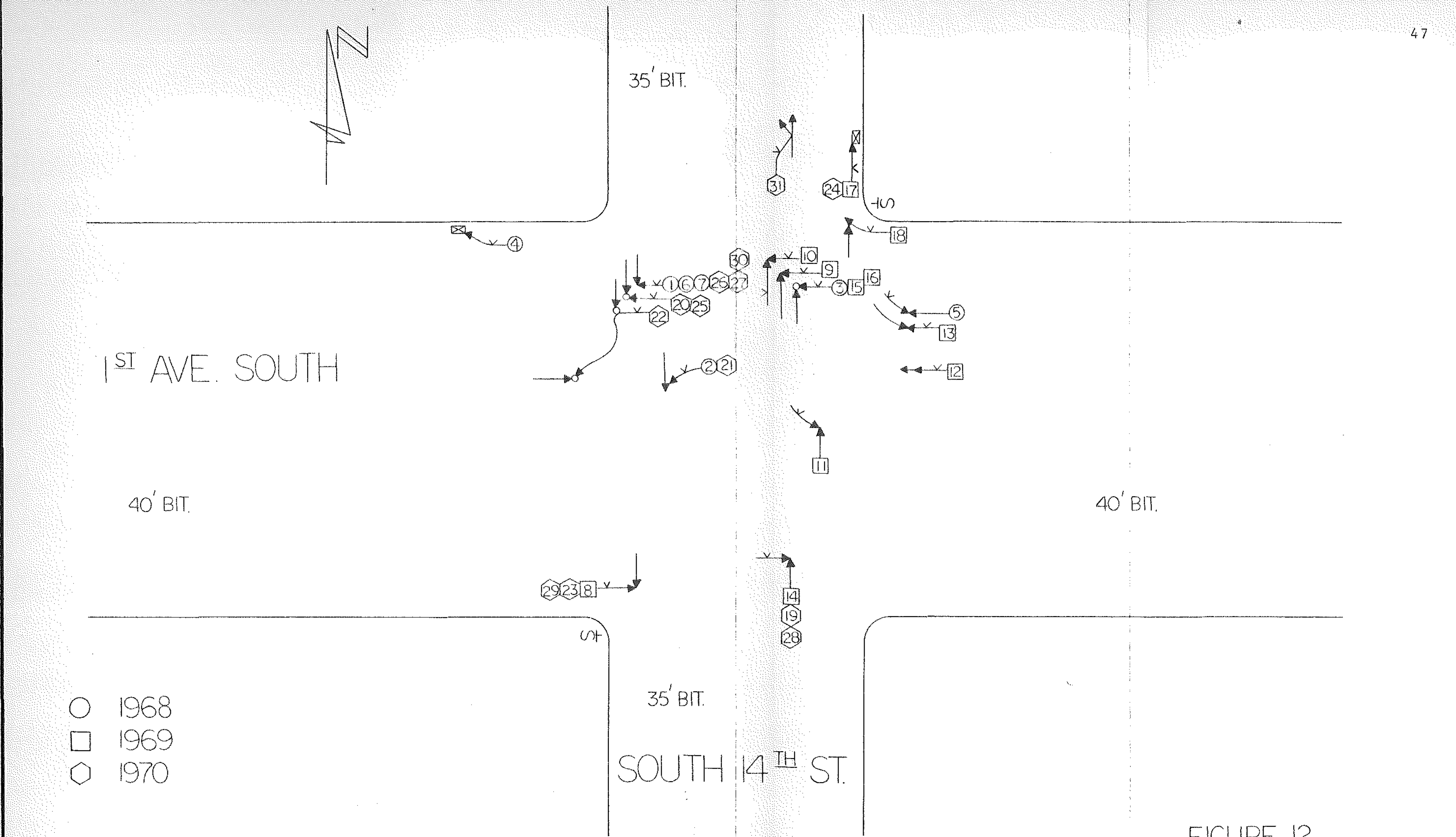


FIGURE 12

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970

Accidents -- Total 31 P.D. 25

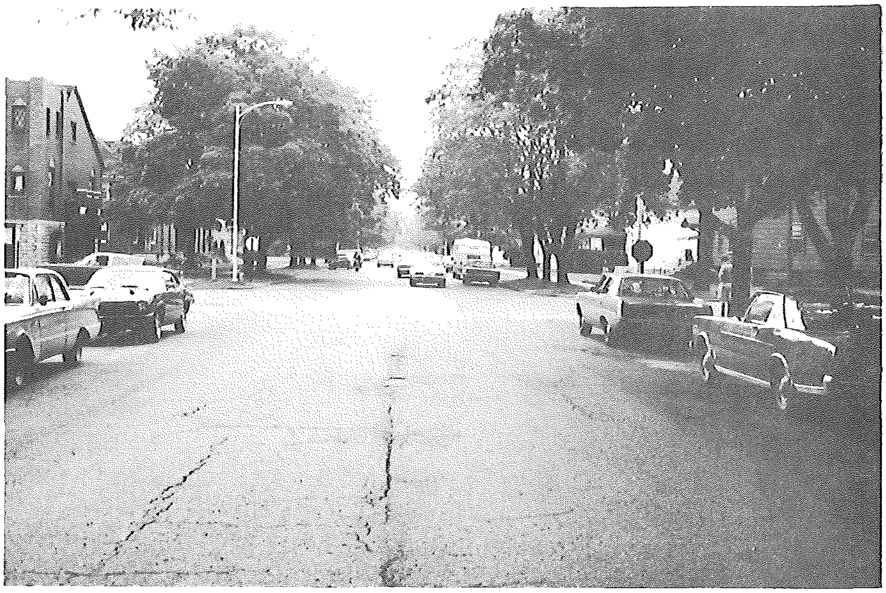
Injury 6 (8) Fatal 0 ( )

C.S. ____ Miles ____ Drawn DVW

Plan No. LOCATION 10 Date 8-4-71

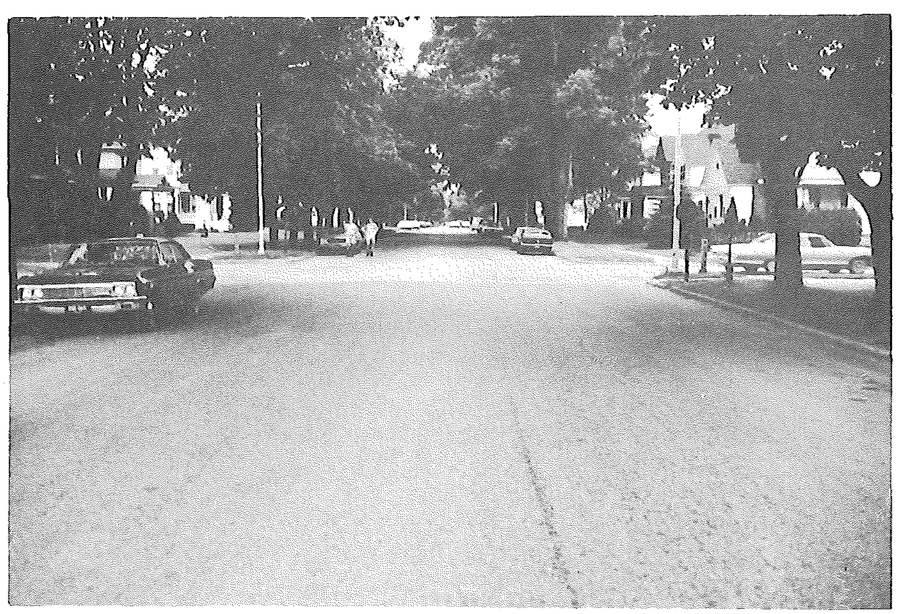
MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location SOUTH 14th ST. at 1st AVE. SOUTH
CITY OF ESCANABA
DELTA CO.



EASTBOUND
1ST AVENUE SOUTH

SOUTHBOUND
SOUTH 14TH STREET



WESTBOUND
1ST AVENUE SOUTH

Figure 12a

LOCATION 11 <u>LUDINGTON STREET AT 9TH STREET</u>

This location had no existing or potential hazards other than the previously discussed parking problem. Field investigation did, however, reveal that the existing 24in. stop sign (R1-1-24, Appendix II, p.76), south of the intersection was in poor condition. It is, therefore, recommended that this sign be replaced by a new 24in. stop sign.

EDCO• 196M 6-71 46430•

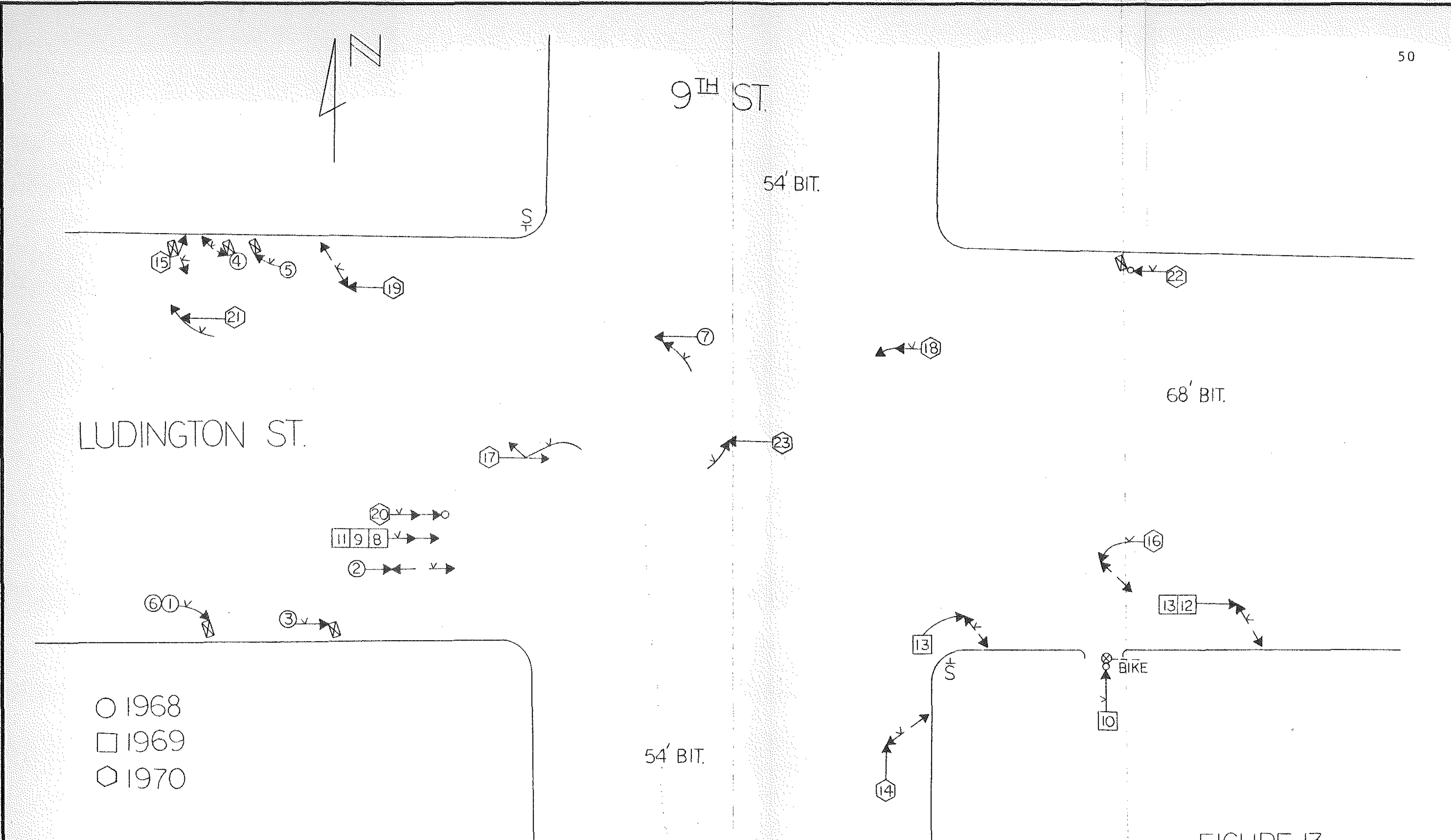


FIGURE 13

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970
Accidents -- Total 23 P.D. 20
Injury 3 (5) Fatal 0 ( )
C.S. ____ Miles ____ Drawn DJM
Plan No. LOCATION 11 Date 8-5-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at 9th ST.
CITY OF ESCANABA
DELTA CO.

FORM NO. 1547 REV. 5-71

EASTBOUND
LUDINGTON STREET

NORTHBOUND
9TH STREET

WESTBOUND
LUDINGTON STREET

Figure 13a

LOCATION 12 SOUTH 10TH STREET AT 1ST AVENUE SOUTH

South 10th Street and 1st Avenue South form a right-angle intersection one block south of the Central Business District. South 10th Street has a 52ft. bituminous pavement, with curb and gutter, and 1st Avenue South has a 40ft. bituminous pavement with curb and gutter. Parallel parking is permitted on both sides of 10th Street, south of the intersection, and 1st Avenue South, east of the intersection. Tenth Street, north of the intersection, has no parking on both sides for 100 feet from the intersection. West of the intersection, 1st Avenue South has parallel parking on the south side and no parking on the north side.

