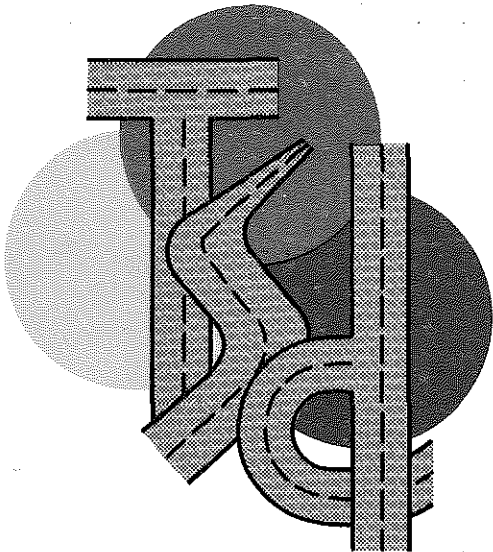


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A TRAFFIC ACCIDENT ANALYSIS
OF HIGH ACCIDENT LOCATIONS
IN ST. JOSEPH COUNTY

Report TSD-SS-140-70



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A TRAFFIC ACCIDENT ANALYSIS
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by

OSCAR E. VARGAS

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

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February, 1971

STUDY CONDUCTED BY THE
Safety & Surveillance Section
Traffic & Safety Division
Bureau of Operations
Michigan Department of State Highways

in cooperation with
National Highway Traffic Safety Administration
Department of Transportation

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"The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration."

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INTRODUCTION

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

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

The State of Michigan carries out a program of this type on the State trunkline system; however, many of the State's city and county agencies lack the financial and technical prerequisites necessary to pursue similar programs with similarly defined objectives. To insure that this Highway Safety Standard is met and to improve the overall evaluation of the accident picture in Michigan, the Michigan Department of State Highways requested and received through the Office of Highway Safety Planning in the

Executive Office of the Governor a federally funded project entitled "Traffic Accident Analysis for Cities and Counties". The intent of this new project is to provide a special traffic engineering field service for cities and counties. In cooperation with participating cities and counties, the proposed service under the direction of Department personnel will make a traffic engineering evaluation of the factors causing traffic accidents and will recommend engineering corrections to those conditions which may be contributing to accidents.

SCOPE

As highway engineers, we have very little influence on changing or correcting the motorist's ability to drive (driver education, experience and enforcement) or for the condition of the vehicle (manufacturer's design and owner responsibility). We do have, however, the responsibility to construct, operate and maintain the roadway environment within feasible economic and design limits so that the driver and vehicle can function safely within the environment.

The intent of the "Traffic Accident Analysis for Cities and Counties" program is to improve traffic safety on all Michigan streets and roads by expanding the traffic engineering evaluation of factors causing accidents. This

is accomplished by conducting a traffic accident analysis of locations which experience high accident frequencies and then summarizing recommendations for corrective action.

STUDY PROCEDURES

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

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 St. Joseph County (and providing an inventory of those locations) was designated as State Police responsibility. Because a modern and automatic system of locating accidents on the county road system has not yet been established, the high accident locations for St. Joseph County were determined by manually extracting and compiling those locations with the highest number of accidents from the 1968 county accident reports. The year 1968 was considered the base year for our study. From this list, the 14 highest accident locations were selected.

Once the problem locations were identified, additional accident information for the years 1966, 1967 and 1969 was compiled in order to expand the accident base at each location. Upon completion of this portion of the data collection, the Department of State Police documented and transmitted to the Traffic and Safety Division of the Department of State Highways a list, along with the accident reports, of the high accident locations for St. Joseph County.

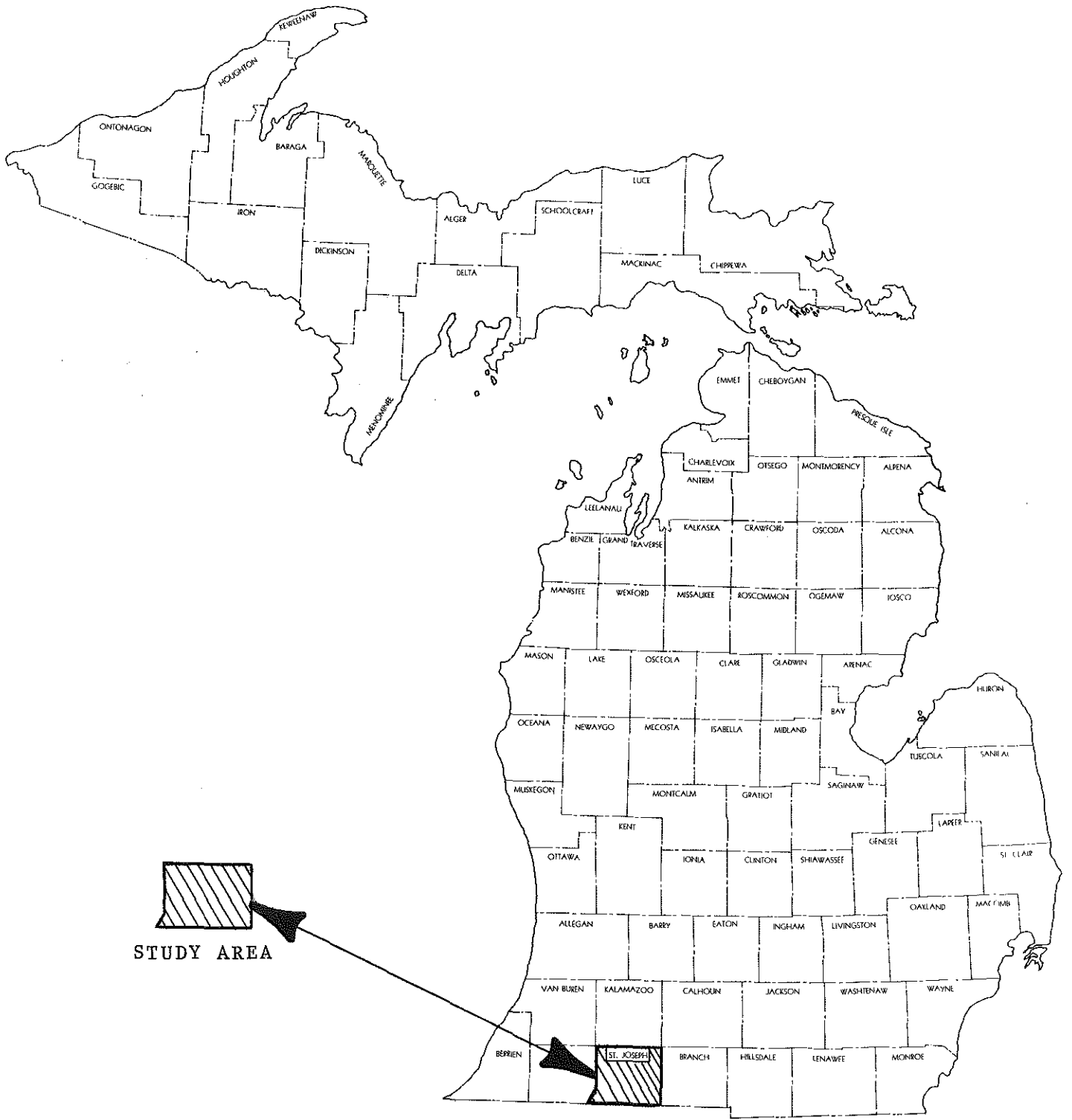
The second portion of the data collection phase, which is the responsibility of the Department of State Highways, involves preparation of collision diagrams and, if necessary, physical condition diagrams and traffic counts for selected locations.

The accident analysis and traffic engineering evaluation phases involve the detailed analysis of the summarized facts and field data and prescribing the proper corrective treatment.

STUDY AREA

St. Joseph County is located in southern Michigan (see map following page). It is bordered on the north by Kalamazoo County, the west by Cass County, the east by Branch County and on the south by the Indiana counties of Elkhart and LaGrange.

The county is divided into 16 townships with an inland water area of 10 square miles and a total area of 508



MAP 1

square miles.

The county's 1960 population was 42,332. This was a 20.7 percent increase over the 1950 census. Part of this large increase in population is accounted for by a net migration to the county equivalent to 7.8 percent in the period 1950 to 1960. Population projections for the next two decades or so indicate that St. Joseph County will continue to grow but at a smaller rate than in the past. The projection indicates an expected increase of 29.1 percent in the period 1960-1990 (see Table I, Appendix I, p. 84). The 1960 census shows that 37.8 percent of the population was urban. The majority of the urban population was concentrated in the cities of Sturgis and Three Rivers.

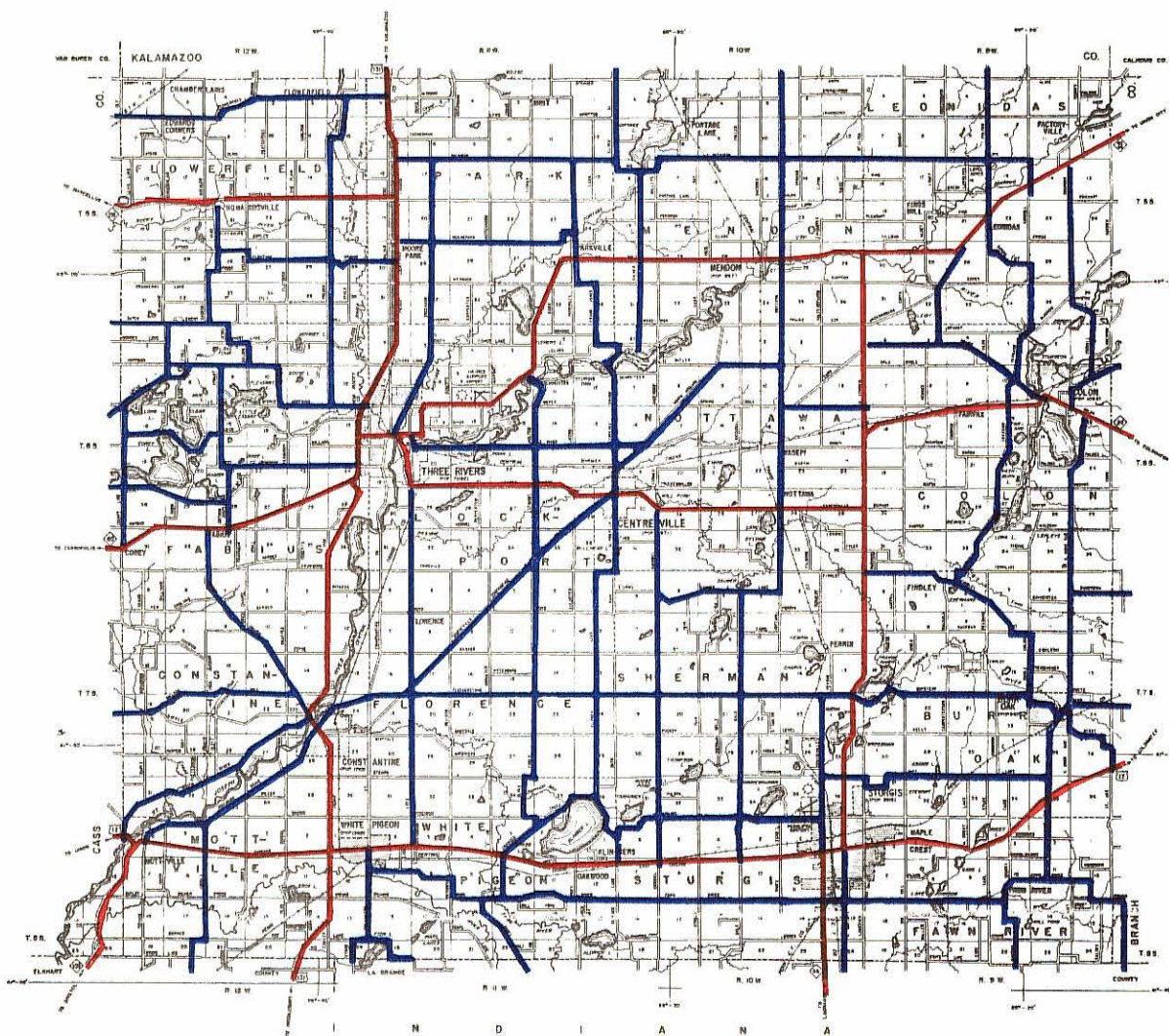
St. Joseph County is primarily an agricultural county with 75.2 percent of its land area in farms (according to 1964 statistics, U. S. Department of Commerce). Production of natural resources is very limited and directed mainly to sand, gravel, peat and stone.

