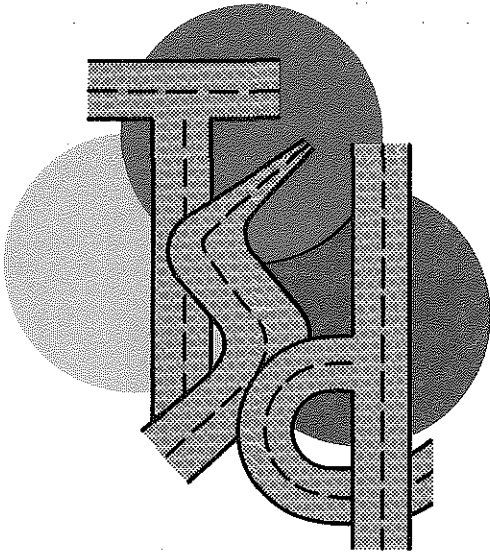


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Report TSD-214-73

A TRAFFIC ACCIDENT ANALYSIS  
OF HIGH ACCIDENT LOCATIONS  
IN KALAMAZOO COUNTY



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Michigan Department  
of  
State Highways and Transportation

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IN KALAMAZOO COUNTY

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January 1974

PREPARED BY

Traffic Engineering Services  
Traffic and Safety Division  
Michigan Department of State Highways and Transportation

in cooperation with

The Michigan Office of Highway Safety Planning  
and  
The U. S. Department of Transportation  
Federal Highway Administration

"The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the State or U. S. Department of Transportation, Federal Highway Administration."

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Captain Amthor  
Lt. Hathaway  
Sgt. Harrison  
Sgt. Hayes

KALAMAZOO COUNTY ROAD COMMISSION

Herbert O. Larkin - Engineer-Manager

MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

G. J. McCarthy	Deputy Director - Highways
M. N. Clyde	Engineer of Traffic and Safety
J. E. Hobria	Traffic Services Engineer
U. L. Savage	Project Engineer
D. V. Wilson	Assisting Technician
D. J. McDonald	Assisting Technician

MICHIGAN OFFICE OF HIGHWAY SAFETY PLANNING

Noel C. Bufe - Director

FHWA Project #MCD-73-001B



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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. Highway safety standards were then developed to assure the orderly implementation of the Act.

### Purpose

Highway Safety Standard 4.4.13, Traffic Engineering Services, is one of those standards. The purpose of Standard 4.4.13 is

"to assure the full and proper application of modern traffic engineering principles and uniform standards for traffic control to reduce the likelihood and severity of traffic accidents".

This standard includes the identifying of specific locations or sections of streets and highways which have a high accident experience or potential as a basis for establishing priorities for improvement, selective enforcement or other practices that will eliminate or reduce the hazards. It provides an orderly inventory of all traffic control devices, which include those signs, signals, markings and devices placed on, over or adjacent to a street or highway to regulate, warn and guide vehicular and pedestrian traffic.

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 and Transportation requested and received through the Office of Highway Safety Planning in the Department of State Police, a federally funded project entitled "Traffic Engineering Services 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; and additionally will recommend the upgrading of traffic control devices where necessary.

### 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, and by providing uniform

standards for traffic control to reduce the likelihood and severity of traffic accidents.

### 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, field investigations, an accident analysis of the 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 Kalamazoo County (and providing an inventory of these locations) was designated as State Police responsibility. The high accident locations for Kalamazoo County were determined by the 1968 county accident reports. From this list the 25 highest accident locations were selected. Once the problem locations were identified additional accident information for the years 1966, 1967, 1969 and 1970 was compiled in order to expand the accident base at each location. After compiling this information the Department of State Police transmitted it to the Department of State Highways and Transportation.

The Department of State Highways and Transportation is then responsible for further data collection utilizing the following basic steps: 1) conducting field investigations; 2) preparing collision diagrams and, if necessary, physical condition diagrams for each selected location; and 3) obtaining traffic counts and preparing an Average Daily Traffic Map (p. 13 ).

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. The collision diagrams which were prepared for each location are used to identify accident patterns and to locate the accident in relation to the intersection. A technical evaluation and engineering analysis of the compiled data is used to recommend corrections to those conditions which may be contributing to accidents.

### Study Area

Kalamazoo County is located in southwestern Michigan and is bordered on the north by Allegan and Barry Counties, on the east by Calhoun County, on the south by St. Joseph County and on the west by Van Buren County (Figure 1). This location puts Kalamazoo County on two primary trade linkages, the east-west Detroit to Chicago corridor and the north-south Grand Rapids to Northern Indiana corridor. These trade linkages have contributed to Kalamazoo County's present development and will continue to do so in the future.

Kalamazoo County is served by excellent transportation facilities including a fine network of regional and local highways. The US-131 and I-94 Freeways provide north-south and east-west access. Three state Highways; M-43, M-89 and M-96 also pass through Kalamazoo County.

Kalamazoo County's population will continue to grow at the same steady pace that it has since World War II (Figure 2). The majority of the growth will occur in the urbanized area surrounding the City of Kalamazoo, reflecting the national trend of the decreasing rural agricultural populace and the increasing urban industrial populace.

The Twentieth Annual Progress Report compiled by the Local Government Division of the Michigan Department of State Highways and Transportation shows a total of 1,223.64 miles of roads in Kalamazoo County. This figure does not include major and local street mileages within incorporated cities and villages. It does include 84.76 miles of rural state trunkline, 406.25 miles of county primary roads and 732.63 miles of county local roads (Figure 3). A total of 922.44 miles of the county roads are hard surfaced while only 216.44 miles are gravel or similar.



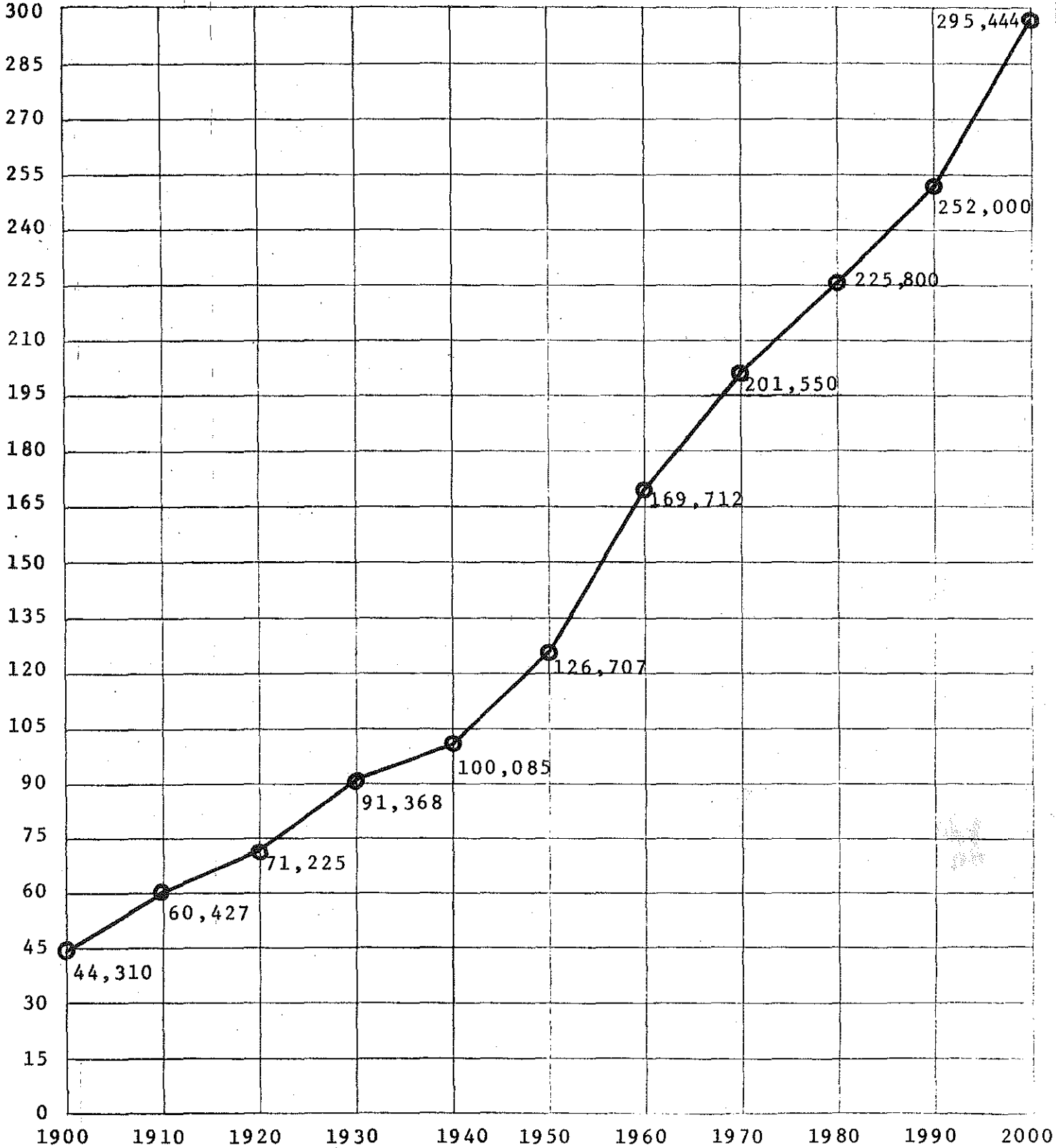


FIGURE 2

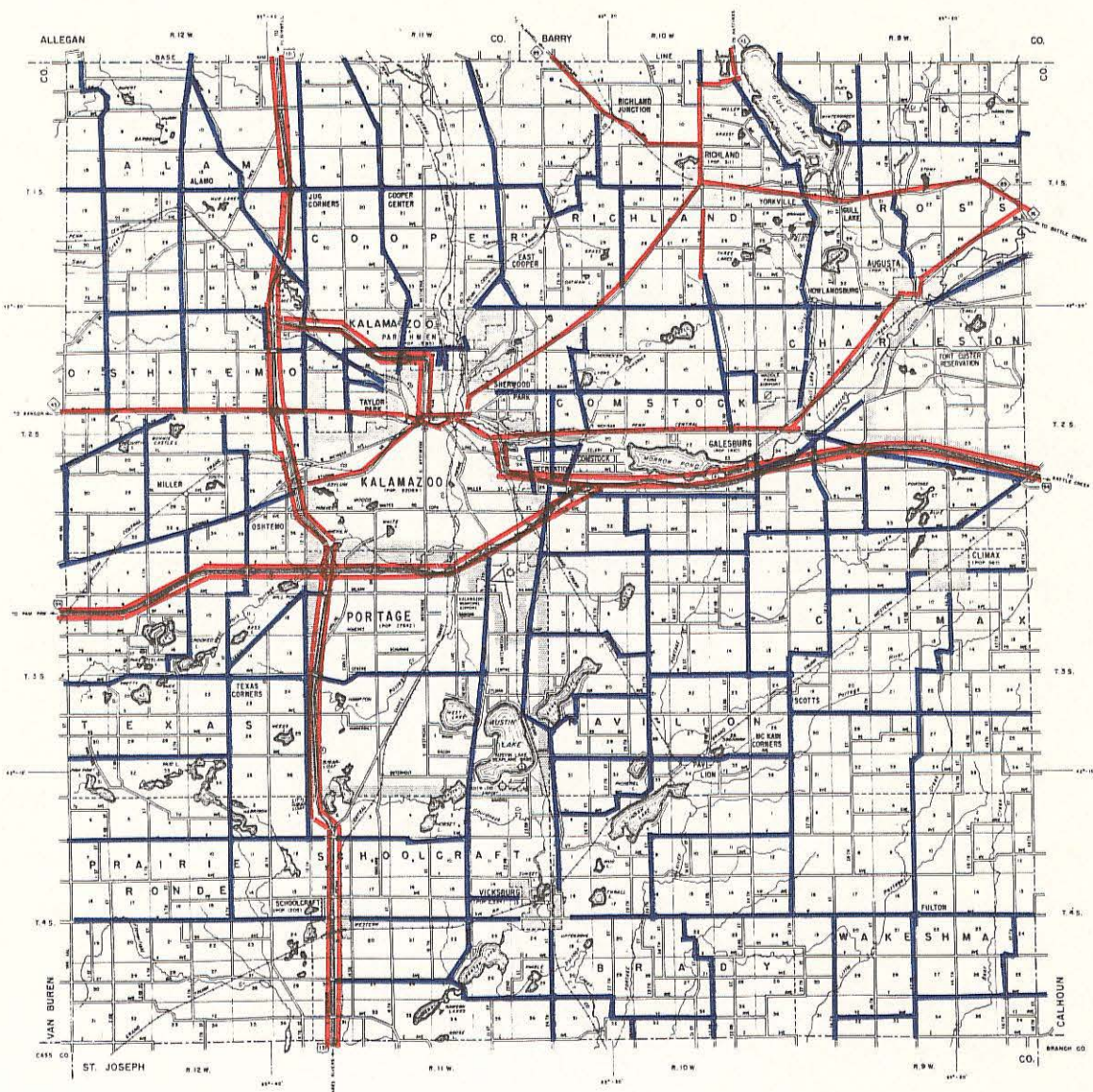
POPULATION PROJECTION

Kalamazoo County: 1900 - 2000

Population:  
Thousands



SOURCE: U. S. Department of Commerce  
Bureau of Census



- STATE TRUNK LINE
- COUNTY PRIMARY
- = COUNTY LOCAL

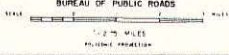


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 DEPARTMENT OF STATE HIGHWAYS

**FIGURE 3**

DATA OBTAINED FROM  
 HIGHWAY PLANNING SURVEY  
 FINANCED IN COOPERATION BY THE  
 U.S. DEPARTMENT OF TRANSPORTATION  
 FEDERAL HIGHWAY ADMINISTRATION  
 BUREAU OF PUBLIC ROADS



## TRAFFIC ENGINEERING ANALYSIS

The traffic engineering analysis phase involves evaluating the summarized facts and field data and prescribing the proper remedial treatment. One of the basic tools used in this type of analysis is a graphic representation of accidents, either in a collision diagram or strip map, which is used to determine accident patterns. An accident pattern is the prevalence of one or more types of accident occurrence. The accident pattern gives an indication of the type of corrective action needed at the specific location.

Accident causes, however, are numerous and often difficult to determine. An accident pattern does not always exist. In some cases, the collisions may involve a combination of driving hazards such as slippery pavement, snow or fog, drinking drivers, defective equipment, excessive speed and inadequate traffic control. In many cases these hazards may be eliminated or at best alleviated. In some cases, the accident causes may lie in factors outside the jurisdiction of the traffic engineer such as enforcement. In this instance he can offer specific information to the police or other responsible agencies and request their cooperation.

### Collection and Analysis of Data

After the 25 high accident locations were transmitted by the Michigan Department of State Police to the Michigan Department of State Highways and Transportation, additional statistical information was collected on the motor vehicle registrations and the reported traffic accidents in Kalamazoo County. Table 1, which is a comparison of motor vehicle registrations to total accidents in Kalamazoo County, indicates that motor vehicle registrations increased 25.2 percent between 1966 and 1970, while total accidents increased 16.1 percent for the same period. Motor vehicle registrations increased every year with the greatest increase occurring between 1966 and 1967. There was a substantial increase in the total number of accidents from 1966 to 1967 and from 1969 to 1970, with the number decreasing each year from 1967 to 1969.

TABLE 1

MOTOR VEHICLE REGISTRATIONS VS.  
ACCIDENTS IN KALAMAZOO COUNTY

<u>Year</u>	<u>Motor Vehicle Registrations</u>	<u>Accidents</u>
1966	93,566	6,968
1967	103,859	7,789
1968	108,568	7,501
1969	112,685	7,348
1970	117,104	8,089

Table 2, which contains the traffic accident data, shows that reported traffic accidents in Kalamazoo County (county roads only) increased every year between 1966 and 1970. There was a total of 4,064 reported accidents on Kalamazoo County roads between 1966 and 1970 for an average of almost 813 accidents per year. The 25 high accident locations accounted for 741 of these accidents which is 18.2 percent. The total reported accidents on Kalamazoo County roads increased 91.6 percent between 1966 and 1970. This figure does indicate an accident criticality when one considers the fact that vehicle registrations in Kalamazoo County increased only 25.2 percent over the same period.

County-Wide RecommendationsWet Pavement Accidents

After the pertinent data was assembled an accident analysis of the 25 high accident locations was conducted. This analysis indicated that wet pavement accidents occurred frequently at many of the locations. At any location where wet pavement accidents are greater than 27 percent of the total accidents and greater than 40 percent of the total accidents minus the snow and ice accidents, skidometer tests are usually warranted. This criteria is used by the Michigan Department of State Highways and Transportation in their safety program. All skidometer test values are expressed as 40 mph coefficients of wet sliding friction (wsf). A wsf value of 0.40 is generally considered the dividing point between "satisfactory" and "unsatisfactory" pavement surfaces and it has been arbitrarily defined as the "Departmental Safety Standard". Surfaces with coefficient values of 0.35 to 0.40 are in a transitional or questionable range. Surfaces below 0.35 could be dangerous under wet conditions depending on prevailing speeds, road alignment, and geometrics. Surfaces with wsf's below 0.20 are considered as slippery as packed snow. Pavements that fall within the unsatisfactory range should be resurfaced in the very near future.

TABLE 2

REPORTED TRAFFIC ACCIDENTS IN KALAMAZOO COUNTY								
Year	Total	County Road	State Route	Prop. Damage	Injury	Fatal	Persons	
							Inj.	Killed
1966	6,968	572	2,199	5,094	1,839	35	2,820	47
1967	7,789	617	1,308	5,901	1,853	35	2,750	39
1968	7,501	810	1,365	5,519	1,936	46	3,079	57
1969	7,348	969	1,538	5,502	1,805	41	2,683	45
1970	8,089	1,096	1,576	6,137	1,921	31	2,888	39

COMPARISON OF ACCIDENT FREQUENCY		
Year	Kalamazoo County Roads	Total Acc. State of Mich.
1966	572	302,880
1967	617	299,004
1968	810	305,495
1969	969	331,223
1970	1,096	313,715

PERCENTAGE CHANGE FOR THE ABOVE TOTALS		
1966-67	7.9	- 1.3
1967-68	31.3	2.2
1968-69	19.6	8.4
1969-70	13.1	- 5.3



If a skidometer test is warranted at a particular location, it will be mentioned under the recommendation portion of the discussion.

### Signalized Locations

Further analysis indicated that some of the high accident locations satisfy the requirements in the 1973 edition of the Michigan Manual of Uniform Traffic Control Devices (hereafter referred to as the Manual) for pretimed signals. Pretimed signals may be installed and operated 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 - School crossings.
- Warrant #5 - Progressive movement.
- Warrant #6 - Accident experience.
- Warrant #7 - Systems.
- Warrant #8 - Combination of Warrants.

The Average Daily Traffic volumes (hereafter referred to as ADT's) were obtained for each of the 25 high accident locations. Furthermore, 24 hour volume counts and eight hour turning movements were obtained from the Transportation Planning Division for select locations. This data was used in conjunction with the signal warrants to make specific signal recommendations. At any location where stop and go signals are either existing or recommended a minimum of two vehicular signal faces should 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 inevitable lamp failure in one face will not leave an approach without any signal indication.

Furthermore, all signal installations county-wide should have a minimum amber time of four seconds and a maximum time of 4.5 seconds. An adequate amber time will contribute to the prevention of right angle accidents at signalized locations.

### High Accident Locations

After the analysis of the 25 high accident locations was complete, it was apparent that no engineering recommendations would be feasible for six of these locations. There were no accident patterns at these six locations and no present or potential serious driving hazards that could be eliminated or controlled by traffic engineering. Consequently, this report will discuss in detail only the remaining 19 locations. The collision diagrams and pictures for each of these will be found on the pages following each recommendation. A cost estimate for each recommendation is included in the Summary portion of this report. These estimates are based on Michigan Department of State Highways and Transportation costs for materials and labor.

# SPOT MAP FOR HIGH ACCIDENT LOCATIONS

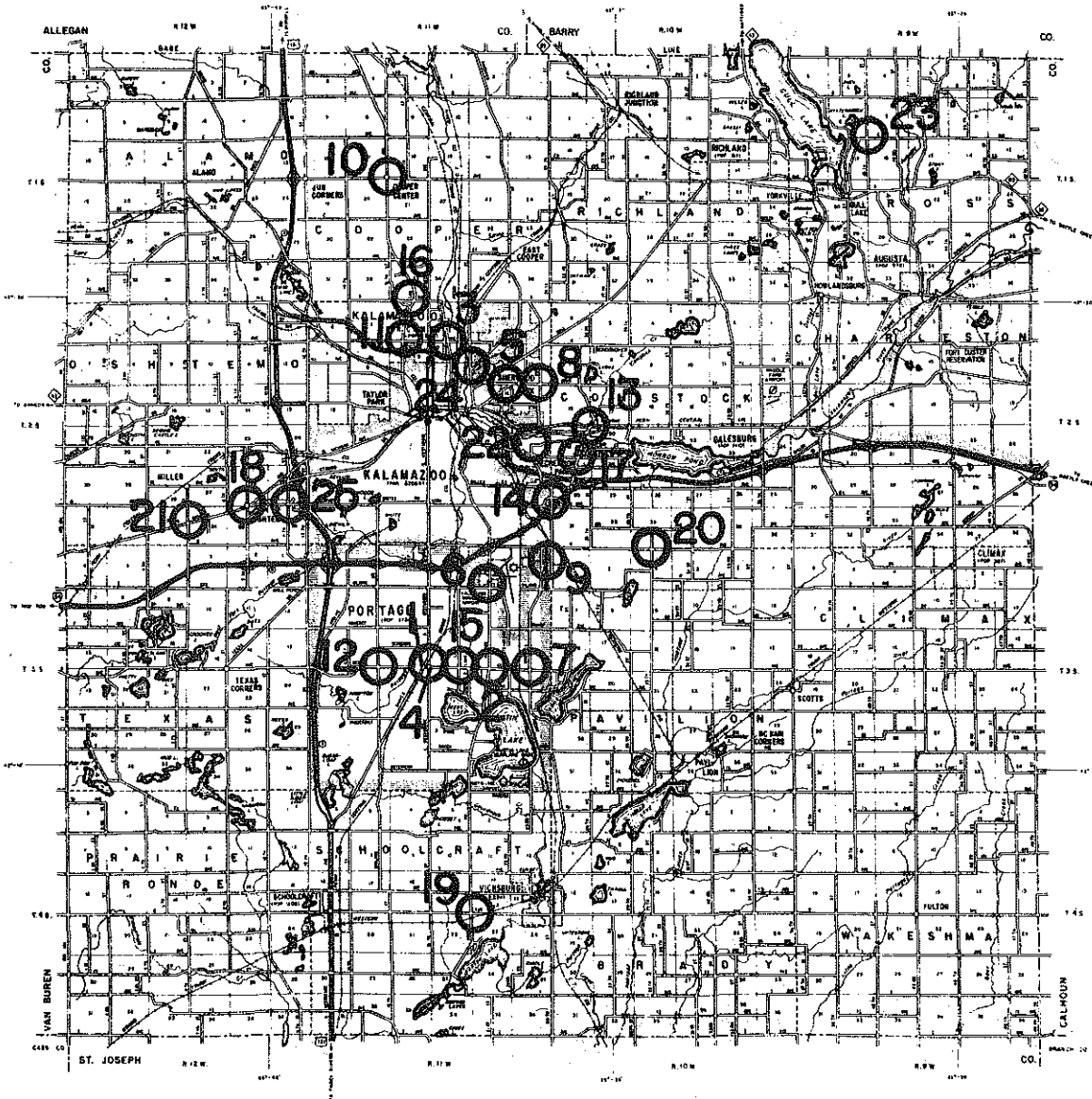
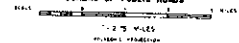


FIGURE 4

## KALAMAZOO COUNTY

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CONDUCTED IN COOPERATION WITH  
U.S. DEPARTMENT OF TRANSPORTATION  
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BUREAU OF PUBLIC ROADS





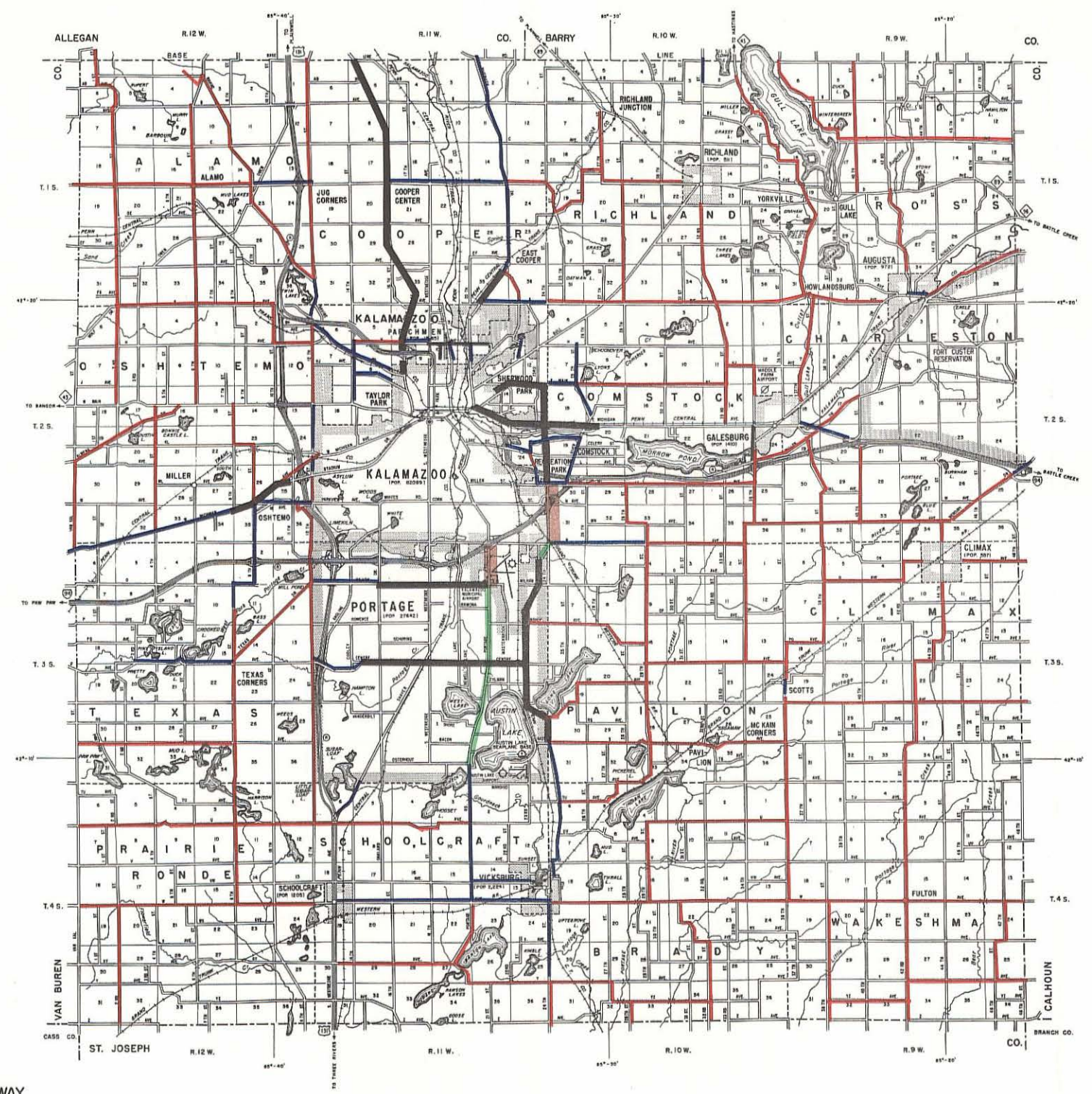
# FIGURE 5

## AVERAGE DAILY TRAFFIC MAP OF COUNTY PRIMARY ROADS IN KALAMAZOO COUNTY

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- 2,000-4,999
- 5,000-9,999
- 10,000-15,999
- 16,000-OVER

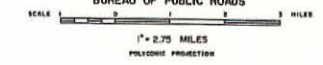


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TRANSPORTATION PLANNING DIVISION,  
MICHIGAN DEPARTMENT OF STATE HIGHWAYS.

### KALAMAZOO COUNTY

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STATE HIGHWAY COMMISSION  
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BOUNDARIES AND CORPORATE LIMITS REVISED JANUARY 1969



LOCATION 1

SHAVER ROAD (F.A.S. 1803) AT CENTRE  
AVENUE (F.A.S. 1601)

Shaver Road and Centre Avenue intersect at a skew. Shaver Road has a four-lane bituminous pavement that is 50 ft wide northeast of the intersection and 48 ft wide southwest of the intersection. Centre Avenue has a four-lane bituminous pavement that is 48 ft wide west of the intersection and 40 ft wide east of the intersection. Both roadways have center line markings and lane line markings. Parking is prohibited on both Shaver Road and Centre Avenue. The Penn Central Railroad tracks, which are marked by flashing signals, cross the east leg of Centre Avenue approximately 15 ft from the intersection.

The traffic controls at this intersection consist of two overhead signals and an overhead case sign which prohibits left turns from northeastbound Shaver Road. Also, located just east of the railroad tracks, there is an overhead signal for westbound Centre Avenue traffic. This signal operates on the same cycle as the two overhead signals for the intersection. When a train approaches Centre Avenue, the signals flash red for Centre Avenue and yellow for Shaver Road. The signals return to their normal cycle after the train leaves the area.

There was a total of 83 reported accidents at this location during the five-year study period. Sixty-four percent of the reported accidents occurred on dry pavement, 23 percent occurred on wet pavement and the remaining 13 percent occurred on snow or ice. Rear end, right-angle and head-on left-turn collisions accounted for 72 percent of the accidents. Fourteen of the 20 rear end accidents occurred on Shaver Road and six occurred on Centre Avenue. Snow and ice were a contributing factor in only four of the rear end accidents. The head-on left-turn accidents were more prevalent from southwestbound Shaver Road (they are prohibited from northeastbound Shaver Road) where 12 of the 20 accidents occurred. Three of these accidents occurred during the yellow clearance interval. There were 20 right-angle accidents at this location with seven occurring during the flashing operation. Five of these seven accidents occurred when there was a train in the area, while the remaining two occurred during the early morning hours.

Recommendations

There were 12 head-on left-turn accidents that occurred from southwestbound Shaver Road. Left turns are already prohibited from northeastbound Shaver Road. Therefore, it is recommended that left turns from southwestbound Shaver Road also be prohibited. This can be accomplished by using the blank side of the existing

overhead case sign. There is an alternate route approximately one-half mile north of this intersection for operators wishing to travel east on Centre Avenue. Southbound Westnedge Avenue forms a "Y" intersection with Shaver Road and intersects Centre Avenue one-half mile further south. The Westnedge Avenue-Centre Avenue intersection is only one block east of the Shaver Road-Centre Avenue intersection. A route direction sign indicating that southbound Westnedge Avenue provides access to eastbound Centre Avenue should be placed on Westnedge Avenue north of its intersection with Shaver Road (See Figure 10). The prohibition on left turns should increase the capacity on Shaver Road and reduce the number of head-on left turn and rear end accidents.