Traffic is controlled by two 24 inch stop signs (R1-1-24, Appendix II, p. 76) on 1st Avenue South.

From 1968-1970 there were 21 accidents at this location. Right-angle accidents, with 10, accounted for 47.6% of the total accidents. The remaining 11 accidents formed no significant correctable patterns.

Recommendations

As a remedial measure to help reduce the incidence of right-angle accidents at this location, it is recommended that a flashing beacon be installed at the intersection.

A flashing beacon is warranted when one of two warrants is met (See Appendix II, pp. 93 and 94). Warrant 1 requires a concentration of four or more angle accidents over a two year period; and, since the average incidence of angle accidents is six per two year period, this warrant is satisfied.

EDCO• 196M 6-71 46430•

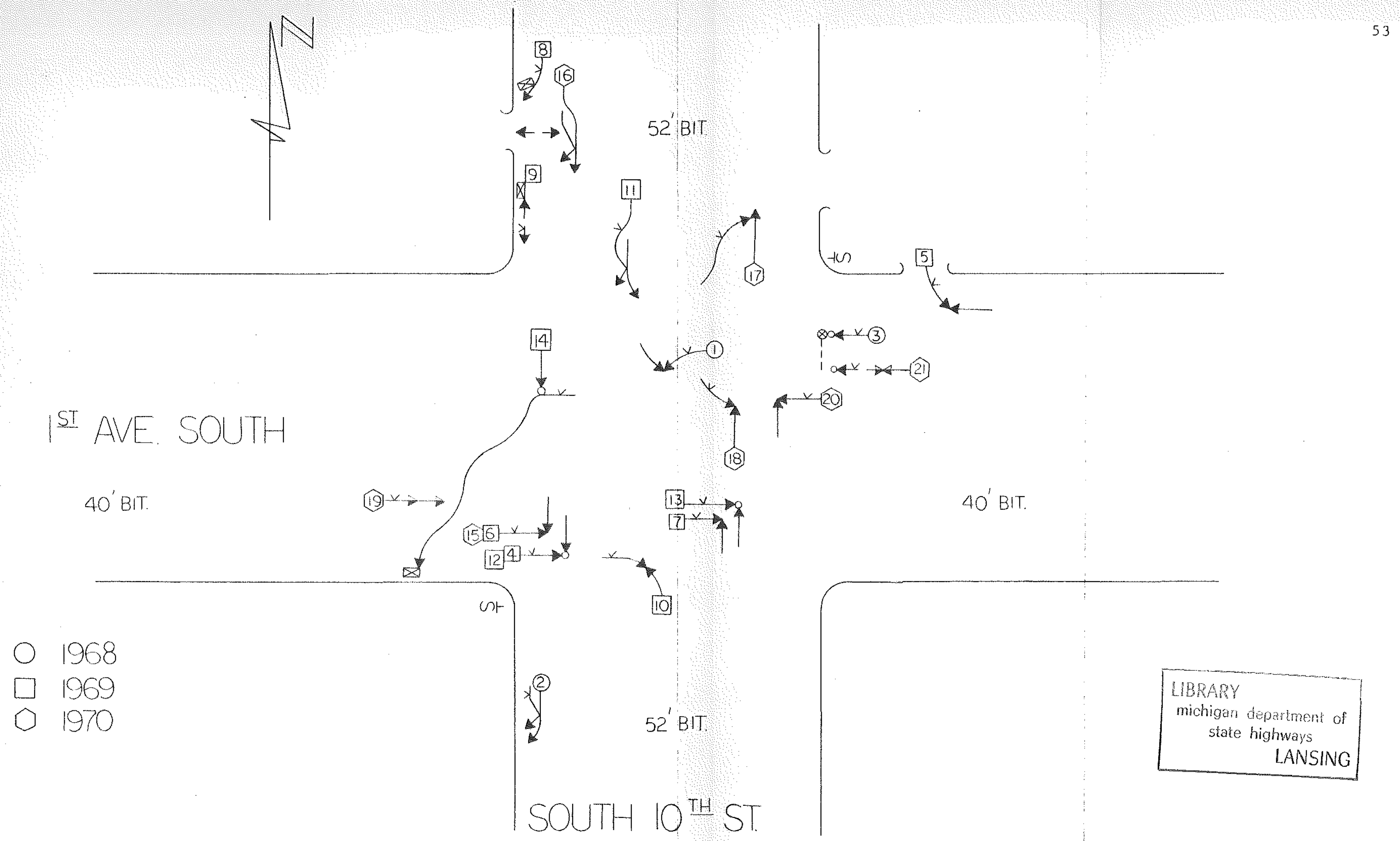


FIGURE 14

LEGEND

Fatal		Out of Control		Pedestrain		Tree	
Injury		Driver Intent		Stop & Go Signal	S	Stop Sign	S
Skidding		Deer	V	Flashing Beacon	F	Yield Sign	Y
Jackknife		Violator					
Overturned		Backing					

Period: 1968 THRU 1970

Accidents – Total 21 P.D. 15

Injury 6 (8) Fatal 0 ( )

C.S. ______ Miles ______ Drawn DVW

Plan No. LOCATION 12 Date 8-5-71

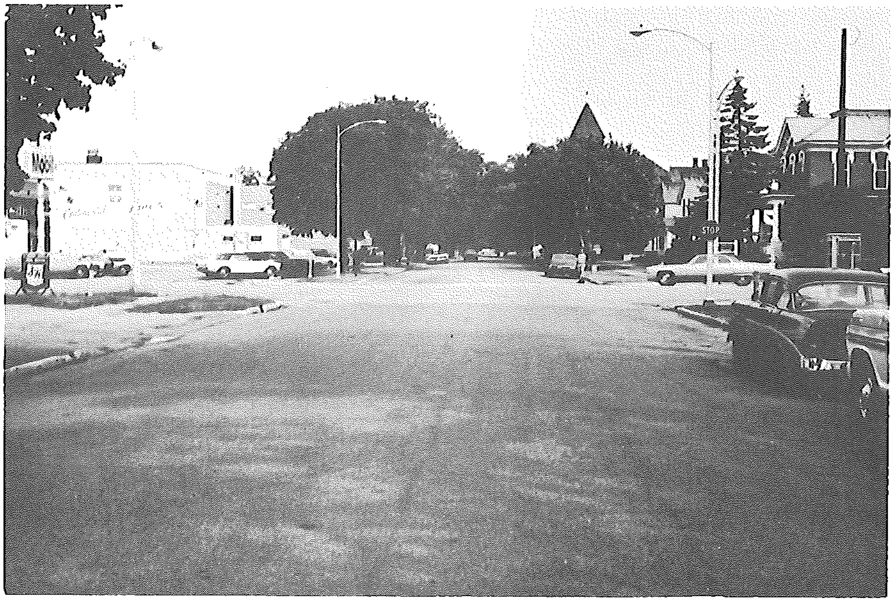
MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location 1st AVE. SOUTH at SOUTH 10th ST.
CITY OF ESCANABA
DELTA CO.

FORM NO. 1547 REV. 5-71

SOUTHBOUND
SOUTH 10TH STREET

EASTBOUND
1ST AVENUE SOUTH



NORTHBOUND
SOUTH 10TH STREET

Figure 14a

LOCATION 13 LUDINGTON STREET AT 15TH STREET

(For Recommendations see TRAFFIC ENGINEERING ANALYSIS and Appendix I, p. 70)

Total	P.D.	Inj.	Fatal
18	15	3	0

LOCATION 14 SHERIDAN AVENUE AT 16TH AVENUE NORTH

Sheridan Avenue and 16th Avenue North form a right-angle intersection located near the northeast city limits. Sixteenth Avenue east of the intersection becomes an unpaved alley 200 feet from Sheridan Avenue. Sheridan Avenue has a 40ft. bituminous pavement, with curb and gutter, and 16th Avenue North has a 30ft. bituminous pavement with curb and gutter. The southeast and southwest quadrants are occupied by taverns. Parallel parking is permitted on all legs of the intersection, except for the south side of 16th Avenue North, west of the intersection, where there is angle parking.

Traffic is controlled by a 24 inch stop sign (R1-1-24, Appendix II, p. 76) on 16th Avenue North for eastbound vehicles. Sheridan Avenue has broken white centerlines.

During the three-year study period there were 15 reported accidents at this location. Parking accidents were the predominant type with 12, or 80% of the total. Fourteen of the 15 accidents occurred between 8:00 p.m. and 2:30 a.m., and eight of the accidents occurred on a Friday or Saturday.

Recommendations

To ease part of the problem, it is recommended that the angle parking on the south side of 16th Avenue North, west of the intersection, be replaced by parallel parking. This will eliminate the conflict between vehicles backing from the angle parking spots on the south side of the street and those vehicles parallel parked on the north side of the street.

There are no other recommended engineering improvements; however, a review of the accident reports showed that only two of the reports stated definitely that neither driver had been drinking. The remaining reports stated that the influence was not known, not known if drinking, not under the influence, and one driver was under the influence.

With these facts in mind and since practically all the accidents occurred during the days and hours when the consumption of alcoholic beverages is the greatest, it is felt part of the problem is the drinking driver. Since this lies outside the jurisdiction of the traffic engineer, as discussed in the TRAFFIC ENGINEERING ANALYSIS, it is felt that police surveillance of the area may be necessary.

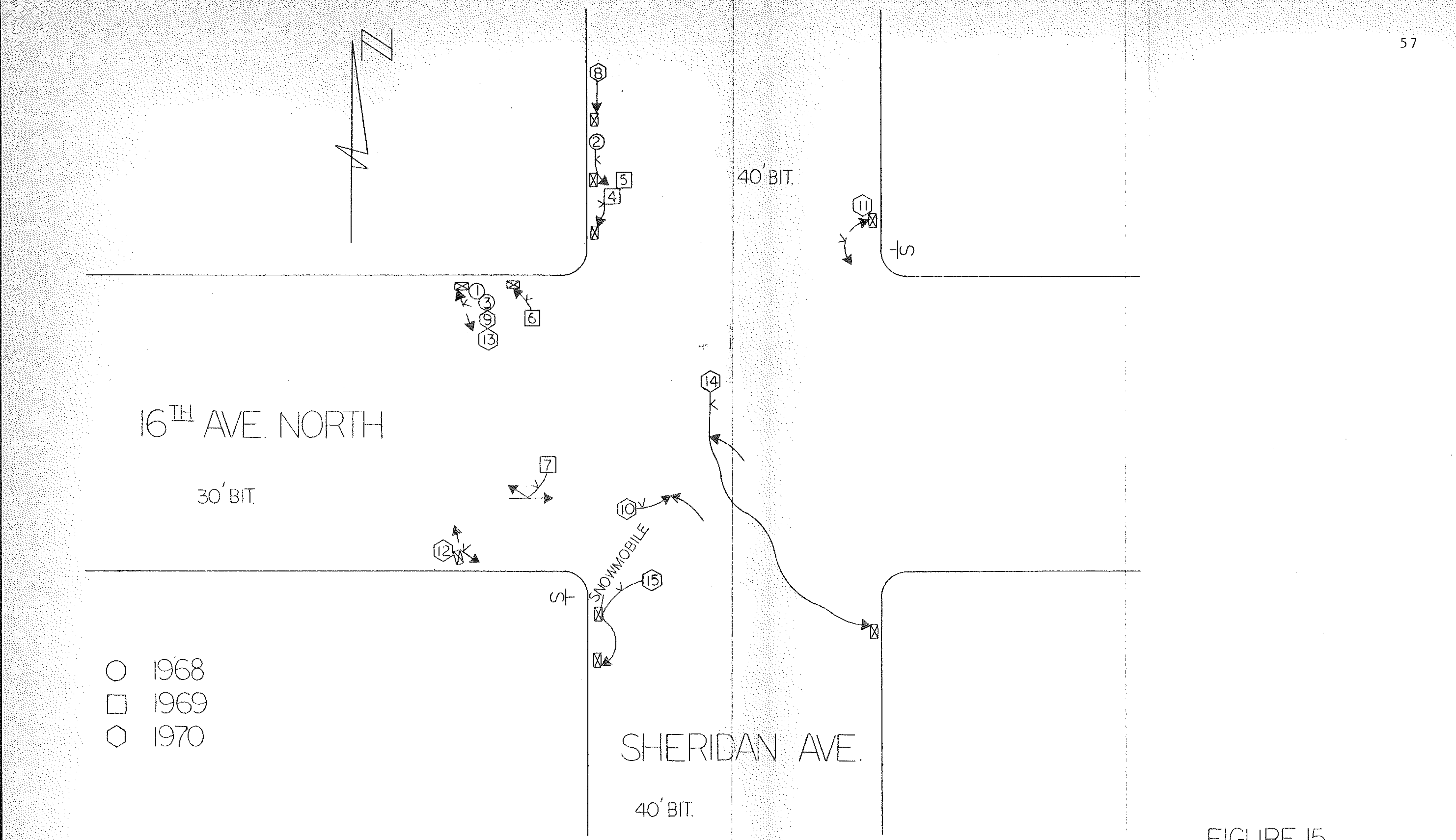


FIGURE 15

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970

Accidents – Total 15 P.D. 15

Injury 0 ( ) Fatal 0 ( )

C.S. ______ Miles ______ Drawn DVW

Plan No. LOCATION 14 Date 8-6-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location SHERIDAN AVE. at 16th AVE. NORTH
CITY OF ESCANABA
DELTA CO.