The employed labor force of St. Joseph County was 16,361 in 1960 with small manufacturing accounting for 42 percent of the total employment. In 1960 there were 140 establishments in the county covering a wide variety of manufacturing industries.

According to the Eighteenth Annual Progress Report, as compiled by the Local Government Division of the Michigan Department of State Highways, St. Joseph County has 1,107.76 miles of highways excluding city and incorporated

village streets and roads. This includes 111.25 miles of state trunkline, 317.28 miles of county primary and 679.23 miles of local roads. Of the 996.51 miles of county roads, 544.86 miles are hard surfaced and the remaining mileage is either gravel, graded and drained earth or unimproved road (see county map following page).

Traffic congestion is not a problem in St. Joseph County. The total number of accidents had a sharp increase in 1968. However, this can be attributed to increased exposure. From 1968 to 1969 the increase in the number of accidents on county roads was 2.79 percent compared to a statewide increase of 8.42 percent for the same period.

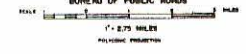


- STATE TRUNKLINE
- COUNTY PRIMARY
- COUNTY LOCAL

ST. JOSEPH COUNTY

MICHIGAN
STATE HIGHWAY COMMISSION
DEPARTMENT OF STATE HIGHWAYS

DATA OBTAINED FROM
HIGHWAY PLANNING SURVEY
CONDUCTED IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
BUREAU OF PUBLIC ROADS



ST. JOSEPH COUNTY MICIGAN

MAP 2

GLOSSARY

The term "Manual" when used in this report will refer to the "Michigan Manual of Uniform Traffic Control Devices"; publication prepared by the Michigan Department of State Highways in conjunction with the Michigan State Police.

Excerpts of the Manual are included in Appendix II.

TRAFFIC ENGINEERING ANALYSIS

Compared to the millions of vehicle miles traveled, accidents are very rare events. However, they are the only present means available to indicate a failure in the driver-road-vehicle environment. Any of these three may be a major contributor to an accident.

In our analysis, we examined the contributing factors from the viewpoint of a highway traffic engineer with special attention to the effect which the highway environment may have had on the accident. At each high accident location, individual accident reports were reviewed in detail and the accident facts were tabulated and grouped in various tables. It was apparent that no unusually high concentration of accidents existed at any one location. In fact, the highest total at any one location for the four-year study period was 20 accidents and this location included two intersections (see Location 1, pps. 13 - 20).

The first step in the traffic engineering analysis phase of St. Joseph County's high accident locations was the preparation of collision diagrams. At each location, accidents were grouped in order to locate the accident in relation to the intersection, approaches to the intersection or section of roadway. The various methods of accident analysis are intended to probe into the detailed

aspects of the accidents to determine the reasons for their occurrence.

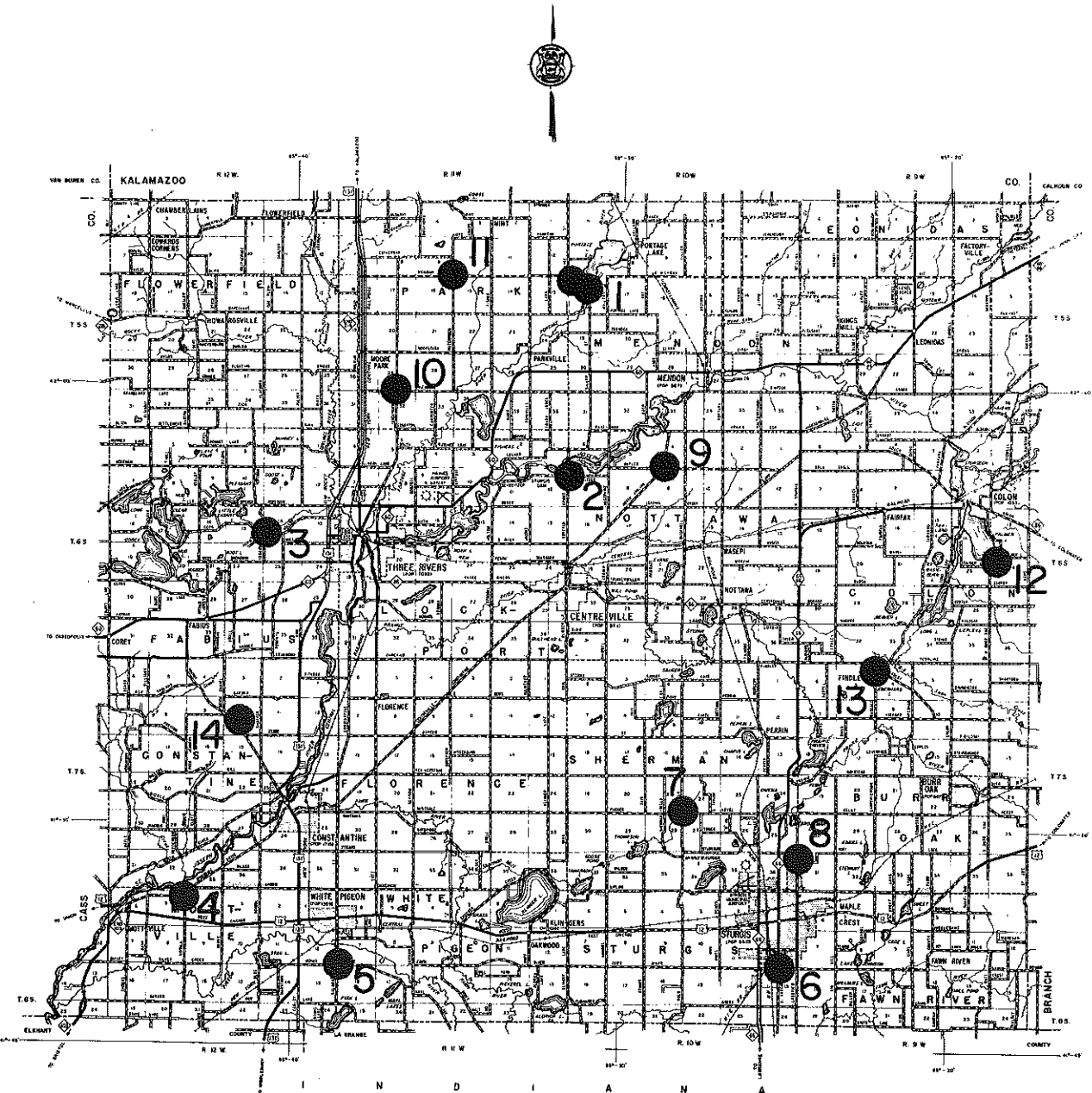
To further document the various facts present at the 14 high accident locations in St. Joseph County, the following tables were prepared to analyze the specific data.

4. Annual Accident Summary
5. Monthly and Daily Accident Occurrence
6. Daily and Hourly Accident Occurrence
7. Weather Conditions at Scene of Accidents
8. Pavement Conditions at Scene of Accidents
9. Age of Drivers Involved in Accidents
10. Residence of Drivers Involved in Accidents

This report will discuss in detail the high accident locations in St. Joseph County. Collision diagrams and photographs for each location will be found on the page following the discussion. A map showing the 14 locations within the county is included on the following page.

Our analysis of the accident problem on county roads in St. Joseph County in relationship to spot or high accident locations reveals that at this time there are no critical problems which cannot be eliminated by the modest engineering means related to a spot improvement program.

The accident information summarized in Tables 4 through 10 may yield some basic information needed by those agencies interested in highway safety from the standpoint of driver education, law enforcement and street patrol activities.



GENERAL HIGHWAY MAP
ST. JOSEPH COUNTY
 MICHIGAN
 STATE HIGHWAY COMMISSION
 DEPARTMENT OF STATE HIGHWAYS

DATA OBTAINED FROM
HIGHWAY PLANNING SURVEY
 CONDUCTED IN COOPERATION WITH
 U.S. DEPARTMENT OF TRANSPORTATION
 FEDERAL HIGHWAY ADMINISTRATION
 BUREAU OF PUBLIC ROADS

SCALE 1" = 2.75 MILES
 PLYMOUTH PROJECTION



HIGH ACCIDENT LOCATIONS

SPOT MAP

MAP 3

1. Michigan Avenue and Silver Street Intersections, Mendon and Park Townships

This location consists of two "T" intersections. One intersection is formed by Michigan Avenue and Silver Street with Michigan Avenue under stop control. It will be referred to as the "west" junction. A second intersection is formed by Silver Street and Michigan Avenue with Silver Street under stop control. It will be considered the "east" junction. The intersections are located 0.75 miles apart.

Michigan Avenue in the vicinity of the west junction is 20 ft bituminous with no shoulders. Silver Street and the section of roadway between the west and the east junctions are 22 ft bituminous with five foot shoulders and centerline markings.

Traffic controls for the Michigan Avenue approach to the west junction are a 30 in. stop ahead sign, a 30 in. stop sign and a 24 in. x 48 in. bi-directional target arrow.

The north approach to the west junction has a 30 in. side road warning sign in advance of the intersection.

Traffic controls for the Silver Street approach to the east junction are a 36 in. stop ahead sign, a 30 in. stop sign and a second 30 in. stop sign on target with a 10 ft x 10 ft lattice background. There are also two 30 in. side road signs between the two junctions. One gives advance warning of the west junction and the other warns of the

proximity of the east junction. The curve between the two intersections is properly signed. It has 24 in. x 48 in. target arrows and 30 in. curve signs with 45 mph advisory speed panels for each direction.

The majority of the accidents occurred at the east junction. Eleven vehicles ran off the roadway at the end of this "T" intersection. The rural nature of the area contributes to high vehicular speeds. During 1969, an additional stop sign (on lattice background) was erected in target position at the end of the south approach to the east intersection. However, it is felt that the location of a stop sign in this location could mislead the motorists. The accident rate decreased at this intersection during 1969.

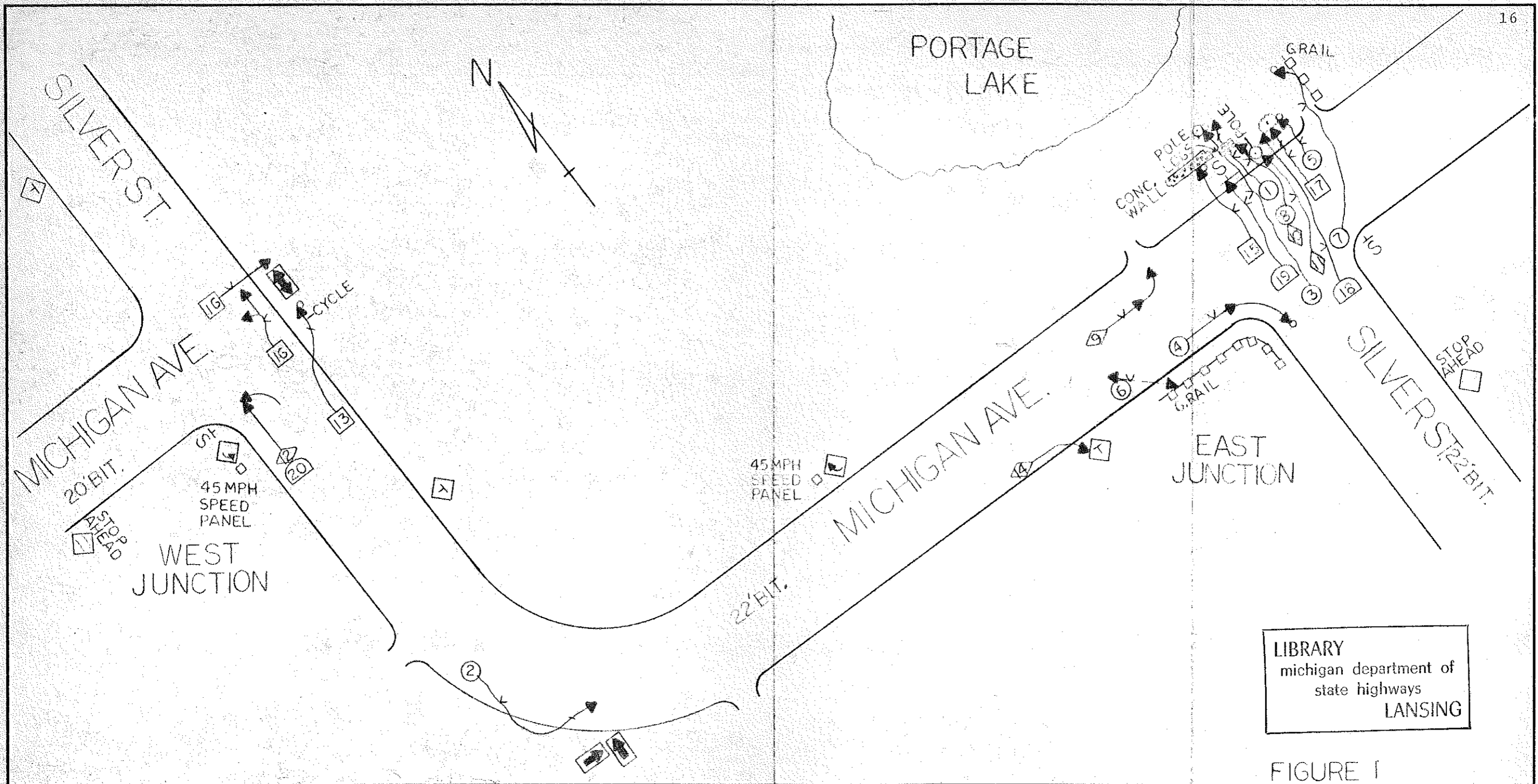
The west intersection was considered to be properly signed and no recommendations for any changes were deemed necessary.