Five of the 20 right-angle accidents at this intersection occurred while a train was approaching the crossing at Centre Avenue. During each of these accidents all the signals were flashing red for Centre Avenue and yellow for Shaver Road. In all five accidents westbound Centre Avenue drivers, upon seeing an approaching train, hurriedly crossed the tracks and entered the intersection without thoroughly checking for Shaver Road traffic. Furthermore, a sight obstruction existed for these motorists due to southwestbound Shaver Road traffic turning left (this obstruction will be nonexistent if the left turn is prohibited as recommended). The following recommendations were formulated to reduce the right angle problem caused by approaching trains:

1. A second signal head should be erected east of the railroad tracks.
2. A back-to-back amber should be incorporated into the signal timing for eastbound Centre Avenue traffic. The yellow clearance interval at the intersection should not begin until the end of the clearance interval provided by the signals located east of the tracks. A back-to-back amber will provide an adequate clearance interval so that vehicles will not store between the railroad tracks and the intersection.
3. An approaching train should activate a solid red signal indication for both directions of Centre Avenue instead of the existing flashing red indication.

Nine of the remaining right-angle accidents occurred because motorists disregarded the traffic signal. All nine drivers involved ran through a red light with the majority of them stating that they weren't aware of its presence. For this reason it is recommended that oversized signal heads with 12 in. lenses be installed at this location. If right-angle accidents continue to be a problem in the future, it is recommended that an all red phase be adopted.

The Michigan Manual of Uniform Traffic Control Devices indicates that Railroad Advance Warning signs shall be erected in advance of all railroad crossings. Thus it is recommended that these signs be placed in advance of the railroad tracks on Centre Avenue for both directions of traffic.

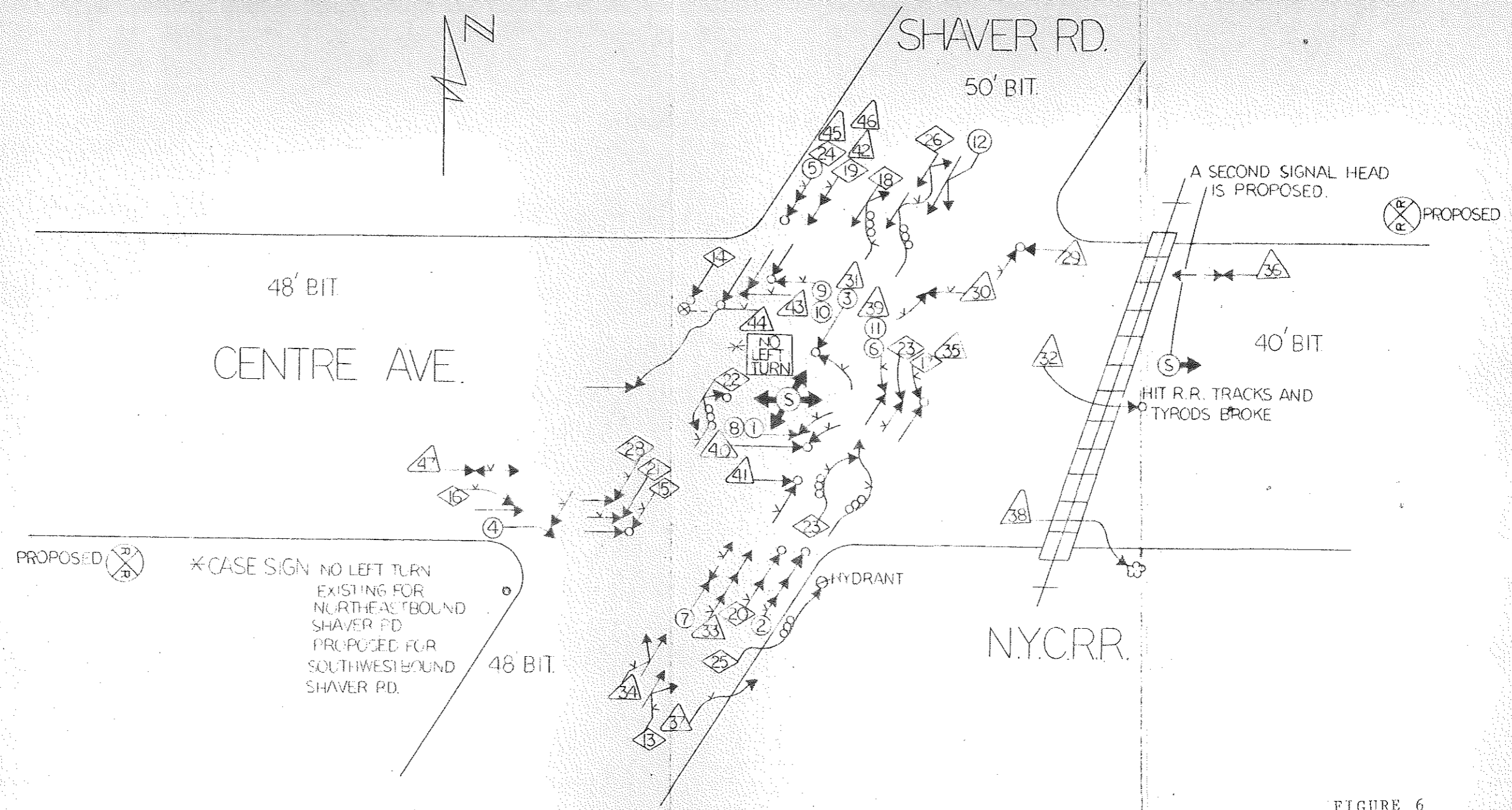
















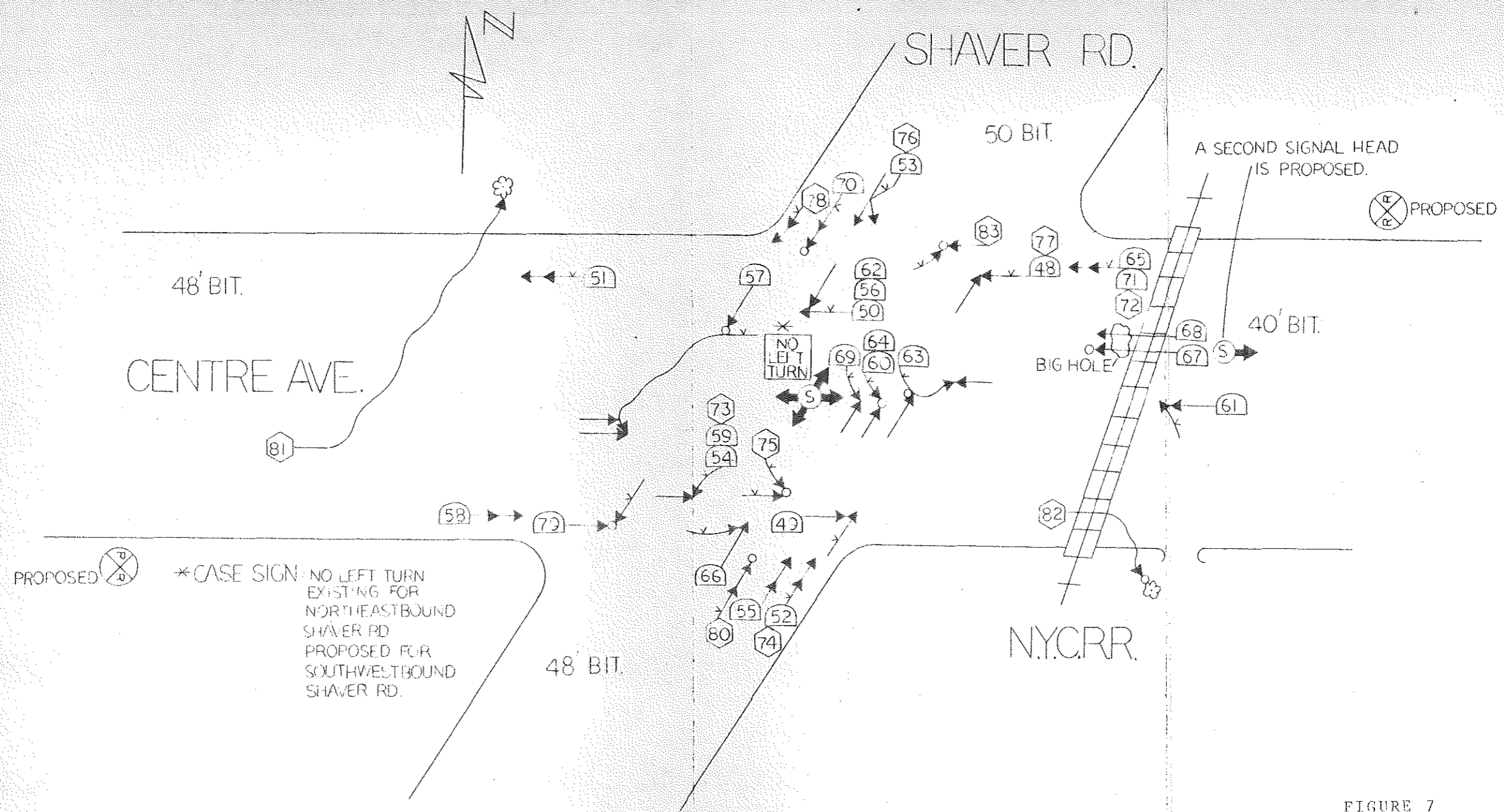


FIGURE 6

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<p>○ 1966</p> <p>◇ 1967</p> <p>△ 1968</p>	<p>Stop &amp; Go Signal  Stop Sign  S</p> <p>Flashing Beacon  Yield Sign  Y</p> <p>Fatal  Pedestrian  (X)</p> <p>Injury  Tree </p> <p>Skidding  Out of Control </p> <p>Jackknife  Driver Intent </p> <p>Overtuned  Deer </p> <p>Backing  Violator </p>	<p>Period: <u>1966 THRU 1968</u></p> <p>Accidents - Total <u>1-47</u></p> <p>P.D. <u>28</u></p> <p>Injury <u>19 (37)</u></p> <p>Fatal <u>0 ( )</u></p>	<p>ADT _____</p> <p>Rate _____ /100 mvm</p> <p>Rate _____ / mv</p>	<p>Location SHAVER RD. at CENTRE AVE. CITY OF PORTAGE KALAMAZOO CO.</p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>5-7-71</u></p> <p>Plan No. <u>LOCATION 1</u></p>






















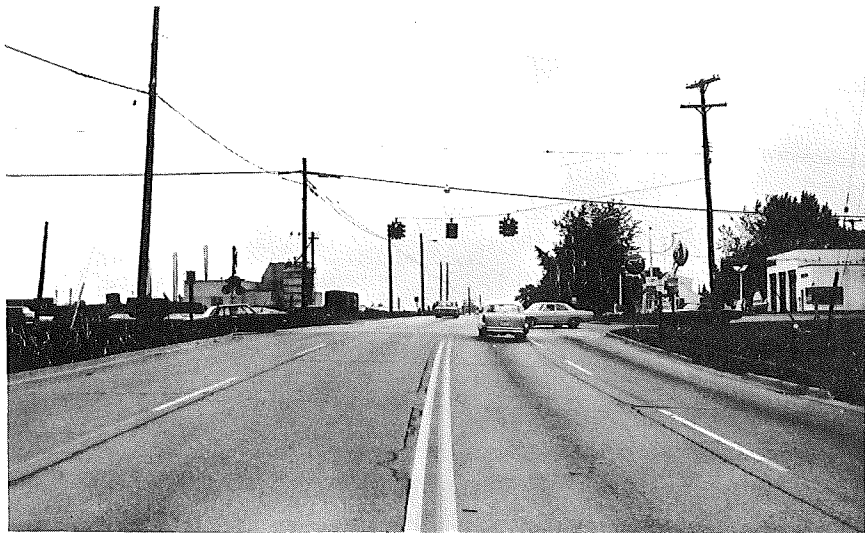
PROPOSED  \*CASE SIGN NO LEFT TURN EXISTING FOR NORTHEASTBOUND SHAVER RD PROPOSED FOR SOUTHWESTBOUND SHAVER RD.

FIGURE 7

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<p>  1969   1970                 </p>	<p>                     Stop &amp; Go Signal  Stop Sign                       Flashing Beacon  Yield Sign                       Fatal  Pedestrian                       Injury  Tree                       Skidding  Out of Control                       Jackknife  Driver Intent                       Overturned  Deer                       Backing  Violator  </p>	<p>                     Period: <u>1969 THRU 1970</u>                      Accidents - Total <u>48-83</u>                      P.D. <u>25</u>                      Injury <u>11 (18)</u>                      Fatal <u>0 ( )</u> </p>	<p>                     ADT _____                      Rate _____ /100 mvm                      Rate _____ / mv                 </p>	<p>                     Location                      SHAVER RD. at CENTRE AVE.                      CITY OF PORTAGE                      KALAMAZOO CO.                      C.S. _____ Miles _____                      Drawn <u>DVW</u> Date <u>5-5-71</u>                      Plan No. <u>LOCATION 1</u> </p>



NORTHEASTBOUND SHAVER ROAD



SOUTHWESTBOUND SHAVER ROAD

FIGURE 8





EASTBOUND CENTRE AVENUE



WESTBOUND CENTRE AVENUE



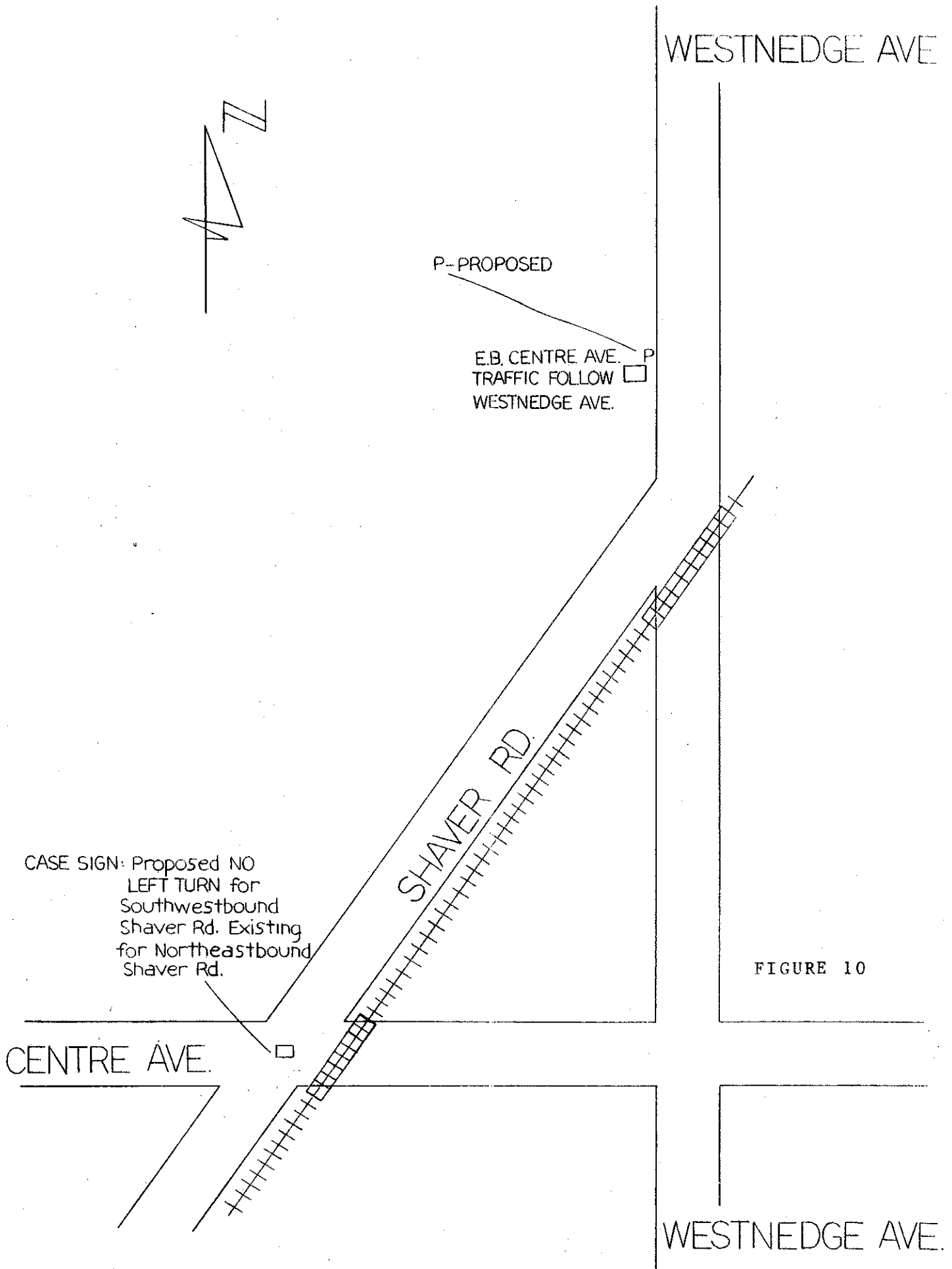


FIGURE 10

## LOCATION 2

PORTAGE ROAD (F.A.S. 16) AT CENTRE  
AVENUE (F.A.S. 1601)

Portage Road and Centre Avenue form a four-legged intersection that is under signal control. Portage Road has a 57 ft wide bituminous pavement north of Centre Avenue and a 53 ft wide bituminous pavement south of Centre Avenue. Centre Avenue has a 44 ft wide bituminous roadway at the intersection due to flares that were constructed for both east and westbound traffic. Both Portage Road and Centre Avenue have new bituminous pavements.

The traffic controls at this intersection consist of two overhead signals. There is also a separate left turn arrow for eastbound Centre Avenue. Passing was prohibited for each leg of the intersection before the repaving and was indicated by painted center line markings.

The collision diagram for this location shows a total of 75 accidents during the five-year study period. Sixty-four percent of the reported accidents occurred on dry pavement, 26.7 percent occurred on wet pavement and the remaining 9.3 percent occurred on snow or ice. A definite pattern exists at this location in the form of 41 head-on left-turn accidents. Thirty-four of these accidents involved a left turn from Portage Road while the remaining seven involved a left turn from Centre Avenue. Northbound Portage Road accounted for 22 and southbound Portage Road accounted for 12 of the head-on left-turn accidents. The remaining accidents at this location consisted of 13 right-angles, 10 sideswipes, eight rear ends, two involving driveways and one ran-off roadway.

Recommendations

Head-on left-turn collisions accounted for 55 percent of the accidents at this location between 1966 and 1970. Eighty-three percent of these accidents happened during a left turn from north or southbound Portage Road. It is recommended that a separate signal phase be incorporated to enable north and southbound Portage Road traffic to turn left at Centre Avenue without interference from other traffic. Due to the fact that Portage Road has recently been widened, the inclusion of a separate signal phase can be accomplished by striping Portage Road for five lanes with the center lane for left turns only and employing five signal heads. A detail drawing of the five lanes and signal configuration can be found on p. 25 .

Also, due to the ten sideswipe accidents that occurred at this location, it is recommended that both center lines and lane lines be applied to each leg of the intersection. Left turn arrows accompanied by the word "Only" should also be applied to the center lane on Portage Road in the immediate intersection area. If these pavement markings are employed at this location, improper lane usage would be reduced.

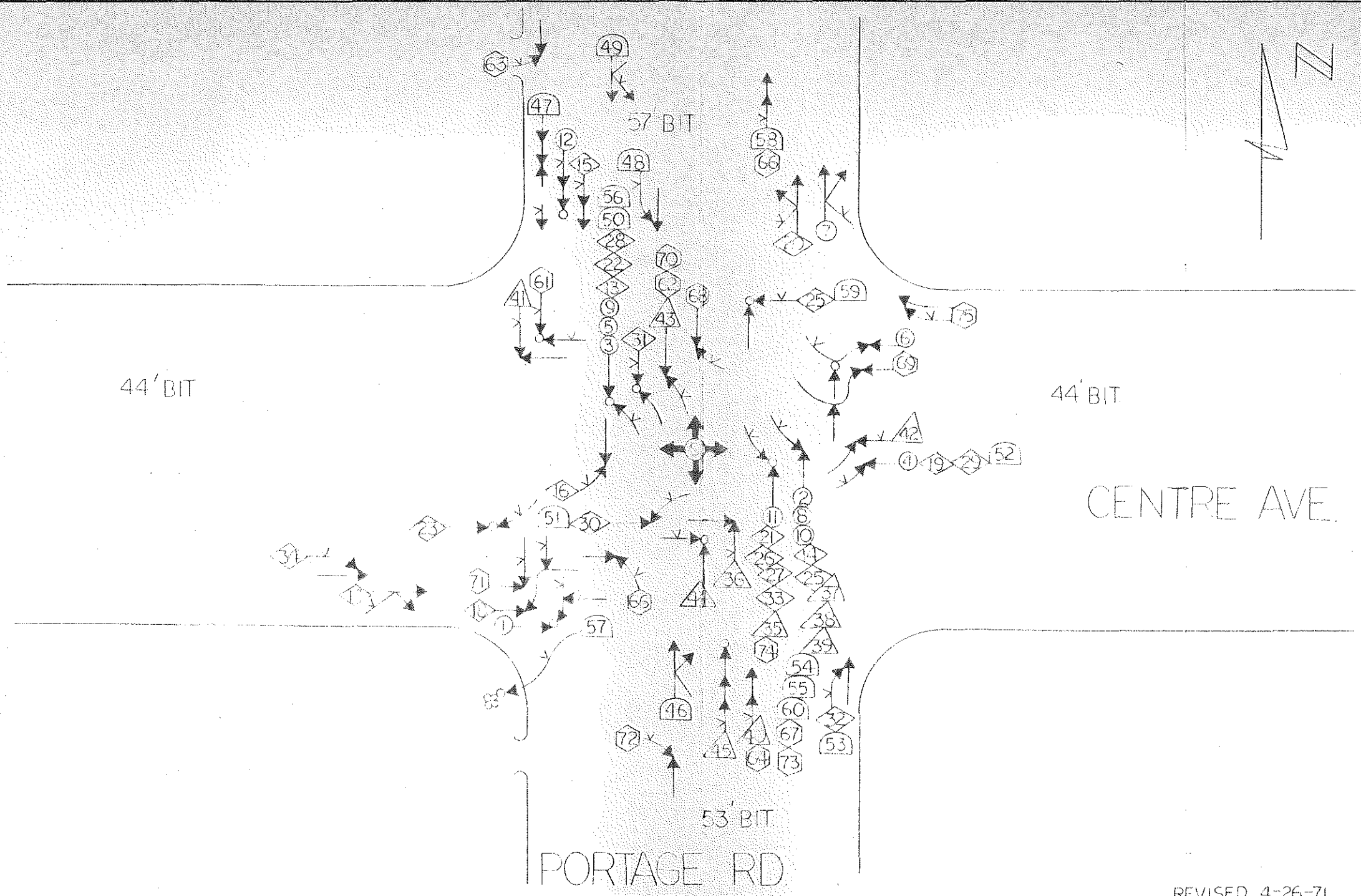


















FIGURE 11

REVISED 4-26-71

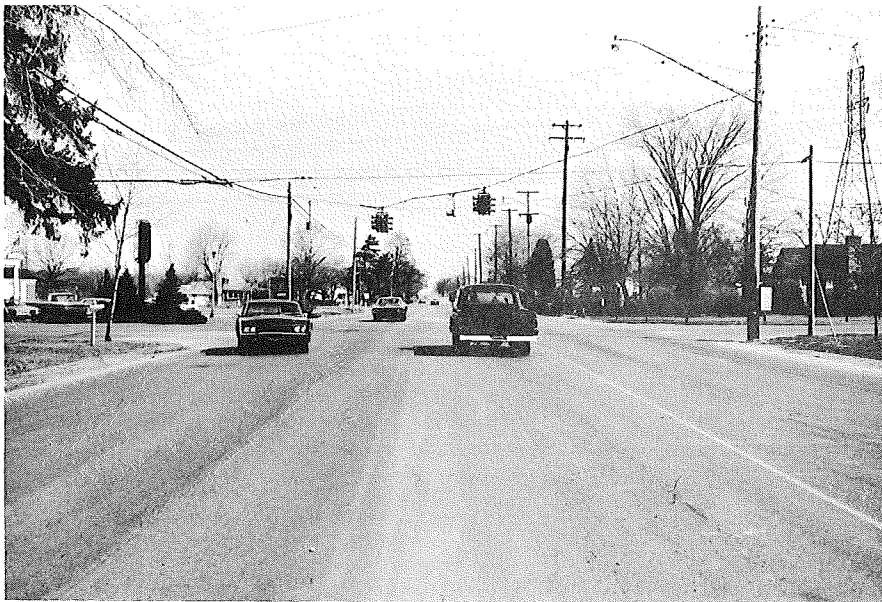
REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
<p>○ 1966</p> <p>◇ 1967</p> <p>△ 1968</p> <p>◐ 1969</p> <p>◑ 1970</p>	<p>Stop &amp; Go Signal  Stop Sign  S</p> <p>Flashing Beacon  Yield Sign  Y</p> <p>Fatal  Pedestrian  (X)</p> <p>Injury  Tree </p> <p>Skidding  Out of Control </p> <p>Jackknife  Driver Intent </p> <p>Overtaken  Deer </p> <p>Backing  Violator </p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>75</u></p> <p>P.D. <u>49</u></p> <p>Injury <u>26 (42)</u></p> <p>Fatal <u>0 ( )</u></p>	<p>ADT _____</p> <p>Rate _____ /100 mvm</p> <p>Rate _____ / mv</p>	<p>Location <u>PORTAGE RD. at CENTRE AVE.</u></p> <p><u>CITY OF PORTAGE</u></p> <p><u>KALAMAZOO CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>5-4-70</u></p> <p>Plan No. <u>LOCATION 2</u></p>	



SOUTHBOUND  
PORTAGE ROAD



WESTBOUND  
CENTRE AVENUE



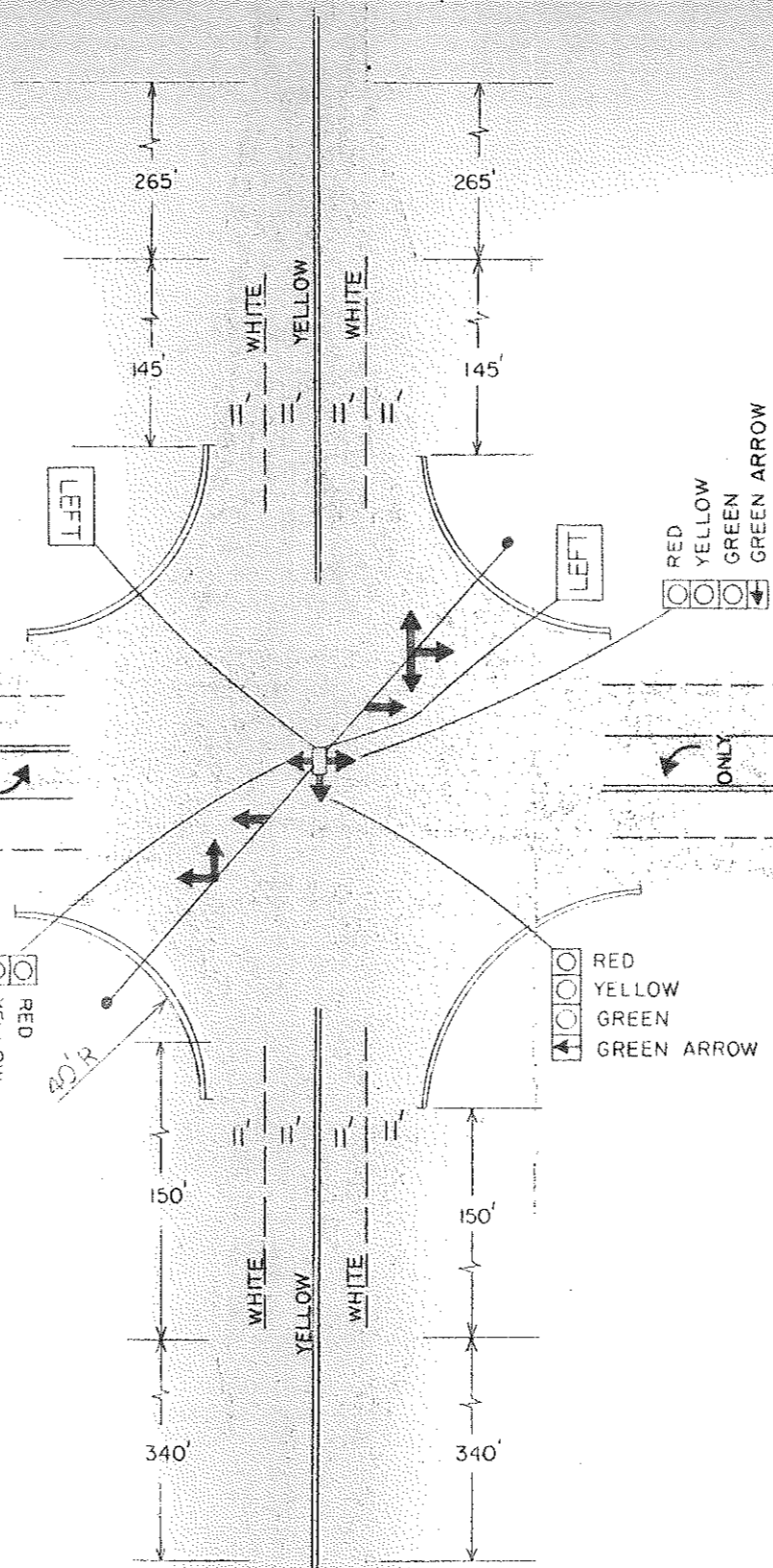
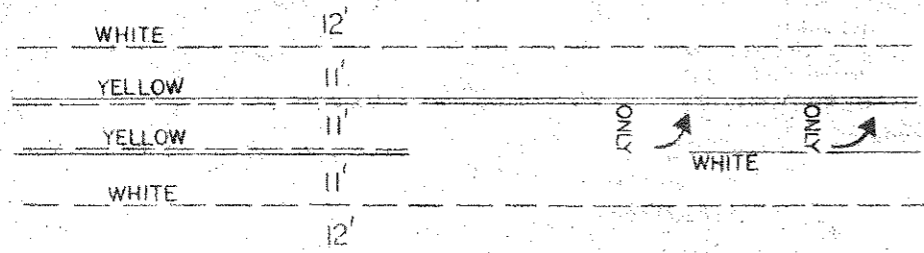
NORTHBOUND  
PORTAGE ROAD

FIGURE 12

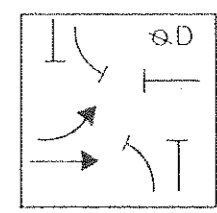
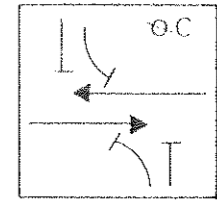
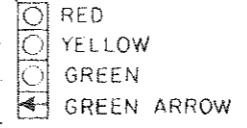
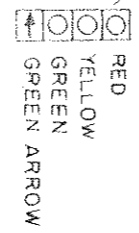
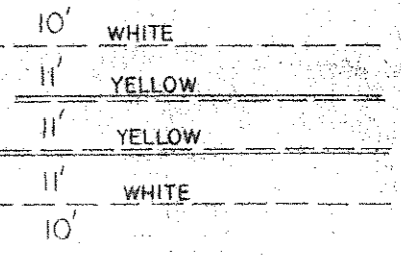
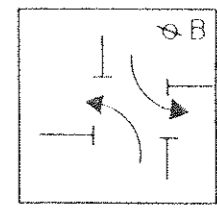
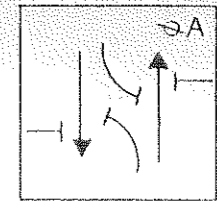




PORTAGE RD.