SOUTHBOUND
SHERIDAN AVENUE

EASTBOUND
16TH AVENUE NORTH

NORTHBOUND
SHERIDAN AVENUE

Figure 15a

LOCATION 15 SOUTH 14TH STREET AT 5TH AVENUE SOUTH

(For Recommendations see TRAFFIC ENGINEERING ANALYSIS and Appendix I, p.72)

Total	P. D.	Inj.	Fatal
10	8	2	0

APPENDIX I

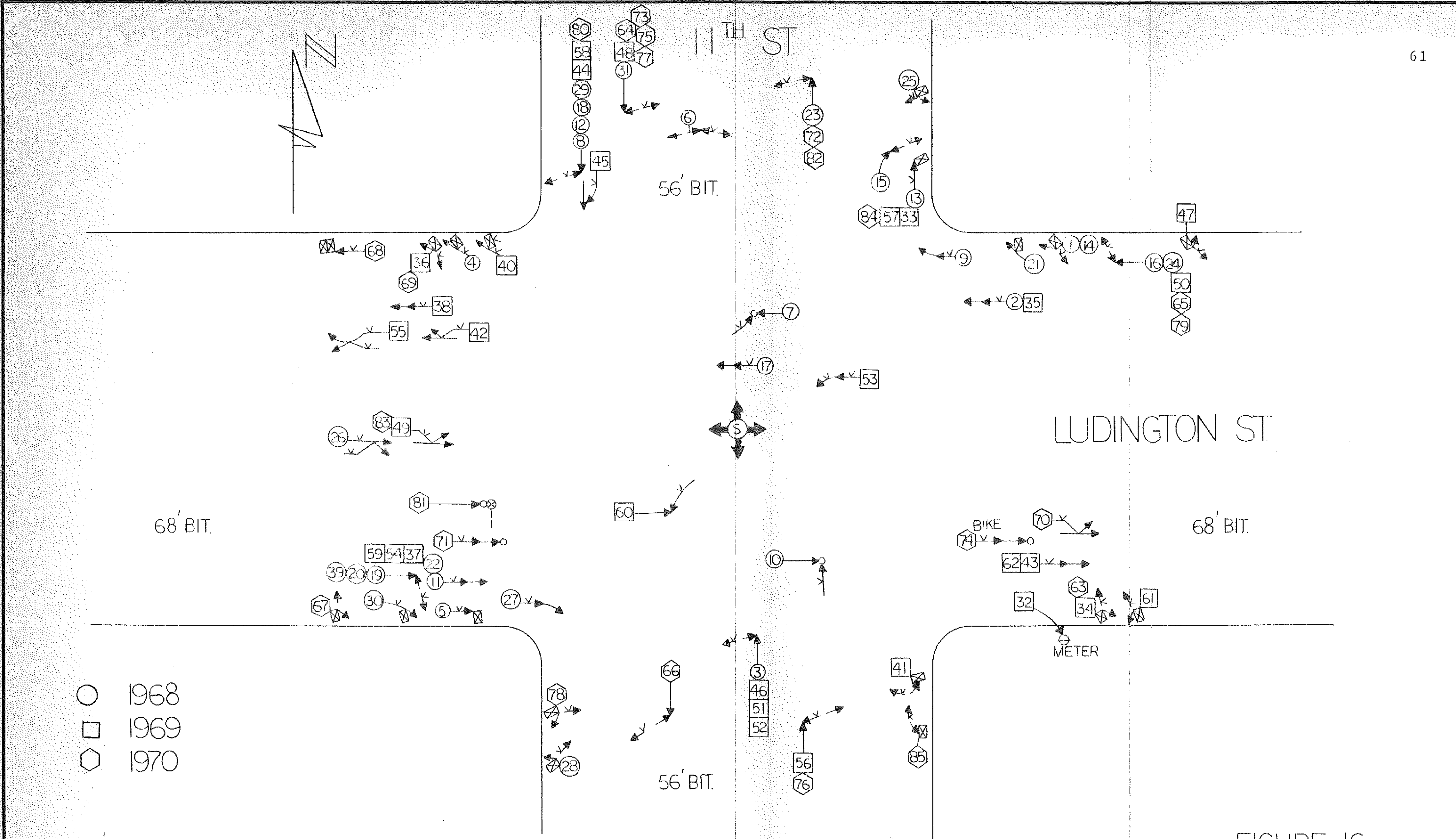


FIGURE 16

LEGEND

Fatal — Injury — Skidding — Jackknife — Overturned
Out of Control — Driver Intent — Deer — Violator — Backing
Pedestrain — Stop & Go Signal — Flashing Beacon
Tree — Stop Sign S — Yield Sign Y

Period: 1968 THRU 1970
Accidents – Total 85 P.D. 80
Injury 5 (7) Fatal 0 ( )
C.S. ____ Miles ____ Drawn DVW
Plan No. LOCATION 1 Date 7-30-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

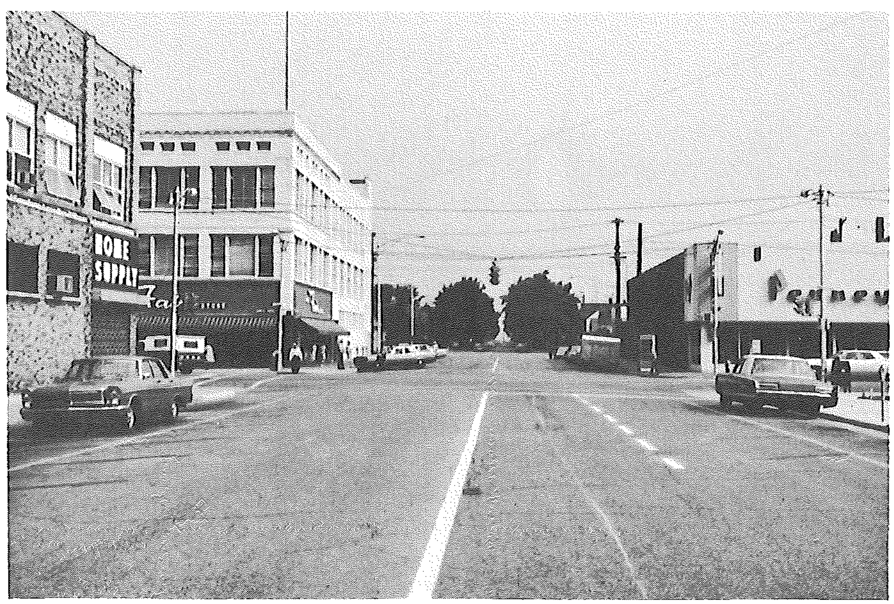
Location LUDINGTON ST. at 11th ST.
CITY OF ESCANABA
DELTA CO.

EASTBOUND
LUDINGTON STREET

WESTBOUND
LUDINGTON STREET

Figure 16a

SOUTHBOUND
11TH STREET



NORTHBOUND
11TH STREET

Figure 16b

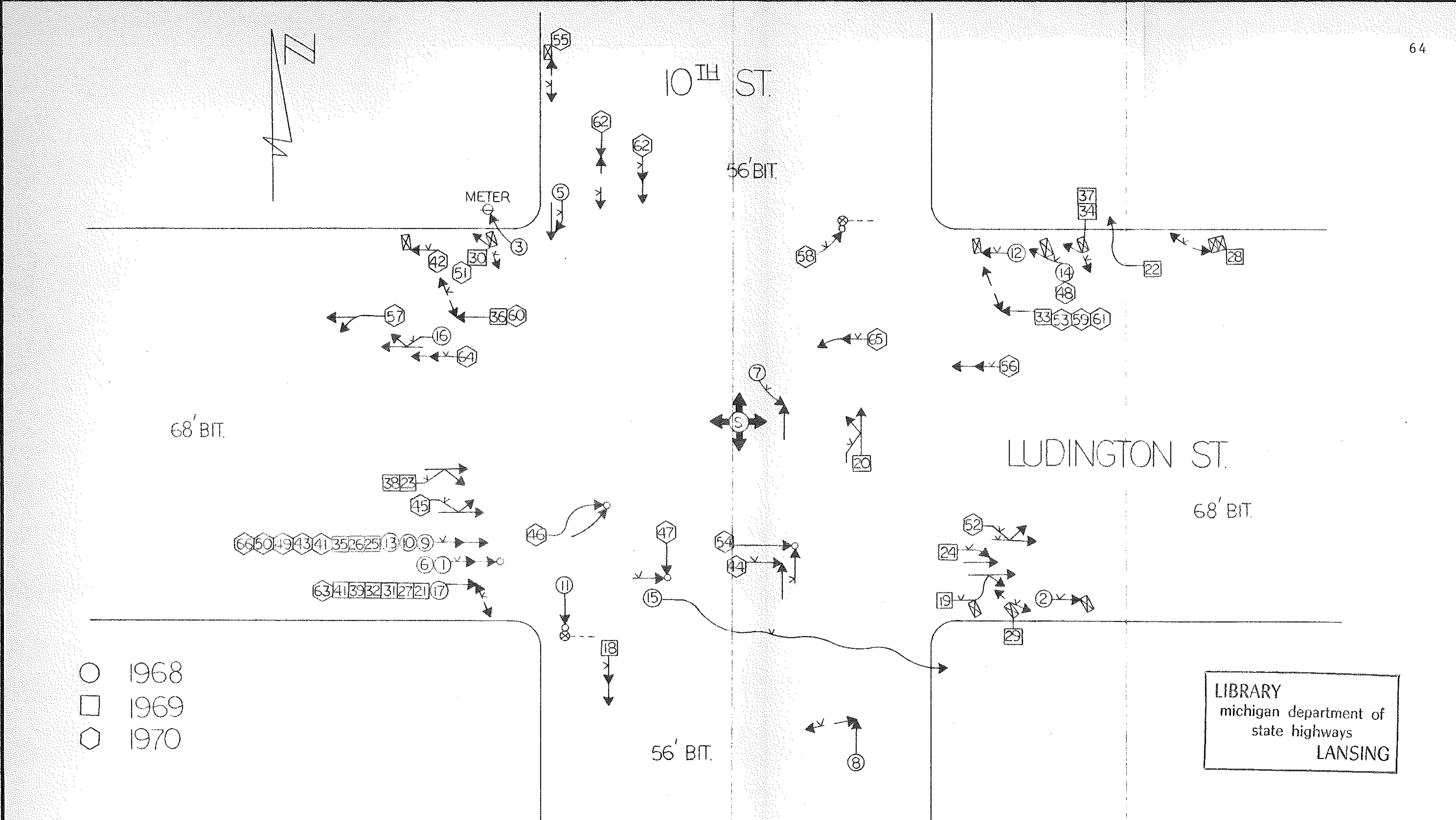


FIGURE 17

LEGEND

Fatal		Out of Control		Pedestrain		Tree	
Injury		Driver Intent					
Skidding		Deer		Stop & Go Signal		Stop Sign	S
Jackknife		Violator					
Overturned		Backing		Flashing Beacon		Yield Sign	Y

Period: 1968 THRU 1970

Accidents – Total 66 P.D. 59

Injury 7 (13) Fatal 0 ( )

C.S. ______ Miles ______ Drawn ______

Plan No. LOCATION 3 Date 8-3-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at 10th ST.
CITY OF ESCANABA
DELTA CO.