Recommendations:

We recommend that the existing 30 in. stop sign erected on lattice background at the end of the south approach (east intersection) be replaced by a four by eight foot bi-directional target arrow (W1-7-96, Appendix II, p. 105). Furthermore, we recommend that the existing lattice background be maintained in position to provide background for the recommended bi-directional target arrow.

We also recommend that the existing 36 in. stop ahead sign on Silver Street (south approach to the east junction) be supplemented with a lattice background (left directional W12-10, Appendix II, p. 114).

We further recommend that the existing 30 in. stop ahead sign on eastbound Michigan Avenue (west approach to the west junction) be replaced by a 36 in. stop ahead sign (W3-1-36, Appendix II, p. 109).



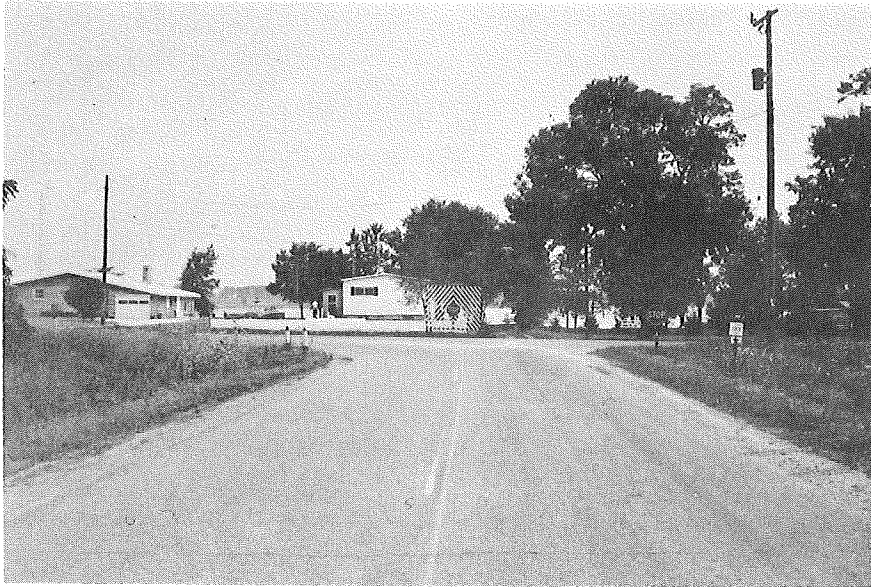
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FIGURE 1

REMARKS	LEGEND Stop & Go Signal Stop Sign Flashing Beacon Yield Sign Fatal Pedestrian Injury Tree Skidding Out of Control Jackknife Driver Intent Overturned Deer Backing Violator	ACCIDENT STUDY COLLISION DIAGRAM		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
		Period: <u>1966 THRU 1969</u> Accidents - Total <u>20</u> P.D. <u>13</u> Injury <u>7 (8)</u> Fatal <u>0 ()</u>	ADT _____ Rate _____ /100 mvm Rate _____ / mv	Location <u>MICHIGAN AVE AT SILVER ST, MENDON + PARK TWP, ST. JOSEPH CO.</u> C.S. _____ Miles _____ Drawn <u>DJM</u> Date <u>9-9-70</u> Plan No. <u>LOCATION 1</u>	



NORTHBOUND SILVER STREET
APPROACHING MICHIGAN AVENUE
(EAST INTERSECTION)

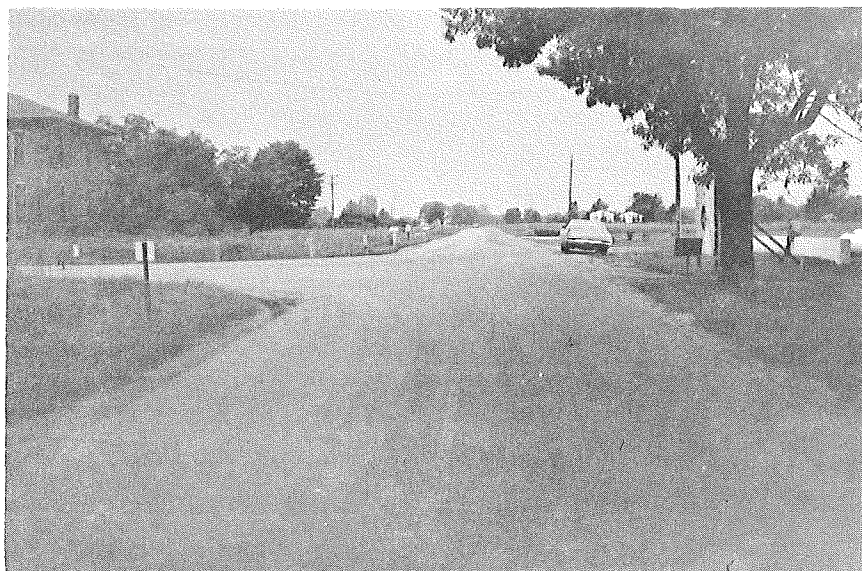


NORTHBOUND SILVER STREET
AT MICHIGAN AVENUE
(EAST INTERSECTION)



EASTBOUND MICHIGAN AVENUE
AT SILVER STREET
(EAST INTERSECTION)

FIGURE 1A



WESTBOUND MICHIGAN AVENUE
AT SILVER STREET
(EAST INTERSECTION)



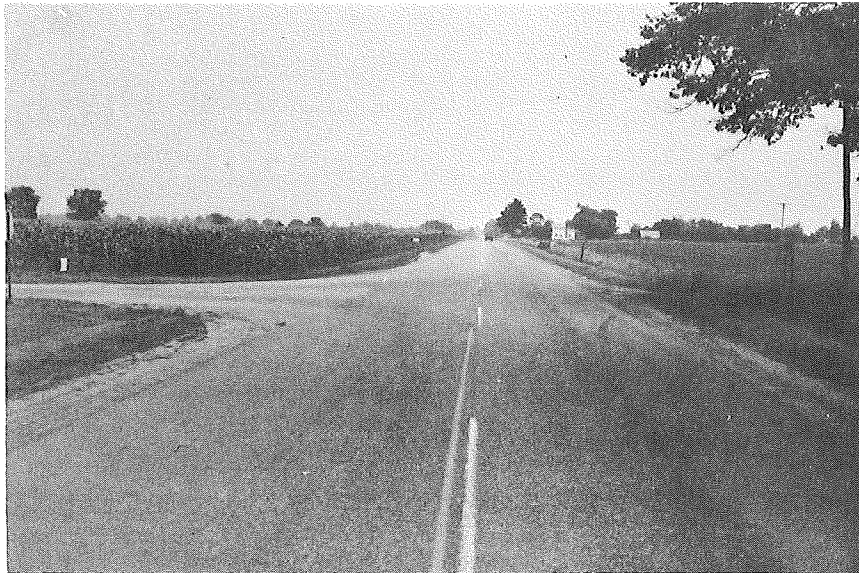
WESTBOUND MICHIGAN AVENUE
(APPROACHING THE CURVE)



WESTBOUND MICHIGAN AVENUE
(AT THE CURVE)



NORTHBOUND SILVER STREET
APPROACHING MICHIGAN AVENUE
(WEST INTERSECTION)

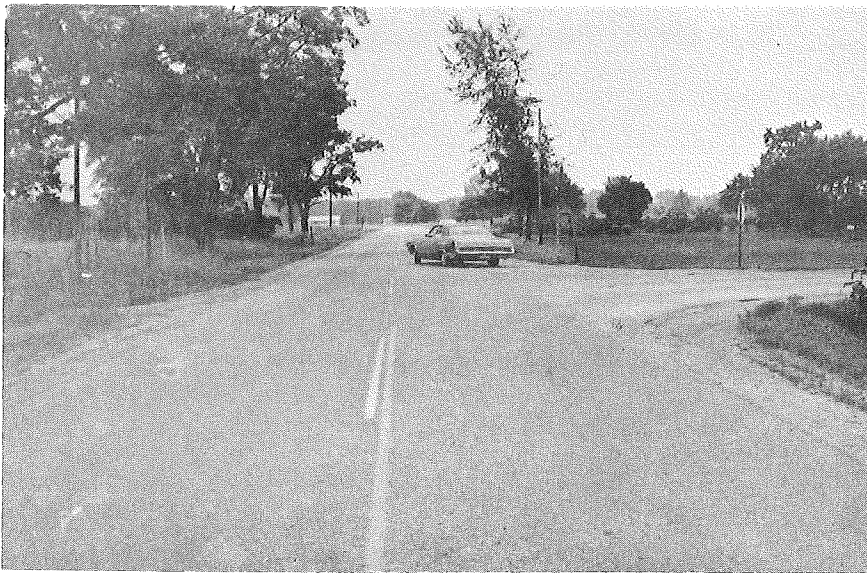


NORTHBOUND SILVER STREET
AT MICHIGAN AVENUE
(WEST INTERSECTION)



EASTBOUND MICHIGAN AVENUE
AT SILVER STREET
(WEST INTERSECTION)

FIGURE 1C



SOUTHBOUND SILVER STREET
AT MICHIGAN AVENUE
(WEST INTERSECTION)



SOUTHBOUND SILVER STREET
(APPROACHING THE CURVE)



SOUTHBOUND SILVER STREET
(AT THE CURVE)

FIGURE 1D

2. Covered Bridge Road @ Schweitzer Road, Lockport and Nottawa Townships

Covered Bridge Road carries traffic over Langley Bridge, more often known as "the covered bridge". This bridge is the largest of its kind in Michigan and is an important historical site. The approach to the bridge from the south is a sharp curve which has been the scene of 14 accidents in the period 1966-1969.

Schweitzer Road intersects Covered Bridge Road just south of the bridge entrance. The geometrics of the intersection are not considered critical and Schweitzer Road will be considered only as a reference point for the description of this accident location.

Covered Bridge Road (south of the bridge) is 22 ft wide bituminous with five to seven foot grass shoulders and center-line markings. North of the bridge the roadway is only 18 ft wide with two foot shoulders and guardrail on both sides. Traffic control for southbound Covered Bridge Road is a 30 in. narrow bridge sign. Traffic controls for northbound Covered Bridge Road are a 30 in. curve sign (W1-2-30, Appendix II, p. 100), a 30 in. narrow bridge sign and an oversize four by eight foot target arrow on a 10 ft by 10 ft lattice background. Guardrail is present on the east side of the northbound approach and on both sides of the southbound approach.

Thirteen of the 14 accidents during the study period

were the ran-off roadway type while the remaining accident was a head-on collision at the bridge entrance. Ten of the 14 accidents occurred when the pavement was snowy or wet. Only three of the accidents occurred during the day with the remaining accidents occurring at dusk (1) or at dark (10 accidents). All of the accidents were reportedly caused by excessive speed. It seems from the accident data that the curve came too unexpectedly for the drivers involved.