LEFT TURN PHASE PHASING DIAGRAM



C-43 DESIGN VEHICLE

CENTRE AVE.

FIGURE 13

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DVW	CENTRE AVE. at PORTAGE RD.  CITY OF PORTAGE  KALAMAZOO CO.
	CONT. SEC.	DATE	
	REF.	SCALE 1"=40'	
	SHEET OF	PLAN LOCATION 2	

## LOCATION 3

MOSEL AVENUE (F.A.S. 1195) FROM BURDICK  
STREET TO PITCHER ROAD

This location includes all of Mosel Avenue from Burdick Street to Pitcher Road including the Penn Central Railroad crossing which is located 75 ft west of Pitcher Road.

Mosel Avenue at Burdick Street is a signalized intersection with two overhead signals. Mosel Avenue has a four lane, 44 ft wide bituminous pavement that has center line and lane line markings. The south leg of Burdick Street has a four lane, 44 ft wide bituminous pavement while the north leg, which is a dead-end, has a 40 ft wide bituminous pavement. There were 37 accidents at this intersection during the five-year study period. Twenty-four accidents happened on dry pavement, eight happened on wet pavement and five happened on snowy or icy pavement. There were no distinct patterns at this intersection. The major accident types were right-angles (9), head-on left turns (9) and driveway accidents (8).

Mosel Avenue and Pitcher Road form a right-angle intersection with traffic controlled by a 24 in. "Stop" sign on the northwest corner and a 36 in. "Stop" sign on the southeast corner of Pitcher Road. The north leg of Pitcher Road has a 20 ft wide bituminous pavement, while the south leg has a four lane, 44 ft wide bituminous pavement. There were 18 accidents at this intersection during the study period. Fifteen of these accidents occurred on dry pavement with only three accidents occurring on wet or slippery pavement. The major accident types consisted of four rear ends, four right-angles, three head-on left turns and two sideswipes.

The Penn Central Railroad crossing has both pedestal and overhead signals, accompanying signal gates and advance warning signs for both east and westbound Mosel Avenue. There were 15 accidents at this crossing, seven of which occurred on wet pavement. Ten of the 11 car-train collisions occurred before the signal gates were installed. The remaining accidents consisted of three rear ends and one sideswipe.

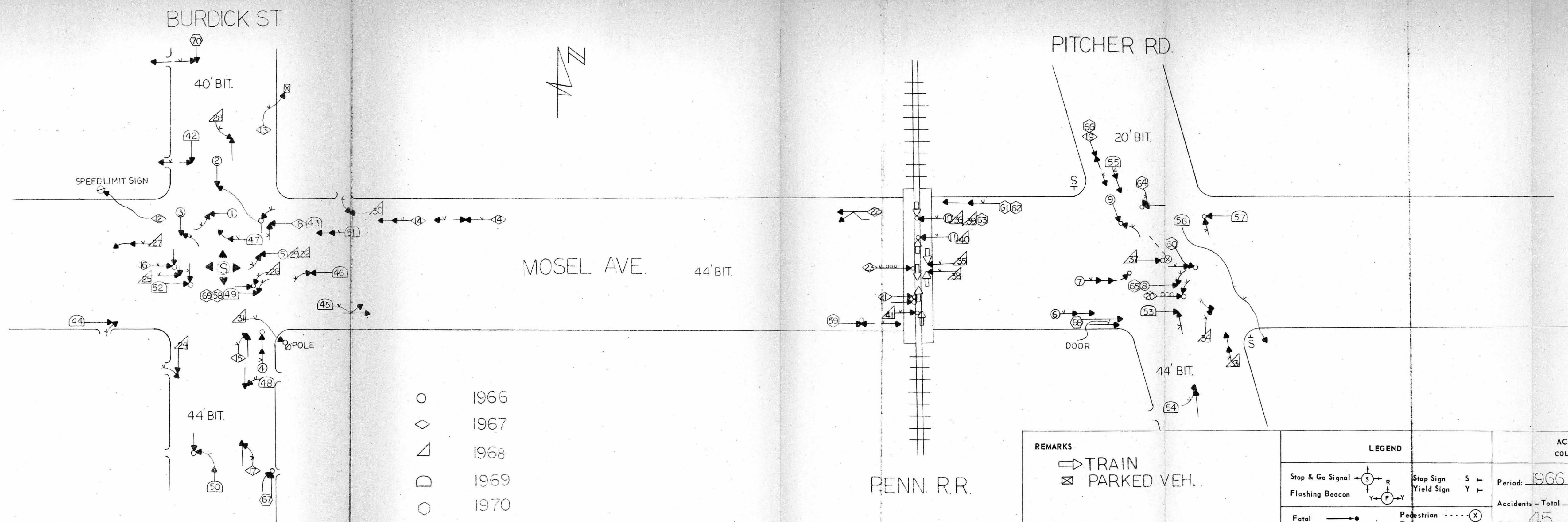
Recommendations

The two signal heads that are suspended above the Mosel Avenue-Burdick Street intersection are not centered over the intersection. One signal head is located directly over the center line for Burdick Street and the other signal head is located west of the center line. It is recommended that these two signal heads be located as close as possible to the proper position as described by the Manual.

At the Mosel Avenue-Pitcher Road intersection there is a cyclone fence and brush growth in the southeast quadrant which causes inadequate visibility for northbound Pitcher Road traffic. It is recommended that this brush growth be maintained so that it doesn't interfere with the vision of motorists on northbound Pitcher Road.

Lastly, the Penn Central Railroad crossing was the scene of 15 accidents with approximately 47 percent of these accidents occurring on wet pavement. For this reason it is recommended that skidometer tests be conducted on each side of the railroad crossing.



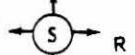
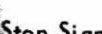
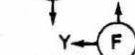




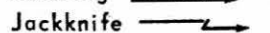
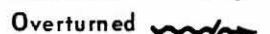

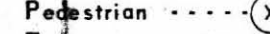


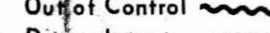




- 1966
- ◇ 1967
- △ 1968
- ◻ 1969
- ◊ 1970

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 LANSING, MICH.  
 P. O. DRAWER "K" 48904

FIGURE 14

REVISED - 4-6-71

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM	MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
⇒ TRAIN ⊠ PARKED VEH.	Stop & Go Signal  Stop Sign  Flashing Beacon  Yield Sign 	Period: <u>1966 THRU 1970</u> Accidents - Total <u>70</u> P.D. <u>45</u> Injury <u>25 (36)</u> Fatal <u>0 ( )</u>	Location MOSEL AVE. FROM BURDICK ST. EAST TO PITCHER RD. KALAMAZOO TWP. KALAMAZOO CO. C.S. _____ Miles _____ Drawn D.V.W. Date <u>4-6-70</u> Plan No. LOCATION <u>3</u>
	Fatal  Injury  Skidding  Jackknife  Overturned  Backing  Pedestrian  Trip  Out of Control  Driver Intent  Deer  Violator 	ADT _____ Rate _____ /100 mv Rate _____ / mv	





NORTHBOUND  
BURDICK STREET

WESTBOUND  
MOSEL AVENUE



SOUTHBOUND  
BURDICK STREET

FIGURE 15



WESTBOUND MOSEL AVENUE



NORTHBOUND PITCHER ROAD

LOCATION 4                    WESTNEDGE AVENUE (F.A.S. 1603) AT  
CENTRE AVENUE (F.A.S. 1601)

Westnedge Avenue and Centre Avenue form a signalized intersection in an urban area. Westnedge Avenue is a three lane, 39 ft wide bituminous roadway on the south leg and a three lane, 38 ft wide bituminous roadway on the north leg. Centre Avenue is a 39 ft wide bituminous roadway.

The traffic controls at this location consist of two overhead signals, each with an oversized red designation. Westnedge Avenue also has center and lane line markings while Centre Avenue has only center line markings. Parking is prohibited on both roadways in the immediate intersection area.

There were 51 accidents at this location during the five-year study period. Thirty-three of the accidents happened on dry pavement, 12 happened on wet pavement and the remaining six happened on snowy or icy pavement. There were 14 rear end accidents with seven occurring on both Westnedge Avenue and Centre Avenue. Five of the rear end accidents on Centre Avenue involved vehicles waiting to turn into the parking area for the Industrial State Bank. There were also nine sideswipe and seven improper turning accidents. Six of the sideswipe and three of the improper turning accidents occurred on Centre Avenue. The largest of the remaining accident categories consisted of six right-angles, five head-on left turns and four involving improper backing.

Recommendations

The cycle length for the signals at this intersection is 60 sec. The amber time is six percent or 3.6 sec. It is recommended that the amber time be increased to seven percent or 4.2 sec. The clearance interval should be no less than four sec. nor greater than 4.5 sec.

Six of the nine sideswipe accidents and three of the seven turning accidents occurred on Centre Avenue. These accidents can be attributed in some respect to the narrowness of Centre Avenue and the absence of lane lines. It is recommended that nine feet be added to the north side of Centre Avenue to create four 12 ft lanes. The west leg should be widened from Westnedge Avenue to Shaver Road while the east leg should be widened a minimum distance of 250 ft with a 225 ft taper. Center lines and lane lines should be applied to indicate how many drivable lanes are available.

Westnedge Avenue should be painted for three lanes using opposing center lanes for left turns only. Painted arrows indicating lane assignments should be applied and two post mounted Lane-Use Control signs; one located at the intersection and one located in advance of the intersection should be erected for both legs of Westnedge Avenue.

A detail drawing of the proposed improvements at this intersection can be found on p. 34 .

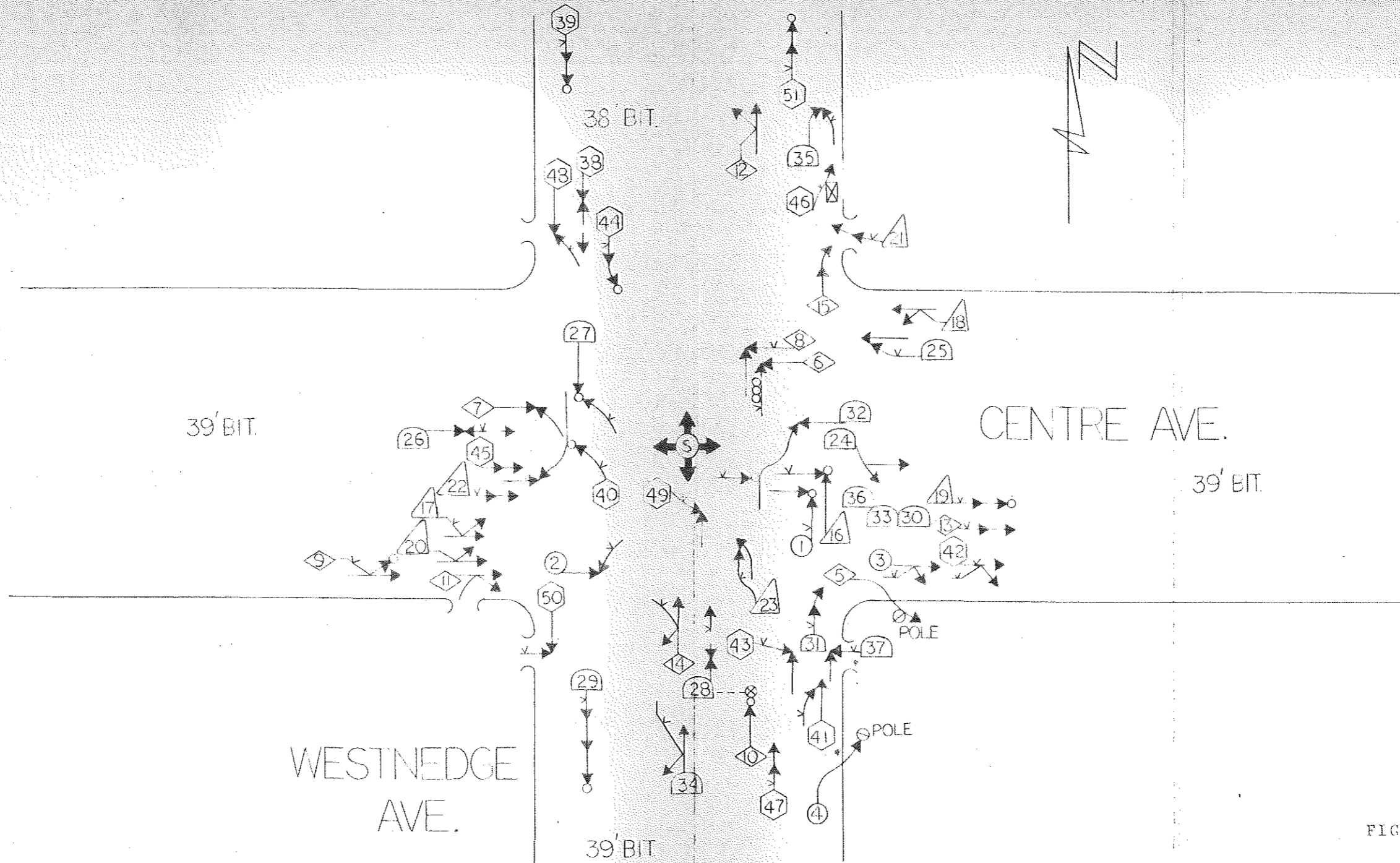


FIGURE 17

<b>REMARKS</b> ○ 1966 ◇ 1967 △ 1968 ◐ 1969 ◑ 1970	<b>LEGEND</b> Stop & Go Signal  Stop Sign  S Flashing Beacon  Yield Sign  Y		<b>ACCIDENT STUDY COLLISION DIAGRAM</b> Period: <u>1966 THRU 1970</u> Accidents - Total <u>51</u>		<b>MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</b> Location <u>WESTNEDGE AVE. at CENTRE AVE.</u> CITY OF PORTAGE KALAMAZOO CO.	
	Fatal  Pedestrian Injury  Tree Skidding  Out of Control Jackknife  Driver Intent Overturned  Deer Backing  Violator	P.D. <u>39</u> Injury <u>12 (17)</u> Fatal <u>0 ( )</u>	ADT _____ Rate _____ /100 mvm Rate _____ / mv	C.S. _____ Miles _____ Drawn <u>DVW</u> Date <u>4-22-71</u> Plan No. <u>LOCATION 4</u>		





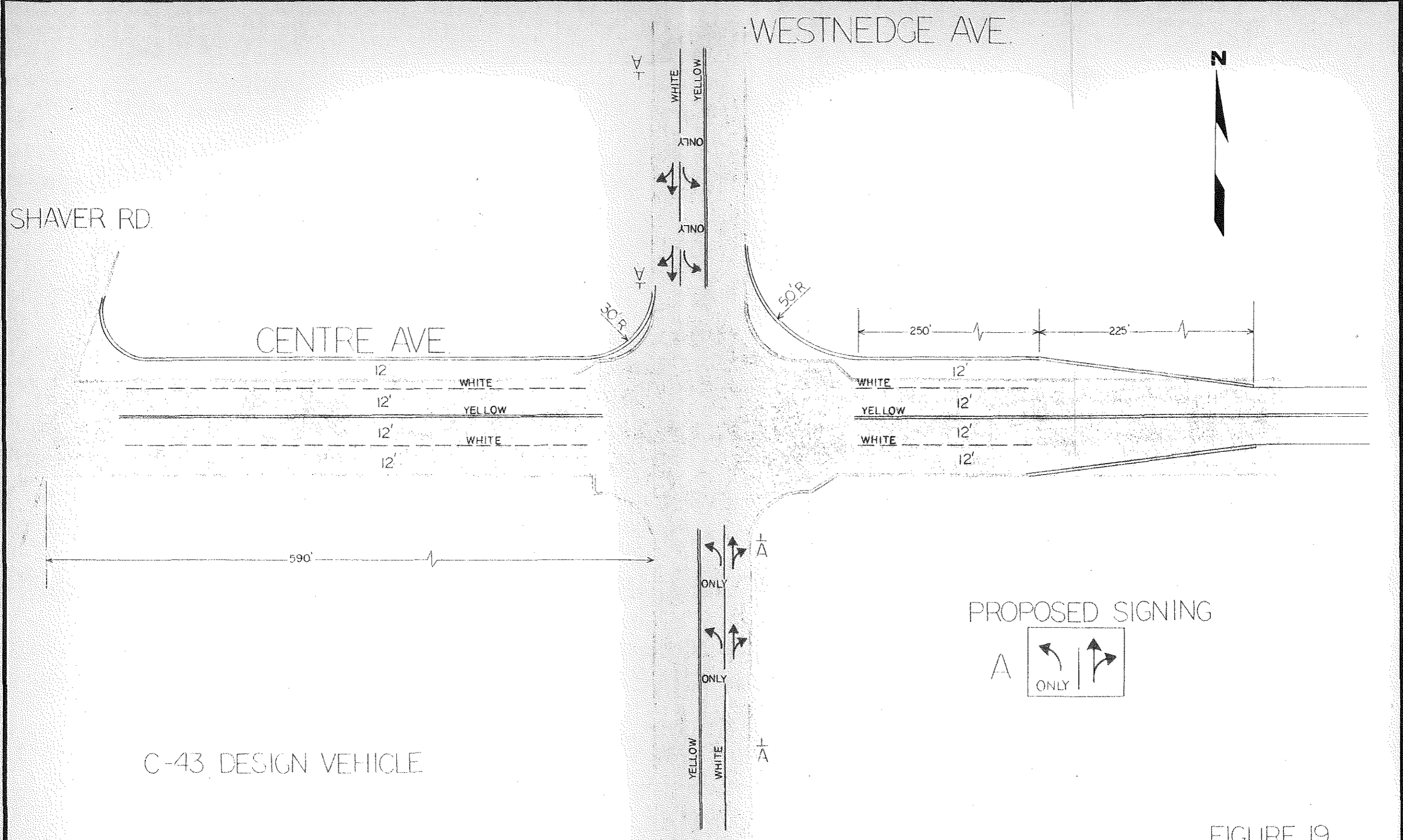
NORTHBOUND  
WESTNEDGE AVENUE

WESTBOUND  
CENTRE AVENUE



SOUTHBOUND  
WESTNEDGE AVENUE

FIGURE 18



SHAVER RD.

WESTNEDGE AVE.

CENTRE AVE.

N

30'R

50'R

250'

225'

590'

12'

WHITE

12'

YELLOW

12'

WHITE

12'

12'

WHITE

12'

YELLOW

12'

WHITE

12'

C-43 DESIGN VEHICLE

PROPOSED SIGNING

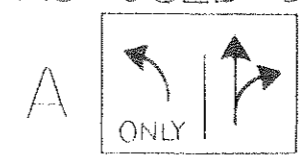


FIGURE 19

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DVW	WESTNEDGE AVE. at CENTRE AVE. CITY OF PORTAGE KALAMAZOO CO.
	CONT. SEC.	DATE	
	REF.	SCALE 1" = 40'	
	SHEET OF	PLAN LOCATION 4	

LOCATION 5                    EAST MAIN STREET (EAST LEG F.A.S. 1591, SOUTH  
LEG F.A.S. 1593) FROM HUMPHREY STREET (F.A.S.  
1591) TO STANFORD STREET

East Main Street and Humphrey Street form a "Y" intersection in a residential area. The horizontal alignment of westbound East Main Street consists of a left-hand curve. Stanford and Washburn Streets intersect East Main Street approximately 100 ft east of the "Y" intersection.

East Main Street is a four lane, 44 ft wide bituminous roadway with center and lane line markings. Humphrey Street has a two lane, 33 ft wide bituminous pavement with center line markings only. Both Stanford Street and Washburn Street have two lane bituminous pavements and provide access for residential traffic.

East Main Street has the right-of-way at this location. Humphrey, Stanford and Washburn Streets all have 24 in. "Stop" signs. There is a 24 in. curve sign, a 24 in. x 48 in. target arrow with lattice background and a "School" warning sign with an accompanying flashing beacon for northbound East Main Street traffic. A traffic island was constructed during the summer of 1970 on Humphrey Street to separate east and westbound traffic. Passing is prohibited on both Humphrey Street and East Main Street by yellow center line markings and parking is prohibited on East Main Street only.

There were 39 reported accidents at this location from 1966 to 1970. Sixteen of these accidents occurred on wet, snowy or icy pavement. Right-angle and sideswipe accidents accounted for 44 percent of the total. All ten of the right-angle accidents occurred when eastbound Humphrey Street traffic encroached on East Main Street in an attempt to see approaching traffic. Six of the seven sideswipe accidents occurred at the "Y" intersection and involved improper lane usage by westbound East Main Street traffic. The remaining accidents at this location consisted of five rear ends, five ran-off roadways, four improper turns, three involving the traffic island, two head-on left turns, one involving a pedestrian, one involving a falling load and one involving loss of control.

#### Recommendations

The construction of the traffic island was completed during the summer of 1970. During the remainder of 1970 there were five reported accidents, three of which involved the new construction. This accident experience is not enough to analyze the long-range effectiveness of the traffic island. It is recommended that future accident records be checked to determine future accident patterns. There were nine accidents during the study period that were reportedly caused by poor sight distance for eastbound

Humphrey Street traffic. The existing laneage has a plus gradient which reduces the sight distance at the intersection. If the existing accident pattern continues in the future, it will be necessary to relocate the laneage for eastbound Humphrey Street south of its present location. The service station which is located in the southwest quadrant has some excess property that could be purchased without affecting the operation of the station. Relocation of the eastbound laneage will reduce the gradient and greatly improve the sight distance.

A second problem at this intersection involves the six sideswipe accidents that involved improper lane usage by westbound East Main Street traffic. The operators indicated that they were confused about the lane assignments as they approached westbound Humphrey Street. To eliminate this confusion, it is recommended that a lane-use control sign be used to indicate lane assignments for westbound East Main Street traffic. This sign should designate the left lane as a thru lane only and the right lane as both a thru lane and a right turn lane.

Lastly, there were two accidents during the study period involving vehicles attempting to turn left from northbound East Main Street to westbound Humphrey Street. This turn is quite difficult to complete especially now that the traffic island has been constructed. Therefore, it is recommended that this left turn be prohibited. An alternate route to westbound Humphrey Street via Chicago Street is located off East Main Street south of the intersection. It is recommended that an advance guide sign indicating access to westbound Humphrey Street be placed on northbound East Main Street south of Chicago Street (Figure 20).



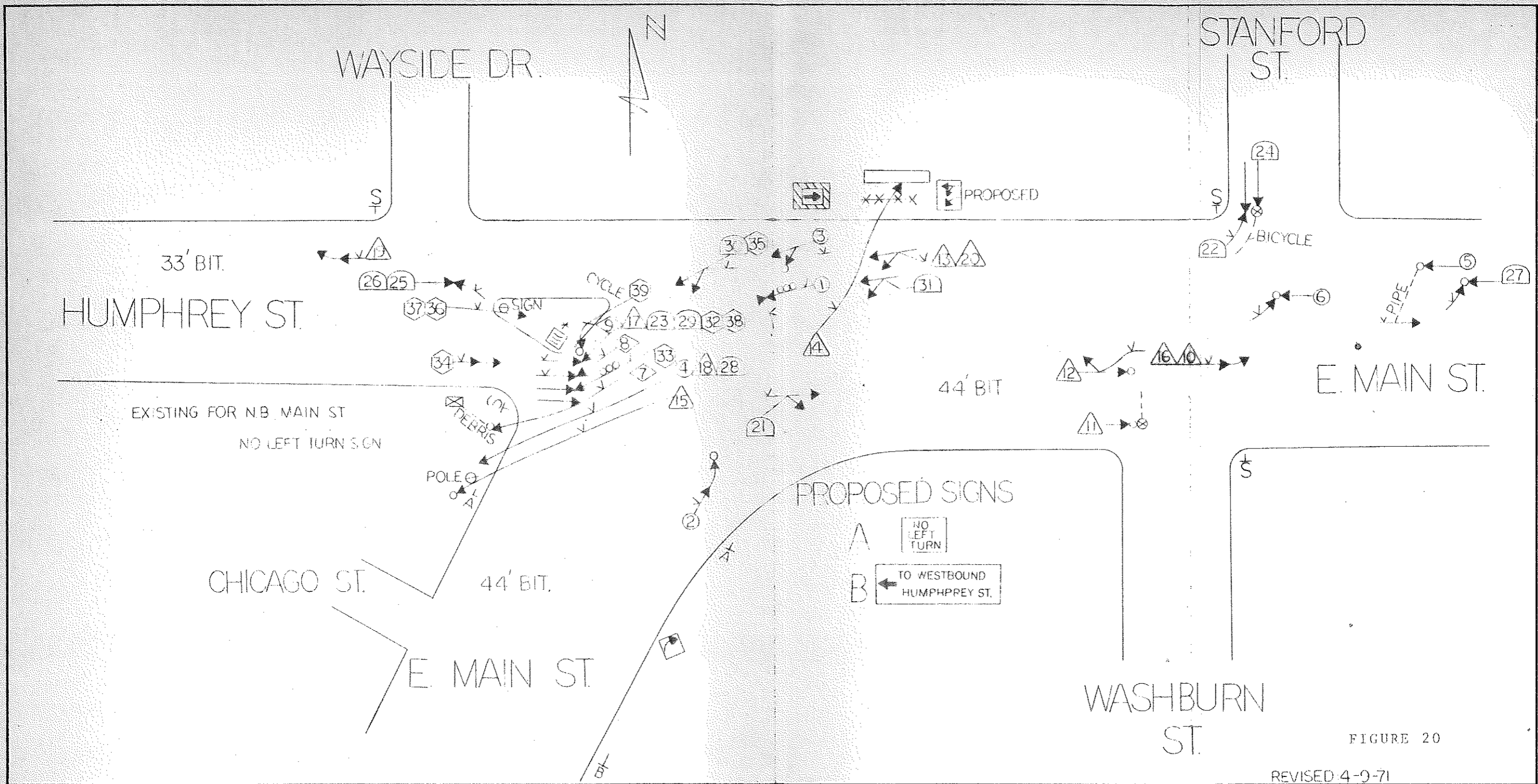


FIGURE 20

REVISED 4-9-71

<b>REMARKS</b> NOTE: ISLAND INSTALLED IN LATE SUMMER OF 1970  ○ 1966 ◇ 1967 △ 1968 ◡ 1969 ◻ 1970	<b>LEGEND</b> Stop & Go Signal  Stop Sign Flashing Beacon  Yield Sign Fatal  Pedestrian Injury  Tree Skidding  Out of Control Jackknife  Driver Intent Overturned  Deer Backing  Violator		<b>ACCIDENT STUDY COLLISION DIAGRAM</b> Period: <u>1966 THRU 1970</u> Accidents - Total <u>39</u> P.D. <u>29</u> ADT _____ Injury <u>10 (17)</u> Rate _____ /100 v.m. Fatal <u>0 ( )</u> Rate _____ / mv		<b>MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</b> Location <u>MAIN ST. FROM HUMPHREY ST. EAST TO STANFORD ST, WASHBURN ST.</u> KALAMAZOO TWP KALAMAZOO CO. C.S. _____ Miles _____ Drawn <u>DVW</u> Date <u>4-7-70</u> Plan No. <u>LOCATION 5</u>
	Form 1547 (Rev. 5/69) Sheet <u>1</u> of <u>1</u>				



WESTBOUND  
E. MAIN STREET

NORTHBOUND  
WASHBURN STREET



SOUTHBOUND  
STANFORD STREET

FIGURE 21



EASTBOUND  
HUMPHREY STREET

NORTHEASTBOUND  
E. MAIN STREET



WESTBOUND  
E. MAIN STREET

FIGURE 22

## LOCATION 6

PORTAGE ROAD (F.A.S. 16) AT MILHAM ROAD  
(WEST LEG - F.A.S. 397)

Portage Road and Milham Road form a right-angle intersection. The only traffic controls consist of two signal heads suspended over the intersection.

Portage Road is a 44 ft wide bituminous roadway north of Milham Road and a 54 ft wide bituminous roadway south of Milham Road. Portage Road has been resurfaced from just north of the intersection to approximately 550 ft south of the intersection. Due to the resurfacing, the center and lane line markings are not visible.

Milham Road has a three lane, 42 ft wide bituminous pavement on the west leg and a two lane, 20 ft wide bituminous pavement on the east leg. The west leg of Milham Road has center and lane line markings while the east leg has no pavement markings. Milham Road provides access to the Kalamazoo County Airport which is located east of this location.

There were 38 accidents at this location during the five-year study period. Fourteen of these accidents, or almost 37 percent occurred on wet pavement, while only six accidents occurred on snowy or icy pavement. Rear end collisions accounted for 19 of the accidents at this location. Nine of the rear end accidents occurred on wet, snowy or icy pavement. Head-on left-turn collisions accounted for ten of the accidents. Seven of these accidents involved the turning maneuver from northbound Portage Road to westbound Milham Road. The remaining accidents at this location consisted of four sideswipes, two ran-off roadways, two involving improper backing and one right-angle.

Recommendations

Thirty-seven percent of the accidents at this location occurred on wet pavement. For this reason it is recommended that skidometer tests be conducted for both Portage Road and Milham Road. Skidometer tests may indicate that the pavement for these roads becomes slippery when wet and may need to be resurfaced.

The pavement on the north leg of Portage Road is deteriorating. This conclusion is drawn from the numerous patches that make the pavement uneven. Therefore, it is recommended that consideration be given to resurfacing the north leg of Portage Road in the immediate intersection area. At the same time we recommend that the width of the north leg of Portage Road be increased from 44 ft to 55 ft and the approach road connection for the east leg of Milham Road be widened to 30 ft (Figure 25). We realize that



Kalamazoo County's resurfacing is scheduled on a priority basis and that the north leg of Portage Road may not have a high priority at this time. The skidometer tests, recommended previously, however, may indicate that the north leg of Portage Road be given a higher priority. In any case, it is recommended that the north leg of Portage Road be included in the construction program as soon as feasible.

Head-on left-turn collisions accounted for 26 percent of the accidents at this location. Seventy percent of these left turn accidents involved a turning movement from northbound Portage Road to westbound Milham Road. These figures indicate a need to separate the left turn movements from the thru movements. Thus it is recommended that Portage Road be marked for five lanes with the center lane for left turns only (Figure 25). An internally illuminated case sign reading "Left Turn Lane" should be suspended over the center lane on the same support system as the traffic signal heads. Left turn arrows and the word "ONLY" should be applied to the center lane to further emphasize the mandatory left turn. A capacity analysis has indicated that a left turn signal phase is not necessary at this time. However, an increase in the ADT's may cause traffic congestion in the future. It is recommended that future ADT's be checked along with future accident reports to determine if signal phases for the left turn lanes are necessary.