EASTBOUND
LUDINGTON STREET

SOUTHBOUND
10TH STREET

WESTBOUND
LUDINGTON STREET

Figure 17a

EDCO• 196M 6-71 46430•

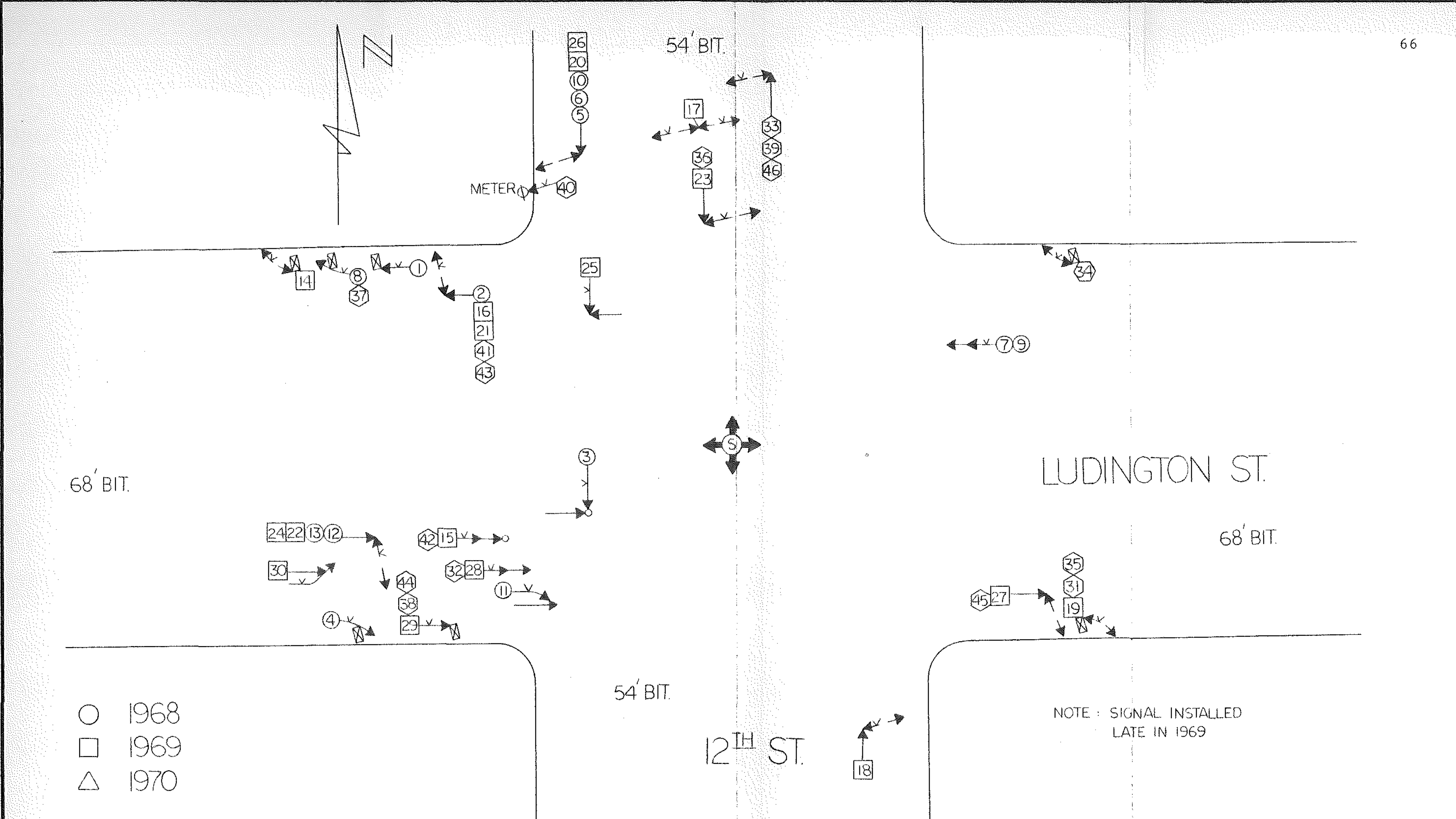


FIGURE 18

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970

Accidents – Total 46 P.D. 43

Injury 3 (6) Fatal 0 ( )

C.S. ______ Miles ______ Drawn DJM

Plan No. LOCATION 4 Date 8-4-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at 12th ST.
CITY OF ESCANABA
DELTA CO.

EASTBOUND
LUDINGTON STREET

SOUTHBOUND
12TH STREET

WESTBOUND
LUDINGTON STREET

Figure 18a

EDCO• 196M 6-71 46430•

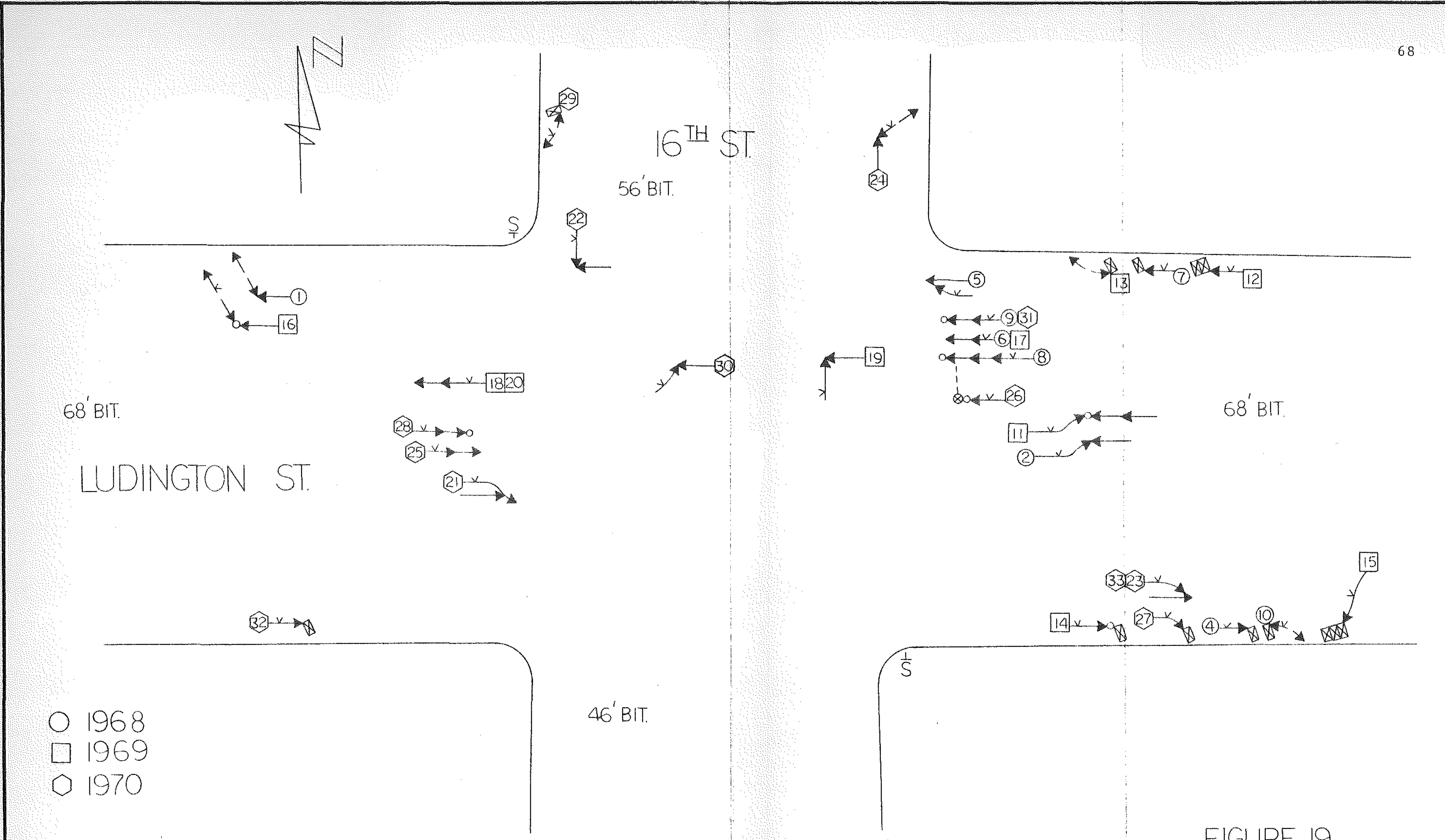


FIGURE 19

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970

Accidents – Total 33 P.D. 25

Injury 8 (14) Fatal 0 ( )

C.S. ______ Miles ______ Drawn DJM

Plan No. LOCATION 9 Date 8-4-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at 16th ST.
CITY OF ESCANABA
DELTA CO.

FORM NO. 1547 REV. 5-71

EASTBOUND
LUDINGTON STREET

NORTHBOUND
16TH STREET

WESTBOUND
LUDINGTON STREET

Figure 19a

EDCO• 196M 6-71 46430•

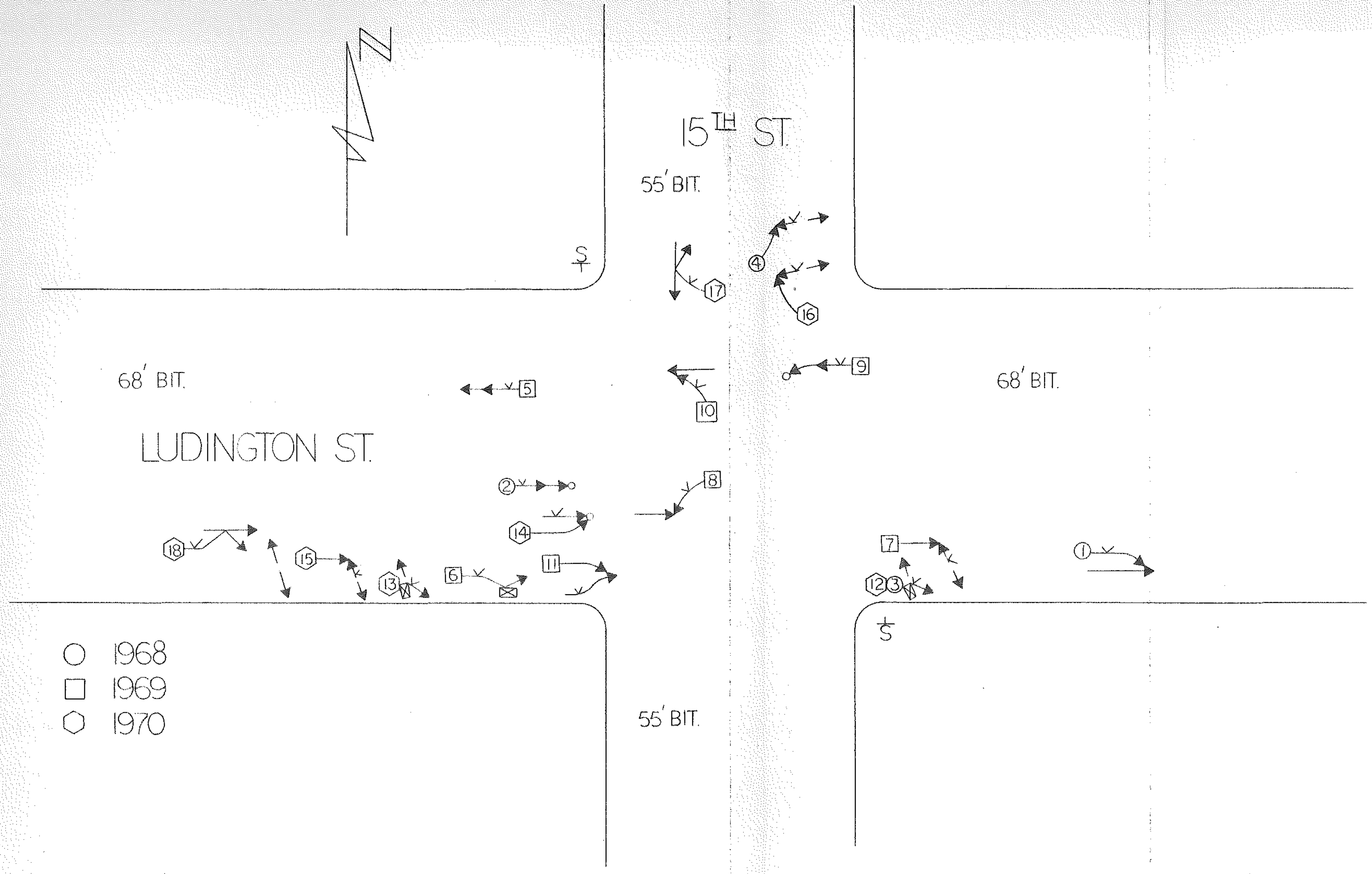


FIGURE 20

LEGEND

Fatal	Out of Control	Pedestrain	Tree
Injury	Driver Intent	Stop & Go Signal	Stop Sign S
Skidding	Deer	Flashing Beacon	Yield Sign Y
Jackknife	Violator		
Overturned	Backing		

Period: 1968 THRU 1970

Accidents – Total 18 P.D. 15

Injury 3 (3) Fatal 0 ( )

C.S. ____ Miles ____ Drawn DVW

Plan No. LOCATION 13 Date 8-4-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location LUDINGTON ST. at 15th ST.
CITY OF ESCANABA
DELTA CO.