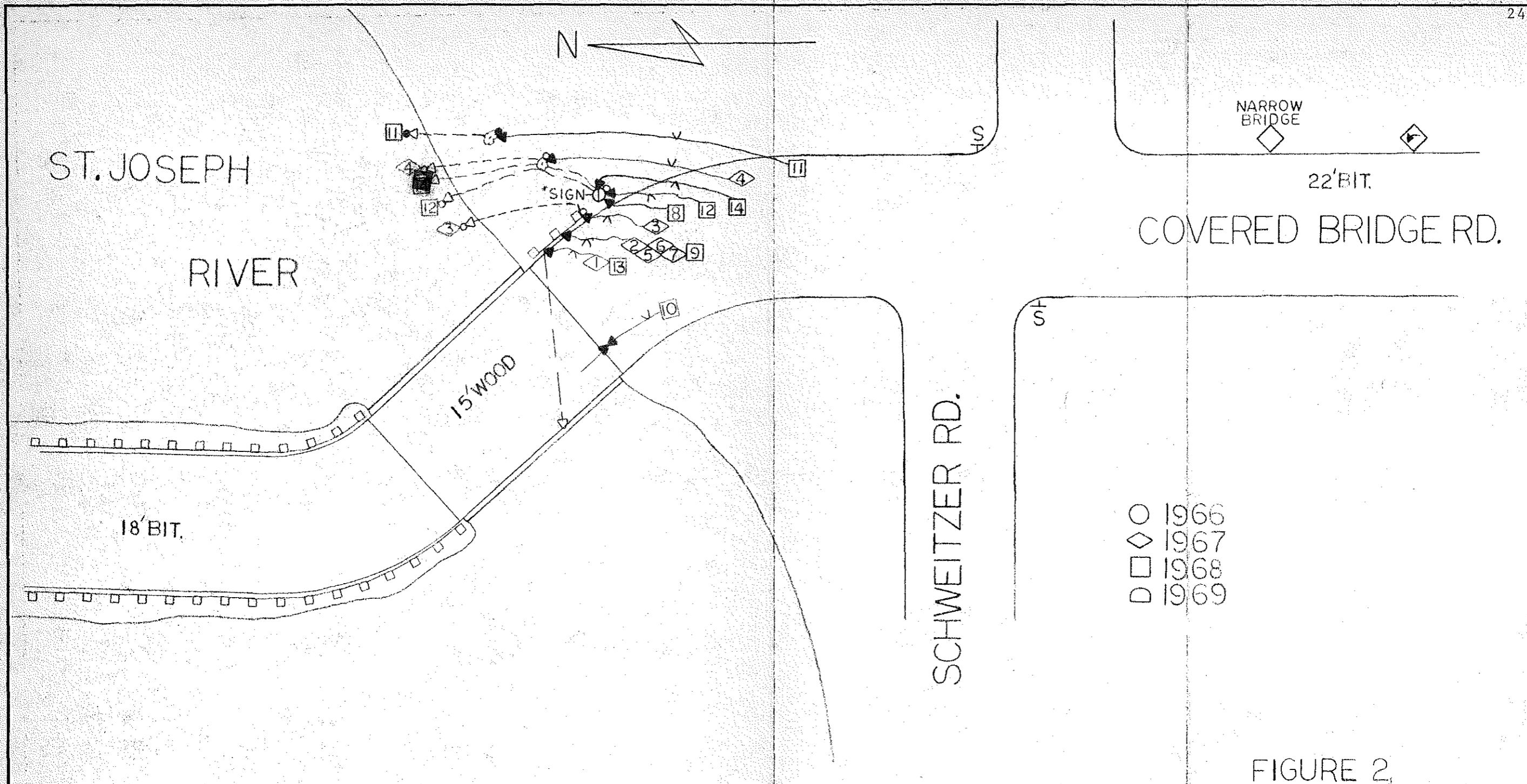
Since the bridge is covered, it is difficult to see any oncoming traffic without reducing the speed considerably at the bridge entrance. Traffic should go slow through the bridge since it is a one-lane bridge with a clear roadway width of only 15 ft.

The existing guardrail (at the approach from the south) does not extend far enough to protect a vehicle leaving the roadway on the tangent. This is considered hazardous since a safe landing area is not provided and the vehicles leaving the roadway could hit the existing trees or land in the St. Joseph River.

Recommendations:

We recommend that the northbound curve sign be replaced by a turn sign, W1-1-30 (see Appendix II, p. 99). Also, we recommend that the existing northbound narrow bridge sign be replaced by a one-lane bridge sign (W5-3-36, Appendix

II, p. 110). The new signs should be erected in the same location as the signs they are replacing. Furthermore, we recommend that the guardrail (on the approach from the south) be extended beyond the target arrow.



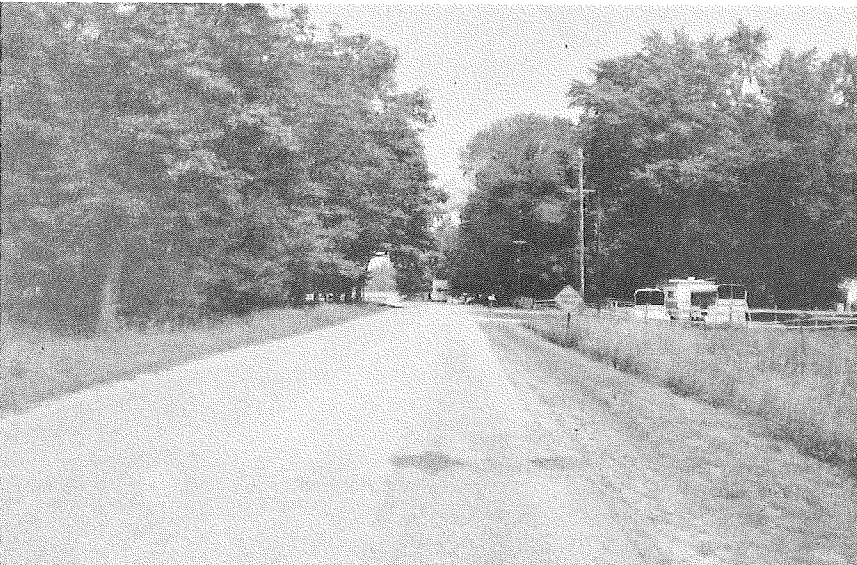
- 1966
- ◇ 1967
- 1968
- ▭ 1969

FIGURE 2

<p>REMARKS *SIGN - </p>	<p>LEGEND</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Stop & Go Signal </p> <p>Flashing Beacon </p> <p>Fatal </p> <p>Injury </p> <p>Skidding </p> <p>Jackknife </p> <p>Overtaken </p> <p>Backing </p> </div> <div style="width: 45%;"> <p>Stop Sign </p> <p>Yield Sign </p> <p>Pedestrian </p> <p>Tree </p> <p>Out of Control </p> <p>Driver Intent </p> <p>Deer </p> <p>Violator </p> </div> </div>	<p>ACCIDENT STUDY COLLISION DIAGRAM</p> <p>Period: <u>1966 THRU 1969</u></p> <p>Accidents - Total <u>14</u></p> <p>P.D. <u>10</u> ADT _____</p> <p>Injury <u>3 (5)</u> Rate _____ /100 mvm</p> <p>Fatal <u>1 (1)</u> Rate _____ / mv</p>	<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p> <p>Location <u>COVERED BRIDGE RD. AT SCHWEITZER RD. NOTTAWA TWP. ST. JOSEPH CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DJM</u> Date <u>10-1-70</u></p> <p>Plan No. <u>LOCATION #2</u></p>
-------------------------	---	---	--



NORTHBOUND
COVERED BRIDGE ROAD
APPROACHING CURVE

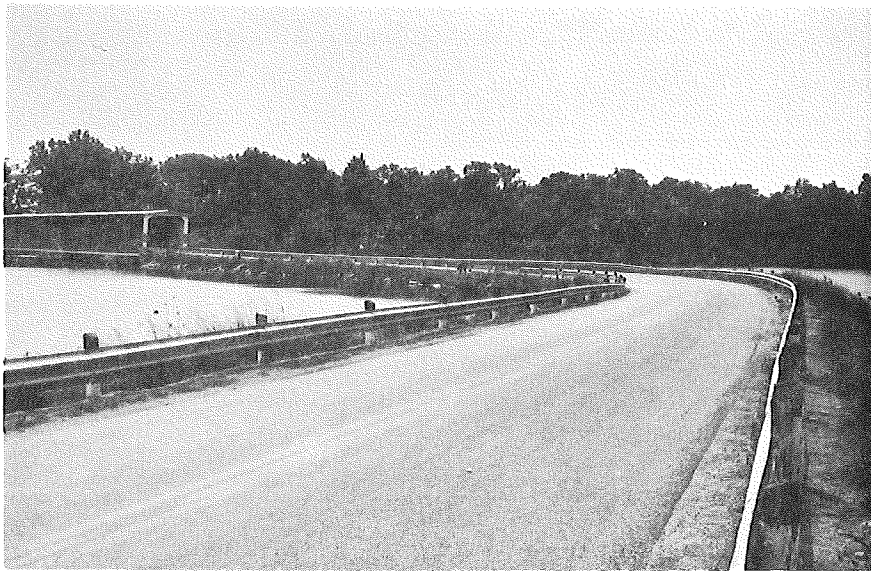


NORTHBOUND
COVERED BRIDGE ROAD
APPROACHING CURVE

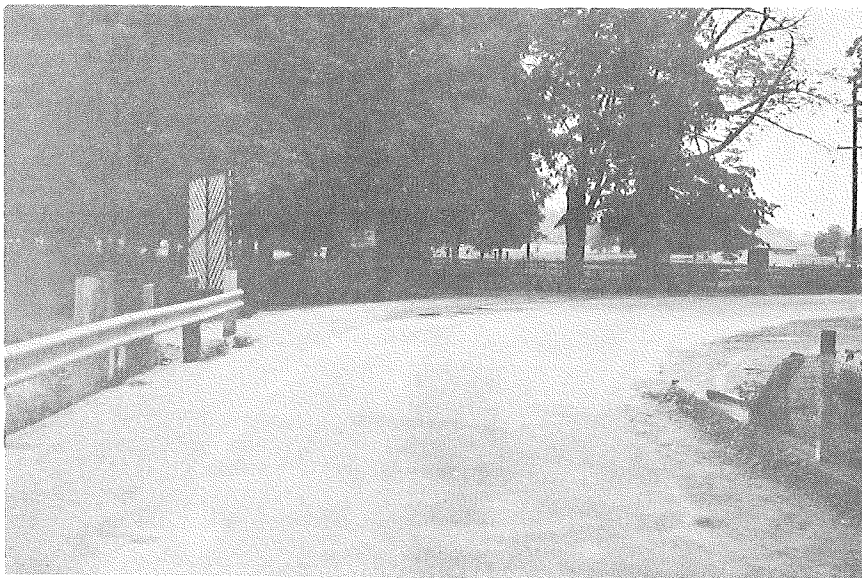


NORTHBOUND
COVERED BRIDGE ROAD
AT THE CURVE

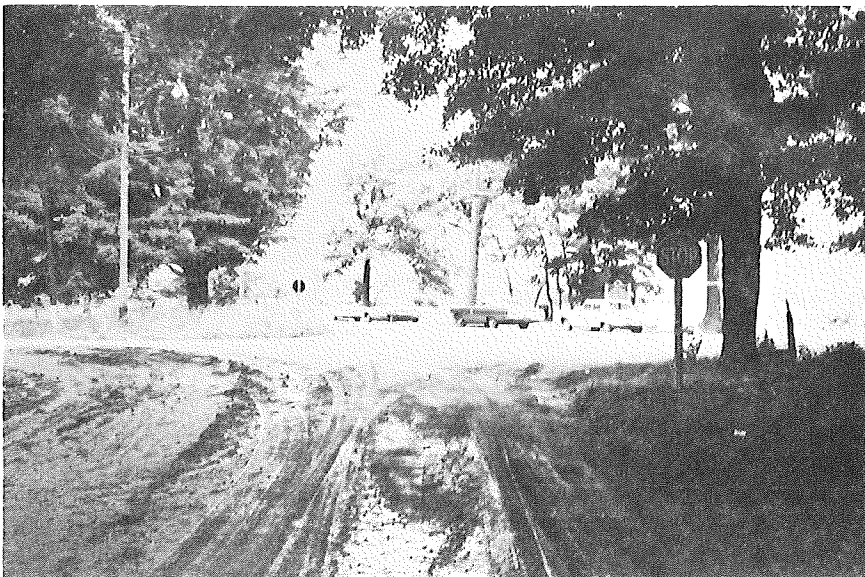
FIGURE 2A



SOUTHBOUND
COVERED BRIDGE ROAD



SOUTHBOUND
COVERED BRIDGE ROAD



WESTBOUND
SCHWEITZER ROAD

FIGURE 2B

3. Coon Hollow Road @ Ferguson Road, Fabius Township

Coon Hollow Road is characterized by sharp horizontal and vertical curves throughout this location. Ferguson Road doglegs with Coon Hollow Road. The two intersections formed are considered as "Y" type intersections. Both the north and south legs of Ferguson Road intersect Coon Hollow Road at sharp curves. Coon Hollow Road is 22 ft bituminous with centerline markings but no shoulders.