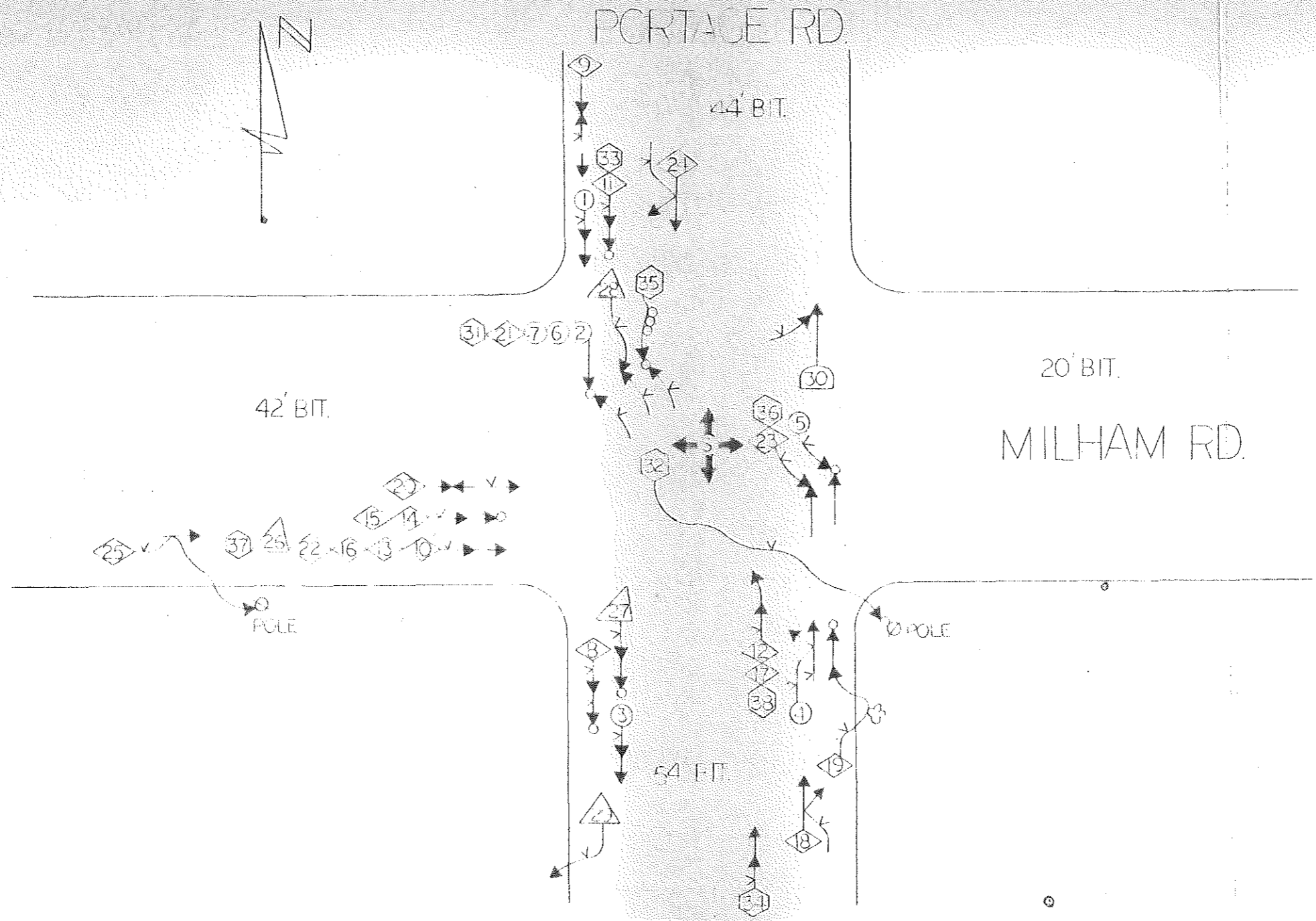
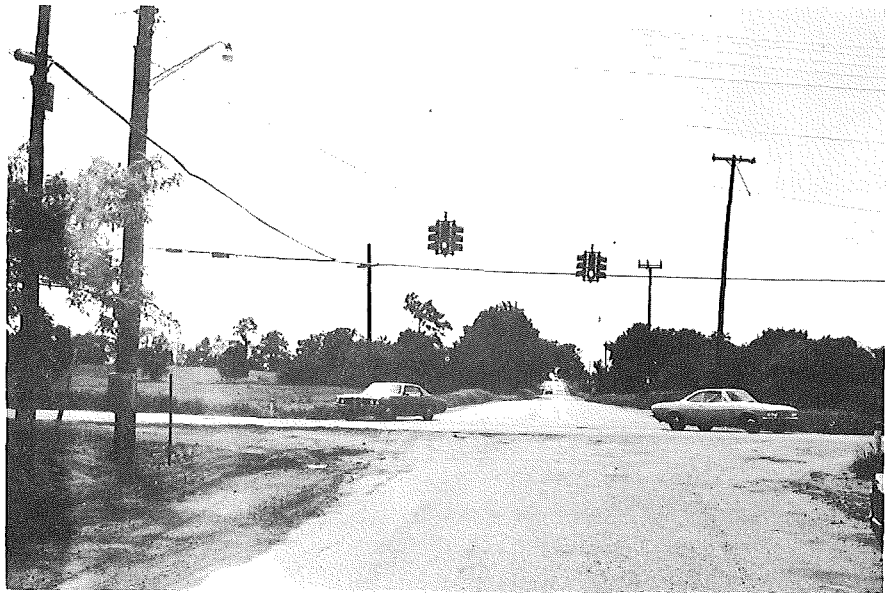


FIGURE 23

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
<ul style="list-style-type: none"> <li>○ 1966</li> <li>◇ 1967</li> <li>△ 1968</li> <li>□ 1969</li> <li>⬡ 1970</li> </ul>	<p>Stop &amp; Go Signal  Stop Sign  S</p> <p>Flashing Beacon  Yield Sign  Y</p> <p>Fatal  Pedestrian  X</p> <p>Injury  Tree  X</p> <p>Skidding  Out of Control  W</p> <p>Jackknife  Driver Intent  V</p> <p>Overturned  Deer  V</p> <p>Backing  Violator  V</p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>38</u></p> <p>P.D. <u>23</u></p> <p>Injury <u>15 (18)</u></p> <p>Fatal <u>0 ( )</u></p>	<p>ADT _____</p> <p>Rate _____ /100 mvm</p> <p>Rate _____ / mv</p>	<p>Location <u>PORTAGE RD. at MILHAM RD.</u></p> <p><u>CITY OF PORTAGE</u></p> <p><u>KALAMAZOO CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>4-23-71</u></p> <p>Plan No. <u>LOCATION 6</u></p>	



SOUTHBOUND  
PORTAGE ROAD



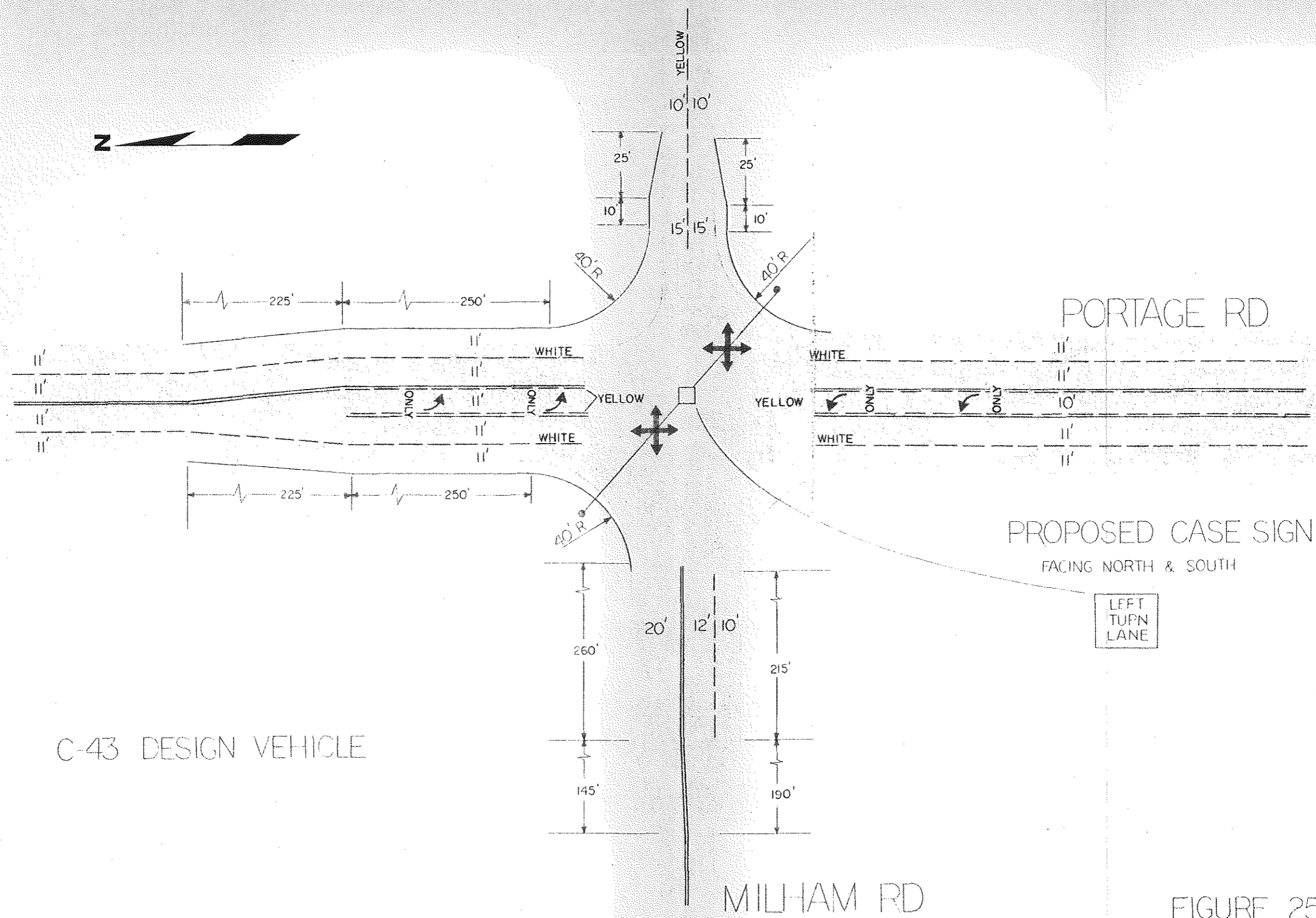
WESTBOUND  
MILHAM ROAD



NORTHBOUND  
PORTAGE ROAD

FIGURE 24





C-43 DESIGN VEHICLE

PORTAGE RD

PROPOSED CASE SIGN  
FACING NORTH & SOUTH

LEFT  
TURN  
LANE

MILHAM RD

FIGURE 25

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DVW	PORTAGE RD. at MILHAM RD.  CITY OF PORTAGE  KALAMAZOO CO.
	CONT. SEC.	DATE	
	REF.	SCALE 1" = 40'	
	SHEET OF	PLAN LOCATION 6	

LOCATION 7                    SPRINKLE ROAD (F.A.S. 1397) AT CENTRE  
AVENUE (WEST LEG - F.A.S. 1601)

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
36	26	10	0

LOCATION 8                    EAST MAIN STREET (F.A.S. 1591) AT  
NAZARETH ROAD

East Main Street and Nazareth Road form a right-angle intersection. East Main Street has a four lane, 40 ft wide bituminous pavement on the west leg and a two lane, 22 ft wide bituminous pavement on the east leg. Nazareth Road has a 32 ft wide bituminous pavement on the north leg and a 24 ft wide bituminous pavement on the south leg. The south leg of Nazareth Road is a truck route for a gravel company located approximately one-half mile south of the intersection.

East Main Street has the right-of-way at this intersection. North and southbound Nazareth Road traffic is controlled by a flashing beacon and 24 in. "Stop" signs. The sight distances from Nazareth Road are adequate.

There were 33 accidents at this location during the five-year study period. Rear end, right-angle and driveway accidents accounted for about 79 percent of the total. The flashing beacon was not installed until 1969. Right-angle accidents decreased and rear end accidents increased after the installation of the flashing beacon. There were 11 right-angle accidents, eight of which occurred before the flashing beacon was installed and there were six rear end accidents, five of which occurred after the installation. The remaining accidents at this location consisted of nine involving driveways, two head-on left-turns, two improper turns, one ran off roadway, one sideswipe and one involving a pedestrian.

Recommendations

Fifty-two percent of the accidents at this location occurred on wet, snowy or icy pavement. Wet accidents alone accounted for 27 percent of the total accidents and 36 percent of the total accidents minus those that occurred on snow and ice. These figures indicate that the pavement at this location becomes slippery when wet. Thus, it is recommended that a skidometer test be conducted.

Furthermore, it is recommended that flares be constructed on each side of the east leg of East Main Street to correlate with the existing four lanes on the west leg of East Main Street. Also,

the approach road connection for the south leg of Nazareth Road should be widened to a minimum of 30 ft. A detail drawing of these designs can be found in the Standard Guides for the Michigan Department of State Highways and Transportation and on p. 49 of this report.

The Michigan Manual indicates the standard size for "Stop" signs shall be 30 in. by 30 in. Thus, it is recommended that the existing 24 in. "Stop" signs be replaced by 30 in. signs.

There was a reduction in right-angle accidents after the installation of the flashing beacon. The Average Daily Traffic volumes for East Main Street and Nazareth Road indicate that this intersection is close to satisfying the minimum vehicular volume requirements of Warrant 1 for pretimed signals. However, due to the initial success of the flashing beacon, it would not be advisable to install a stop and go signal at this time. If right-angle accidents or traffic volumes increase in the future, it is recommended that the feasibility of a stop and go signal be considered.

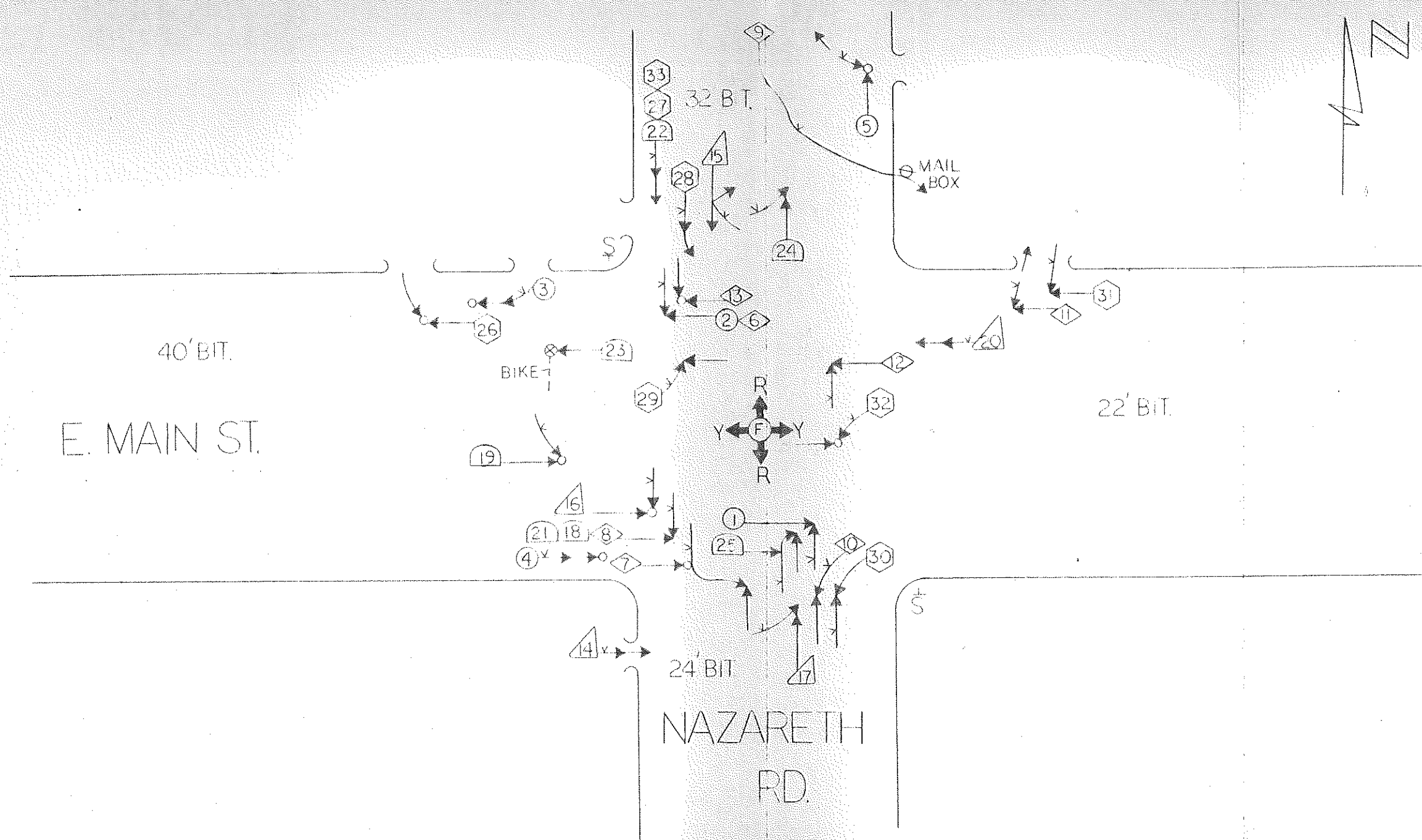


FIGURE 26

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<ul style="list-style-type: none"> <li>○ 1966</li> <li>◇ 1967</li> <li>△ 1968</li> <li>◡ 1969</li> <li>⬡ 1970</li> </ul>	<p>Stop &amp; Go Signal  Stop Sign S  Yield Sign Y </p> <p>Flashing Beacon  Pedestrian  Tree </p> <p>Fatal  Pedestrian  Out of Control </p> <p>Injury  Driver Intent </p> <p>Skidding  Deer  Backing </p> <p>Jackknife  Violator </p> <p>Overtaken </p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>33</u></p> <p>P.D. <u>24</u></p> <p>Injury <u>9 (11)</u></p> <p>Fatal <u>0 ( )</u></p>	<p>ADT _____</p> <p>Rate _____ /100 mvm</p> <p>Rate _____ / mv</p>	<p>Location <u>E. MAIN ST. at NAZARETH ST.</u></p> <p><u>KALAMAZOO TWP.</u></p> <p><u>KALAMAZOO CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>4-9-71</u></p> <p>Plan No. <u>LOCATION 8</u></p>



EASTBOUND  
EAST MAIN STREET

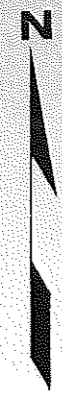
NORTHBOUND  
NAZARETH ROAD



WESTBOUND  
EAST MAIN STREET

FIGURE 27

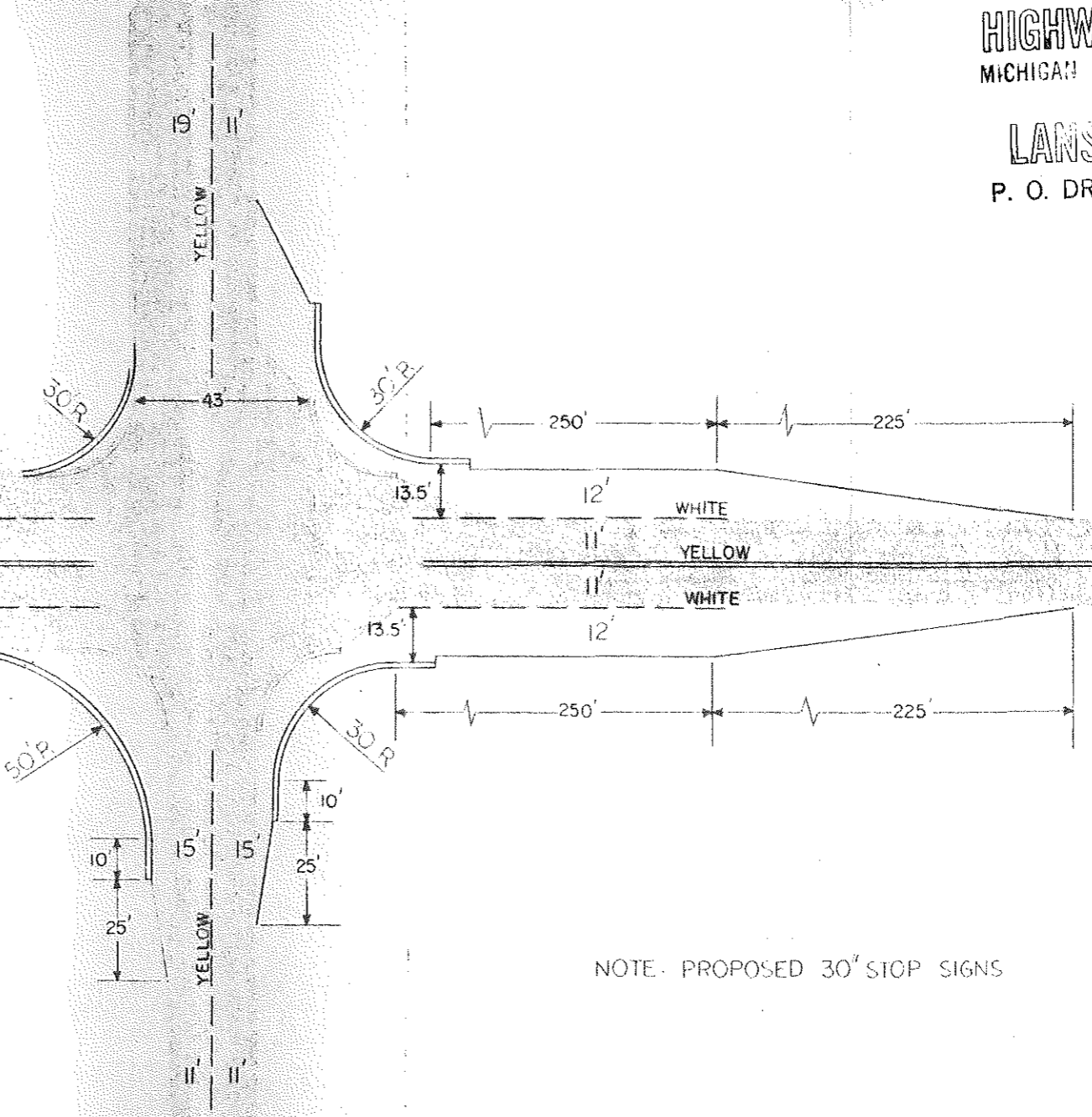
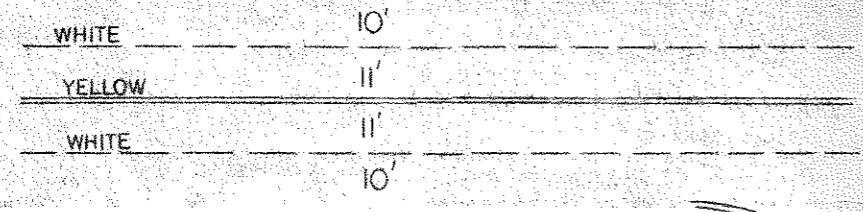




NAZARETH RD.

HIGHWAY LIBRARY  
MICHIGAN DEPARTMENT OF STATE  
HIGHWAYS  
LANSING, MICH.  
P. O. DRAWER "K" 48904

MAIN ST.



NOTE: PROPOSED 30" STOP SIGNS

C-43 DESIGN VEHICLE.

FIGURE 28

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC & SAFETY DIVISION		AUTH. NO.	DRAWN DVW	MAIN ST. at NAZARETH RD. KALAMAZOO CO. KALAMAZOO CO
		CONT. SEC.	DATE	
SHEET OF		REF.	SCALE 1" = 40'	LOCATION 8
		PLAN		



## LOCATION 9

SPRINKLE ROAD (F.A.S. 1397) AT MEREDITH ROAD

Sprinkle Road and Meredith Road form a skewed intersection in a rural area of Kalamazoo County. Sprinkle is a major county road that provides access to I-94. Meredith is a minor county road that provides access for local traffic. Sprinkle Road has a two lane, 21 ft wide bituminous pavement that is center and edge line marked. Meredith Road has a new bituminous cap that is 22 ft wide for both legs.

The only traffic controls present at this location are two 24 in. "Stop" signs for north and southbound Meredith Road traffic. The sight distances from both north and southbound Meredith Road are adequate.

There were 33 accidents at this intersection during the five-year study period. Fifteen of these accidents occurred on wet, snowy or icy pavement. Rear end and right-angle collisions accounted for 54 percent of the accidents. Four of the nine right-angle accidents and three of the nine rear end accidents occurred on wet pavement. All nine of the right-angle accidents involved carelessness on the part of the operators.

Recommendations

Thirty-nine percent of the accidents at this location occurred on wet pavement. It appears from this figure that wet pavement may have contributed to the occurrence of accidents. For this reason it is recommended that skidometer tests be conducted.

In all nine right-angle accidents and in six of the nine rear end accidents, the violator was traveling on north or southbound Meredith Road. It seems that the drivers need a more pronounced warning that they will be required to stop at Sprinkle Road. For this reason it is recommended that the "Stop" signs for Meredith Road be increased in size to 36 in. The present "Stop" sign for southbound Meredith Road has a 4 ft bottom height. It is recommended that the required 5 ft bottom height as indicated by the Manual be adhered to for the installation of the larger "Stop" signs.

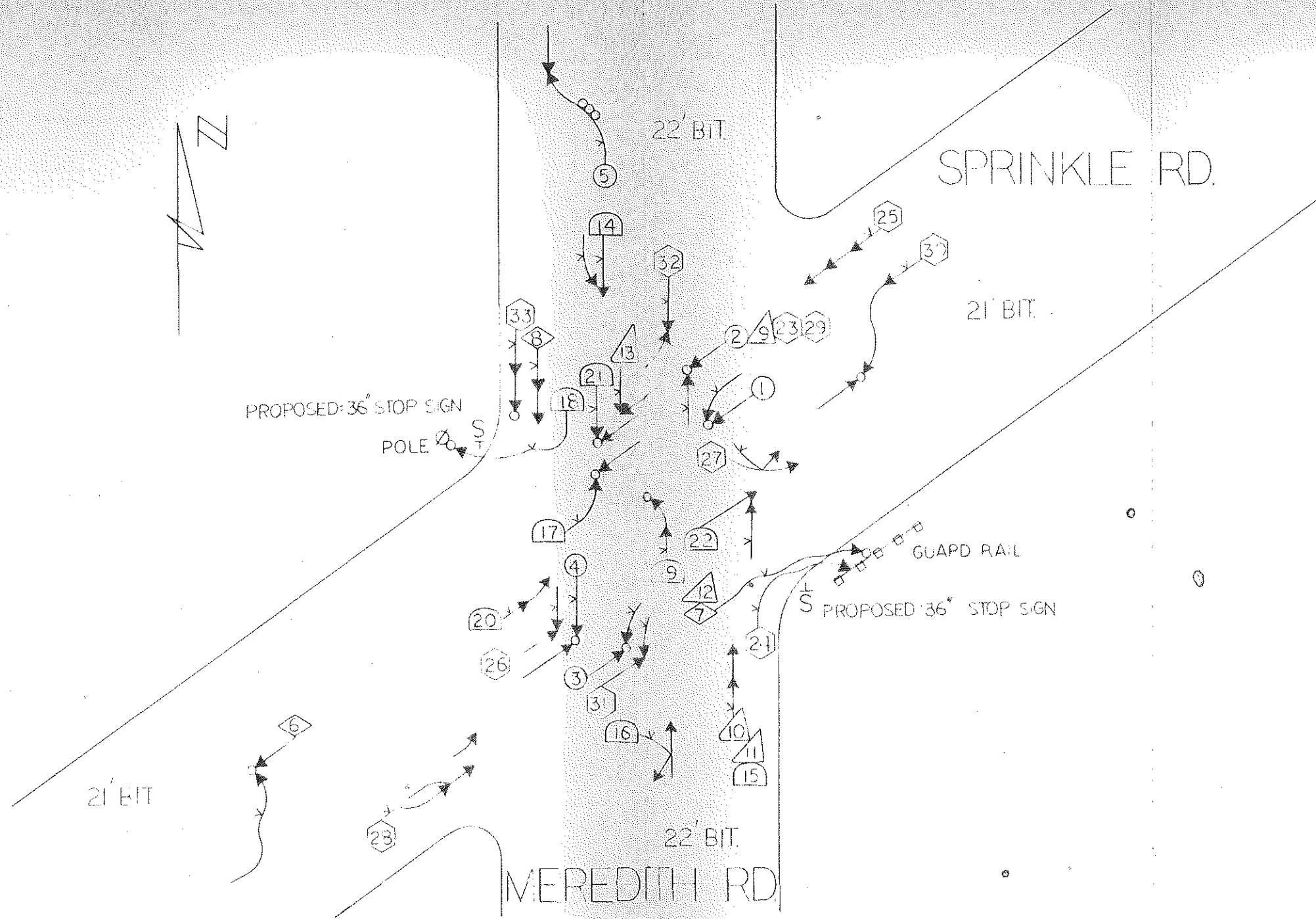


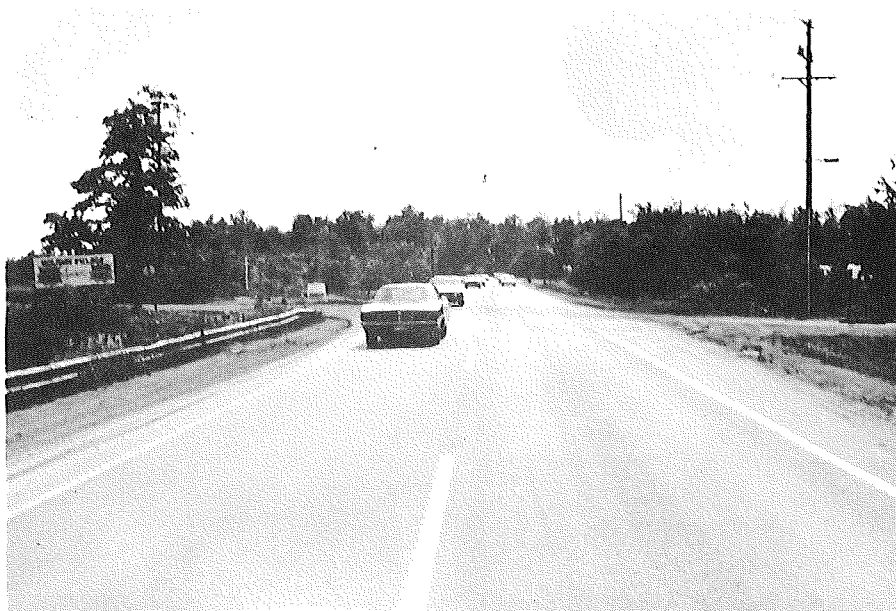
FIGURE 29

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<ul style="list-style-type: none"> <li>○ 1966</li> <li>◇ 1967</li> <li>△ 1968</li> <li>◡ 1969</li> <li>⬡ 1970</li> </ul>	<p>Stop &amp; Go Signal  Stop Sign  S</p> <p>Flashing Beacon  Yield Sign  Y</p> <p>Fatal  Pedestrian </p> <p>Injury  Tree </p> <p>Skidding  Out of Control </p> <p>Jackknife  Driver Intent </p> <p>Overtaken  Deer </p> <p>Backing  Violator </p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>33</u></p> <p>P.D. <u>17</u></p> <p>Injury <u>16 (29)</u></p> <p>Fatal <u>0 ( )</u></p>	<p>ADT _____</p> <p>Rate _____ /100 mvm.</p> <p>Rate _____ / mv.</p>	<p>Location <u>SPRINKLE RD. at MEREDITH RD.</u></p> <p><u>CITY OF PORTAGE</u></p> <p><u>KALAMAZOO CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>4-13-71</u></p> <p>Plan No. <u>LOCATION 9</u></p>



NORTHBOUND  
MEREDITH ROAD

SOUTHWESTBOUND  
SPRINKLE ROAD



SOUTHBOUND  
MEREDITH ROAD

FIGURE 30

LOCATION 10            DOUGLAS AVENUE (F.A.S. 1803) AT "D"  
AVENUE (F.A.S. 10)

Douglas Avenue and "D" Avenue form a right-angle intersection in a rural area of Kalamazoo County. Douglas Avenue has a four lane, 40 ft wide bituminous pavement with center line markings only. The east leg of "D" Avenue has a 43 ft wide bituminous pavement with an 18 ft wide eastbound lane and a 25 ft wide westbound lane. The west leg of "D" Avenue has a 28 ft wide bituminous pavement.