FORM NO. 1547 REV. 5-71

EASTBOUND
LUDINGTON STREET

SOUTHBOUND
15TH STREET

WESTBOUND
LUDINGTON STREET

Figure 20a

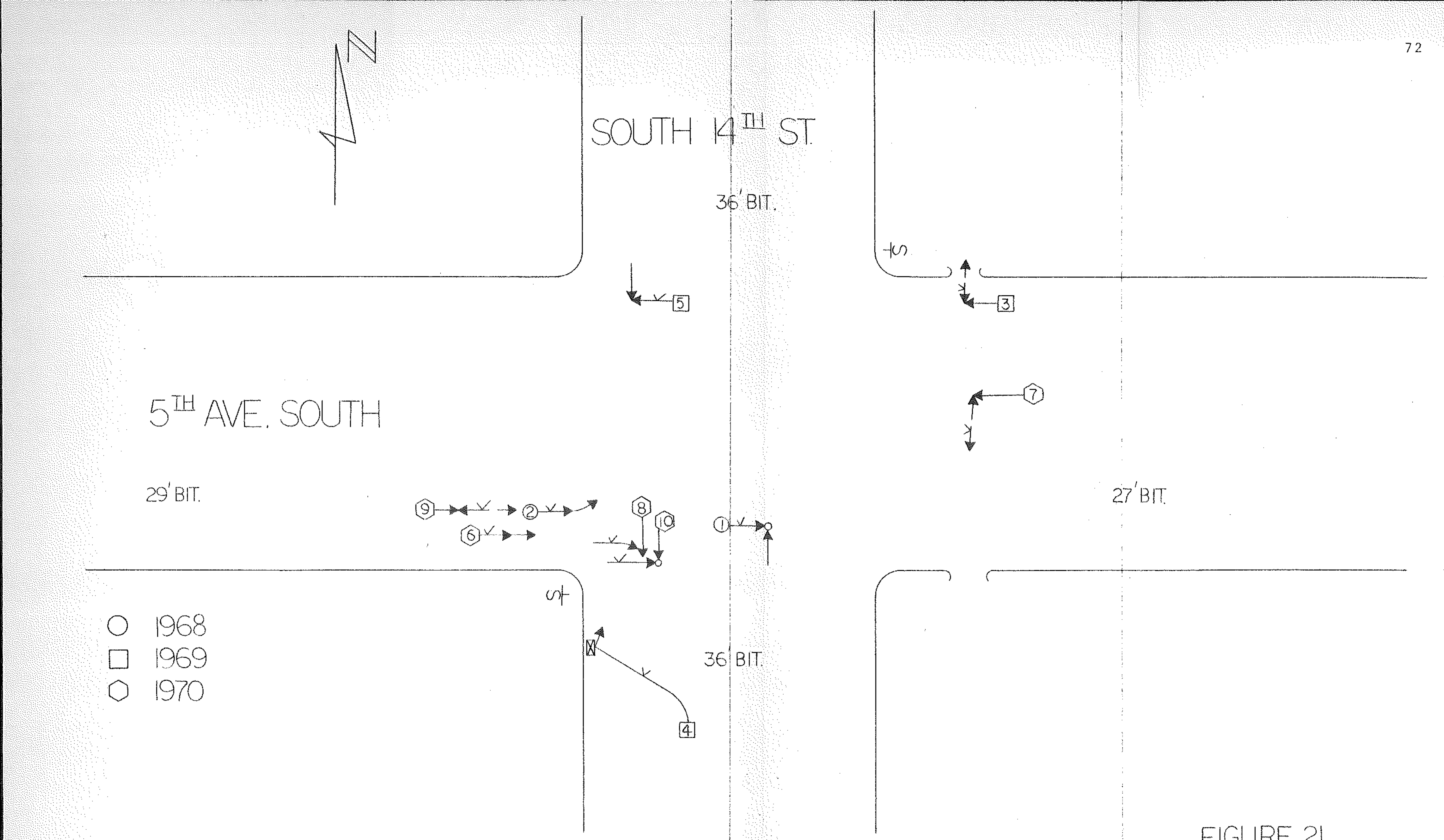


FIGURE 21

LEGEND

Fatal		Out of Control		Pedestrain		Tree	
Injury		Driver Intent		Stop & Go Signal		Stop Sign	S
Skidding		Deer		Flashing Beacon		Yield Sign	Y
Jackknife		Violator					
Overturned		Backing					

Period: 1968 THRU 1970

Accidents – Total 10 P.D. 8

Injury 2 (2) Fatal 0 ( )

C.S. ______ Miles ______ Drawn DJM

Plan No. LOCATION 15 Date 8-6-71

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location SOUTH 14th ST. AT 5th AVE SOUTH
CITY OF ESCANABA
DELTA CO.

SOUTHBOUND

SOUTH 14TH STREET

EASTBOUND

5TH AVENUE SOUTH

NORTHBOUND

SOUTH 14TH STREET

Figure 21a

APPENDIX II

Section B. Regulatory Signs

Regulatory Signs shall be used to inform highway users of traffic laws or regulations that apply at given places or on given highways. They are essential to indicate the applicability of legal requirements that would not otherwise be apparent. Great care must be exercised to see that they are erected wherever needed to fulfill this purpose, but unnecessary mandates should be avoided.

Included among regulatory signs are some, like those marking the end of a restricted zone, that are related to operational controls though not in themselves imposing any obligations or prohibitions.

Regulatory signs shall be erected at those locations where the regulations apply and shall be mounted so as to be easily visible and legible to the motorist whose actions they are to govern. Signs that have been erected but are no longer applicable shall be removed. Regulatory signs cannot be expected to command respect and obedience unless the regulations thereon set forth are adequately enforced.

Regulatory signs are classified in the following groups:

(1) Right-of-Way (R1 Series)
- a. "STOP" Sign
- b. "YIELD" Sign

(2) Speed (R2 Series)

(3) Movement (R3 Series)
- a. Turning
- b. Alignment
- c. One Way
- d. Exclusion

(4) Parking (R4 Series)

(5) Pedestrian (R5 Series)

(6) Miscellaneous (R6 Series)

With few exceptions, hereinafter detailed in the specifications for individual signs, regulatory signs are rectangular in shape with the larger dimension vertical and have black legends on white backgrounds. The principal exceptions referred to are the "STOP" sign, the Yield sign, the One Way arrow, and the Parking signs.

STOP SIGN

Reflectorized

R1-1-24	24″ x 24″	(8″ letters)
R1-1-30	30″ x 30″	(12″ letters)
R1-1-36	36″ x 36″	(12″ letters)

All "STOP" signs shall be reflectorized or internally illuminated so that the shape, color, and legend will be comparable to that in day time conditions and will not produce detrimental glare to traffic.

The "STOP" sign may be supplemented by two alternating red flashing beacons in the face or by one red flashing beacon directly above the sign. Such beacon(s) shall be operated continuously.

Place at the point where it is desired to have traffic stop, or as near thereto as possible at the following locations:

1. On streets or highways intersecting a through street or highway.
2. Railroad crossing where a stop is required by order of the appropriate public authority.
3. Opposite all Stop lines applied on the pavement, except at intersections controlled by a traffic control signal.
4. At intersections where a flashing red beacon exists.

There shall be no "STOP" signs on approaches to an intersection where such approaches are controlled by a traffic control signal.

An overhead internally illuminated "STOP" sign may be used in lieu of roadside "STOP" signs.

Secondary messages shall not be used on the face of a "STOP" sign. At a four-way stop intersection, each "STOP" sign may

Section C. Warning Signs

Introduction

Warning signs shall be used for the purpose of warning traffic of existing or potentially hazardous conditions either on or adjacent to the roadway. Warning signs require caution on the part of the motorist and may call for reduction of speed or other maneuver in the interest of his own safety and that of other motorists and pedestrians. Adequate warnings are of great assistance to the vehicle operator and are valuable in safeguarding and expediting traffic. However, the use of warning signs should be kept to a minimum. Too frequent use of them or their unnecessary use to warn of conditions which are apparent tends to bring disrespect for all signs.

The conditions warranting warning signs are classified in the following groups according to the type of conditions to which they are applied:

1.	Changes in Horizontal Alignments	(W1 Series)
2.	Intersections	(W2 Series)
3.	Advance Warning of Control Devices	(W3 Series)
4.	Converging Traffic Lanes	(W4 Series)
5.	Narrow Roadways	(W5 Series)
6.	Changes in Highway Design	(W6 Series)
7.	Grades	(W7 Series)
8.	Roadway Surface Conditions	(W8 Series)
9.	Schools and Pedestrians	(W9 Series)
10.	Railroad Crossings	(W10 Series)
11.	Entrances and Crossings	(W11 Series)
12.	Miscellaneous	(W12 Series)
13.	Construction and Maintenance	(W13 Series)*

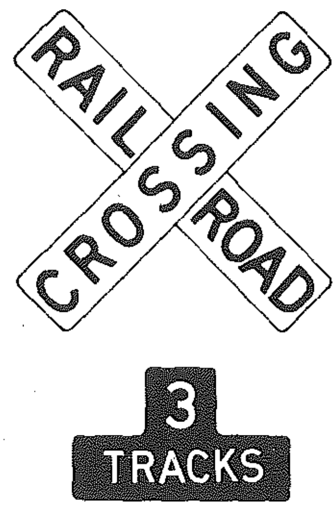
Warning signs with certain exceptions shall be diamond-shaped (square with one diagonal vertical) and shall have a "Highway Yellow" background with black legend. These exceptions are

*Special warning signs for highway construction and maintenance projects are to be found in Part II of this Manual.

the Railroad Crossing signs, the Target Arrow signs, the Curve Speed panel, the Exit Speed sign, the Obstruction panel, and the Lattice Background. Other exceptions to the diamond shape are provided for in the case of temporary signs for highway construction and maintenance.

The use of warning signs should be limited to those standard signs set forth in this section. However, after the Engineer has exhausted all possibilities, it may be found that no standard sign fits the situation and warning signs, other than those specified, may be required. Such signs shall conform with the general specifications for size (30″ minimum), shape, and color of warning signs. All warning signs having significance during hours of darkness shall be reflectorized or illuminated.

RAILROAD CROSSING SIGN



Reflectorized

W10-2 (5½″ and 4″ letters)

The Railroad Crossing sign shall be used in advance of a railroad-highway grade crossing. A supplementary legend denoting the number of tracks may be used only for those crossings consisting of two or more tracks. If crossings are separated by 100 feet or more each shall be treated as a separate crossing.

This sign shall be located in advance of the nearest rail at a distance specified by railroad authorities. Distance from the roadway shall be as specified by figure 1-11. In no case shall this sign be mounted or placed in the roadway.

Details concerning responsibility for furnishing, renewing, or maintaining the Railroad Crossing sign are outlined in Section 5, Act 270 P.A. 1921, as amended.

Section D. Pretimed Signals

Definition

A pretimed signal is a traffic control signal which alternately directs traffic to stop or to proceed in accordance with a single predetermined time schedule or a series of such schedules.

Operational features of pretimed signals, such as cycle length, split, sequence, offset, etc., can be changed according to a predetermined program.

Advance Engineering Data Required

A comprehensive investigation of traffic conditions and physical characteristics of the intersection is required to determine the necessity for a signal installation and to furnish necessary data for the proper design and operation of a signal that is found to be warranted. Such data may include:

1. The number of vehicles entering the intersection in each hour from each approach during all 24 hours of a representative day.
2. Vehicular volumes for each traffic movement from each approach (may be classified by vehicle type) during each 15-minute period of the high eight hours of a representative day.
3. Pedestrian volume counts on each crosswalk during the same periods as the vehicular counts in paragraph two above and also during hours of highest pedestrian volume, if not already covered. Pedestrian surveys must usually be tailored to fit the expected problem. For instance, at locations where complaints have been received concerning school children crossing the highway, the survey should differentiate between school children and adults.
4. The 85th-percentile speed of vehicles on the approaches to the intersection.
5. A condition diagram showing details of the physical layout, including such features as intersectional geometrics, channelization, grades, sight-distance restrictions, bus stops and routings, parking conditions, pavement markings, street lighting, driveways, location of nearby rail-

road crossings, distance to nearest signals, utility poles and fixtures, and adjacent land use.

6. A collision diagram showing accident experience by type, direction of movement, severity, weather, pavement condition, time of day, date and day of week for at least one year.
7. Vehicle-seconds delay determined separately for each approach.
8. The number, length of gap (in seconds) and distribution of gaps in the vehicular traffic on the major street.

Warrants for Pretimed Signals

Pretimed signals may be installed and operated only when one or more of the following warrants are satisfied:

Warrant 1.—Minimum vehicular volume.
Warrant 2.—Interruption of continuous traffic.
Warrant 3.—Minimum pedestrian volume.
Warrant 4.—Progressive movement.
Warrant 5.—Accident experience.
Warrant 6.—Combinations of warrants.

The investigation of the need for signal control should include an analysis of the degree to which each of the above warrants is met.

When for a period of four or more consecutive hours any traffic volume drops to 50 percent or less of the stated volume warrants, it is desirable that flashing operation be substituted for conventional operation for the duration of such periods. However, such flashing operation should be restricted to no more than three separate periods during each day.

Warrant 1, Minimum Vehicular Volume

The minimum vehicular volume warrant is intended for application where the volume of intersecting traffic is the principal reason for consideration of signal installation. The warrant is satisfied when for each of any eight hours of an average day the traffic volumes given below exist on the major street and on the higher-volume minor-street approach to the intersection.

Minimum Vehicular Volumes for Warrant 1.

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)	Vehicles per hour on higher-volume minor-street approach (one direction only)
Major Street	Minor Street		
1*	1*	500	150
2 or more	1*	600	150
2 or more	2 or more	600	200
1*	2 or more	500	200

*Flaring required to separate left turning traffic from through and right turning traffic.

The major-street and the minor-street volumes are for the same eight hours. During those eight hours, the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85th-percentile speed of major-street traffic exceeds 40 miles per hour, or when the intersection lies within the built-up area of an isolated community having a population less than 10,000, the minimum vehicular volume warrant is 70 percent of the requirements above, in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities.

Warrant 2, Interruption of Continuous Traffic

The interruption of continuous traffic warrant is intended for application where operating conditions on a major street are such that the minor-street traffic suffers undue delay or hazard in entering or crossing the major street. The warrant is satisfied when for each of any eight hours of an average day the traffic volumes given below exist on the major street and on the higher-volume minor-street approach to the intersection, and the signal installation will not seriously disrupt progressive traffic flow.

Minimum Vehicular Volumes for Warrant 2.

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)	Vehicles per hour on higher-volume minor-street approach (one direction only)
Major Street	Minor Street		
1*	1*	750	75
2 or more	1*	900	75
2 or more	2 or more	900	100
1*	2 or more	750	100

*Flaring required to separate left turning traffic from through and right turning traffic.