Traffic controls for westbound Coon Hollow Road are a 24 in. curve sign and a 24 in. x 48 in. target arrow. For eastbound Coon Hollow Road there is a 24 in. x 48 in. target arrow.

Traffic controls for Ferguson Road are three yield signs. Two of these yield signs are on southbound Ferguson Road (north leg, west junction) and the other on northbound Ferguson Road (south leg, east junction).

The north leg of Ferguson Road is a 22 ft gravel road and the south leg is 20 ft wide gravel. Ferguson Road has channelized lanes for each direction of traffic with a grass island separating the lanes.

There were 14 accidents at this location over the study period 1966 through 1969. Two of the accidents were car-deer and all the others were of the ran off the roadway variety. The majority of the accidents were for westbound traffic. Six of the accidents occurred just west

of the east junction and were due to speed too fast for conditions. These six vehicles either landed in the swamp or hit the bridge railings. However, it is worthwhile to note that 12 out of the 14 accidents occurred when the light condition was dark. Although the accident experience does not justify major reconstruction (as easing the curves), we should recognize this possibility as the ultimate solution to the problem, and it should be considered in the county's long range planning. At the present time some changes in signing are necessary to make the motorist aware of the existing conditions.

The yield signs at this location (on north and southbound Ferguson Road) are smaller than the minimum size required by the Manual and consideration should be given to bringing these signs up to standard whenever the condition of the signs requires their replacement.

Recommendations:

We recommend that the existing curve sign for westbound Coon Hollow Road be replaced by a reverse turn sign (W1-3-30, Appendix II, p. 101) and that an additional reverse turn sign be erected for westbound traffic just west of the bridge location. These signs should be supplemented with 25 mph advisory speed panels. The appropriate speed panel legend was determined by using a devil level indicator and the criteria outlined in Appendix II, pps. 111 - 112. The following averages were obtained during field investigation.

Devil Level Readings

	MPH	Curve at East Intersection	Curve at West Intersection
Westbound Curves	23	12°	10°
	30-32	22°	15°

We also recommend that new W1-3-30 reverse turn signs be erected for eastbound traffic on Coon Hollow Road. One of these signs should be erected approximately 500 ft in advance of the target arrow existing at the first curve encountered by eastbound traffic. The second sign should be erected in advance of the second series of curves and just west of the bridge location. The first sign should be supplemented with a 25 mph advisory speed panel.

The following devil level reading averages were obtained during field investigation.

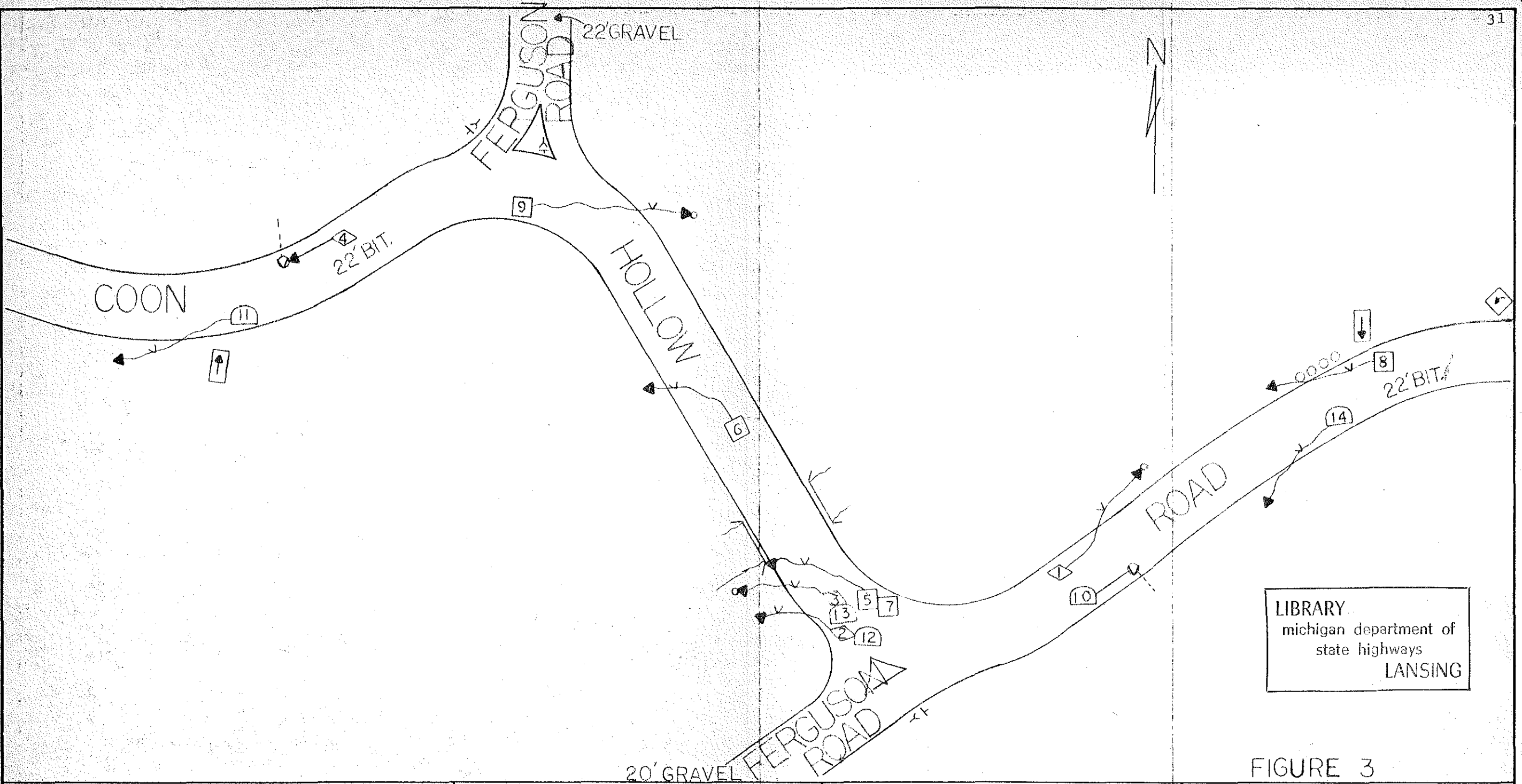
Devil Level Readings

	MPH	Curve at West Intersection	Curve at East Intersection
Eastbound Curves	23	12°	9°
	32	18°	12°

The second reverse turn sign for eastbound traffic should be supplemented with a 30 mph speed panel legend.





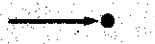

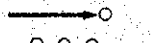

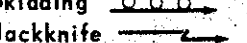

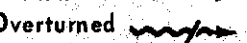

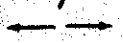

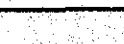

This location will further benefit with the use of target arrows. We recommend that target arrows (W1-6-48,

Appendix II, p. 104) be erected at each curve in target position. This may require the erection of some signs in the traffic islands formed by the intersection of Ferguson Road and Coon Hollow Road. However, if this is not practical, these signs should be placed as near to target position as the configuration of the intersection will allow.



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FIGURE 3

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>Stop & 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: 1966 THRU 1969</p> <p>Accidents - Total 14</p> <p>P.D. 10</p> <p>Injury 4 (6)</p> <p>Fatal 0 ()</p>	<p>ADT _____</p> <p>Rate _____ /100 mvm</p> <p>Rate _____ / mvm</p>	<p>Location ST. JOSEPH CO. FABIUS TWP. COON HOLLOW ROAD AT FERGUSON ROAD</p> <p>C.S. _____ Miles _____</p> <p>Drawn QEV. Date 12-8-70</p> <p>Plan No. LOCATION 3</p>	



WESTBOUND
COON HOLLOW ROAD



WESTBOUND COON HOLLOW ROAD
APPROACHING THE
EAST INTERSECTION

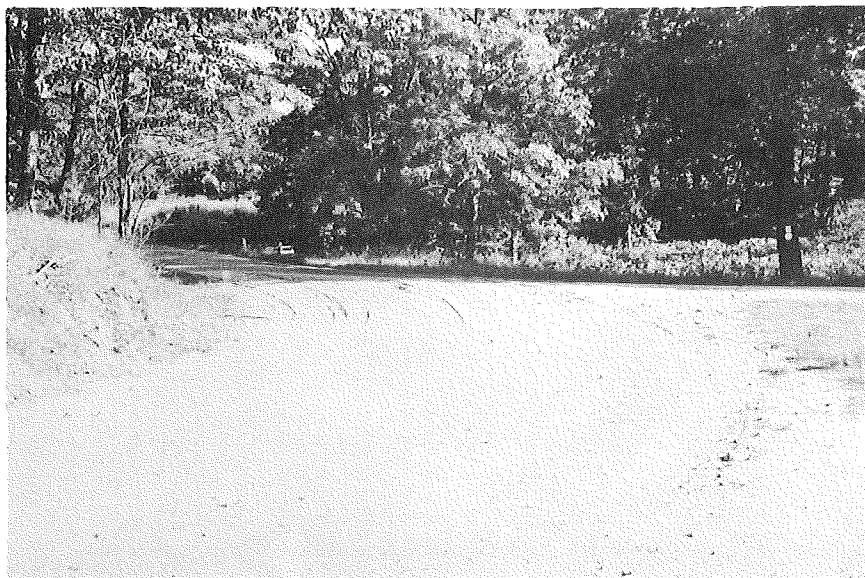


WESTBOUND COON HOLLOW ROAD
AT THE
EAST INTERSECTION

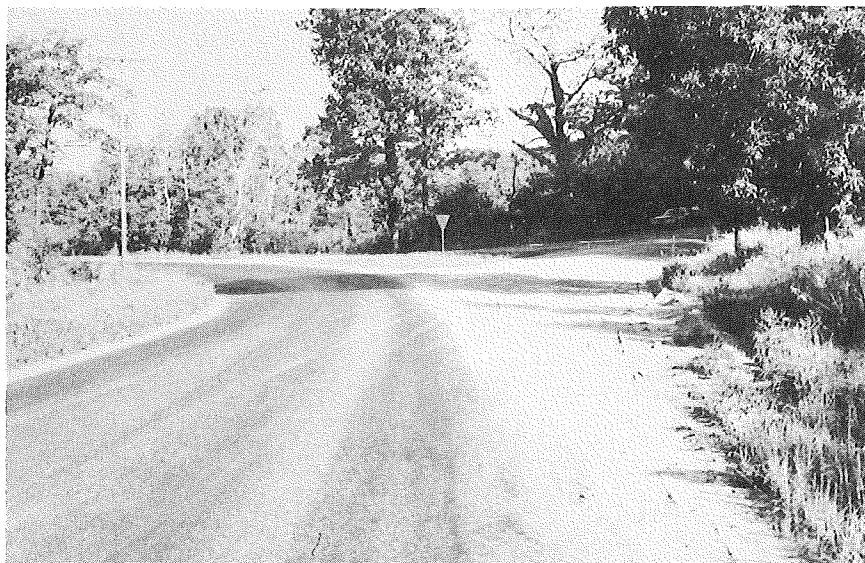
FIGURE 3A



NORTHBOUND FERGUSON ROAD
AT COON HOLLOW ROAD
(EAST INTERSECTION)



NORTHBOUND FERGUSON ROAD
AT COON HOLLOW ROAD
(EAST INTERSECTION)



WESTBOUND COON HOLLOW ROAD
AT THE WEST INTERSECTION



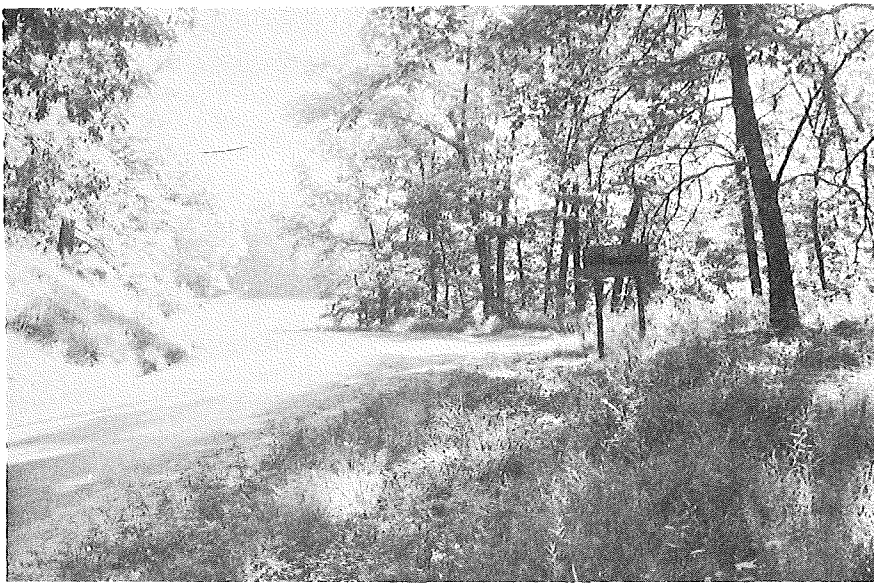
SOUTHBOUND FERGUSON ROAD
APPROACHING COON HOLLOW ROAD
(WEST INTERSECTION)