The traffic controls at this location consist of a 36 in. "Stop" sign for both east and westbound "D" Avenue traffic and an overhead flashing beacon. Also there are 32 in. "Stop Ahead" warning signs for both directions of traffic on "D" Avenue. The sight distance from the east leg of "D" Avenue is inadequate due to brush growth in the southeast quadrant while the sight distance from the west leg is adequate.

There were 29 accidents at this intersection during the five-year study period. Three of these accidents occurred on wet pavement and seven occurred on snowy or icy pavement. Right-angle, rear end and ran-off roadway accidents accounted for 66 percent of the total. Four of the eight right-angle accidents involved operators who ran through the "Stop" signs and flashing beacon. Four of the six rear end accidents involved a left turn into the grocery store parking lot located in the northwest quadrant. Three rear end accidents occurred on wet pavement and four of the five ran-off roadway accidents occurred on icy pavement. The remaining accidents at this location consisted of four head-on left turns, two improper turns, two sideswipes and two involving a driveway.

Recommendations

There were eight right-angle accidents at this location, four of which involved operators who ran through the "Stop" signs and flashing beacon. Thus, it is recommended that the lens size of the flashing beacon be increased from an 8 in. to a 12 in. lens. This should increase the operator's awareness of the intersection and may reduce the number of operators who have been violating the stop control at Douglas Avenue.

Furthermore, it is recommended that three 12 ft lanes be established on "D" Avenue with the center lane for left turns only. This can be accomplished on the east leg by painting the existing pavement for three lanes. On the west leg, however, eight feet would have to be added to the existing pavement to create three 12 ft lanes. It is recommended that the eight feet be added to the north side of the west leg to correlate with an existing curb line. Painted arrows indicating lane assignments should be applied and a post mounted Lane-Use Control sign located in advance

of the intersection should be erected for both legs of "D" Avenue. Also, the existing 32 in. "Stop Ahead" signs are non-standard and should be replaced by 36 in. signs. A detail drawing of these improvements can be found on p. 57 .

The sight distance from the east leg of "D" Avenue is inadequate. Thus, it is recommended that the bushes in the southwest quadrant be trimmed and then periodically maintained.



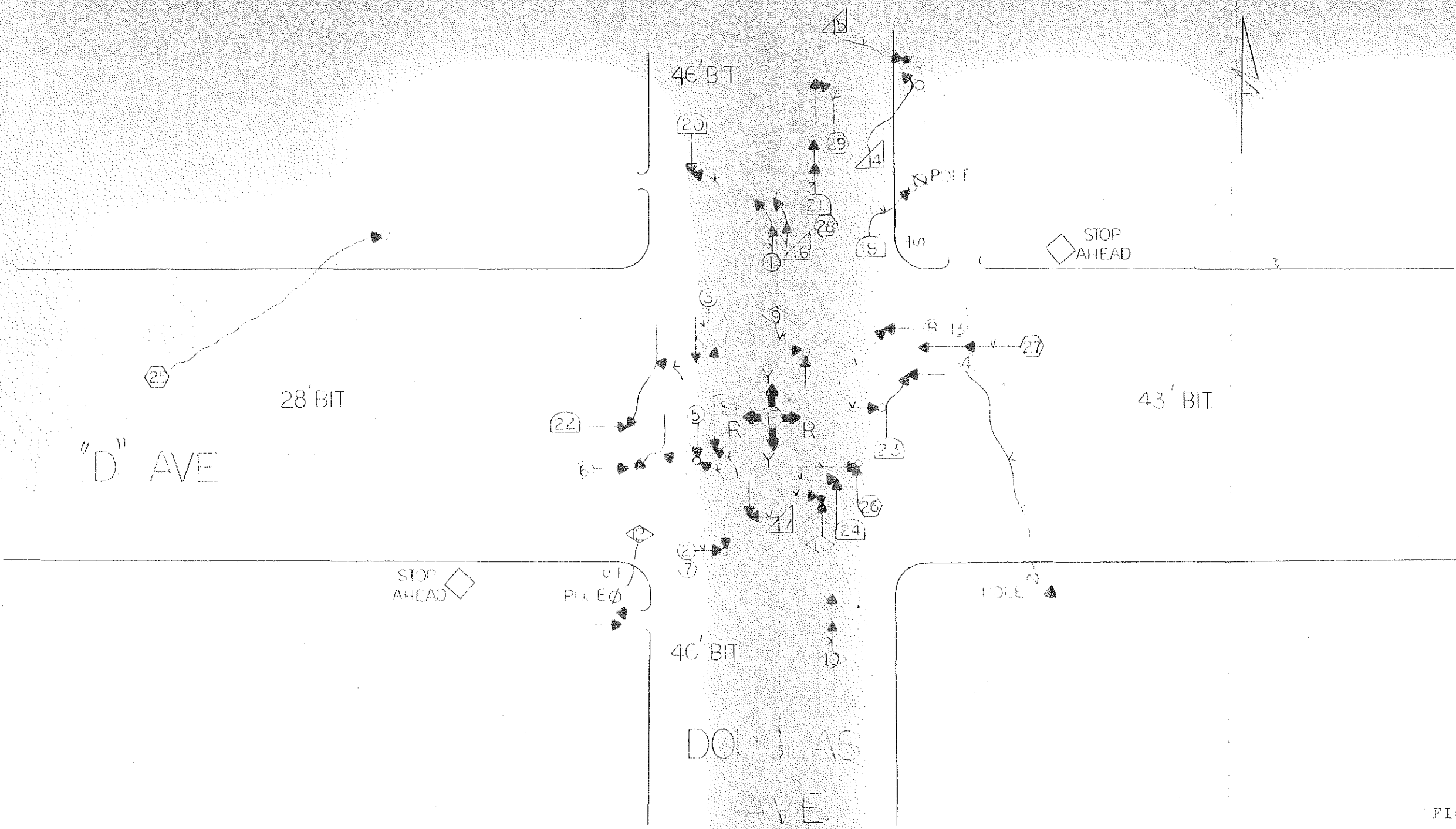










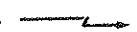







FIGURE 31

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM	MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<p>○ 1966</p> <p>◇ 1967</p> <p>△ 1968</p> <p>◡ 1969</p> <p>⬡ 1970</p>	<p>Stop &amp; Go Signal  Stop Sign </p> <p>Flashing Beacon  Yield Sign </p> <p>Fatal  Pedestrian </p> <p>Injury  Tree </p> <p>Skidding  Out of Control </p> <p>Jackknife  Driver Intent </p> <p>Overtaken  Deer </p> <p>Backing  Violator </p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>29</u></p> <p>P.D. <u>15</u> ADT _____</p> <p>Injury <u>12 (29)</u> Rate _____ /100 mvm</p> <p>Fatal <u>2 (2)</u> Rate _____ / mv</p>	<p>Location DOUGLAS AVE AT "D" AVE</p> <p>COOPER TWP</p> <p>KALAMAZOO CO.</p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>4-12-71</u></p> <p>Plan No. <u>LOCATION 10</u></p>



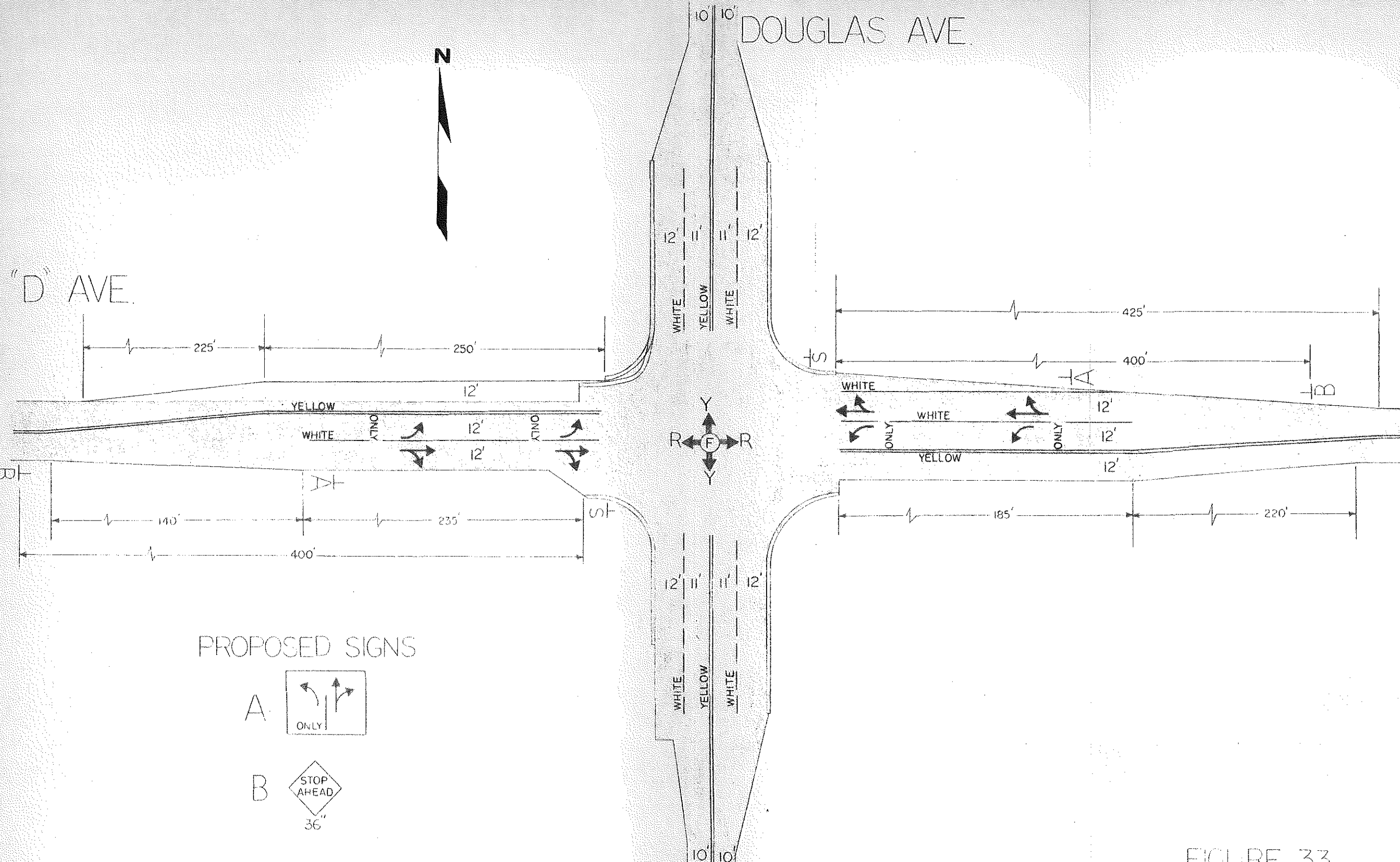
EASTBOUND  
"D" AVENUE

SOUTHBOUND  
DOUGLAS AVENUE



WESTBOUND  
"D" AVENUE

FIGURE 32



PROPOSED SIGNS

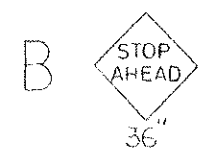


FIGURE 33

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DVW	DOUGLAS AVE. at "D" AVE.  COOPER TWP.  KALAMAZOO CO.
	CONT. SEC.	DATE	
	REF.	SCALE 1"=40'	
	SHEET OF	PLAN LOCATION 10	

LOCATION 11

DOUGLAS AVENUE (F.A.S. 1803) AT MOSEL AVENUE  
(F.A.S. 1195) AND BARNEY ROAD (F.A.S. 1195)

Douglas Avenue at Mosel Avenue and Barney Road forms a right-angle intersection. Douglas Avenue is a north-south roadway while Mosel Avenue and Barney Road provide east-west access.

Douglas Avenue has a four lane bituminous pavement that is 44 ft wide on the south leg and 40 ft wide on the north leg. Mosel Avenue has a two lane, 24 ft wide bituminous pavement and Barney Road has a two lane, 20 ft wide bituminous pavement. Mosel Avenue has flares on each side of the road that are 70 ft long while Barney Road has a 55 ft long right turn flare.

Douglas Avenue has the right-of-way at this intersection. The existing traffic controls consist of 36 in. "Stop" signs for Mosel Avenue and Barney Road, and an overhead flashing beacon. Also there is a 32 in. "Stop Ahead" warning sign located in advance of the "Stop" sign for both Mosel Avenue and Barney Road. The sight distances from Barney Road are adequate while the sight distances from Mosel Avenue are poor due to the eye level signs at the service station in the southeast quadrant and the high brush growth in the northeast quadrant.

Thirteen of the 29 accidents that occurred at this location during the five year study period occurred on wet, snowy or icy pavement. Right-angle and rear end collisions accounted for 55 percent of the total accidents. Six of the eight rear end accidents occurred during adverse pavement conditions and six of the eight right-angle accidents involved a careless maneuver by the vehicle operators. The remaining accidents at this location consisted of four ran-off roadways, four sideswipes, two improper turns and one head-on left turn. Also there was one accident involving a parked car and one involving a vehicle leaving a driveway.

Recommendations

A Traffic Signal Warrant Graph was prepared from 24 hour volume counts that were recorded in March of 1973 (p. 63). The Warrant Graph indicates that both the major and minor streets satisfy the minimum requirements of Warrant 1 for pretimed signals found in the Michigan Manual. Warrant 1 is based on a minimum vehicular volume that must occur during the highest eight hours of a day. It is recommended that two signal heads be erected at this intersection to provide two visible signal faces per approach.

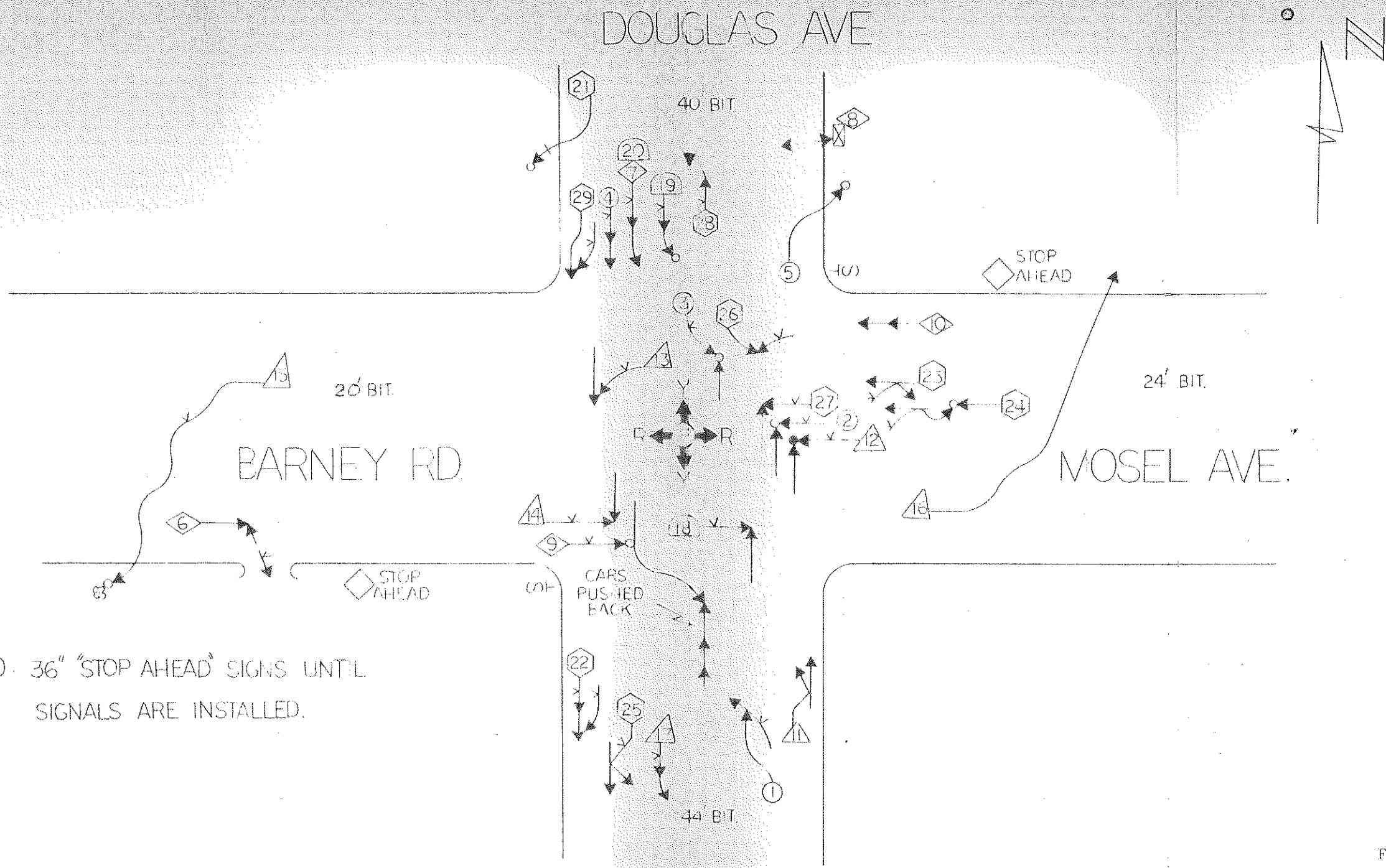
Furthermore, it is recommended that right-turn flares be used at a signalized intersection where there is only one lane for moving traffic on each approach. Both Mosel Avenue and Barney Road have existing right turn flares. It is recommended that these flares be extended by use of a Type 3 right turn flare as found in the

Standard Guides for the Michigan Department of State Highways and Transportation. A detail drawing of this design can be found on p. 62 .

Thirty-one percent of the accidents at this location occurred on wet pavement. This percentage indicates that the pavement at this intersection may become slippery when wet. For this reason it is recommended that skidometer tests be conducted.

















Lastly, it is recommended that 36 in. "Stop Ahead" signs replace the present 32 in. signs until the traffic signal is erected. The Manual recommends that a 36 in. "Stop Ahead" sign be used in conjunction with a 36 in. "Stop" sign.





PROPOSED 36" "STOP AHEAD" SIGNS UNTIL SIGNALS ARE INSTALLED.

FIGURE 34

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<p>○ 1966</p> <p>◇ 1967</p> <p>△ 1968</p> <p>◡ 1969</p> <p>⬡ 1970</p>	<p>Stop &amp; Go Signal  Stop Sign </p> <p>Flashing Beacon  Yield Sign </p> <p>Fatal  Pedestrian </p> <p>Injury  Tree </p> <p>Skidding  Out of Control </p> <p>Jackknife  Driver Intent </p> <p>Overtuned  Deer </p> <p>Backing  Violator </p>	<p>Period: 1966 THRU 1970</p> <p>Accidents - Total 29</p> <p>P.D. 20</p> <p>Injury 8 (10)</p> <p>Fatal 1 (1)</p>	<p>ADT _____</p> <p>Rate _____ /100 mvm</p> <p>Rate _____ / mv</p>	<p>Location DOUGLAS AVE. at MOSEL AVE., BARNEY RD.</p> <p>KALAMAZOO TWP.</p> <p>KALAMAZOO CO.</p> <p>C.S. _____ Miles _____</p> <p>Drawn DVW Date 4-10-71</p> <p>Plan No. LOCATION II</p>



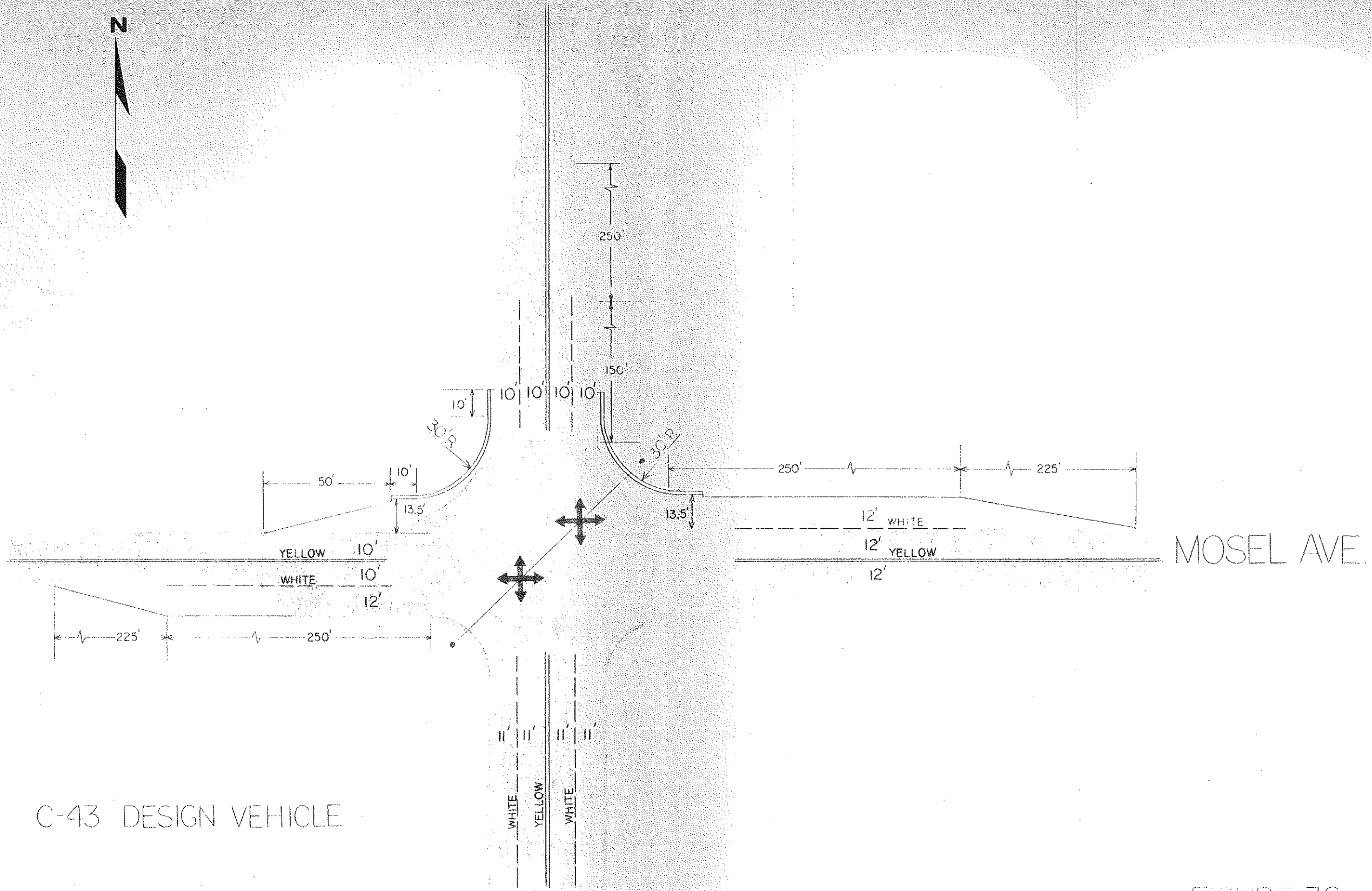
NORTHBOUND  
DOUGLAS AVENUE

WESTBOUND  
MOSEL AVENUE



SOUTHBOUND  
DOUGLAS AVENUE

FIGURE 35



C-43 DESIGN VEHICLE

DOUGLAS AVE.

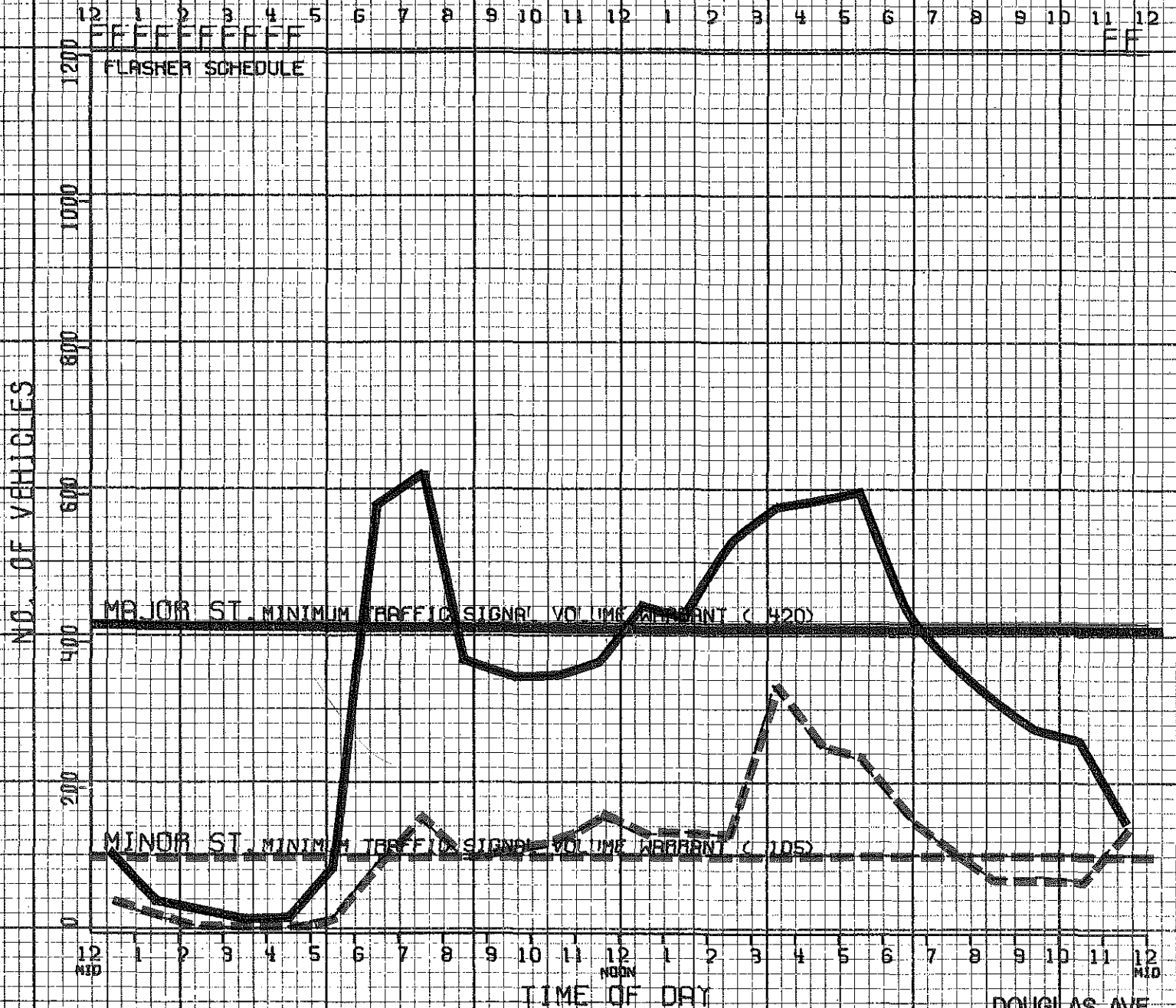
MOSEL AVE.

FIGURE 36

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DVW	DOUGLAS AVE. at MOSEL AVE. KALAMAZOO TWP. KALAMAZOO CO.
	CONT. SEC.	DATE	
	REF.	SCALE 1"=40'	
	SHEET OF	PLAN LOCATION 11'	



# TRAFFIC SIGNAL WARRANT GRAPH



### ANALYSIS

APPLICABLE WARRANT RURAL VEHICULAR

MAJOR STREET MEETS WARRANT 9 HOURS OF REQUIRED 8 HOURS  
 MINOR STREET MEETS WARRANT 13 HOURS OF REQUIRED 8 HOURS

ACCIDENTS REPORTED IN \_\_\_\_\_, RATE \_\_\_\_\_ /M.V.  
 ACCIDENTS REPORTED IN \_\_\_\_\_, RATE \_\_\_\_\_ /M.V.

SURVEY TAKEN 3-27-73 PLAN NO. B9000-00 DATE 08-03-73

MICHIGAN  
 DEPARTMENT OF STATE HIGHWAYS  
 TRAFFIC - SAFETY  
 DIVISION

DOUGLAS AVE AT  
 MOSEL AVE  
 KALAMAZOO TWP., KALAMAZOO CO

FIGURE 37

LOCATION 12

CENTRE AVENUE (F.A.S. 1601) AT OAKLAND  
DRIVE (F.A.S. 396)

Centre Avenue and Oakland Drive form a right-angle intersection with Centre Avenue having the right-of-way. Both Centre Avenue and Oakland Drive have four lane bituminous pavements in the immediate intersection area. Centre Avenue is 46 ft wide and Oakland Drive is 42 ft wide.

The traffic controls at this location consist of an overhead flashing beacon accompanied by 36 in. "Stop" signs and 30 in. "Stop Ahead" signs for both directions of traffic on Oakland Drive. The "Stop Ahead" sign for the north leg of Oakland Drive has a 40 in. bottom height while the sign for the south leg has a 48 in. bottom height. The sight distances from Oakland Drive are adequate.

The collision diagram for this location shows a total of 29 accidents during the five year study period. Only seven of the total accidents occurred on wet, snowy or icy pavement. Right-angle collisions accounted for 19 accidents which is 65.5 percent of the total. Eight of the right-angle collisions occurred in 1966 and 1967 before the flashing beacon was installed. The remaining accidents at this location consisted of four rear ends, two ran-off roadways, two involving careless driving, one improper turn and one sideswipe.

Recommendations

It is recommended that 36 in. "Stop Ahead" signs be erected in place of the existing 30 in. signs. The Manual recommends that a 36 in. "Stop Ahead" sign be used in conjunction with a 36 in. "Stop" sign.

Furthermore, the Manual stipulates that signs erected at the side of the road in rural districts shall be mounted at a height of at least five feet, measured from the bottom of the sign to the near edge of the pavement. It is recommended that the proposed signs be erected at the minimum bottom height called for in the Manual.