The major-street and minor-street volumes are for the same eight hours. During those eight hours, the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85th-percentile speed of major-street traffic exceeds 40 miles per hour, or when the intersection lies within the built-up area of an isolated community having a population less than 10,000, the interruption of continuous traffic warrant is 70 percent of the requirements above, in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities.

Warrant 3, Minimum Pedestrian Volume

The minimum pedestrian volume warrant is satisfied when for each of any eight hours of an average day the following traffic volumes exist:

1. On the major street 600 or more vehicles per hour enter the intersection (total of both approaches); or 1,000 or more vehicles per hour (total of both approaches) enter the intersection on the major street where there is a raised median island four feet or more in width; and
2. During the same eight hours as in paragraph one there are 150 or more pedestrians per hour on the highest volume crosswalk crossing the major street.

When the 85th-percentile speed of major-street traffic exceeds

40 miles per hour, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the minimum pedestrian volume warrant is 70 percent of the requirements above, in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities.

A signal installed under this warrant at an isolated intersection should be of the semi-traffic-actuated type with push buttons for pedestrians crossing the main street. If such a signal is installed at an intersection within a coordinated system, it should be equipped and operated with control devices which provide proper coordination.

Signals installed under this warrant shall be equipped with pedestrian indications.

In connection with signals installed for school crossings, it should be understood that a signal is not the only remedy nor is it necessarily the correct solution to the perplexing problem of traffic conflicts between vehicles and school children. Brief periods during which the hazards are unusually high are often better handled by officer control or adult crossing guards.

In some circumstances the pupils' response to signal indications is so inadequate that the signal can become a contributory factor in increasing rather than decreasing accidents. The response to officer control or adult crossing guards is usually less uncertain.

It is, therefore, believed that signals should not ordinarily be installed at school crossings where schoolboy patrols or adult crossing guards can be used effectively, where students can be directed to cross at locations which are already controlled by signals or police officers, or where pedestrian refuge islands provide adequate protection.

Complete facts should be obtained and studied by competent traffic engineering authorities before decisions are made on the installation of signals in the vicinity of schools. As a result of these studies and consideration of the control methods listed above, traffic signals may be warranted if:

1. Pedestrian crossing volumes at a designated school crossing on the major street exceed 250 pedestrians in each of two hours; and
2. During each of the same two hours vehicular traffic through the designated school crossing exceeds 800 vehicles; and

3. There is no signal within 1,000 feet of the crossing.

When the 85th-percentile speed of major-street traffic exceeds 40 miles per hour or when the intersection lies within the built-up area of an isolated community having a population less than 10,000, the warrant is 70 percent of the requirements above, in recognition of differences in the nature and operational characteristics of traffic in urban and rural environments and smaller municipalities.

School crossing signals installed under this warrant should be of the pedestrian-actuated type. They shall be equipped with pedestrian indications.

Warrant 4, Progressive Movement

Progressive movement control sometimes necessitates traffic signal installations at intersections where they would not otherwise be warranted in order to maintain proper grouping of vehicles and effectively regulate group speed. The progressive movement warrant is satisfied when:

1. On an isolated one-way street or on a street which preponderantly has unidirectional traffic significance, adjacent signals are so far apart that the desired degree of platooning and speed control of vehicles would otherwise be lost.
2. On a two-way street, adjacent signals do not provide the desired degree of platooning and speed control; and the proposed and adjacent signals can constitute a progressive signal system.

In a single-alternate signal system the minimum spacings between the proposed signal and existing adjacent signals should closely approximate the distance D in feet, or full unit multiples thereof, given by the formula $D = CS \div 1.364$ where $C =$ cycle length in seconds, and $S =$ design speed of signal system in miles per hour. The above table, illustrating the relationship between cycle length, signal spacing, and system speed, shows that signal spacings under 1,000 feet are not capable (with practical cycle lengths) of rendering progressive, two-way movement with acceptable speeds. It further indicates that desirable minimum signal spacing with 60-, 65-, or 70-second cycle lengths is approximately 1,320 feet or ¼ mile.

System Design Speeds in Relation to Cycle Length and Signal Spacing for Single-alternate Systems[1]

Cycle length of System	Design Speed for Signal Spacing of—		
	1320 feet (¼ mile)	1,000 feet (approx. 3/16 mile)	660 feet (⅛ mile)
Seconds	M.p.h.	M.p.h.	M.p.h.
40	45	34.1	22.5
45	40	30.3*	20
50	36	27.3*	18
55	32.7	24.8*	16.4
60	30*	22.7	15
65	27.7*	21	13.8
70	25.7*	19.5	12.9
75	24	18.2	12
80	22.5	17.1	11.3

[1]With identical speeds in both directions.
*Starred numbers represent practical speeds.

Warrant 5, Accident Experience

The common opinion of the general public that signals materially reduce the number of accidents is rarely substantiated by experience. Not infrequently there are more accidents with signals in operation than before signal installation. Hence, if none of the warrants except the accident experience warrant described below is fulfilled, the initial presumption should be against signalization. Signals should not be installed on the basis of a single spectacular accident or on the basis of unreasonable demands and dire predictions of accidents which allegedly might occur. The accident-experience warrant is satisfied when:

1. Adequate trial of less restrictive remedies with satisfactory observance and enforcement has failed to reduce the accident frequency; and
2. Five or more reported accidents of types susceptible of correction by a traffic control signal have occurred within a 12-month period, each accident involving personal

injury or property damage to an apparent extent of $100 or more; and

3. There exists a volume of vehicular and pedestrian traffic not less than 80 percent of the requirements specified in the minimum vehicular-volume warrant, the interruption of continuous traffic warrant, or the minimum pedestrian-volume warrant; and

4. The signal installation will not seriously disrupt progressive traffic flow.

Any signal installed solely on the accident experience warrant should be semi traffic-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system, and normally should be full traffic-actuated if installed at an isolated intersection.

A traffic control signal, when obeyed by drivers and pedestrians, can be expected to eliminate or reduce materially the number and seriousness of the following types of accidents:

1. Those involving substantially right-angle collisions or conflicts, such as occur between vehicles on intersecting streets.

2. Those involving conflicts between straight-moving vehicles and crossing pedestrians.

3. Those between straight-moving and left-turning vehicles approaching from opposite directions, if an independent time interval is allowed during the signal cycle for the left-turn movement.

On the other hand, traffic control signals cannot be expected to reduce the following types of accidents:

1. Rear-end collisions, which often increase after signalization.

2. Collisions between vehicles proceeding in the same or opposite directions, one of which makes a turn across the path of the other.

3. Accidents involving pedestrians and turning vehicles when both move during the same interval.

4. Other types of accidents, if pedestrians or drivers do not obey the signals.

Warrant 6, Combination of Warrants

Signals may occasionally be justified where no one warrant is satisfied but two or more are satisfied to the extent of 80 percent or more of the stated values. These exceptional cases should be decided on the basis of a thorough analysis of facts.

Adequate trial of other remedial measures which cause less delay and inconvenience to traffic should precede installation of signals under this warrant.

Selection of Type of Pretimed, Control Mechanism

Where any of the previously described warrants is satisfied and the decision has been made to install a pretimed signal, it is necessary to select the type of pretimed mechanism to be installed. The possible choices include the following, for which advantages are set forth in the next few paragraphs:

1. Nonsynchronous pretimed controller for isolated intersections.
2. Synchronous type of pretimed controller for isolated intersections.
3. Controllers providing for coordination.

Nonsynchronous Pretimed Controllers for Isolated Intersections

This type of controller, which is timed by an electronic device, is not desirable and should be used only at isolated intersections warranting signalization where it is unlikely that there will be any need for coordination with other intersections during the expected life of the controller.

By use of auxiliary devices, cycle lengths and proportions allotted to the various go intervals can be changed a limited number of times during the day. However, traffic-actuated or synchronous pretimed equipment is preferable where such changes are desirable.

Synchronous Pretimed Controller for Isolated Intersections

This type of controller uses a synchronous timing motor and should be used at isolated intersections where:

1. In the future, the installation is likely to be coordinated with other signal installations or to be supervised by a master controller.

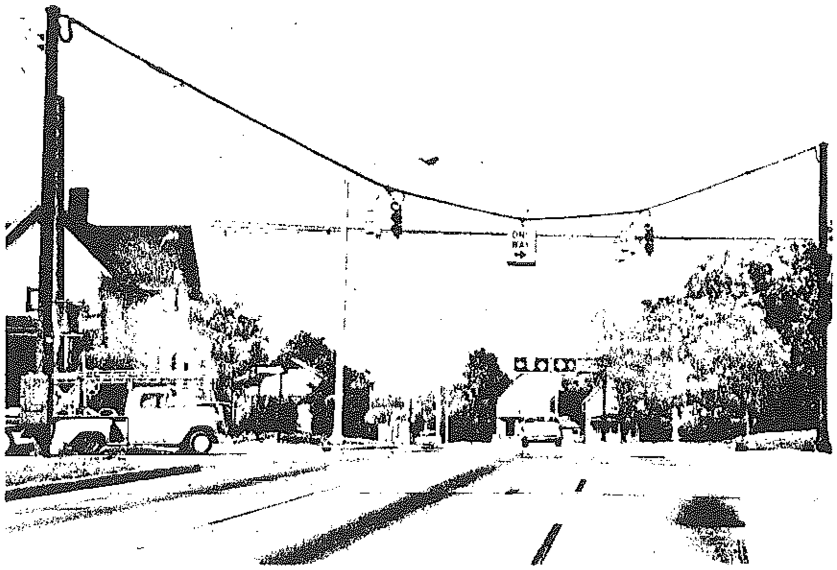


Figure 4-2. Traffic control signal installation with illuminated case sign.

Types of Mountings for Signal Heads

Signal heads shall be mounted over the traveled portion of the roadway using either cable or mast arm suspension. Supplementary signal heads may be placed along the side of the roadway on poles or pedestals.

Signals shall be so located that the meaning of the indications is always clear and unmistakeable. It is essential that signal indications be readily visible to drivers in all lanes approaching the signal location.

Number of Signal Faces

At signalized intersections, where one or more approach is a State trunkline highway, there shall be a minimum of two overhead vehicular signal faces, located over the traveled portion of the roadway, visible to traffic on each approach. Where a separate turning signal(s) is provided, only one indication is required for each signalized turning movement. See figure 4-13.

At all other signalized intersections, a minimum of one overhead vehicular signal face per approach is required. It is strongly recommended, however, that at least two vehicular signal faces be provided per approach for the following reasons:

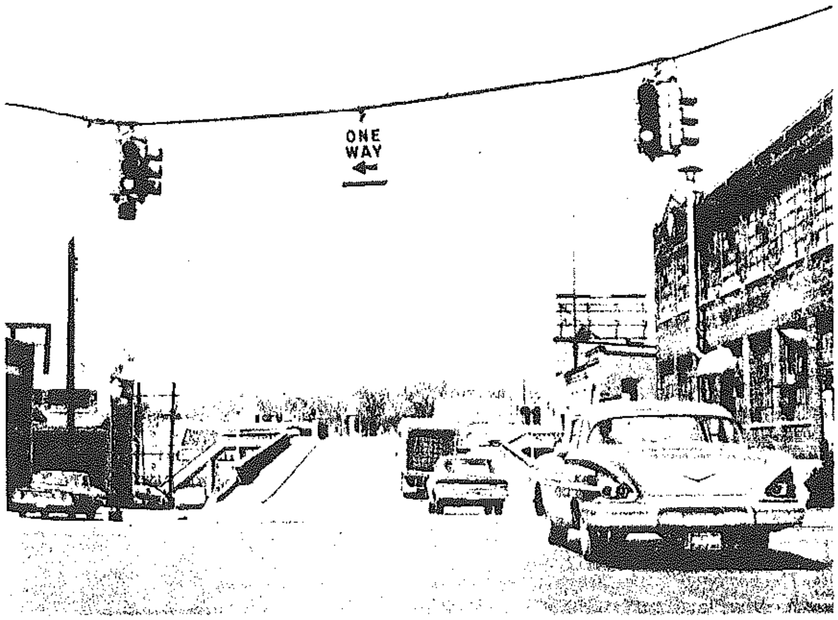


Figure 4-3. Traffic control signal installation with delayed left turn arrow.

1. Two (or more) properly located overhead faces will in almost all cases provide drivers with a signal indication even though trucks or buses may momentarily obscure one signal face.
2. Multiple faces provide a safety factor where the signals must compete with a brilliant background such as advertising signs or the sun.
3. The occasional inevitable lamp failure in one face will not leave an approach without any signal indication.

Where only one vehicular signal face is provided per approach, it shall be positioned as near to the intersection of the centerlines of the intersecting roadways as possible.

The number of signal faces in excess of two per approach will be dictated by local conditions such as the number of vehicular lanes, the need for special turn indications, and the configuration of the intersection and channelizing islands.

Vehicular signals may be supplemented by pedestrian signals, where warranted, located at each end of each controlled crosswalk.

Signal faces shall be located at the intersection so as to give drivers and pedestrians a clear, unmistakeable indication of the right-of-way assignment from their normal positions on the approaches and as they pass through the intersection area. At intersections where signals are installed on the basis of the pedestrian volume warrant, or at other signalized locations where the pedestrian volume equals or exceeds the warrant, pedestrian signals shall be installed.