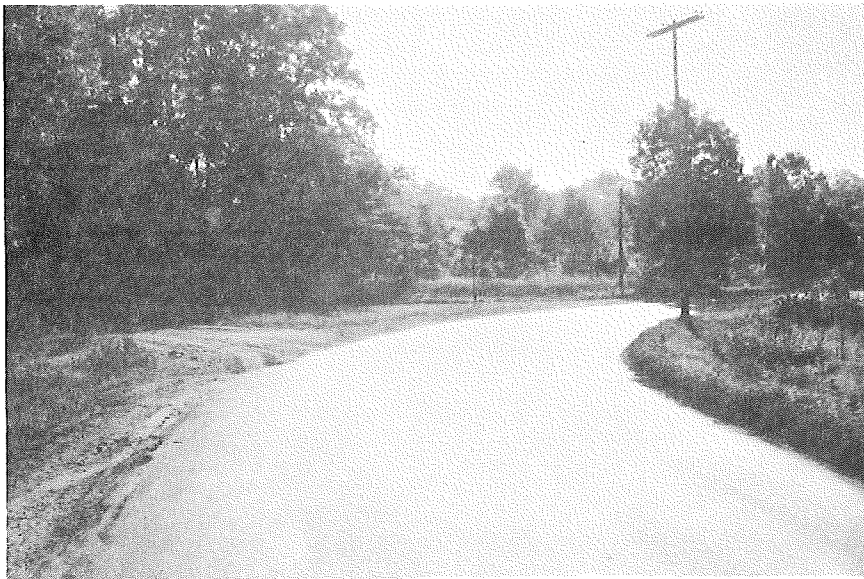
SOUTHBOUND FERGUSON ROAD
AT COON HOLLOW ROAD
(WEST INTERSECTION)



SOUTHBOUND FERGUSON ROAD
AT COON HOLLOW ROAD
(WEST INTERSECTION)



EASTBOUND COON HOLLOW ROAD
APPROACHING THE
WEST INTERSECTION



EASTBOUND COON HOLLOW ROAD
AT THE WEST INTERSECTION



EASTBOUND COON HOLLOW ROAD
AT THE EAST INTERSECTION

FIGURE 3D

4. Riverside Drive @ Vistula Road, Mottville Township

Riverside Drive and Vistula Road intersect on a skew, but for practical purposes the junction could be considered a "T" intersection. The major traffic movements are from the south to the northeast and from the northeast to the west or the south.

Riverside Drive is a 20 ft wide bituminous roadway with six foot grass shoulders and Vistula Road is a 20 ft wide bituminous roadway with four foot grass shoulders. Centerline markings exist on both roads.

The existing traffic control devices for eastbound Riverside Drive are a 36 in. stop sign, a 36 in. stop ahead sign, a 30 in. "T" symbol sign and a 24 in. x 48 in. bi-directional target arrow. The speed limit on Riverside Drive west of the intersection is 50 mph. Traffic controls for both westbound Riverside Drive and northbound Vistula Road are 30 in. curve signs and 30 in. side road signs. There is no speed zone on Vistula Road in this area.

There were ten accidents at this location during the study period 1966 through 1969. Eight of the accidents were reportedly caused by speed too fast for conditions. There were eight reported accidents for eastbound traffic on Riverside Drive during the study period. Two of these eight accidents involved a second vehicle while the remaining

six were ran-off the roadway type. There were major changes in signing at this location during February, 1969. At this time the yield sign for eastbound Riverside Drive was replaced by a stop sign and the warning signs referenced were erected.

During 1969 and 1970 there were two reported accidents at this location; one during each of these years. Judging by the improvements made at this location and the subsequent accident picture, no recommendations are being made.

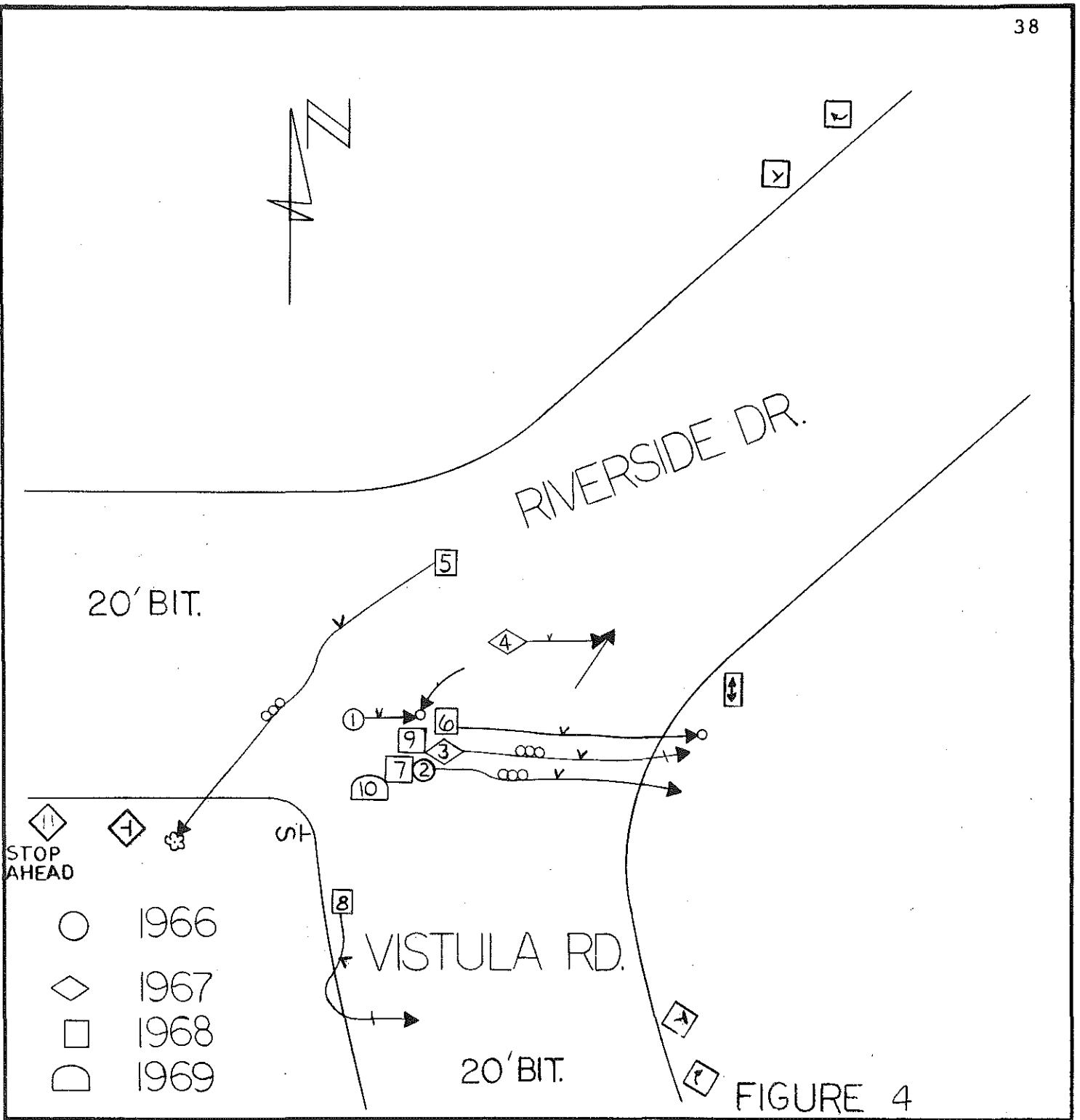


FIGURE 4

<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS Traffic Division</p>	<p>ACCIDENT STUDY COLLISION DIAGRAM</p>
<p>LEGEND</p>	<p>Period: <u>1966 THRU 1969</u></p> <p>ST. JOSEPH CO. Description <u>RIVERSIDE DR. at VISTULA RD.</u></p> <p>MOTTVILLE TWP.</p> <p>Accidents - Total <u>10</u></p> <p>P.D. <u>7</u> Injury <u>3</u> (4)</p> <p>Fatal <u>0</u> ()</p> <p>Acc. Rate/mv _____</p> <p>Acc. Rate/mvm _____</p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>5-22-70</u> Rev. _____</p> <p>Plan No. <u>LOCATION 4</u></p>
<p>Stop & Go Signal Stop Sign S T-</p> <p>Flashing Beacon Yield Sign Y T-</p>	
<p>Fatal Overtaken Out of Control </p> <p>Injury Backing Driver Intent </p> <p>Skidding Pedestrian Deer </p> <p>Jackknife Tree Violator </p>	



EASTBOUND RIVERSIDE DRIVE
APPROACHING THE INTERSECTION



EASTBOUND RIVERSIDE DRIVE
AT THE INTERSECTION



NORTHBOUND VISTULA ROAD
APPROACHING THE INTERSECTION



NORTHBOUND VISTULA ROAD
AT THE INTERSECTION



WESTBOUND RIVERSIDE DRIVE
APPROACHING THE INTERSECTION



WESTBOUND RIVERSIDE DRIVE
AT THE INTERSECTION

5. Kalamazoo Street @ Indian Prairie Road, White Pigeon and Mottville Townships

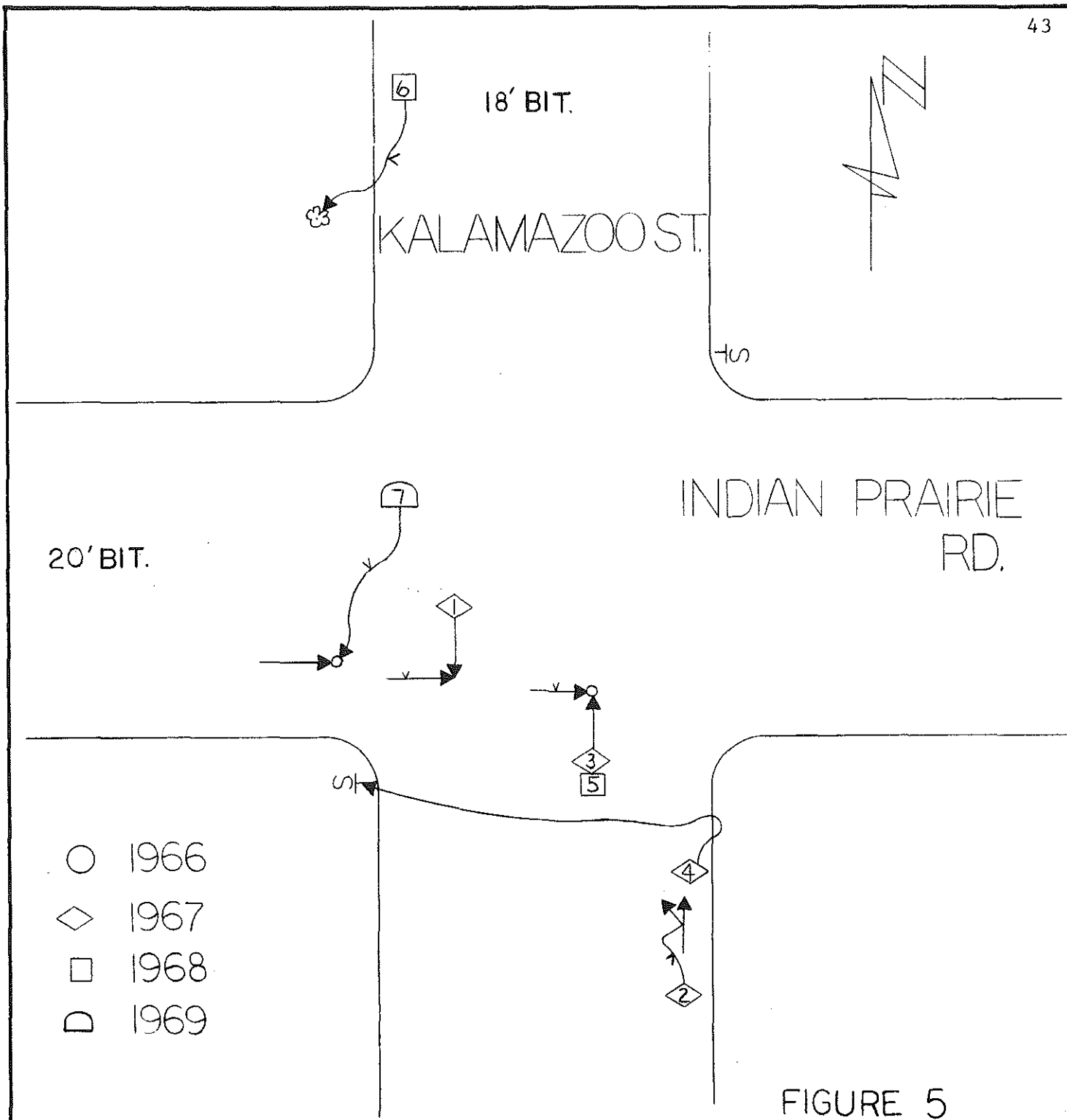
These two roads intersect at right angles forming a typical rural intersection. Indian Prairie Road is a 20 ft wide bituminous roadway with five foot shoulders but no centerline markings. The overall condition of this road is good. Kalamazoo Street has an 18 ft wide bituminous surface with five foot shoulders and centerline markings.