There are no lane lines on either Centre Avenue or Oakland Drive. It is recommended that lane lines be applied to all legs of this intersection for both directions of traffic.



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 LANSING, MICH.  
 P. O. DRAWER "K" 48904

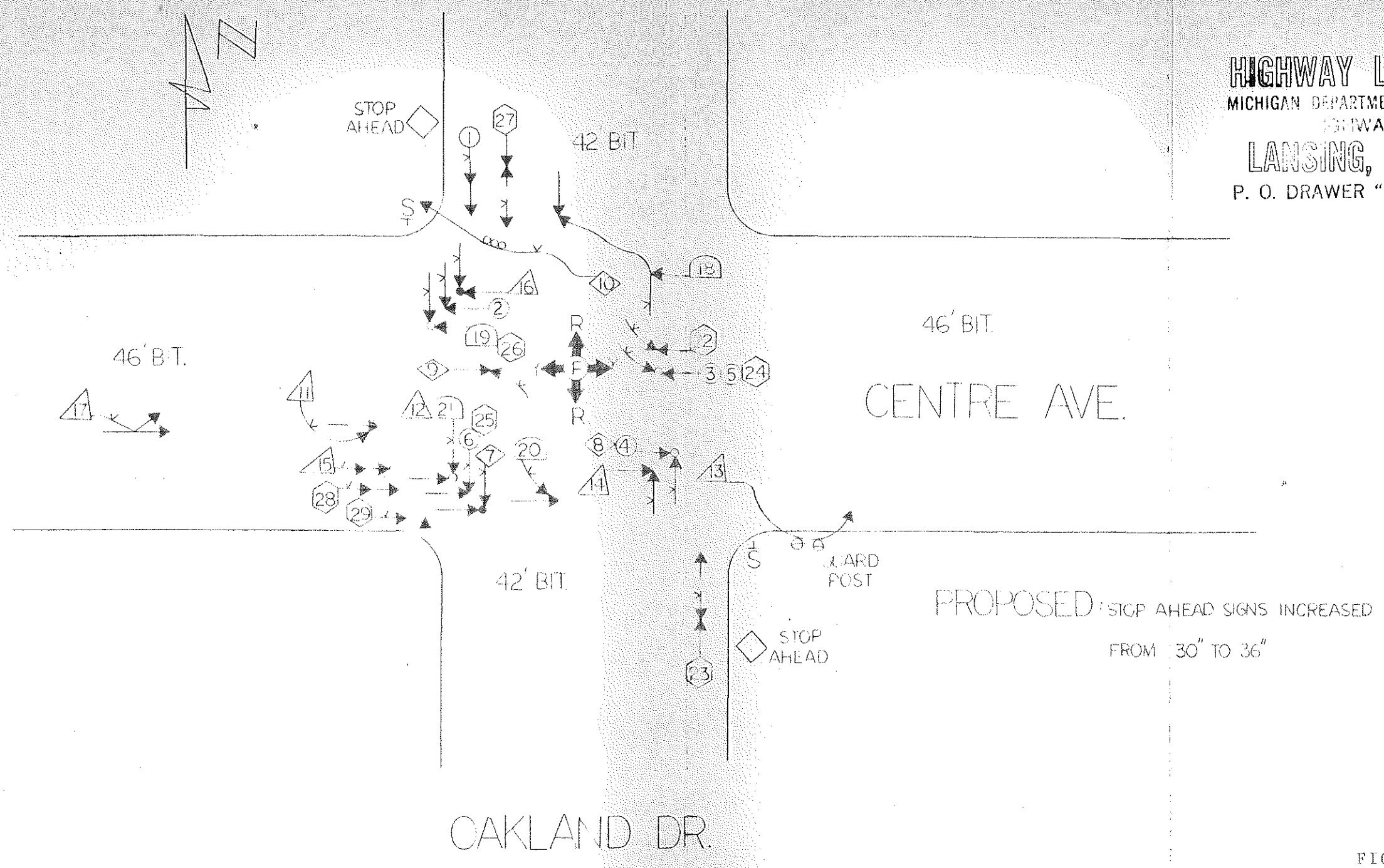
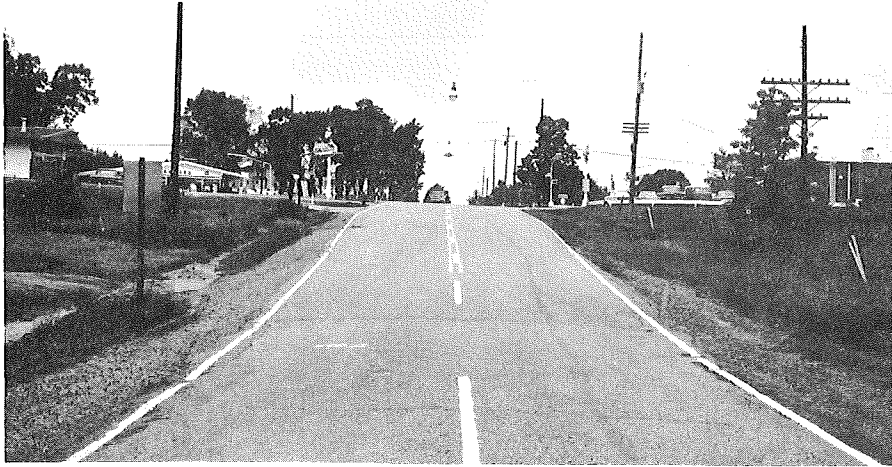


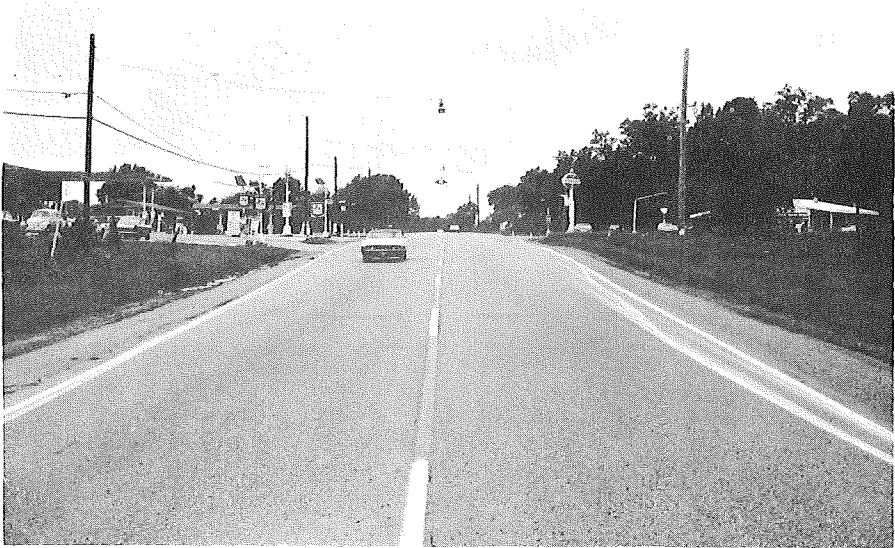
FIGURE 38

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM	MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
○ 1966 ◇ 1967 △ 1968 ◐ 1969 ◑ 1970	Stop & Go Signal Flashing Beacon Stop Sign Yield Sign Pedestrian Tree Out of Control Driver Intent Deer Violator Fatal Injury Skidding Jackknife Overturned Backing	Period: <u>1966 THRU 1970</u> Accidents - Total <u>29</u> P.D. <u>17</u> ADT _____ Injury <u>10 (18)</u> Rate _____ /100 mvm Fatal <u>2 (2)</u> Rate _____ / mv	Location CENTRE AVE. at OAKLAND DR. CITY OF PORTAGE KALAMAZOO CO. C.S. _____ Miles _____ Drawn <u>DVW</u> Date <u>4-10-71</u> Plan No. <u>LOCATION 12</u>



NORTHBOUND  
OAKLAND DRIVE

WESTBOUND  
CENTRE AVENUE



SOUTHBOUND  
OAKLAND DRIVE

FIGURE 39

LOCATION 13      MICHIGAN AVENUE (F.A.S. 1593) FROM RIVER STREET (F.A.S. 1144) TO 26TH STREET

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
21	13	8	0

LOCATION 14      SPRINKLE ROAD (F.A.S. 1397) AT CORK STREET (WEST LEG - F.A.S. 395)

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
20	12	8	0

LOCATION 15      CENTRE AVENUE (F.A.S. 1601) AT LOVERS LANE (NORTH LEG - F.A.S. 1589)

Centre Avenue and Lovers Lane form a four-legged intersection with the north and south legs of Lovers Lane offset in relation to each other. Centre Avenue has a two lane, 22 ft wide bituminous pavement and Lovers Lane has a two lane, 20 ft wide bituminous pavement. Centre Avenue has center and edge line markings while Lovers Lane has no pavement markings.

Centre Avenue has the right-of-way at this intersection. There are two 24 in. "Stop" signs for Lovers Lane traffic. The "Stop" sign for southbound Lovers Lane is not immediately visible due to an elevation in the roadway just before the intersection. There are also two overhead flashing beacons, one for each leg of Lovers Lane. These overhead signals are hard to distinguish because of telephone wires and tree foliage, as can be seen from the pictures on p. 70. The sight distance from the south leg of Lovers Lane is inadequate due to bushes in the southeast and southwest quadrants. The sight distance from the north leg of Lovers Lane is adequate.

There were 20 reported accidents at this location from 1966 to 1970. Seven of the 20 accidents occurred on wet, snowy or icy pavement. Rear end and right-angle collisions accounted for a little over 50 percent of the accidents. There were six rear end accidents, four of which occurred on wet or icy pavement. Four of the five right-angle accidents involved operators who reported that they did not see the vehicle they struck. The remaining accidents at this location consisted of four ran-off roadways, two sideswipes, one improper turn and one backing accident. There was also one accident involving a pony.

### Recommendations

The two overhead flashing beacons are difficult to see due to telephone wires and trees. Thus, it is recommended that oversized signal heads be erected at this intersection. The oversized signal heads will be easier to see for both Lovers Lane and Centre Avenue traffic.

Another problem at this location is the sight distance from the south leg of Lovers Lane. Three of the five right-angle accidents involved a vehicle traveling on northbound Lovers Lane. All three of these operators indicated that they did not see any traffic on Centre Avenue. The reason for this could be the bushes located in the southeast and southwest quadrants. It is recommended that these bushes be maintained so that the sight distance from the south leg of Lovers Lane will be adequate.

Furthermore, the "Stop" sign for the north leg of Lovers Lane traffic is not immediately visible due to a small elevation in the roadway just before the intersection. Thus, it is recommended that a 30 in. "Stop Ahead" sign be erected for southbound Lovers Lane traffic. This sign will provide advance warning of the forthcoming traffic control.

Lastly, the ultimate solution to the problem at this intersection involves relocation of either of the legs of Lovers Lane to eliminate the offset. It is recommended that the feasibility of this construction be investigated. Until the offset is eliminated this intersection will not operate efficiently nor safely.

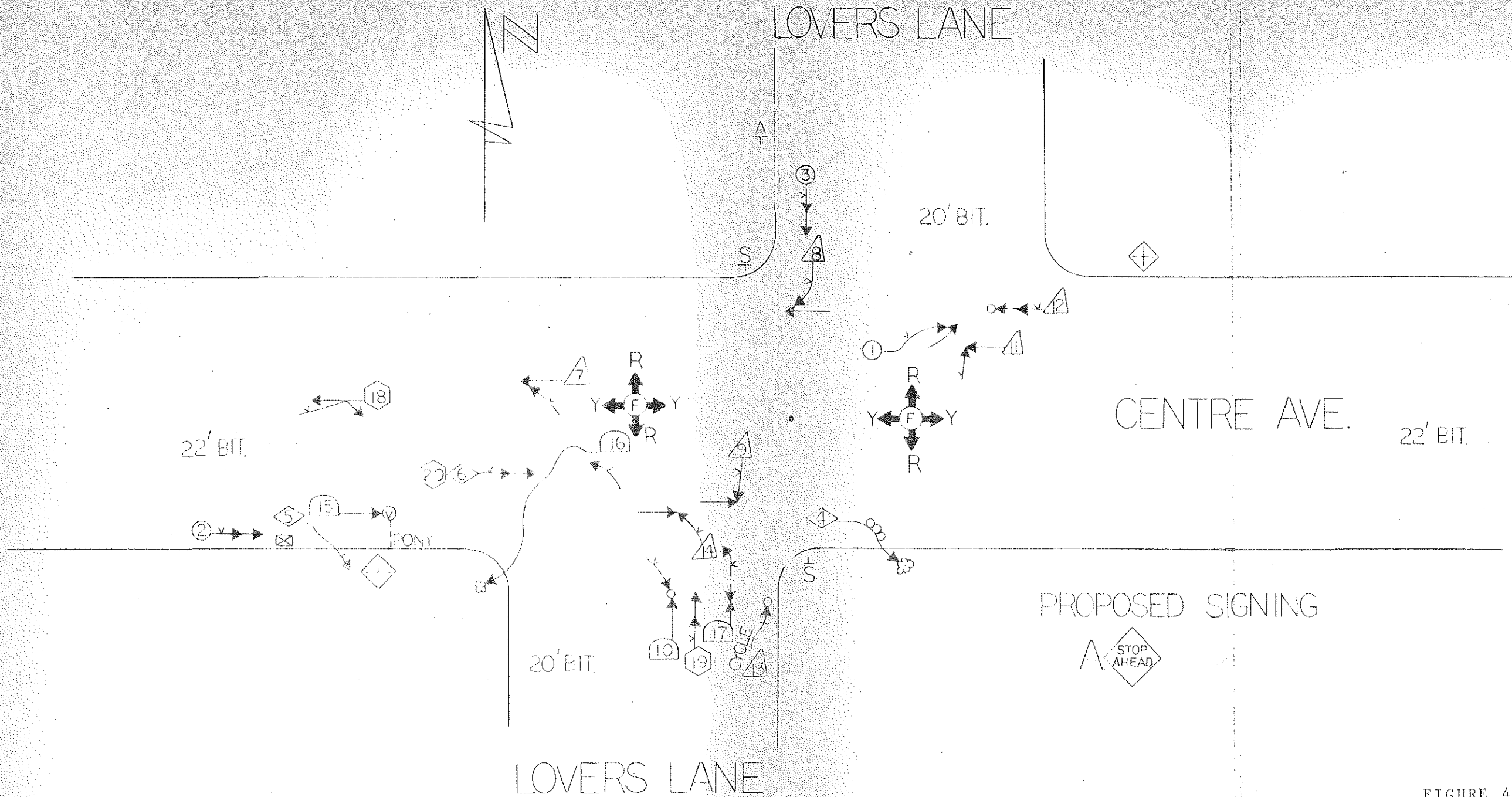
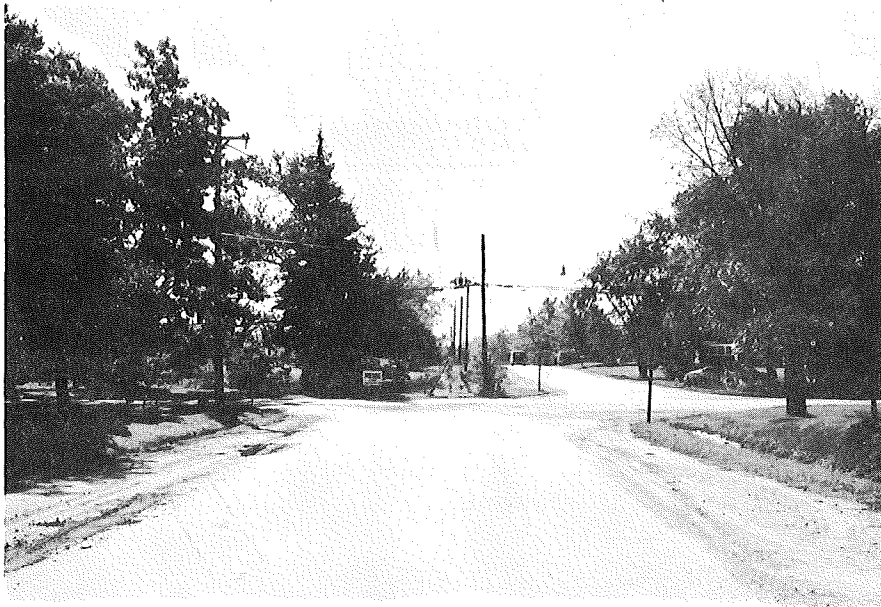


FIGURE 40

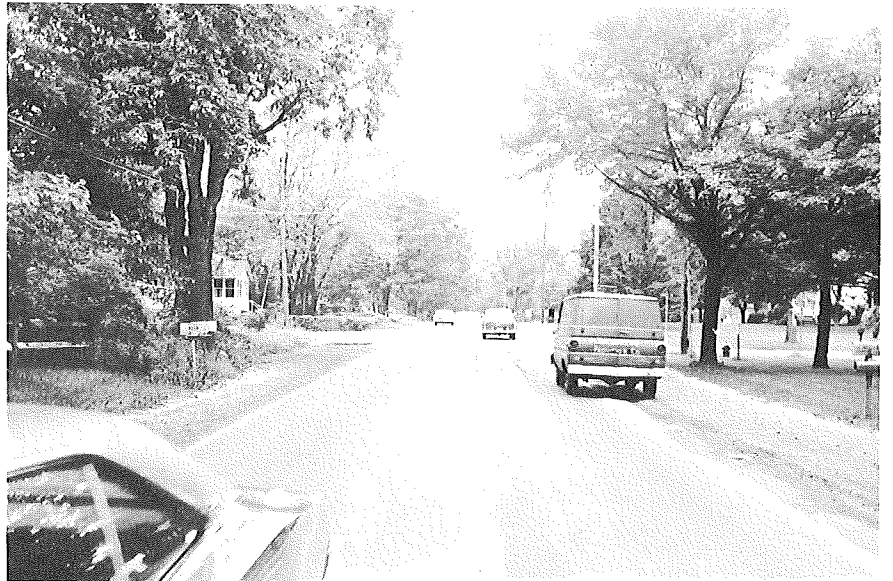
REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM	MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<ul style="list-style-type: none"> <li>○ 1966</li> <li>◇ 1967</li> <li>△ 1968</li> <li>◡ 1969</li> <li>⬡ 1970</li> </ul>	<p>Stop &amp; Go Signal  Stop Sign  S</p> <p>Flashing Beacon  Yield Sign  Y</p> <p>Fatal  Pedestrian  (X)</p> <p>Injury  Tree </p> <p>Skidding  Out of Control </p> <p>Jackknife  Driver Intent </p> <p>Overtaken  Deer  (V)</p> <p>Backing  Violator  (V)</p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>20</u></p> <p>P.D. <u>17</u> ADT _____</p> <p>Injury <u>3 (3)</u> Rate _____ /100 mvm</p> <p>Fatal <u>0 ( )</u> Rate _____ / mv</p>	<p>Location CENTRE AVE. at LOVERS LANE CITY OF PORTAGE KALAMAZOO CO.</p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DYW</u> Date <u>4-12-71</u></p> <p>Plan No. <u>LOCATION 15</u></p>





SOUTHBOUND  
LOVERS LANE

WESTBOUND  
CENTRE AVENUE



NORTHBOUND  
LOVERS LANE

FIGURE 41

LOCATION 16

DOUGLAS AVENUE (F.A.S. 1803) AT EDISON STREET

Douglas Avenue and Edison Street form a four-legged intersection with the west leg of Edison Street joining the intersection at a skew. Douglas Avenue has a two lane, 22 ft wide bituminous pavement and Edison Street has a two lane, 20 ft wide bituminous pavement.

Douglas Avenue has the right-of-way at this intersection. There is a 24 in. "Stop" sign for both east and westbound Edison Street. Eastbound Edison Street also has a 30 in. "Stop Ahead" sign which is difficult to see due to brush which has grown in front of the sign. The sight distance from east and westbound Edison Street is adequate. Douglas Avenue has center and lane line markings while Edison Street has no pavement markings.

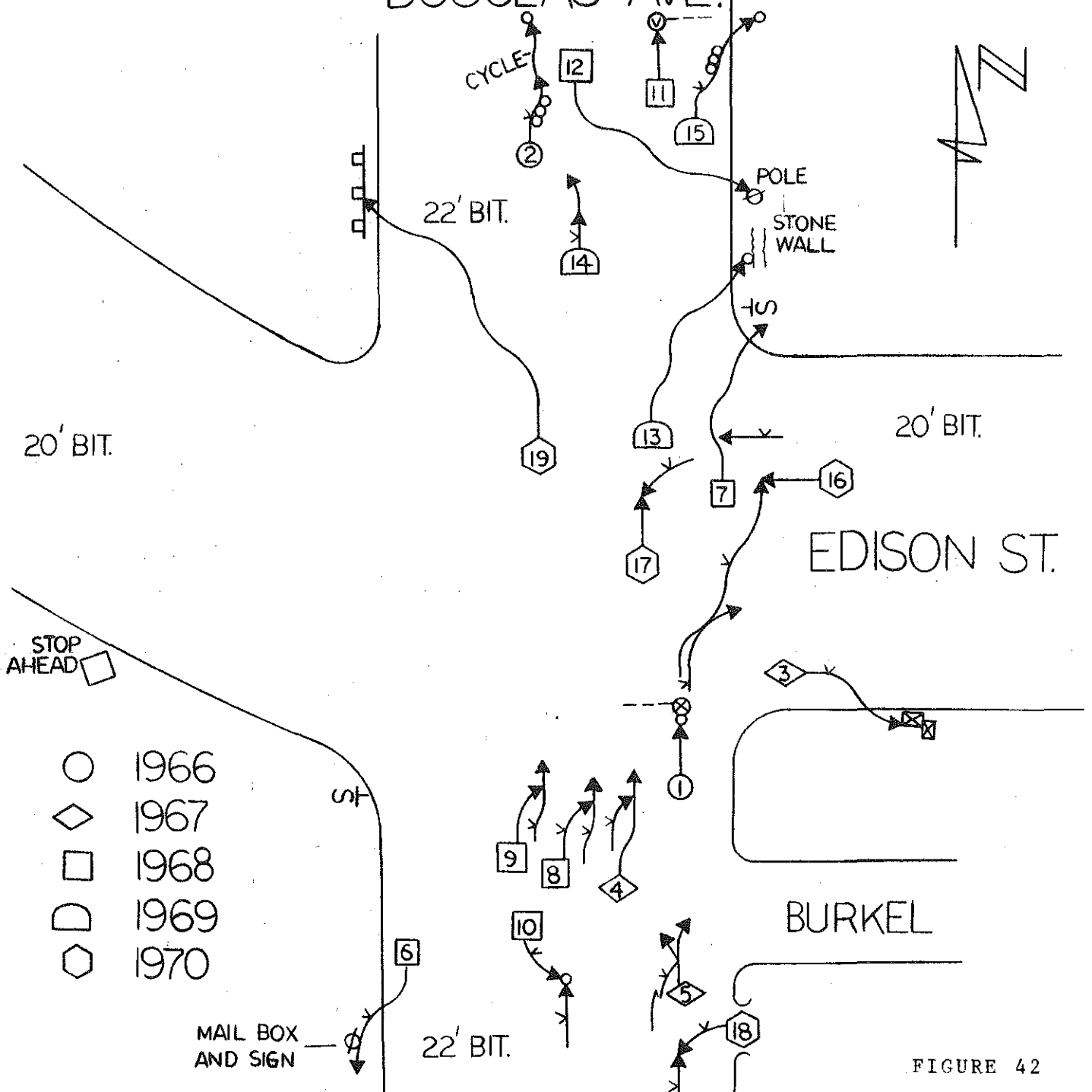
The collision diagram for this location indicates a five-year total of 19 accidents. Ten of these accidents occurred on wet or snowy pavement. There were seven ran-off roadway accidents with four of them occurring on wet or snowy pavement. Two of the ran-off roadway accidents were reportedly caused by excessive speed and two other accidents involved intoxicated drivers. There were four sideswipe accidents, three of which involved a careless turning movement. The remaining accidents at this location consisted of two rear ends, two right-angles, one improper turn and one involving a driveway. There was also one accident involving a pedestrian and one accident involving a deer.

Recommendations

The "Stop Ahead" sign for eastbound Edison Street is hidden from the motorist's view. It is recommended that the foliage that surrounds the "Stop Ahead" sign be maintained periodically, or that the sign be moved so that it will be completely visible to eastbound Edison Street traffic.

A further problem at this intersection is the high percentage of accidents that occurred on wet pavement. Thirty-seven percent of the accidents occurred on wet pavement, while a little over 50 percent occurred on wet, snowy or icy pavement. These figures seem to indicate that the pavement at this intersection becomes slippery when wet. Thus, it is recommended that skidometer tests be conducted at this intersection to determine if resurfacing is necessary.

# DOUGLAS AVE.



# EDISON ST.

# BURKEL

FIGURE 42

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal		Stop Sign	S
Flashing Beacon		Yield Sign	Y
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overturned		Deer	
Backing		Violator	
		Location	DOUGLAS AVE. at EDISON ST. KALAMAZOO TWP. KALAMAZOO CO.
		Period:	1966 THRU 1970
		Accidents - Total	19 P.D. 14
		Injury	5 (6) Fatal 0 ( )
		C.S.	Miles _____ Drawn DVW
		Plan No.	LOCATION 16 Date 6-16-70
			Date 4-6-71



NORTHBOUND  
DOUGLAS AVENUE

WESTBOUND  
EDISON STREET



SOUTHBOUND  
DOUGLAS AVENUE

FIGURE 43

LOCATION 17      RIVER STREET (F.A.S. 1144) AT COMSTOCK AVENUE

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
19	16	3	0

LOCATION 18      MICHIGAN AVENUE (F.A.S. 1801) AT 9TH STREET  
(F.A.S. 1582)

Michigan Avenue and 9th Street form a four-legged intersection that is under signal control. The two overhead signals were erected on September 12, 1970. During the other four years (1966-1969) of the five-year study period, a flashing beacon and "Stop" signs controlled traffic at this intersection.

The west leg of Michigan Avenue has a 40 ft wide bituminous pavement, while the east leg has a 32 ft wide bituminous pavement. The south leg of 9th Street has a two lane, 22 ft wide bituminous pavement, while the north leg has a two lane, 24 ft wide bituminous pavement. Both Michigan Avenue and 9th Street have center line and edge line markings.

There were 19 accidents at this location during the five-year study period. Ran-off roadway accidents accounted for 42 percent of this total. Six of the eight ran-off roadway accidents involved a collision with a utility pole. Careless driving was reportedly the cause of four of the ran-off roadway accidents. There were four right-angle collisions at this intersection, one occurring before the stop and go signal was installed and the remaining three occurring after the installation. Two of the right-angle collisions occurred only a few days after the signal installation. Both vehicle operators indicated that they were accustomed to having the right-of-way and had not adjusted to the presence of the signals. The remaining accidents at this location consisted of four that involved entering or exiting a driveway, two sideswipes and one rear end.

Recommendations

The 24 hour volume counts for this intersection were obtained in March of 1973. A warrant graph (Figure 47) based on this data indicates that the hourly volumes for both Michigan Avenue and 9th Street are greater than the minimum volumes for Warrant 1 in the Manual. Thus we concur with the placement of the stop and go signals. However, it is recommended that extra laneage be used to separate left turning traffic from through and right turning traffic. Michigan Avenue is wide enough that the additional laneage can be obtained through the use of pavement markings. Both east and westbound Michigan Avenue should be marked for



three lanes with the center lane for left turns only and the outside lane for right turns and through movements. Painted arrows indicating lane assignments should be applied and two post-mounted Lane-Use Control signs, one located at the intersection and one located in advance of the intersection, should be erected for both legs of Michigan Avenue (Figure 46 ).

On 9th Avenue flaring should be used to separate left turning traffic from through and right turning traffic. A detail drawing of this treatment can be found on page 78 of this report. It is recommended that this construction be included in Kalamazoo County's future construction program.

There were eight ran-off roadway accidents at this location. Six of these accidents involved a collision with a utility pole. Due to the high concentration of utility poles at this intersection it is recommended that the utility company be contacted to determine if reduction of the number of utility poles is feasible. Also, the feasibility of moving those poles that are in target position should be investigated.