Pedestals in the roadway to carry signals are driving hazards, and are prohibited despite any advantages as a conspicuous signal location. This is not intended however, to preclude the use of signals on pedestals or posts within the area of properly designed channelized islands or in the median strip of divided roadways.

Where physical conditions prevent the driver from having a continuous view of at least one signal indication for approximately ten seconds before reaching the stop line, consideration may be given to the use of a supplementary signal to improve this visibility.

Advance warning of a signal may be provided by the use of a W3-3 (Signal Ahead) sign. For greater emphasis flashing yellow beacons may be used in conjunction with this sign as provided in Part V, Miscellaneous Electrical Devices.

Height of Vehicular Signal Faces

The vertical clearance of overhead signals shall not be less than 15 feet or normally more than 17 feet. Where used, supplementary pedestal or pole mounted signals shall have a bottom height of not less than 8 feet nor more than 15 feet.

Maximum visibility and adequate clearance should be the guiding consideration in deciding signal height. Grades on approaching streets may be important factors, however, in determining the most appropriate height.

Transverse Location of Signal Faces

Where dual overhead signal faces are provided over the approach to a signal they should normally be centered on the approach with a minimum of 14 foot separation from each other. Transverse spacing, however, should be carefully checked by the Engineer to provide prominent and conspicuous location.

VOLUME WARRANTS FOR SIGNAL INSTALLATION

A comprehensive analysis of traffic patterns in the City of Detroit, at monthly count locations, shows that the volume occurring during the highest eight hours is 54.2% of the Average Daily Traffic. Analysis also shows that a ratio of two to one exists between the high volume direction and the low volume direction for the eight hour period. Using the 50% A.D.T. as the high eight hour volume and a two to one ratio as representing the high volume approach versus the low volume approach relationship, the degree to which Warrant 1 is met can be determined as follows:

Minimum Vehicle Volume

1) Major Street

Since;

50% A.D.T. = Min. Veh. Vol. Warr. x 8hr.

$$\text{Min. A.D.T.} = \frac{500 \text{ Veh./hr. } \times 8\text{hr.}}{.5}$$

Min. A.D.T. = 8,000 Veh.

2) Minor Street

Since;

50% A.D.T. = Min. Veh. Vol. Warr. (high vol. + low vol.) x 8hr.

$$\text{Min. A.D.T.} = \frac{(150 \text{ Veh./hr. } + \frac{150}{2} \text{ Veh./hr.})}{.5} \times 8\text{hr.}$$

Min. A.D.T. = 3,600 Veh.

PART V. MISCELLANEOUS ELECTRICAL DEVICES

Section A. Introduction

The number of applications of electricity in the field of traffic control devices is numerous, limited only to the ingenuity of the traffic engineer. A few of these applications will be discussed in this Part of the Manual.

In addition to traffic control signals (which were discussed in Part IV.) electrical traffic control devices may be broken into the following categories:

1. Flashing Beacons.
2. Illuminated Signs.
3. Highway Lighting.
4. Lane Control Signals.

Section B. Flashing Beacons

Definition and Application

A flashing beacon is a section of a standard traffic signal head or a similar type of device, having a yellow or red lens in each face, which is illuminated by intermittent flashes.

Flashing beacons perform a useful function at locations where traffic or physical conditions do not justify conventional traffic signals. At other special points of hazard, experience has indicated that the flashing beacon is effective in calling the attention of drivers to these locations.

Warrants for Flashing Beacons at Intersections

A flashing beacon which flashes yellow for the major highway and red for the minor highway, may be installed over the point of intersection of the center lines of two highways under any one of the following warrants:

1. Where a serious concentration of accidents (four or more over a two year period) which are susceptible of correction by the cautioning or stopping of traffic exists.

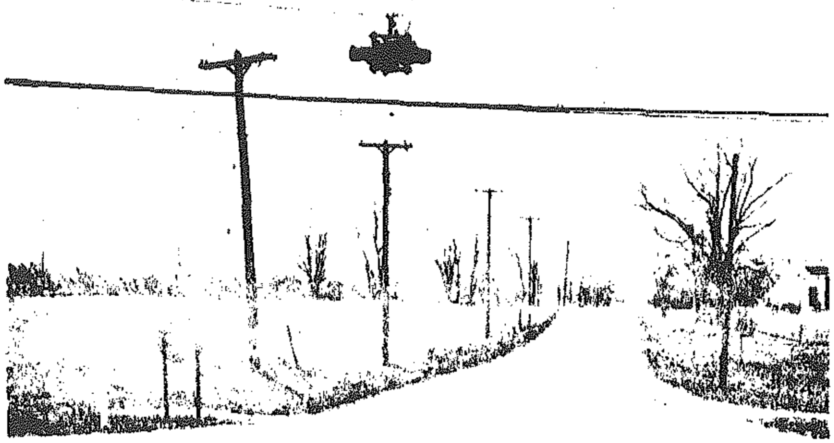


Figure 5-1. Overhead flashing beacon.

2. Where sight distance is extremely limited or where other conditions make it especially desirable to emphasize the need for stopping one street and for cautioning the other.

Since public respect of the flashing beacon depends, to some extent, on the limited, judicial use of the device, it is best to consider the installation of the flashing beacon only after lesser control devices have been tried, such as a 36 inch "STOP" sign (R1-1), a "STOP AHEAD" sign (W3-1), and a Lattice Background (W12-10).

Design

Flashing beacon units and their mountings shall follow the general design specifications for standard traffic signals, which include the following essentials:

1. Each signal unit lens shall have a visible diameter of not less than 8 inches.
2. The illuminating element, lens, reflector, and visor shall each be of such design as to render the lens, when illuminated, clearly visible to traffic facing the signal at all distances up to 1000 feet under all atmospheric conditions except dense fog.

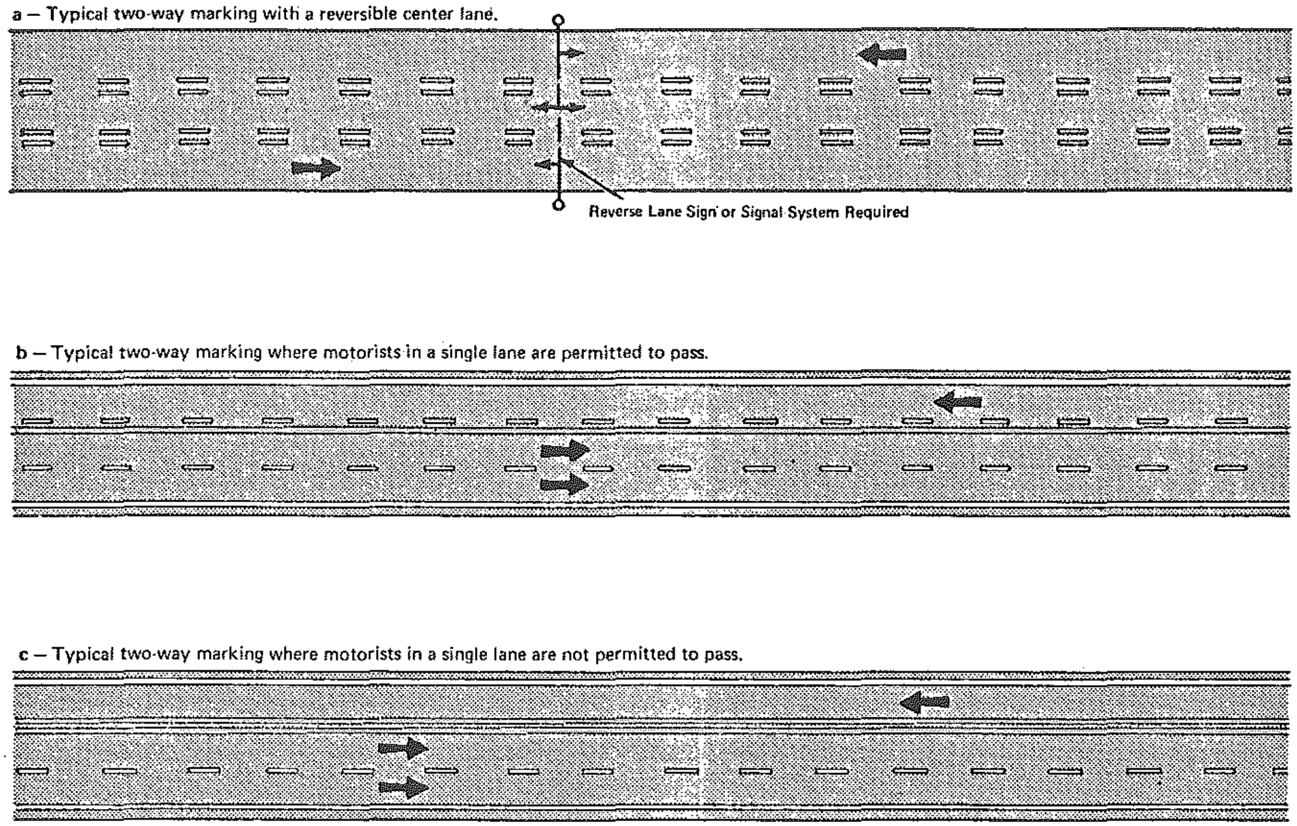


Figure 3–1. Typical two-way marking applications.

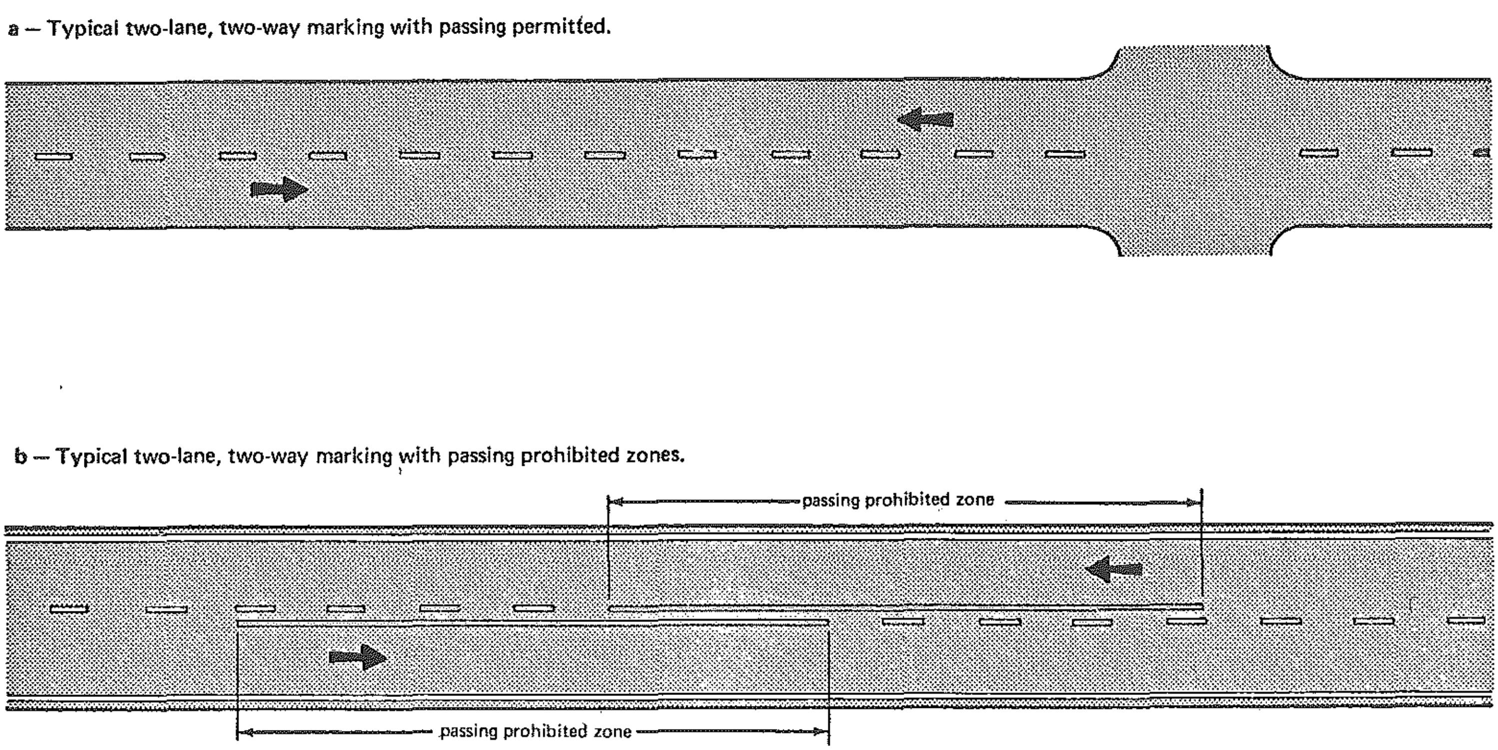
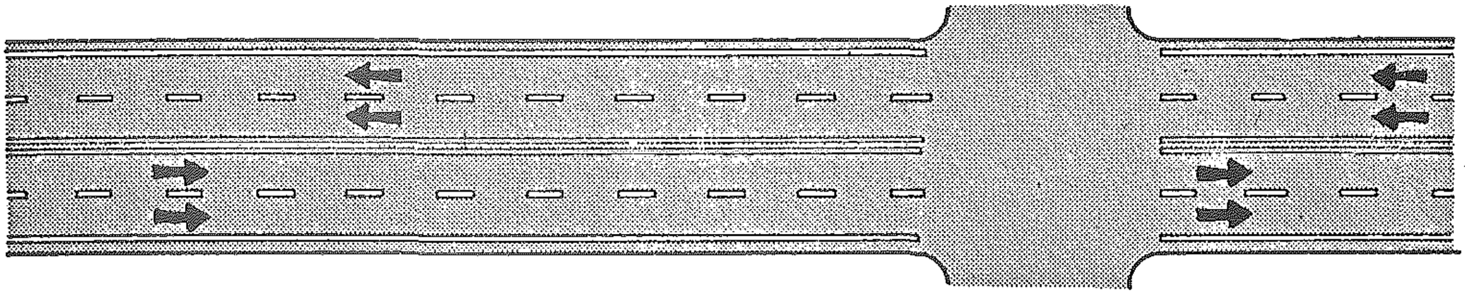


Figure 3–2. Typical 2-lane, two-way marking applications.

a — Typical multi-lane, two-way marking.



b — Typical multi-lane, two way marking with single lane left turn channelization.