The traffic controls at this location are two 30 in. stop signs for Indian Prairie Road.

During the study period 1966-1969 there were seven accidents at this location. Three of the accidents were violations of the stop sign for eastbound Indian Prairie Road traffic and two of them resulted in serious injuries. The intersection is visible from all approaches. However, due to high rural speeds, traffic on Indian Prairie Road may not realize the presence of the stop sign in time to take appropriate action.

Recommendation:

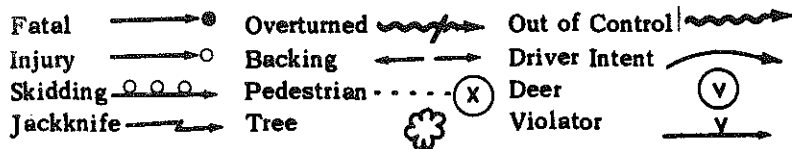
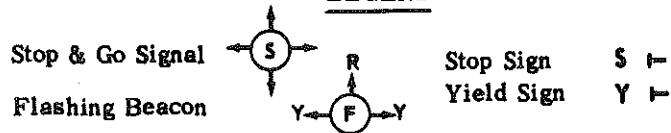
We recommend that stop ahead warning signs (W3-1-36, Appendix II, p. 109) be erected for each direction of traffic on Indian Prairie Road.



MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

ACCIDENT STUDY
COLLISION DIAGRAM

LEGEND



Period: 1966 THRU 1969

ST. JOSEPH CO. Description KALAMAZOO ST. at INDIAN PRAIRIE RD
WHITE PIGEON & MOTTVILLE TWP.

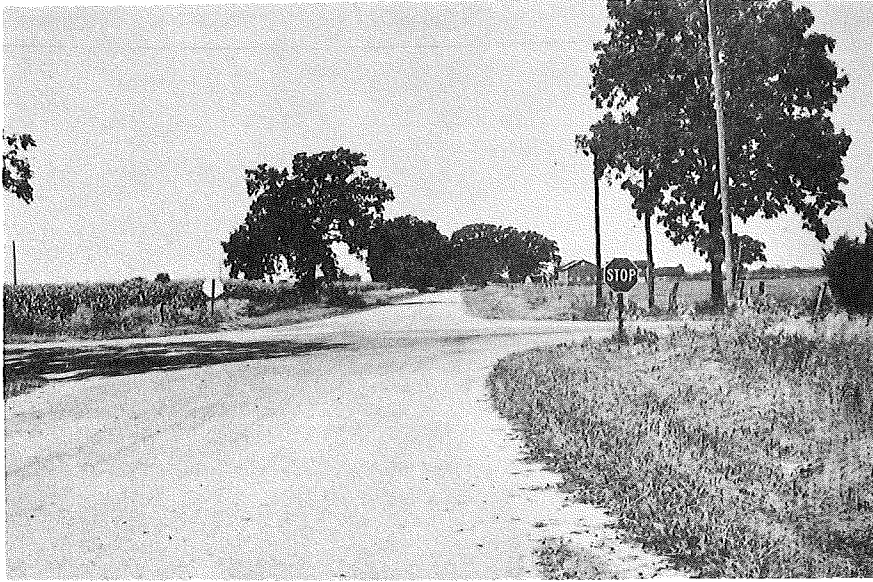
Accidents - Total 10
P.D. 5 Injury 5 (12)
Fatal 0 ()

Acc. Rate/mv _____
Acc. Rate/mvm _____

C.S. _____ Miles _____

Drawn DVW Date 5-25-70 Rev. _____

Plan No. LOCATION 5



WESTBOUND
INDIAN PRAIRIE ROAD



SOUTHBOUND
KALAMAZOO STREET



EASTBOUND
INDIAN PRAIRIE ROAD

6. Nottawa Road @ Fawn River Road, Sturgis Township

Nottawa Road intersects Fawn River Road at right angles forming a typical suburban intersection. Fawn River Road has a 20 ft bituminous surface that has been recently re-sealed. Nottawa Road is 22 ft bituminous roadway throughout this location and has been heavily patched north of the intersection.

The existing traffic controls are 36 in. stop signs for each direction of traffic on Fawn River Road. There is no posted speed limit on Fawn River Road. A traffic control order for Nottawa Road (recorded at the State Police) authorizes a speed zone of 35 mph north of the intersection and 45 mph south of the intersection. According to the Manual, if a sign cannot be placed at the exact point of change in limit (in this location the zones change at the centerline of Fawn River Road), the sign shall be placed as near as practicable but in advance of the point of change for a decrease. This criteria would require a 35 mph speed limit sign south of the intersection for north-bound Nottawa Road traffic.

Traffic on both roads is medium to light through most of the day. However, it becomes very congested at times because of a large factory located 0.2 miles south of the intersection. There were eight accidents at this location during the study period 1966 through 1969. Six of the accidents involved failure to yield the right of

way. Five of these six violations involved eastbound Fawn River Road traffic. There are no vision obstructions present at this location.

Recommendations:

We recommend that stop ahead signs (W3-1-36, Appendix II, p. 109) be erected for each direction of traffic on Fawn River Road.

We also recommend that a 35 mph speed limit sign be erected on Nottawa Road for northbound traffic. It shall be erected south of the intersection and as near as practicable to the intersection, but preferably across from the sign indicating the speed zone change for southbound traffic.

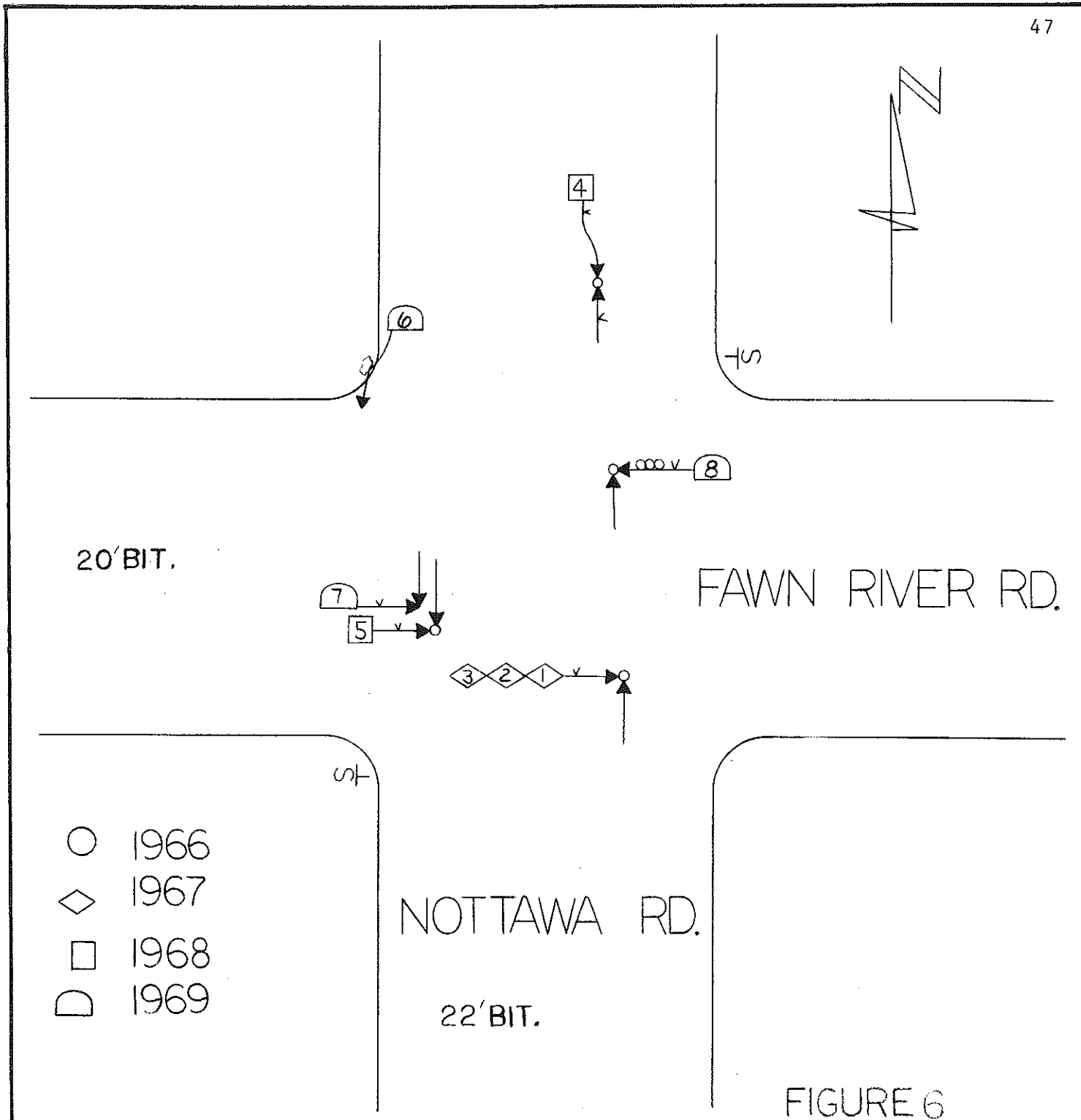
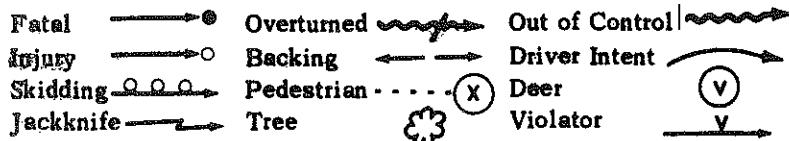
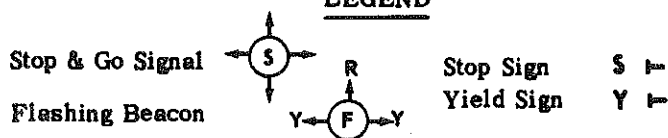


FIGURE 6

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969

ST. JOSEPH CO. Description NOTTAWA RD. at FAWN RIVER RD. STURGIS TWP.

Accidents - Total 8

P.D. 2 Injury 6 (13)

Fatal 0 ()

Acc. Rate/mv _____

Acc. Rate/mvm _____

C.S. _____ Miles _____

Drawn DVW Date 5-26-70 Rev. _____

Plan No. LOCATION 6



EASTBOUND
FAWN RIVER ROAD



SOUTHBOUND
NOTTAWA ROAD



WESTBOUND
FAWN RIVER ROAD

7. Balk Road @ Pucker Level Road, Sherman Township

This is a right angle intersection with Balk Road having the right of way. Balk Road curves to the west just north of the intersection and then begins a vertical alignment with a plus gradient. Balk Road is a 20 ft wide bituminous roadway with four foot grass shoulders and center-line markings. Pucker Level Road, which has been recently resealed, is a 24 ft wide bituminous roadway with no shoulders. Traffic controls are a 30 in. stop sign for each direction of traffic on Pucker Level Road. There is also a 30 in. winding road sign on northbound Balk Road just north of the intersection.

There were eight accidents at this location during the study period. There were three accidents during 1968. One of them was a fatal in which one person was killed and six were injured. At the time of this accident the traffic control devices present at Pucker Level Road were yield right of way signs for each direction of traffic. Subsequently, the traffic control was changed from a yield sign to a stop sign. The five remaining accidents occurred during 1969 and all with the exception of one were of the ran-off roadway type.

Recommendation:

We recommend that stop ahead signs (W3-1-36, Appendix

II, p.109) be erected for each direction of traffic on
Pucker Level Road.