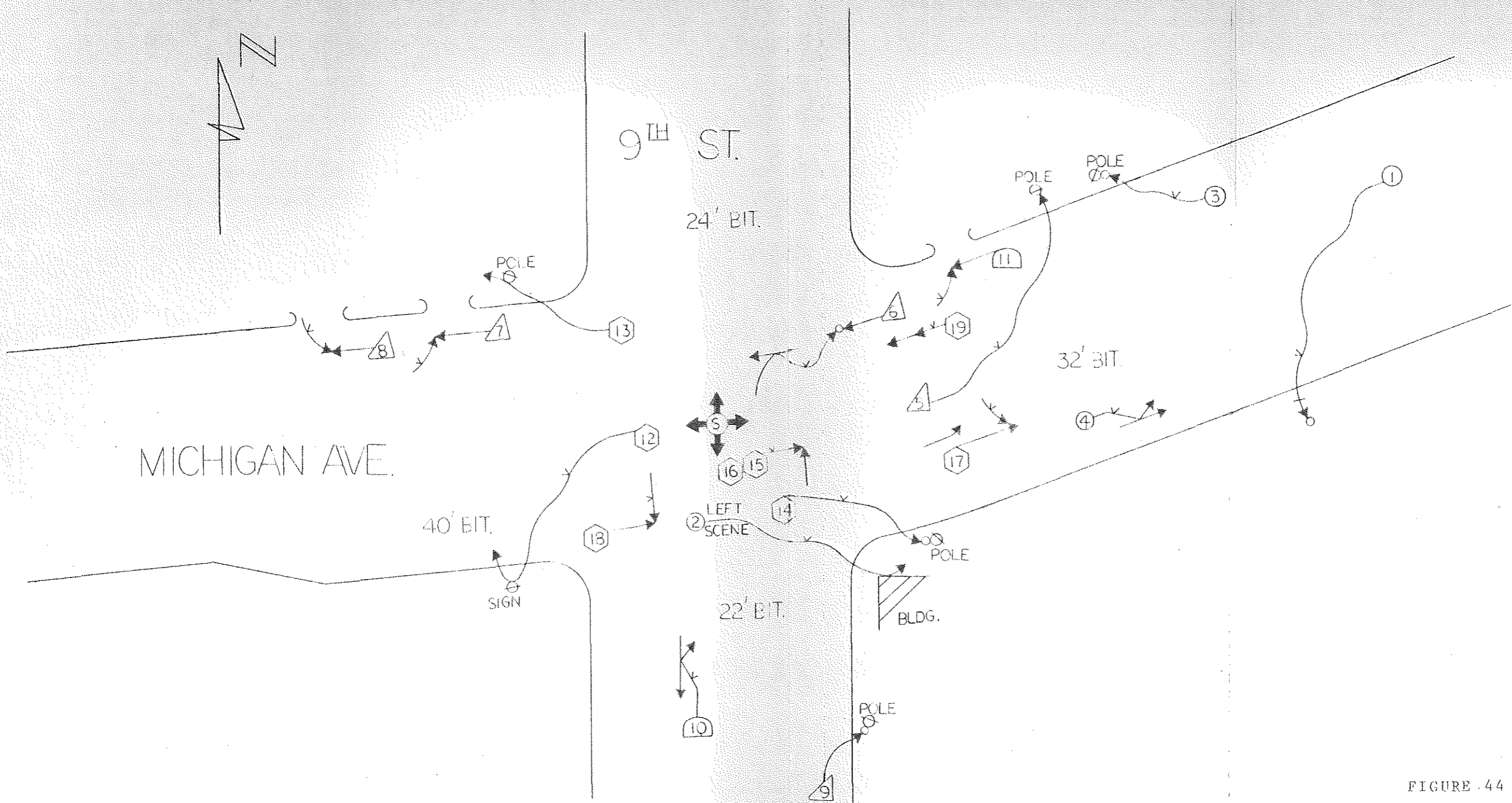


FIGURE 44

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<ul style="list-style-type: none"> <li>○ 1966</li> <li>◇ 1967</li> <li>△ 1968</li> <li>◐ 1969</li> <li>◑ 1970</li> </ul>	<p><b>Stop &amp; Go Signal</b> <b>Stop Sign</b> </p> <p><b>Flashing Beacon</b> <b>Yield Sign</b> </p> <p><b>Fatal</b> <b>Pedestrian</b> </p> <p><b>Injury</b> <b>Tree</b> </p> <p><b>Skidding</b> <b>Out of Control</b> </p> <p><b>Jackknife</b> <b>Driver Intent</b> </p> <p><b>Overturned</b> <b>Deer</b> </p> <p><b>Backing</b> <b>Violator</b> </p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>19</u></p> <p>P.D. <u>14</u></p> <p>Injury <u>5 (6)</u></p> <p>Fatal <u>0 ( )</u></p>	<p>ADT _____</p> <p>Rate _____ /100 mvm</p> <p>Rate _____ / mv</p>	<p>Location <u>MICHIGAN AVE. at 9<sup>th</sup> ST.</u></p> <p><u>OSHTEMO TWP.</u></p> <p><u>KALAMAZOO CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>4-6-71</u></p> <p>Plan No. <u>LOCATION 18</u></p>



EASTBOUND  
MICHIGAN AVENUE

SOUTHBOUND  
9TH STREET



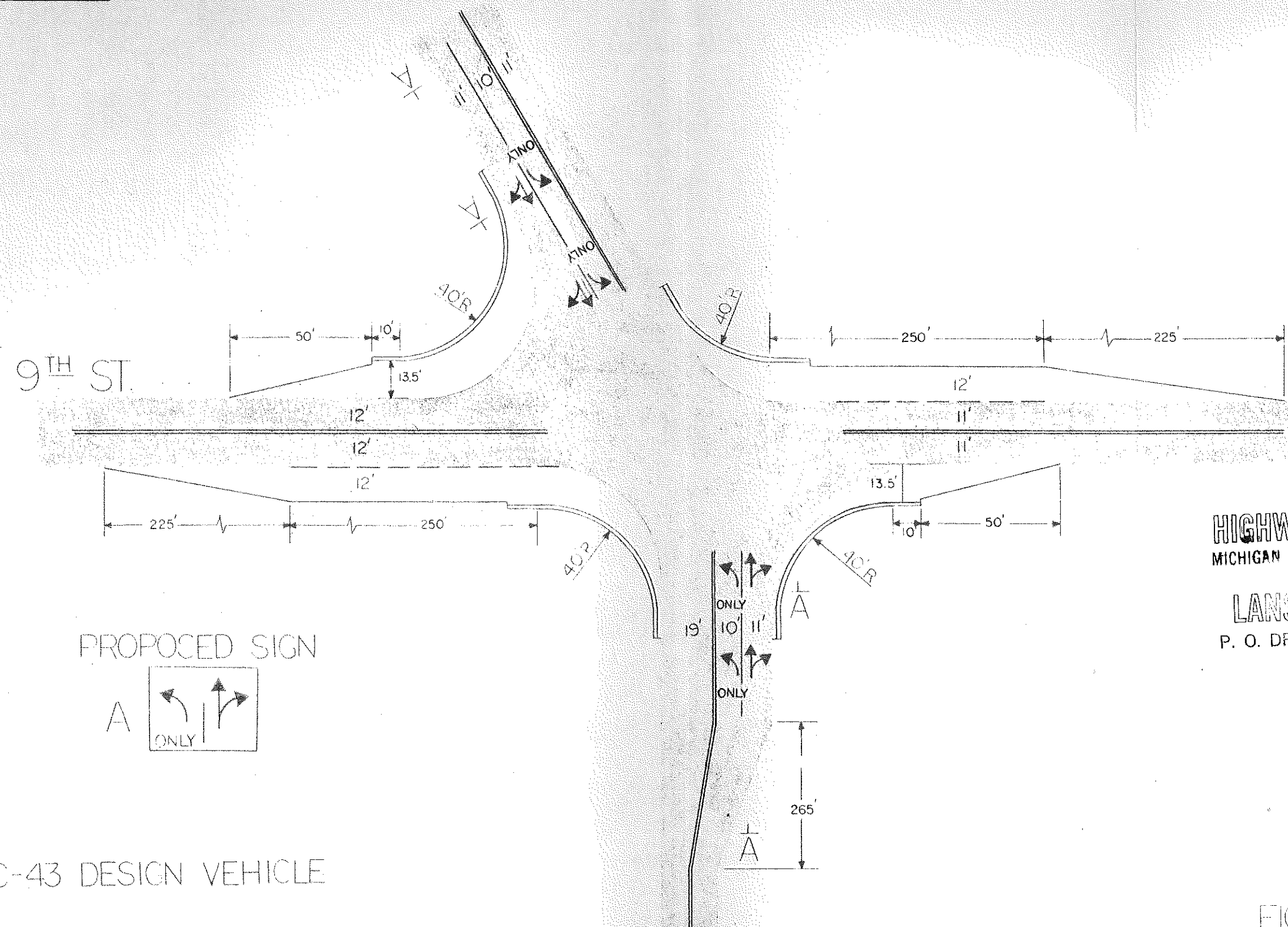
SOUTHWESTBOUND  
MICHIGAN AVENUE

FIGURE 45



MICHIGAN AVE

9<sup>TH</sup> ST.



PROPOSED SIGN



C-43 DESIGN VEHICLE

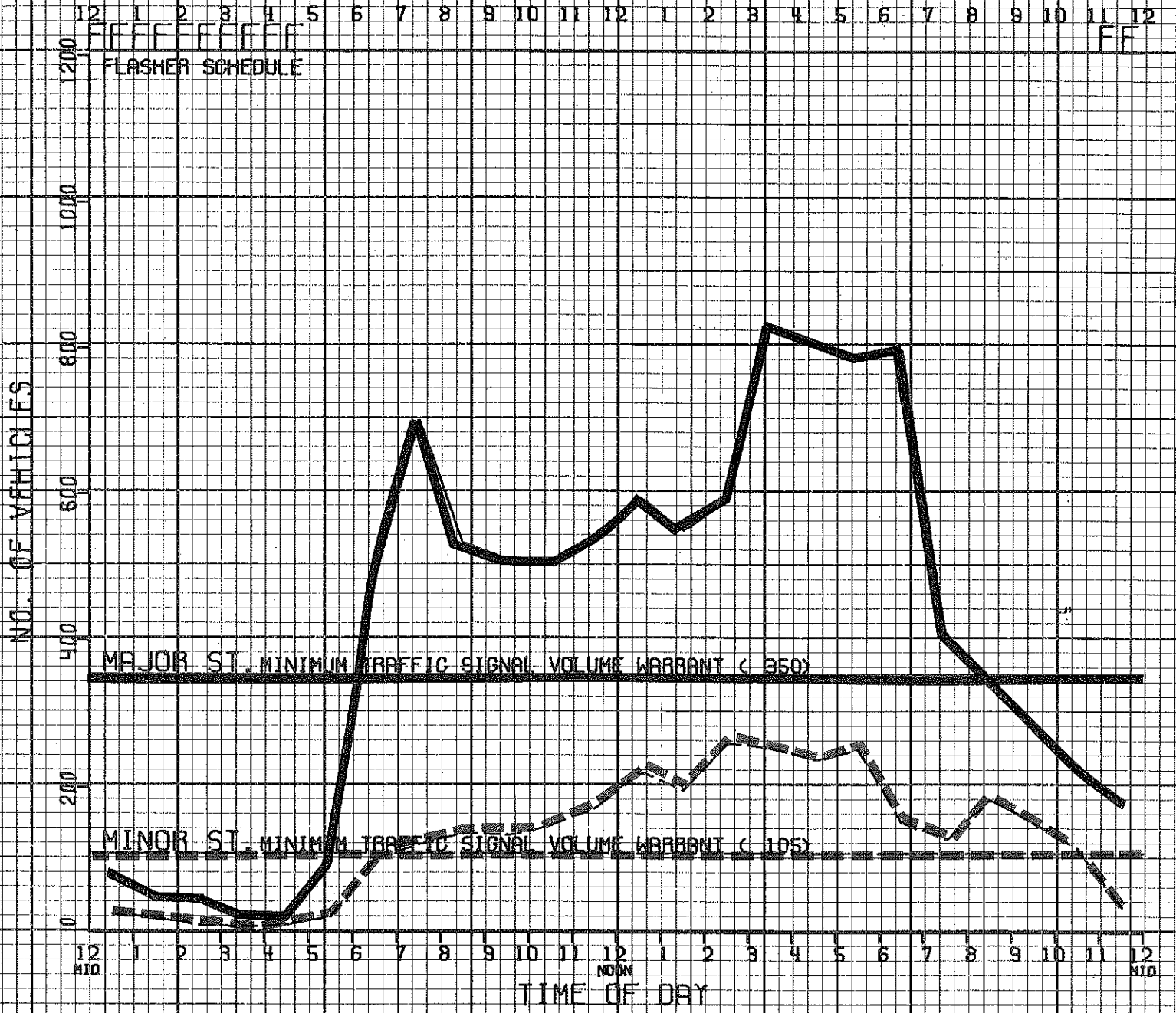
HIGHWAY LIBRARY  
 MICHIGAN DEPARTMENT OF STATE  
 HIGHWAYS  
 LANSING, MICH.  
 P. O. DRAWER "K" 48904

FIGURE 46

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DVW	MICHIGAN AVE. at 9 <sup>th</sup> ST. OSHTEMO TWP KALAMAZOO CO.
	CONT. SEC.	DATE	
	REF.	SCALE 1" = 40'	
	SHEET OF	PLAN LOCATION 18	



# TRAFFIC SIGNAL WARRANT GRAPH



## ANALYSIS

APPLICABLE WARRANT URBAN VEHICULAR

MAJOR STREET MEETS WARRANT 14 HOURS OF REQUIRED 8 HOURS

MINOR STREET MEETS WARRANT 16 HOURS OF REQUIRED 8 HOURS

ACCIDENTS REPORTED IN \_\_\_\_\_ RATE \_\_\_\_\_ /M.V.

ACCIDENTS REPORTED IN \_\_\_\_\_ RATE \_\_\_\_\_ /M.V.

SURVEY TAKEN 3-28-73 PLAN NO. 39000-00 DATE 08-06-73

MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS

TRAFFIC & SAFETY  
DIVISION

MICHIGAN AVE AT  
9TH ST  
OSHTMO TWP KALAMAZOO CO

FIGURE 47



## LOCATION 19

PORTAGE ROAD (NORTH LEG - F.A.S. 16 AND SOUTH  
LEG - F.A.S. 1598) AT "W" AVENUE (F.A.S. 244)

Portage Road and "W" Avenue form a four-legged intersection located in a rural area of Kalamazoo County. Portage Road has a two lane, 22 ft wide bituminous pavement, while "W" Avenue has a two lane, 24 ft wide bituminous pavement. There is a railroad crossing on "W" Avenue approximately one-quarter of a mile east of the intersection. Northbound Portage Road is the only leg of the intersection that does not have center line markings.

Portage Road has a 36 in. "Stop" sign on each corner. The sight distance from the south leg of Portage Road is adequate, but the sight distance from the north leg of Portage Road is inadequate due to a large tree that is in the line of sight. The only other traffic controls present are two 30 in. Crossroad Warning signs for east and westbound "W" Avenue traffic.

The collision diagram for this location from 1966 to 1970 shows a total of 16 accidents. Right-angle and ran-off roadway accidents accounted for 81 percent of this total. All nine of the right-angle accidents were caused by carelessness. The remaining accidents at this location consisted of two involving an improper turn and one involving an operator who disobeyed the railroad signal.

Recommendations

A definite accident pattern exists at this location in the form of nine right-angle accidents. There have been five right-angle accidents over the last two years of the study period. The accident warrant for the installation of a flashing beacon requires a minimum of six accidents over a two-year period that are considered correctable by the installation of a beacon. The accident history at this location is close to meeting the minimum requirements. It is recommended that a flashing beacon be installed if right-angle accidents increase in the future.

There is a sight distance problem for southbound Portage Road traffic due to a tree located in the northeast quadrant. It is recommended that this tree be maintained so that operators on southbound Portage Road can see westbound "W" Avenue traffic.

On all major rural highways having an even number of lanes center lines are necessary and should be applied throughout the entire length of the pavement. They should be applied on two-lane pavements 16 ft or more in width with prevailing speeds of greater than 35 mph. Thus, it is recommended that the center line be applied to northbound Portage Road.

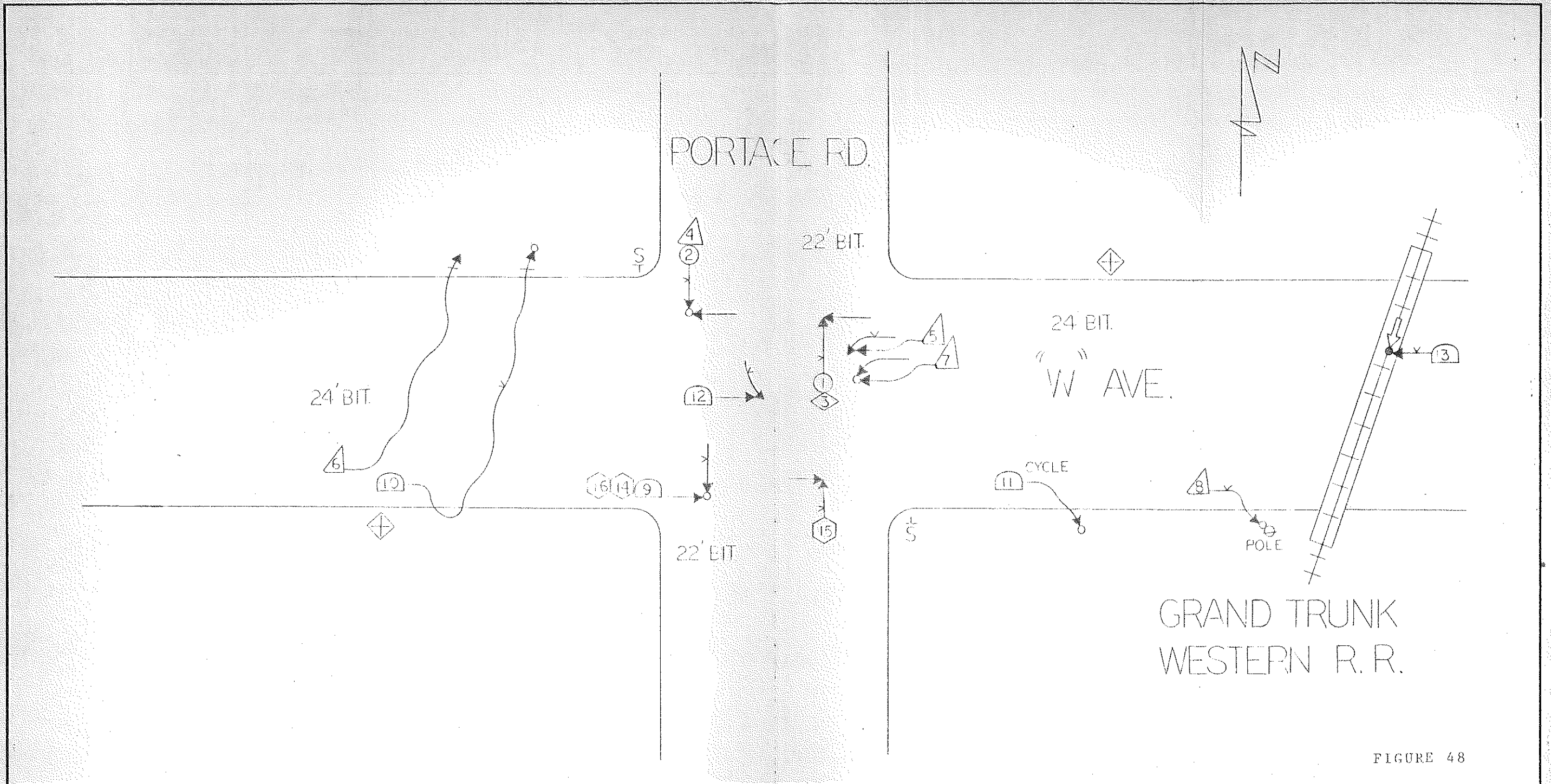


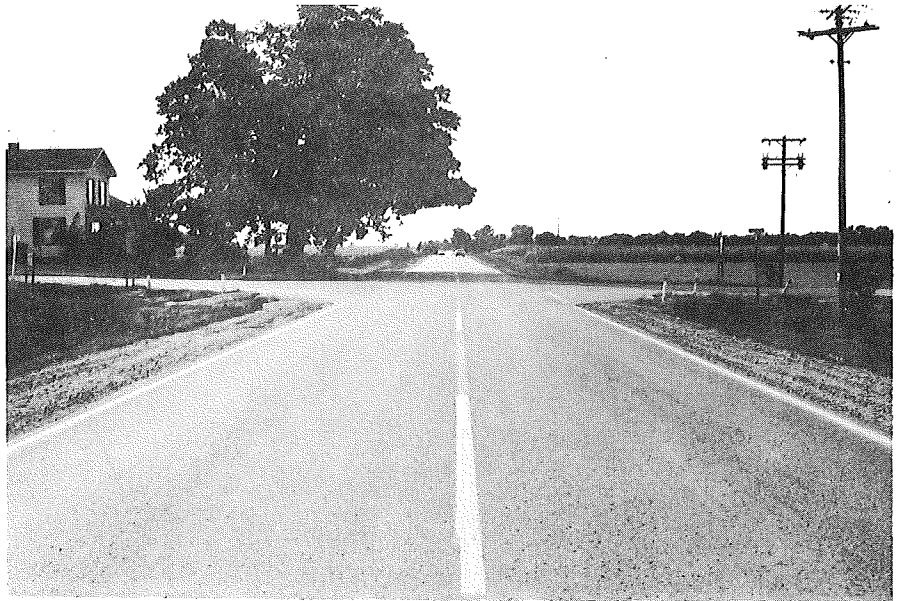
FIGURE 48

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM	MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<ul style="list-style-type: none"> <li>○ 1966</li> <li>◇ 1967</li> <li>△ 1968</li> <li>◡ 1969</li> <li>⬡ 1970</li> </ul>	<p>Stop &amp; Go Signal  Stop Sign  Flashing Beacon  Yield Sign </p> <p>Fatal  Pedestrian  Injury  Tree  Skidding  Out of Control  Jackknife  Driver Intent  Overturned  Deer  Backing  Violator </p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>16</u></p> <p>P.D. <u>6</u> ADT _____</p> <p>Injury <u>9 (16)</u> Rate _____ /100 mvm</p> <p>Fatal <u>1 (1)</u> Rate _____ / mv</p>	<p>Location <u>PORTAGE RD. at "W" AVE.</u></p> <p><u>SCHOOLCRAFT TWP.</u></p> <p><u>KALAMAZOO CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>4-12-71</u></p> <p>Plan No. <u>LOCATION 19</u></p>



NORTHBOUND  
PORTAGE ROAD

WESTBOUND  
"W" AVENUE



SOUTHBOUND  
PORTAGE ROAD

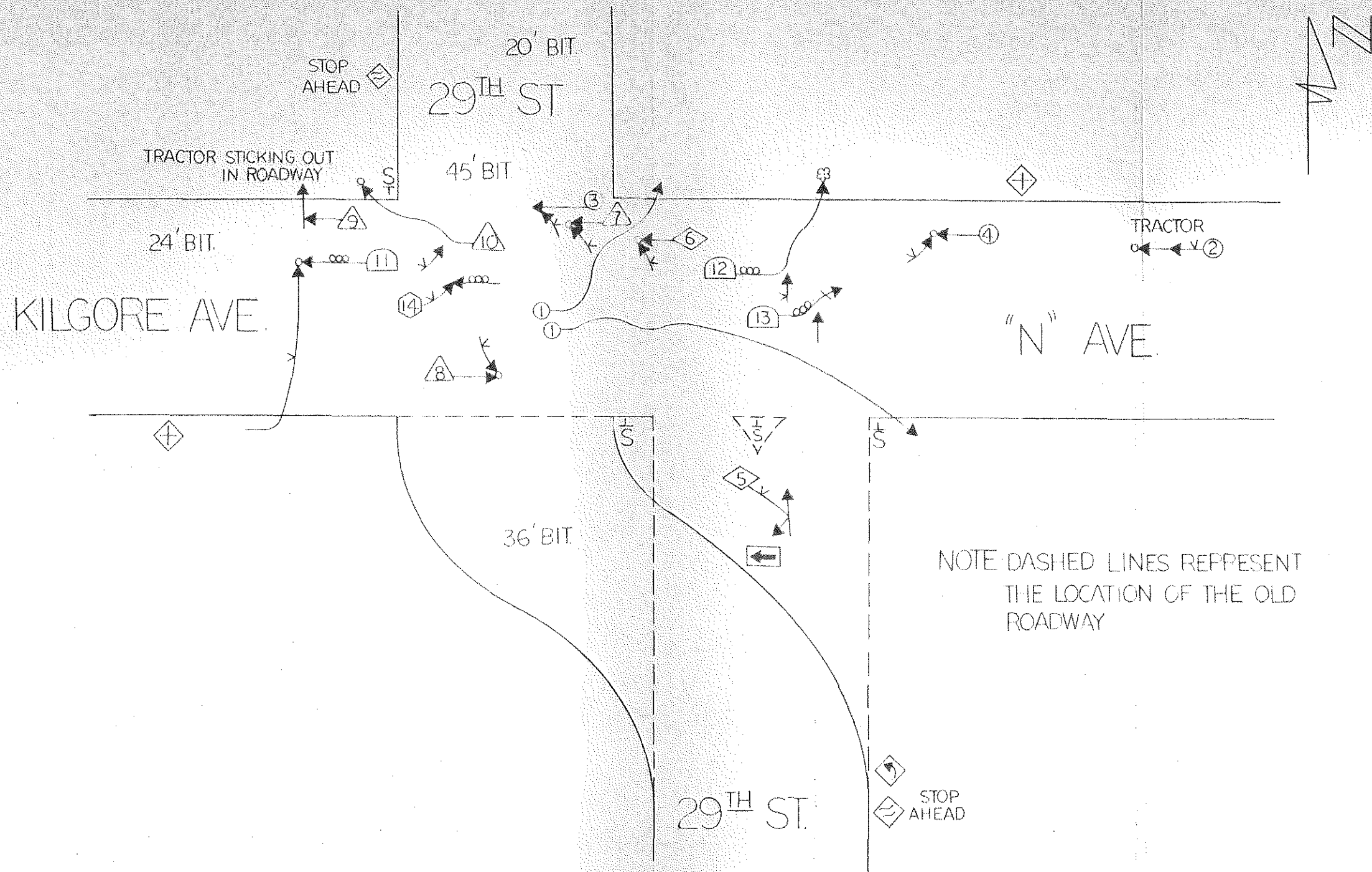
FIGURE 49

LOCATION 20

KILGORE AVENUE AND "N" AVENUE (F.A.S. 380)  
AT 29TH STREET (F.A.S. 1600)

Kilgore Avenue and "N" Avenue form a four-legged intersection with 29th Street. Traffic on Kilgore Avenue or "N" Avenue has the right-of-way with 29th Street traffic controlled by 36 in. "Stop" signs.

Kilgore Avenue and "N" Avenue both have two lane, 24 ft wide bituminous pavements. The north leg of 29th Street has a two lane, 20 ft wide bituminous pavement. The south leg of 29th Street, which was offset in relation to the north leg, had a two lane roadway with a traffic island separating the north and southbound lanes. Recent construction has removed the offset (See Drawing, p. 84 ) creating a 36 ft wide bituminous surface at the intersection. The additional signing erected for northbound traffic consisted of a 36 in. "Stop Ahead" sign, a 30 in. Curve sign and a 24 in. x 48 in. Target Arrow. It is recommended that the future accident reports for this intersection be checked to determine the effectiveness of the new construction.



NOTE DASHED LINES REPRESENT THE LOCATION OF THE OLD ROADWAY

FIGURE 50

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM	MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<ul style="list-style-type: none"> <li>○ 1966</li> <li>◇ 1967</li> <li>△ 1968</li> <li>◡ 1969</li> <li>◻ 1970</li> </ul>	<p>Stop &amp; Go Signal  Stop Sign  Yield Sign </p> <p>Flashing Beacon  Pedestrian </p> <p>Fatal  Tree </p> <p>Injury  Out of Control </p> <p>Skidding  Driver Intent </p> <p>Jackknife  Deer </p> <p>Overturned  Backing </p> <p>Violator </p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents: Total <u>14</u></p> <p>P.D. <u>7</u> ADT _____</p> <p>Injury <u>7 (17)</u> Rate _____ /100 mvm</p> <p>Fatal <u>0 ( )</u> Rate _____ / mv</p>	<p>Location <u>KILGORE, "N" AVE. at 29<sup>TH</sup> ST.</u></p> <p><u>COMSTOCK TWP.</u></p> <p><u>KALAMAZOO CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>4-5-71</u></p> <p>Plan No. <u>LOCATION 20</u></p>



EASTBOUND  
KILGORE AVENUE



SOUTHBOUND  
29TH STREET



NORTHBOUND  
29TH STREET

FIGURE 51

NORTHBOUND  
29TH STREET



NORTHBOUND  
29TH STREET



NORTHBOUND  
29TH STREET



FIGURE 52

LOCATION 21

MICHIGAN AVENUE (F.A.S. 1801) AT 6TH STREET  
(SOUTH LEG - F.A.S. 1599)

Michigan Avenue and 6th Street form a four-legged intersection in a rural area of Kalamazoo County. Michigan Avenue is a two lane, 30 ft wide bituminous roadway and 6th Street is a two lane, 20 ft wide bituminous roadway. Traffic volumes at this intersection are low, especially on 6th Street.

Michigan Avenue has the right-of-way at this intersection. There is a 24 in. "Stop" sign on the northwest corner of 6th Street and a 36 in. "Stop" sign on the southeast corner. There is also a 30 in. "Stop Ahead" sign for southbound 6th Street traffic and a 36 in. "Stop Ahead" sign for northbound 6th Street traffic. The traffic controls for Michigan Avenue consist of double yellow center line markings to prohibit passing and 30 in. Crossroad Warning signs for both east and westbound traffic.

There was a total of 14 accidents at this location during the five-year study period. Rear end and ran-off roadway accidents accounted for 71 percent of this total. Three of the five rear end accidents and two of the five ran-off roadway accidents happened during adverse pavement conditions. Four of the rear end accidents happened during an attempted left turn from westbound Michigan Avenue to southbound 6th Street. The remaining accidents at this location consisted of two sideswipes, one right-angle, and one improper turn.

Recommendations

Four of the five rear end accidents at this intersection involved westbound Michigan Avenue traffic attempting a left turn onto southbound 6th Street. Michigan Avenue has a negative gradient approaching 6th Street from both the easterly and westerly directions. Each of the four operators involved in the above mentioned rear end accidents claimed to have not seen the left turning vehicle in time to stop. It is recommended that Michigan Avenue in the immediate intersection area be painted so that there are three ten foot lanes with the center lane used for left turns. Painted arrows indicating lane assignments should be applied and two post-mounted Lane-Use Control signs, one located at the intersection and one located in advance of the intersection, should be erected for both legs of Michigan Avenue (Figure 56 ). These changes will enable Michigan Avenue traffic to continue through the intersection without stopping. It should considerably reduce the rear end accidents on Michigan Avenue.

Also, the Michigan Manual indicates that there should be 60 in. from the shoulder of the road to the bottom of a sign. The two Crossroad Warning signs on Michigan Avenue had a bottom height of 45 in. and the "Stop Ahead" sign for southbound 6th Street traffic had a

bottom height of 48 in. It is recommended that these signs be adjusted to correspond to the bottom height called for in the Michigan Manual.

6<sup>TH</sup> ST.

20' BIT.

STOP AHEAD

S  
T

30' BIT.

MICHIGAN AVE.

30' BIT.

20' BIT.

CAR BEING TOWED

STOP AHEAD

- 1966
- ◇ 1967
- △ 1968
- ◐ 1969
- ◑ 1970

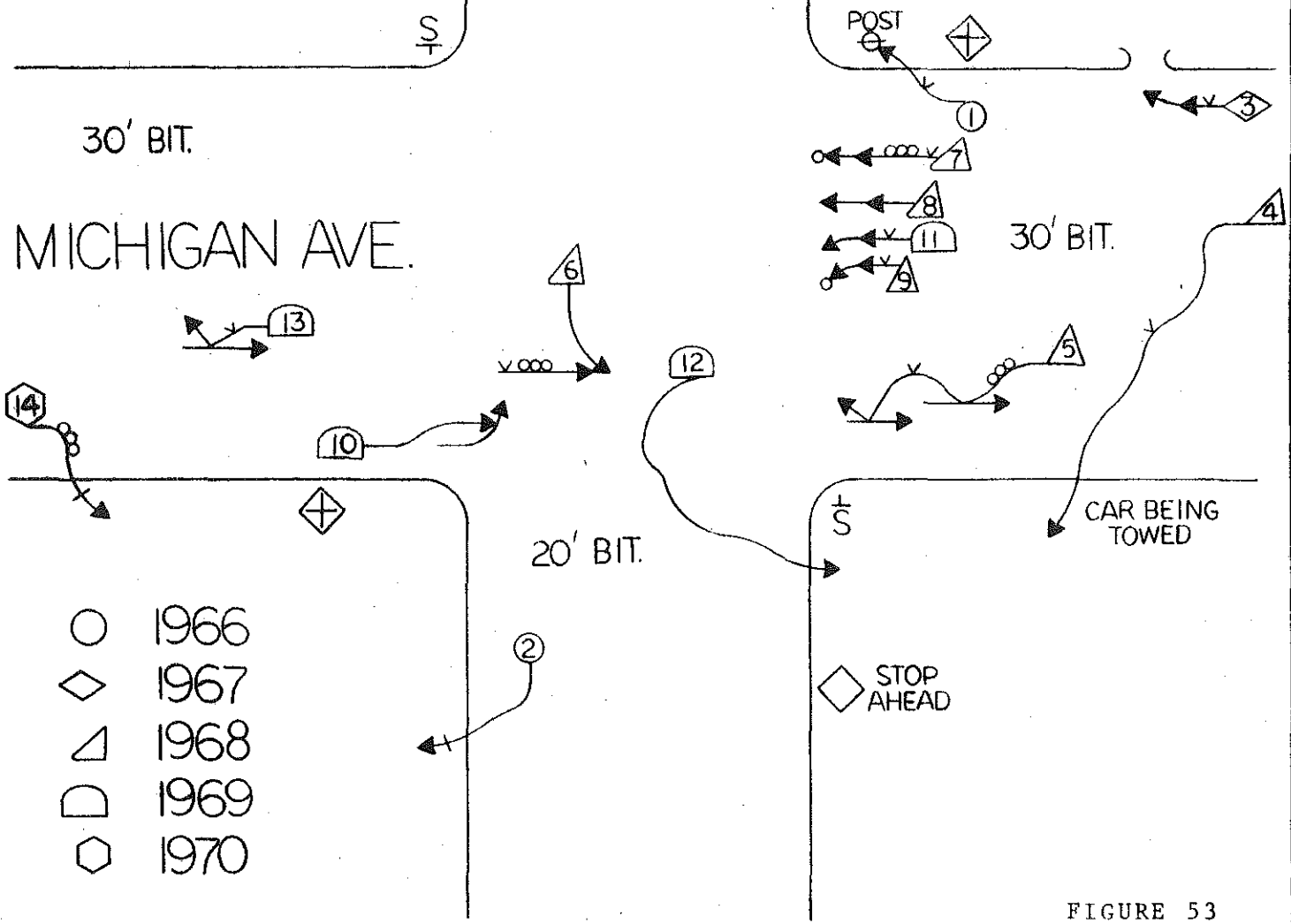


FIGURE 53

LEGEND

MICHIGAN DEPARTMENT OF STATE HIGHWAYS  
TRAFFIC AND SAFETY DIVISION

Stop & Go Signal Stop Sign S T  
Flashing Beacon Yield Sign Y T

Location MICHIGAN AVE. at 6<sup>th</sup> ST.  
OSHTEMO TWP.  
KALAMAZOO CO.