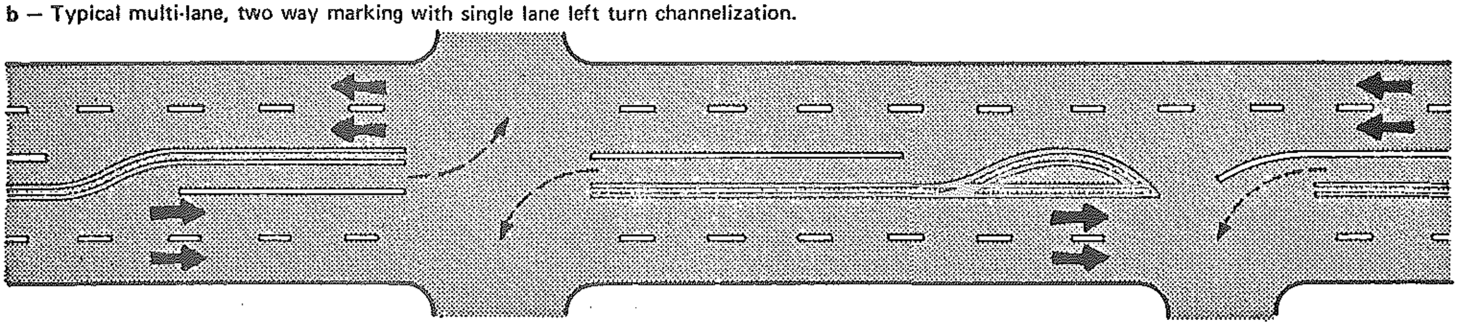
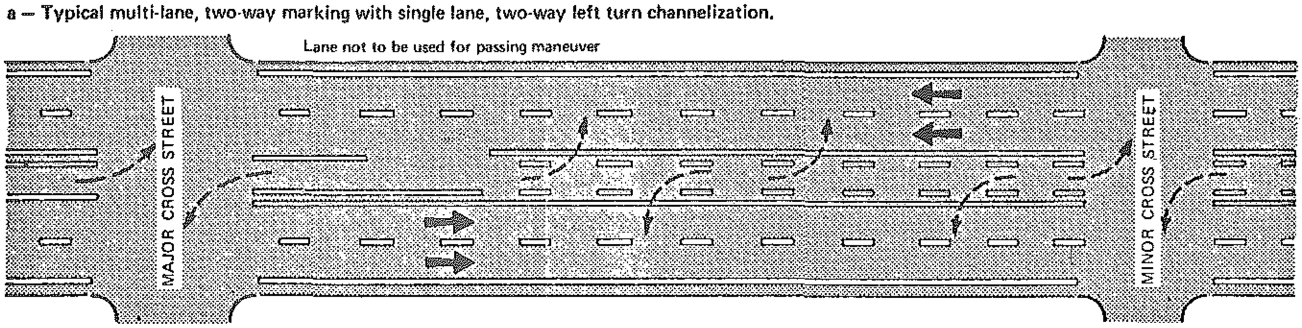


Figure 3—3. Typical multilane, two-way marking applications.

a — Typical multi-lane, two-way marking with single lane, two-way left turn channelization.



b — Typical multi-lane, two-way marking with dual lane left turn channelization.

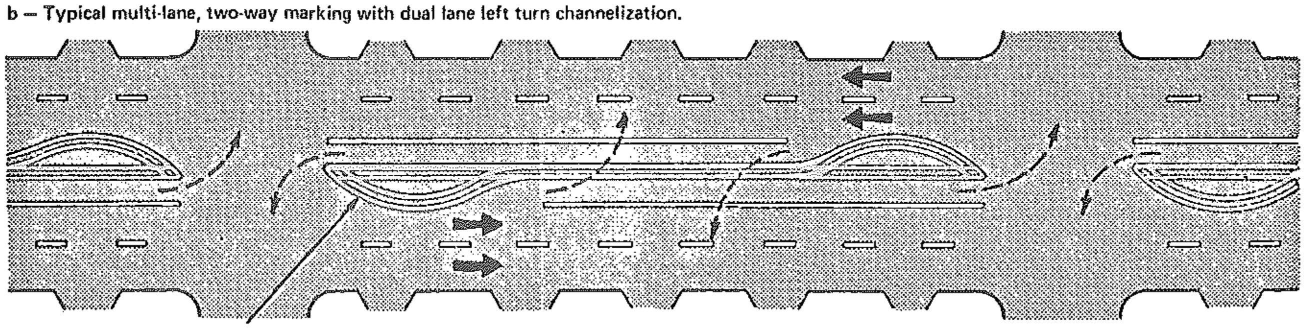


Figure 3—4. Typical multilane, two-way marking applications.

OFFICE MEMORANDUM

MICHIGAN

DEPARTMENT OF STATE HIGHWAYS NOV 10 1971

To: All Holders on Record This Date of the 1963 Edition of the "Michigan Manual of Uniform Traffic Control Devices"

From: Henrik E. Stafseth, Director, Michigan Department of State Highways; John R. Plants, Director, Michigan Department of State Police

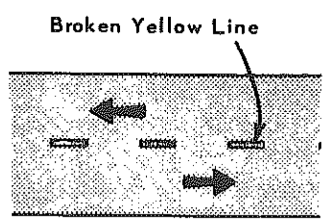
Subject: Change Memorandum No. 5

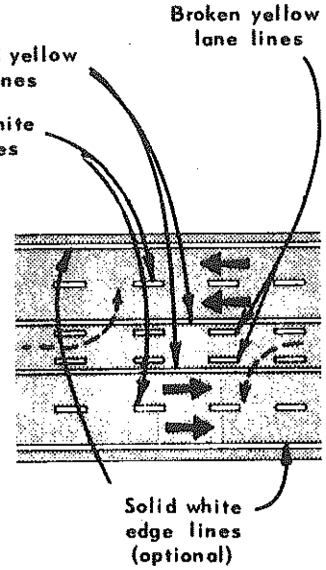
In order to more nearly conform to the design and application of traffic control devices prescribed by the 1971 edition of the National "Manual on Uniform Traffic Control Devices" (MUTCD) and to comply with recent revisions to the "Michigan Vehicle Code" (MVC), it is necessary that the following changes in the "Michigan Manual of Uniform Traffic Control Devices" (MMUTCD) be made. These and other changes to the 1963 edition of the MMUTCD will ultimately be encompassed in a revised edition of the MMUTCD. However, this Change Memorandum will serve to authorize interim changes of more urgent concern to state, county and municipal agencies.

In instances where "may" is used in this memorandum, the 1971 edition of the MUTCD and forthcoming revised edition of the MMUTCD possibly will read "shall". The purpose of using "may" in this memorandum is to temporarily permit the extended use of existing sign inventories.

The interim changes, numerically designated, follow (code numbers shown beneath sign illustrations are from the MUTCD sign coding system):

1. On all two-lane, two-way, hard-surface roadways, beginning with the 1972 pavement-marking season, any center-line marking placed shall be a broken yellow line. Line width, segment length, and the marking of "no-passing" zones shall be the same as currently specified by the MMUTCD.





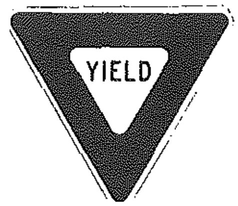
2. Beginning with the 1972 pavement-marking season, on each two-way roadway consisting of three lanes or more, where a two-way, left-turn lane is to be designated, the two-way, left-turn lane shall be marked by a single-direction, no-passing markings (4-inch solid yellow line on the outside and 4-inch broken yellow line on the inside) on each edge of the center lane.

3. By December 31, 1972, the limits of no-passing zones at vertical curves, identified by pavement markings and/or "DO NOT PASS" and "PASS WITH CARE" signs, shall be established where the minimum sight distance measured between points 3.75 feet (maximum) above the roadway surface becomes less than that specified by the table on page 281 (MMUTCD).

4. In accordance with section 257.640 (MVC), a pennant-shaped sign, having a black legend "NO PASSING ZONE" and border on a yellow reflectorized background, shall be located on the left side of the roadway opposite the beginning of each no-passing zone identified by a "DO NOT PASS" sign and/or no-passing zone pavement markings. Consideration of item #3 should be taken into account when locating these signs.

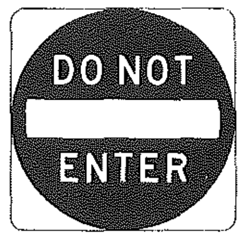
W14-3
36" x 48" x 48"

5. Where an R1–2–36 "YIELD" sign is to be replaced or added, a sign with a red legend and 5-inch red border on a white background may be used.



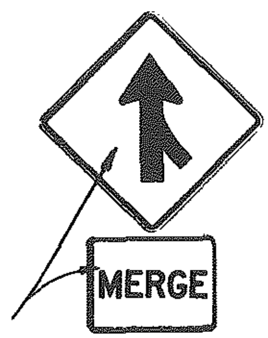
R1–2
36" x 36" x 36"

6. Where an R3–27–24 "DO NOT ENTER" sign is to be replaced or added, a 30-inch white square panel may be used, on which is inscribed a 29-inch diameter red circle with a white band 5 inches in width placed horizontally across the center of the circle. The legend "DO NOT ENTER" shall appear in white letters, with the words "DO NOT" above the band and "ENTER" below the band. If an R3–27–36 sign is to be replaced or added, a similar design, correspondingly larger, may be used. The use of an R3–36–24 "BULLSEYE" sign, as provided for by general revision number 2 to the MMUTCD, is hereby rescinded except for use as an illuminated sign suspended over the roadway at an intersection facing the "wrong-way" direction of travel.



R5–1
30" x 30"

7. Where a W4–1 "MERGING TRAFFIC" sign is to be replaced or added, a 30-inch or 48-inch diamond-shaped symbol sign, together with appropriate size "MERGE" panel, may be used.



W4–1
30" x 30"
24" x 18"

8. Where a W9–1 "SCHOOL" or a W9–2 "SCHOOL CROSSING" sign is to be

Black Legend
on a yellow
background

S1-1
30" x 30"

replaced or added, a 30-inch-by 30-inch pentagon-shaped sign, with figures to represent school children, may be used. When such sign includes crosswalk markings, it shall only be used at or adjacent to an established crosswalk and shall be preceded by a pentagonal sign which excludes crosswalk markings (School Advance Sign).

Black Legend
on a yellow
background

S2-1
30" x 30"

9. Where a "PEDESTRIAN CROSSING" or a W9-6 "WATCH FOR PEDESTRIANS" sign is to be replaced or added, a 30-inch diamond-shaped sign, bearing a black stylized human shape on yellow reflectorized background, together with a 24-inch-by-18-inch "PED XING" panel, may be used.

W11-2
30" x 30"
24" x 18"

10. For construction, maintenance, or utility operations, warning signs may be designed with a black legend on a reflectorized orange background; barricades may be designed with alternate reflectorized orange and white stripes; barrels may be equipped with alternate reflectorized orange and white, circumferential stripes; and cones, having orange as a predominant color, may be used. The use of standard orange flags in conjunction with orange signs is permitted so long as they do not interfere with a clear view of the sign face. The use of the orange color devices, however, shall be limited to those operations where all warning signs, barricades, barrels, and cones pertaining to the same construction, maintenance, or utility operation are designed with the orange color.

11. On construction, maintenance, or utility operations, where orange is used for traffic control devices and flagmen are required, each flagman shall wear an orange vest and/or an orange cap, conforming to the designs specified by the 1971 edition of the MUTCD.

Standard plans for all signs described in this memorandum may be obtained from the Traffic and Safety Division, Michigan Department of State Highways.

We hereby certify that the provisions of this memorandum constitute an official change in the provisions of the "Michigan Manual of Uniform Traffic Control Devices", as adopted September 3, 1963 in accordance with Section 608, Act 300, P.A. 1949, as amended (MVC).

Director
Michigan Department of State Highways

Director
Michigan Department of State Police

Note for Change Memorandums Only

This change will be reflected in the next Manual Edition. Therefore, this memorandum should be discarded when you receive that Edition.