Fatal Pedestrian   
Injury Tree   
Skidding Out of Control   
Jackknife Driver Intent   
Overturned Deer   
Backing Violator

Period: 1966 THRU 1970  
Accidents - Total 14 P.D. 12  
Injury 2 (3) Fatal 0 ( )  
C.S. 0 Miles Drawn DVW  
Plan No. LOCATION 21 Date 4-12-71





EASTBOUND MICHIGAN AVENUE



WESTBOUND MICHIGAN AVENUE

FIGURE 54

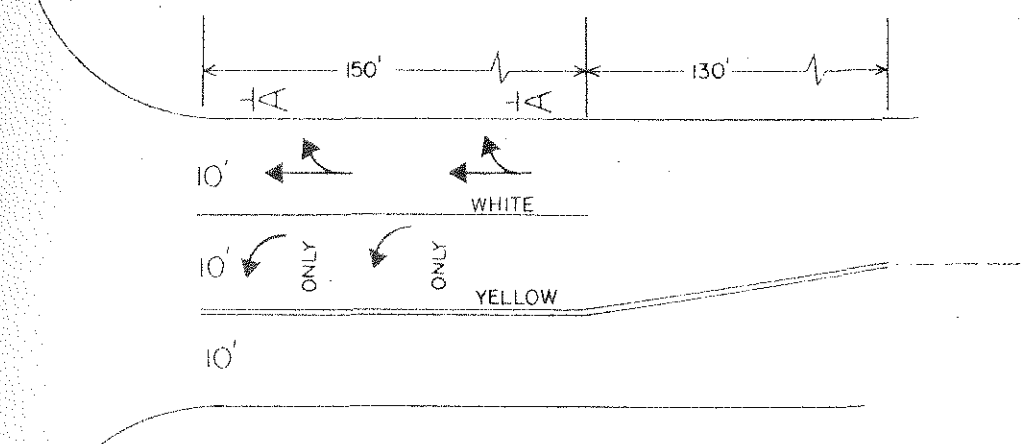
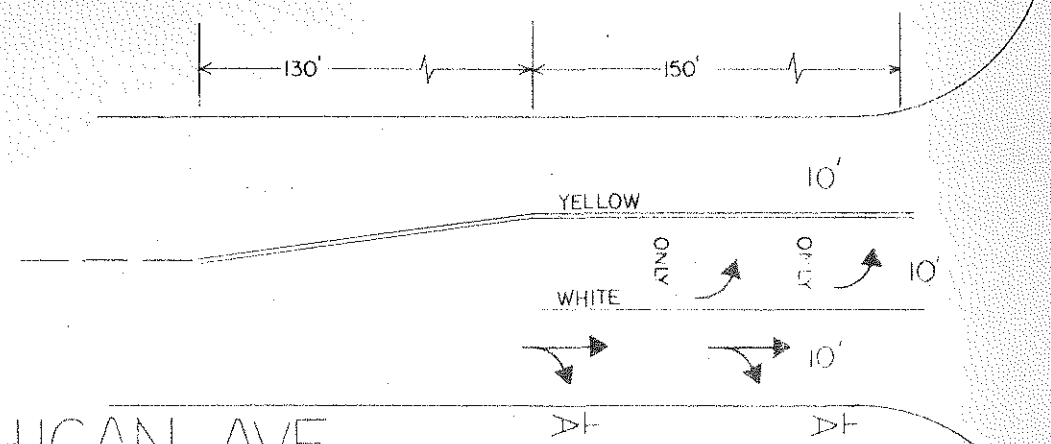


NORTHBOUND 6TH STREET



SOUTHBOUND 6TH STREET

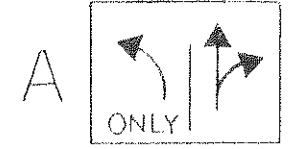
FIGURE 55



MICHIGAN AVE.

6<sup>TH</sup> AVE.

PROPOSED SIGNING



**HIGHWAY LIBRARY**  
 MICHIGAN DEPARTMENT OF STATE  
 HIGHWAYS  
 LANSING, MICH.  
 P. O. DRAWER "K" 48904

FIGURE 56

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DVW	MICHIGAN AVE. at 6 <sup>th</sup> ST.  OSHTEMO TWP.  KALAMAZOO CO.
	CONT. SEC.	DATE	
	REF.	SCALE # 1"=20'	
	SHEET OF	PLAN LOCATION 21	

LOCATION 22      OLMSTEAD ROAD (F.A.S. 19) AT LAKE STREET  
(F.A.S. 18)

Olmstead Road and Lake Street form a 90 degree turn. Both streets have 22 ft bituminous roadways with double yellow center line markings to prohibit passing. There are also 30 in. turn signs for both northbound Olmstead Road and westbound Lake Street.

Six of the ten accidents at this location during the five-year study period were the ran-off roadway type. Five of these accidents were reportedly caused by excessive speed. The remaining accidents at this location consisted of one sideswipe, one head-on, one rear end and one involving a motorcycle.

Recommendations

The accident problem at this location involves the sharp horizontal alignment between Olmstead Road and Lake Street. A majority of the ran-off roadway accidents were reportedly caused by excessive speed. It is recommended that 15 mph Advisory Speed Panels accompany the turn signs for both westbound Lake Street and northbound Olmstead Road. The 15 mph Advisory Speed Panel was selected on the basis of the following Devil Level readings:

<u>Speed</u>	<u>Westbound Lake Street</u>	<u>Northbound Olmstead Road</u>
15 mph	8°	10°
20 mph	14°	18°
25 mph	18°	22°

Furthermore, seven of the ten accidents at this location and five of the six ran-off roadway accidents occurred at night. It appears from these figures that the alignment of the roadway is not apparent to the drivers during darkness. Thus, it is recommended that 24 in. x 48 in. Target Arrows be placed in target position for both westbound Lake Street and northbound Olmstead Road.

In addition, there is a telephone pole in target position for both directions of traffic. These telephone poles are a safety hazard to the operators of vehicles that run off the roadway. Thus, it is recommended that these telephone poles be relocated so that they are not in target position.



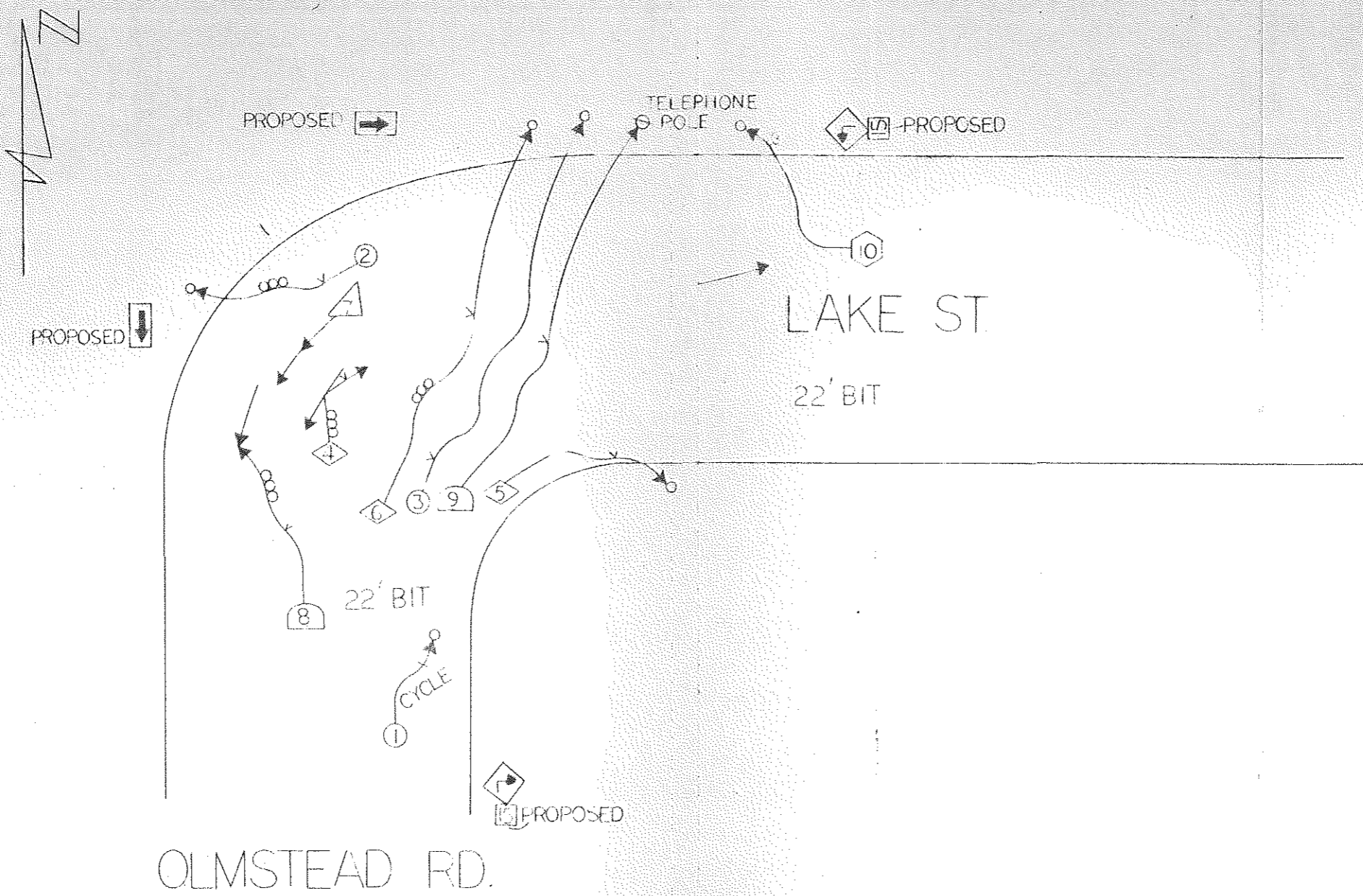


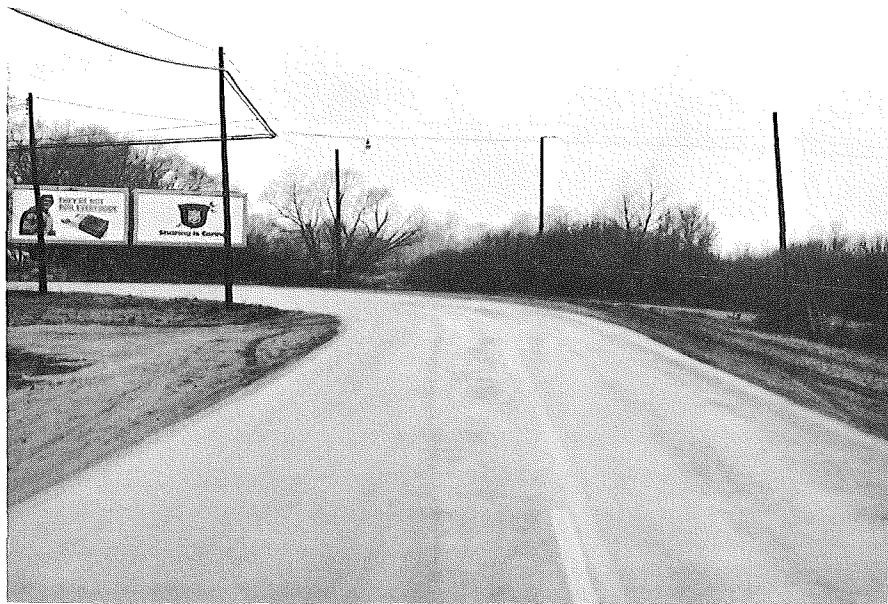
FIGURE 57

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM	MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION
<ul style="list-style-type: none"> <li>○ 1966</li> <li>◇ 1967</li> <li>△ 1968</li> <li>◡ 1969</li> <li>⬡ 1970</li> </ul>	<p>Stop &amp; Go Signal  Stop Sign  S</p> <p>Flashing Beacon  Yield Sign  Y</p> <p>Fatal  Pedestrian  X</p> <p>Injury  Tree  *</p> <p>Skidding  Out of Control  ~</p> <p>Jackknife  Driver Intent  V</p> <p>Overturned  Deer  V</p> <p>Backing  Violator  V</p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>10</u></p> <p>P.D. <u>4</u> ADT _____</p> <p>Injury <u>6 (8)</u> Rate _____ /100 mvm</p> <p>Fatal <u>0 ( )</u> Rate _____ / mv</p>	<p>Location LAKE ST. at OLMSTEAD PD. KALAMAZOO TWP. KALAMAZOO CO.</p> <p>C.S. _____ Miles _____ Drawn <u>DVW</u> Date <u>4-7-71</u> Plan No. <u>LOCATION 22</u></p>





NORTHBOUND OLMSTEAD ROAD



WESTBOUND LAKE STREET

LOCATION 23      40TH STREET (F.A.S. 393) AT  
"C" AVENUE (F.A.S. 897)

Fortieth Street and "C" Avenue form a right-angle, four-way stop intersection located in a rural area of Kalamazoo County. Fortieth Street, which is a two lane, 20 ft wide bituminous roadway, has a negative gradient approaching the intersection in both the north and southbound directions. The west leg of "C" Avenue has a two lane, 22 ft wide bituminous pavement while the east leg has a two lane, 20 ft wide bituminous pavement.

All four corners of this intersection have 36 in. "Stop" signs with accompanying "4-Way" panels. Northbound 40th Street has a 30 in. "Stop Ahead" sign mounted on lattice background for each side of the roadway and a 30 in. Crossroad sign for the east side of the roadway. Southbound 40th Street has a 30 in. "Stop Ahead" sign mounted on lattice background and a 30 in. Crossroad sign, both located on the west side of the roadway. Passing for north and southbound 40th Street traffic is prohibited south of the intersection by double yellow centerline markings.

There were ten accidents at this location during the five-year study period. Four of these were right-angle accidents, two of which occurred on wet pavement. Nine of the total accidents happened before 1969, which was the year the four-way stop was put into effect. There was only one accident in 1969 (a rear end) and no accidents in 1970. The remaining accidents at this location consisted of two ran-off roadways, two rear ends, one sideswipe, and one involving a parked car.

#### Recommendations

The number of accidents at this location has decreased since adoption of the four-way stop. It is recommended that future accident reports be checked to determine if the four-way stop remains effective.

Furthermore, the "Stop Ahead" signs on 40th Street are only 30 in. signs. A 30 in. "Stop Ahead" sign should be used in advance of a 24 in. "Stop" sign and a 36 in. "Stop Ahead" sign should be used in advance of a 30 or 36 in. "Stop" sign. Since 40th Street has 36 in. "Stop" signs, it is recommended that 36 in. "Stop Ahead" signs be used.

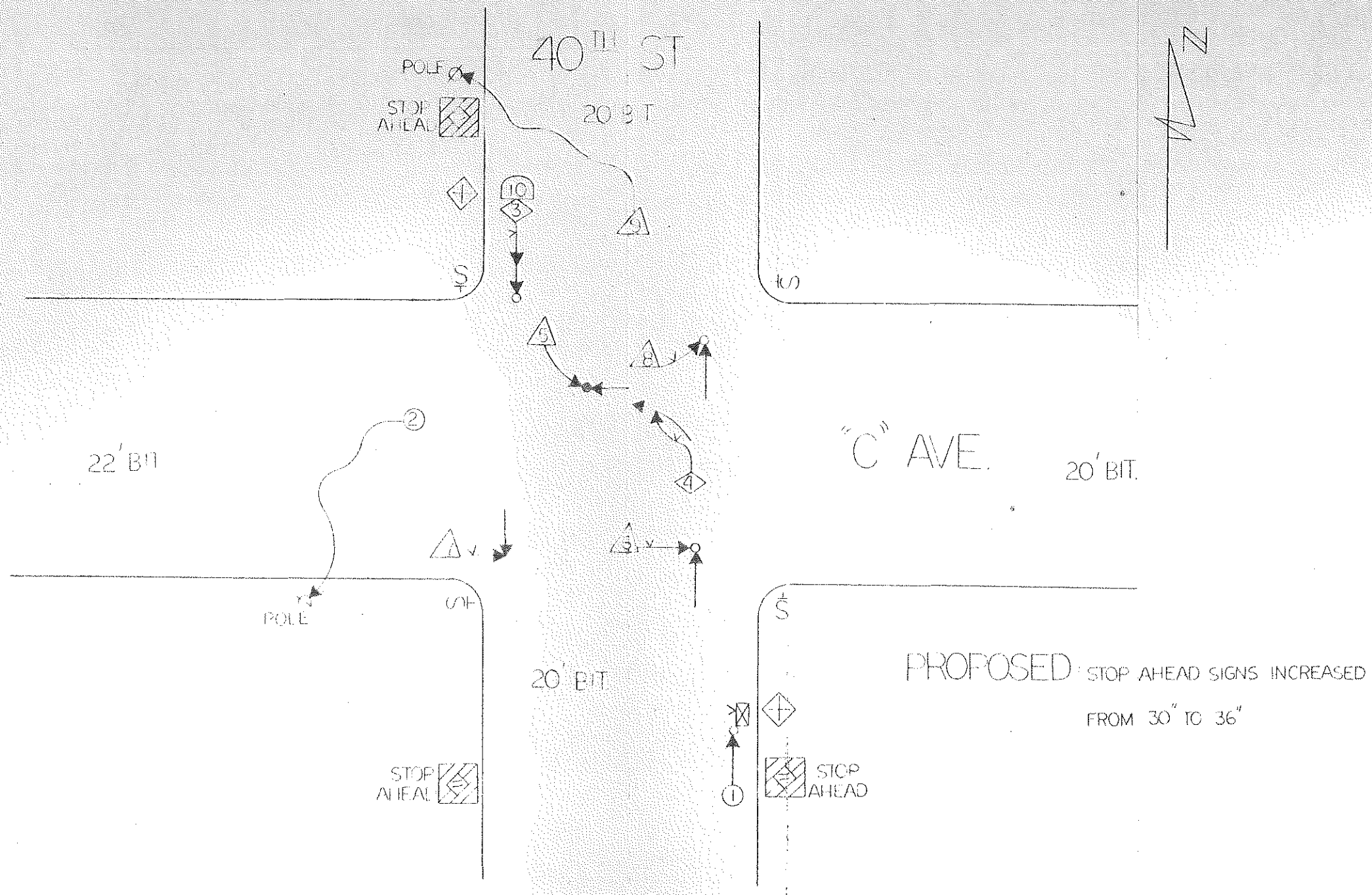


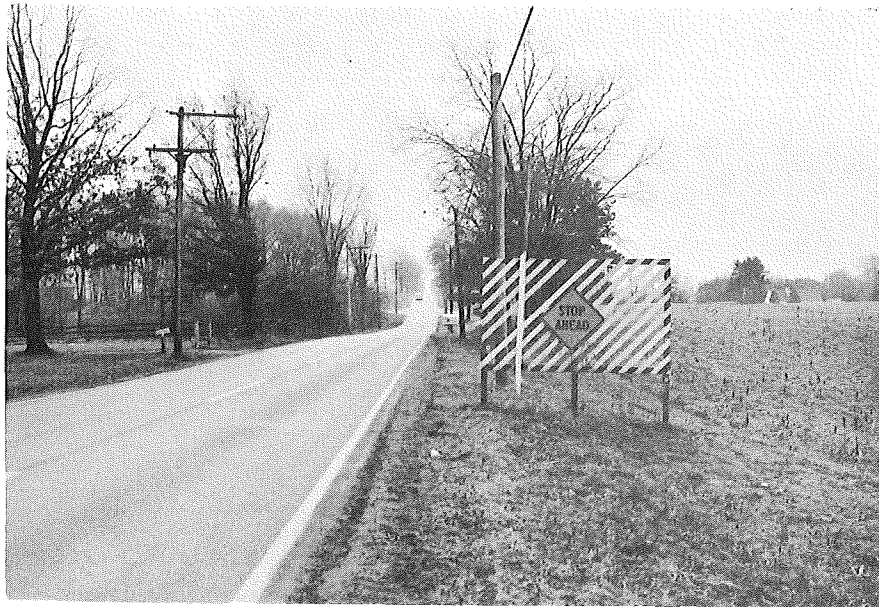
FIGURE 59

REMARKS	LEGEND	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
<p>○ 1966</p> <p>◇ 1967</p> <p>△ 1968</p> <p>◡ 1969</p> <p>⬡ 1970</p>	<p>Stop &amp; Go Signal </p> <p>Flashing Beacon </p> <p>Stop Sign </p> <p>Yield Sign </p> <p>Fatal </p> <p>Injury </p> <p>Skidding </p> <p>Jackknife </p> <p>Overtured </p> <p>Backing </p> <p>Pedestrian </p> <p>Tree </p> <p>Out of Control </p> <p>Driver Intent </p> <p>Deer </p> <p>Violator </p>	<p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>10</u></p> <p>P.D. <u>4</u></p> <p>Injury <u>5 (11)</u></p> <p>Fatal <u>1 (1)</u></p>	<p>ADT _____</p> <p>Rate _____ /100 mv.m</p> <p>Rate _____ / mv</p>	<p>Location <u>40<sup>th</sup> ST. at "C" AVE.</u></p> <p><u>ROSS TWP.</u></p> <p><u>KALAMAZOO CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>4-6-71</u></p> <p>Plan No. <u>LOCATION 23</u></p>	



NORTHBOUND  
40TH STREET

NORTHBOUND  
40TH STREET



SOUTHBOUND  
40TH STREET

FIGURE 60





SOUTHBOUND  
40TH STREET

EASTBOUND  
"C" AVENUE



WESTBOUND  
"C" AVENUE

FIGURE 61



LOCATION 24

RIVERVIEW DRIVE (F.A.S. 1194) AT MT. OLIVET  
DRIVE (F.A.S. 1604)

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
8	7	1	0

LOCATION 25

PARKVIEW AVENUE (F.A.S 395) AT 11TH STREET

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
6	1	4	1

SUMMARY OF RECOMMENDATIONS

High Accident Locations

The Department of State Police submitted 25 high accident locations for Kalamazoo County to the Michigan Department of State Highways and Transportation. After an in depth study of these locations, recommendations were formulated for 19 of them. The locations, their recommendations and the approximate cost of these recommendations is as follows:

<u>Location Number</u>	<u>Location Description</u>	<u>Recommendations</u>	<u>Estimated Costs</u>		
1	Shaver Road at Centre Avenue	Prohibit left turn from southbound West-nedge Avenue.	\$ 25.00		
		Erect a route direction sign indicating access to eastbound Centre Avenue.	22.00		
		Install 12 in. signal heads.	1,200.00		
		Install an extra signal head east of the railroad tracks.	450.00		
		A back-to-back amber should be incorporated into the signal timing. Approaching trains should activate a solid red indication for Centre Avenue.			
		Erect railroad advance warning signs.	66.00		
		TOTAL	\$ 1,763.00		
		2	Portage Road at Centre Avenue	Erect five signal heads with one signal equipped with left turn phases for Portage Road and the west leg of Centre Avenue.	\$ 2,000.00
				Apply center line and lane line markings to each leg.	80.00
				Apply left turn arrows to the center lane on Portage Road.	280.00
TOTAL	\$ 2,360.00				

<u>Location Number</u>	<u>Location Description</u>	<u>Recommendations</u>	<u>Estimated Costs</u>
3	Mosel Avenue from Burdick Street to Pitcher Road	Locate the signals for Burdick Street and Mosel Avenue over the center of the intersection.	\$ 300.00
		Keep the brush growth located in the southeast quadrant of Pitcher Road and Mosel Avenue trimmed. Skidometer tests should be conducted at the railroad crossing.	250.00
		TOTAL	\$ 550.00
4	Westnedge Avenue at Centre Avenue	Increase the amber time to 7 percent.	
		Add 9 ft to the north side of Centre Avenue from Westnedge Avenue west to Shaver Road and east 250 ft with a 225 ft taper.	\$42,863.00
		Center lines and lane lines should be applied to Centre Avenue.	34.00
		Westnedge Avenue should be painted for three lanes.	20.00
		Painted arrows indicating lane assignments should be applied.	420.00
		Erect four post-mounted Lane-Use Control signs.	110.00
		\$43,447.00	
5	East Main Street from Humphrey Street to Stanford Street	Erect one post-mounted Lane-Use Control sign.	\$ 28.00
		Erect two "No Left Turn" signs.	55.00
		Erect a route direction sign indicating access to westbound Humphrey Street via Chicago Street.	22.00
			\$ 105.00

<u>Location Number</u>	<u>Location Description</u>	<u>Recommendations</u>	<u>Estimated Costs</u>
6	Portage Road at Milham Road	Skidometer tests should be conducted.	\$ 250.00
		Resurface the north leg of Portage Road and widen it to 55 ft using a 30 ft approach road connection for the east leg of Milham Road.	42,000.00
		Portage Road should be striped for five lanes.	60.00
		Painted arrows should be applied to the center lane of Portage Road.	280.00
		An internally illuminated case sign which says "Left Turn Lane" should be erected over the center lane of Portage Road.	179.00
		TOTAL	\$42,769.00
8	East Main Street at Nazareth Road	Skidometer tests should be conducted.	\$ 250.00
		Erect 30 in. "Stop" signs.	55.00
		Construct flares for the east leg of East Main Street and use a 30 ft approach road connection for the south leg of Nazareth Road.	45,500.00
		TOTAL	\$45,805.00
9	Sprinkle Road at Meredith Road	Skidometer tests should be conducted.	\$ 250.00
		Erect two 36 in. "Stop" signs.	66.00
		TOTAL	\$ 316.00
10	Douglas Avenue at "D" Avenue	Install 12 in. signal heads.	\$ 1,200.00
		The east leg of "D" Avenue should be striped for three lanes.	13.00

<u>Location Number</u>	<u>Location Description</u>	<u>Recommendations</u>	<u>Estimated Costs</u>
		Eight ft should be added to the north side of the west leg to create three 12 ft lanes.	\$ 9,410.00
		Painted arrows should be applied to both legs of "D" Avenue.	420.00
		Erect two post-mounted Lane-Use Control signs.	55.00
		Erect two 36 in. "Stop Ahead" signs.	66.00
		The bushes in the south-east quadrant should be maintained.	
		TOTAL	\$11,164.00
11	Douglas Avenue at Mosel Avenue and Barney Road	Erect two stop and go signals.	\$ 5,000.00
		Construct a Type 3 right turn flare on both Mosel Avenue and Barney Road.	40,275.00
		Conduct skidometer tests.	250.00
		Erect two 36 in. "Stop Ahead" signs until the signals are in place.	66.00
		TOTAL	\$45,591.00
12	Centre Avenue at Oakland Drive	Erect two 36 in. "Stop Ahead" signs at the minimum height called for in the Michigan Manual.	\$ 66.00
		Apply lane lines on all four legs of the intersection.	40.00
		TOTAL	\$ 106.00



<u>Location Number</u>	<u>Location Description</u>	<u>Recommendations</u>	<u>Estimated Costs</u>	
15	Centre Avenue at Lovers Lane	Install two 12 in. flashers to replace the existing 8 in. heads.	\$ 652.00	
		Erect a 30 in. "Stop Ahead" sign for the north leg of Lovers Lane.	28.00	
		Maintain the brush in the southeast and southwest quadrants.		
		TOTAL	\$ 680.00	
16	Douglas Avenue at Edison Street	Skidometer tests should be conducted.	\$ 250.00	
		The brush surrounding the "Stop Ahead" sign should be cut down or the sign should be moved.		
		TOTAL	\$ 250.00	
18	Michigan Avenue at 9th Street	A Type 3 right turn flare should be constructed for both north and southbound 9th Street.	\$50,000.00	
		East and westbound Michigan Avenue should be marked for three lanes.	30.00	
		Painted arrows should be applied to both legs of Michigan Avenue.	420.00	
		Four post-mounted Lane-Use Control signs should be erected.	110.00	
		The utility company should be contacted to determine the feasibility of reducing the number of utility poles.		
				TOTAL

<u>Location Number</u>	<u>Location Description</u>	<u>Recommendations</u>	<u>Estimated Costs</u>
19	Portage Road at "W" Avenue	The tree located in the northwest quadrant that causes inadequate sight distance should be kept trimmed. The centerline should be applied to the north leg of Portage Road.	\$ 50.00
		TOTAL	\$ 50.00
21	Michigan Avenue at 6th Street	Michigan Avenue should be painted to provide three 10 ft lanes. Painted arrows should be applied to both legs of Michigan Avenue. Four post-mounted Lane-Use Control signs should be erected. The two Crossroad Warning signs and the "Stop Ahead" warning sign for south-bound 6th Street should be raised to the minimum bottom height in the Michigan Manual.	\$ 15.00 420.00 110.00 10.00
		TOTAL	\$ 555.00
22	Olmstead Road at Lake Street	Erect two Advisory Speed Panels. Erect two 48 in. Target Arrows. Relocate telephone poles that are in target position.	\$ 44.00 55.00
			\$ 99.00
23	40th Street at "C" Avenue	Erect two 36 in. "Stop Ahead" signs.	\$ 66.00
		TOTAL	\$ 66.00

The total cost of the recommendations formulated at the 19 high accident locations is \$246,236.00.

County-Wide Recommendations

1. Apply wet pavement accident criteria to locations throughout the county to determine where slippery pavement conditions exist.
2. At any signalized location a minimum of two vehicular signal faces should be provided per approach.
3. All signal installations should have a minimum amber time of four seconds and a maximum time of 4.5 seconds.