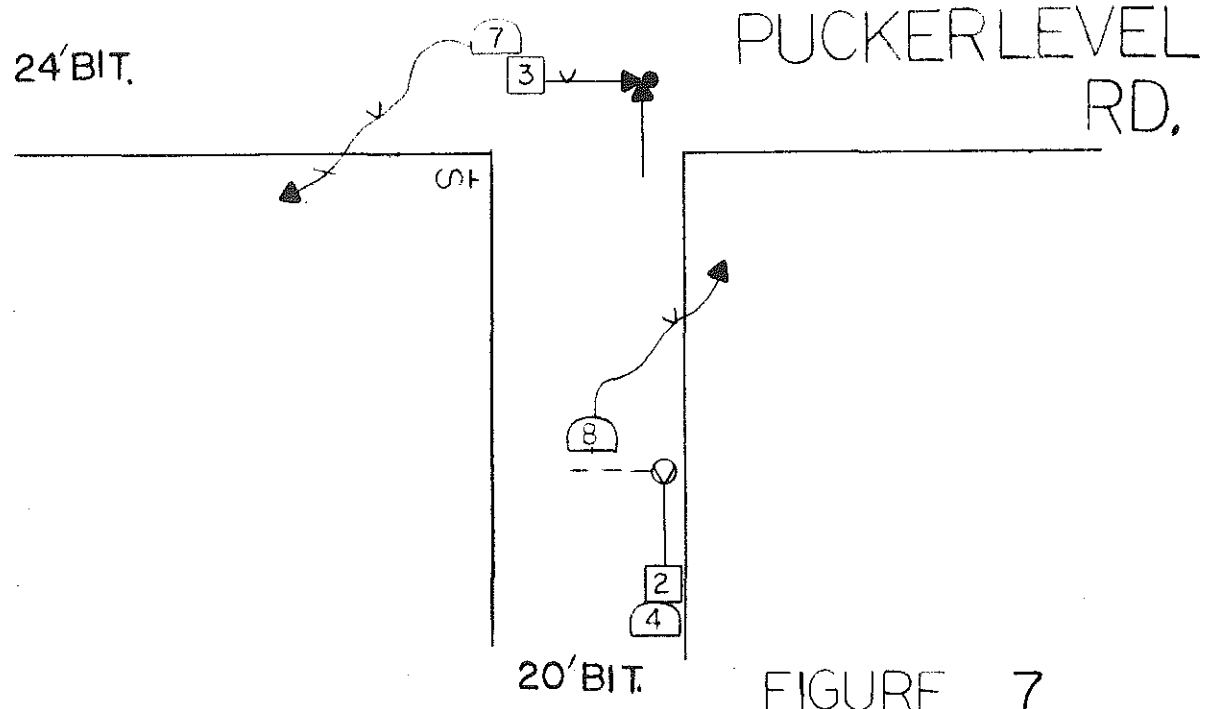
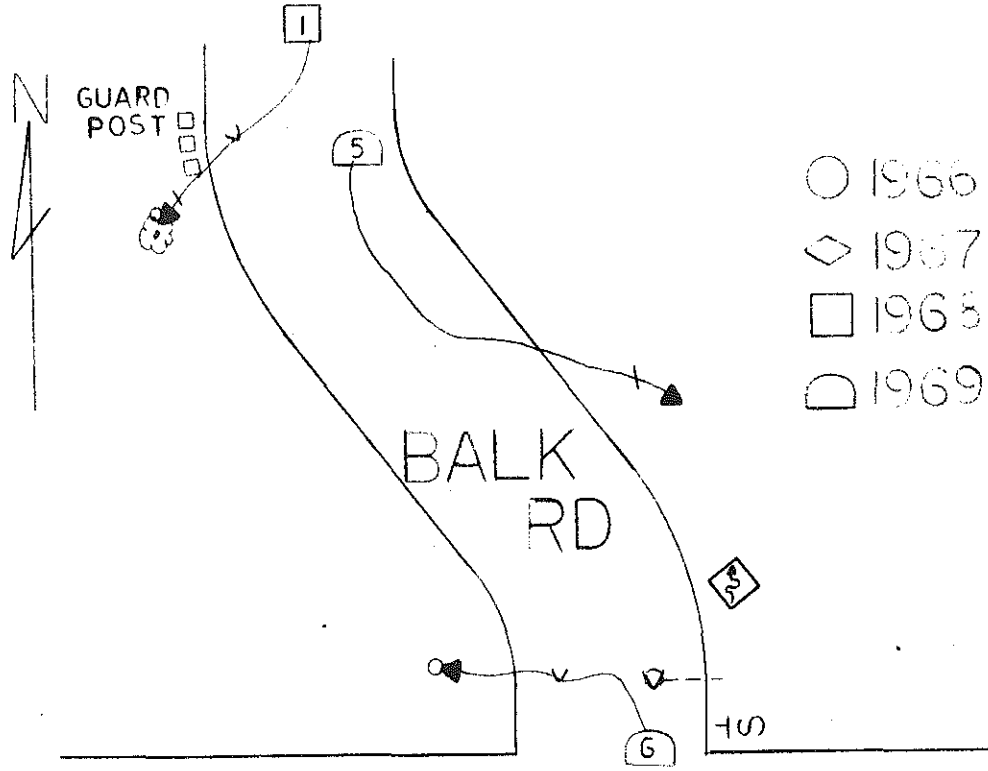
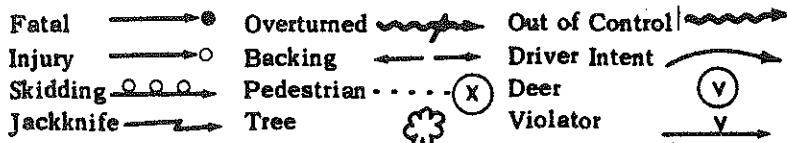
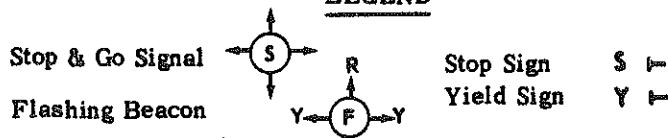


FIGURE 7

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
ST. JOSEPH CO. Description SHERMAN TWP.

Accidents - Total 8
P.D. 4 Injury 3 (9)
Fatal 1 (1)
Acc. Rate/mv _____
Acc. Rate/mvm _____
C.S. _____ Miles _____
Drawn DVW Date 5-1-70 Rev. _____
Plan No. LOCATION 7



EASTBOUND
PUCKER LEVEL ROAD



NORTHBOUND
BALK ROAD



WESTBOUND
PUCKER LEVEL ROAD

FIGURE 7A

8. Lakeview Road @ Wait and Witt Roads, Burr Oak and Sherman Townships

Both Wait Road and Witt Road form a "T" intersection with Lakeview Road. The two intersections are 0.25 miles apart. Wait Road approaches Lakeview Road from the west and Witt Road approaches it from the east. Wait Road and Lakeview Road have 20 ft wide bituminous surfaces with centerline markings but no shoulders. Witt Road has a 20 ft wide bituminous surface with three foot shoulders and centerline markings.

Existing traffic controls for westbound Witt Road are a 30 in. stop ahead sign, a 24 in. stop sign and a 24 in. x 48 in. target arrow. For eastbound Wait Road the controls are a 24 in. stop sign and a 24 in. x 48 in. target arrow. Lakeview Road has two 24 in. side road signs in advance of Wait Road. There is no advance warning of the south junction in the vicinity of Witt Road.

There were six accidents at the two intersections during the period 1966-1969. Five of these accidents were in the vicinity of the Wait Road and Lakeview Road intersection. There is a large hill at the intersection of Wait Road and Lakeview Road. The crest of the hill is just south of the intersection and the change in vertical alignment affects the majority of the movements at the intersection.

Northbound traffic on Lakeview Road must slow down to assure adequate visibility of southbound approaching traffic before safely completing a left turn on Wait Road. There are adequate centerline markings (double yellow lines) indicating no passing zones throughout the location.

A 65/55 mph speed limit sign (northbound Lakeview traffic) was in place at the time of our initial field investigation. Subsequently this sign has been removed. The existing speed limit signs indicate a 35 mph zone for Lakeview traffic. However, no traffic control order has been recorded for this location. Consequently, the existing speed control signs are not considered legal.

Recommendations:

We recommend that all signs relating to these illegal speed restrictions be removed. However, if it is felt that these speed control zones are necessary, the St. Joseph County Road Commission should contact the Department of State Police and pursue the legal requirements for determining and establishing speed restrictions.

We further recommend that the existing side road signs be replaced by larger size signs (W2-2-30, Appendix II, p. 106).

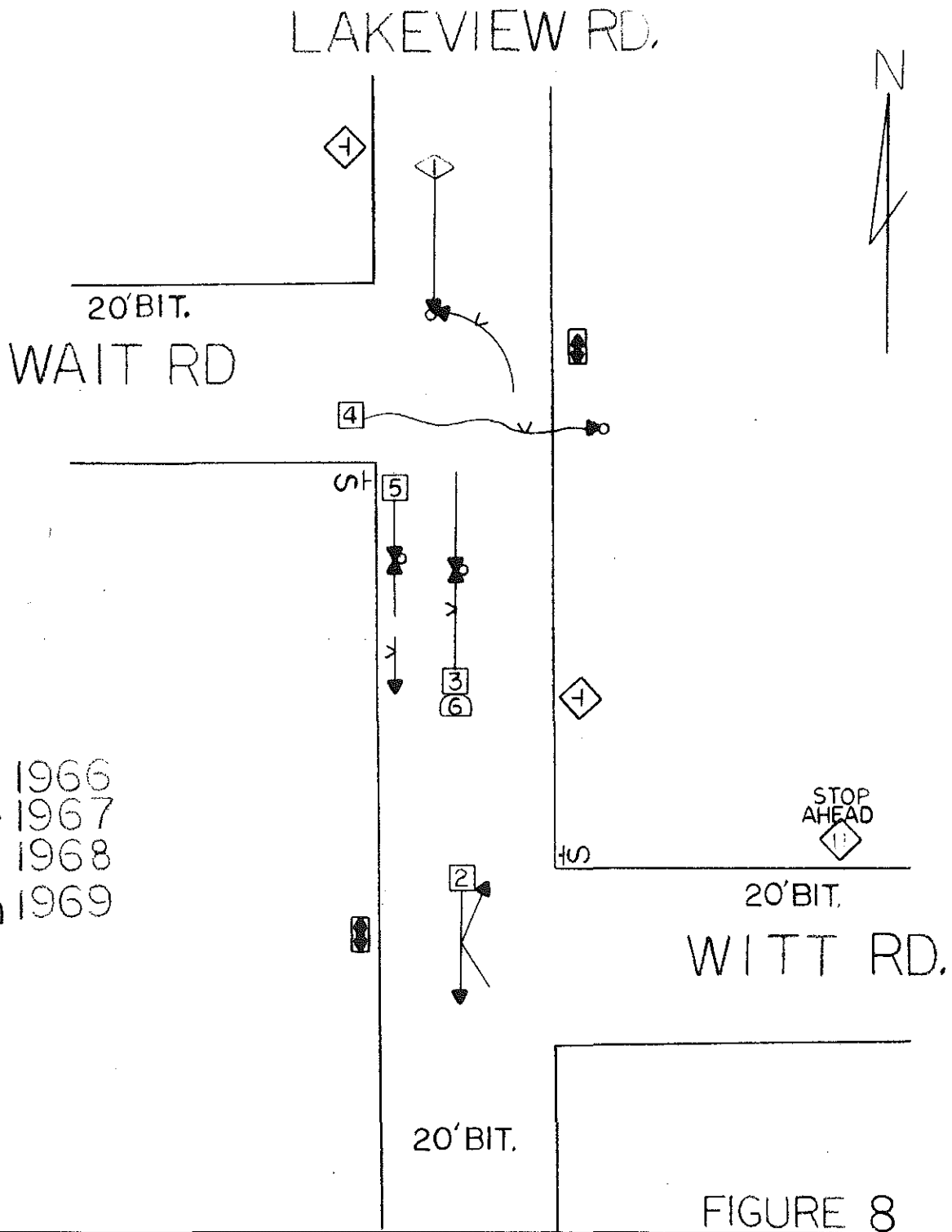
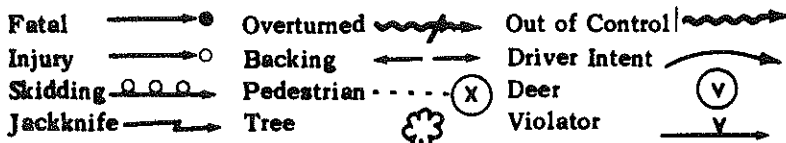
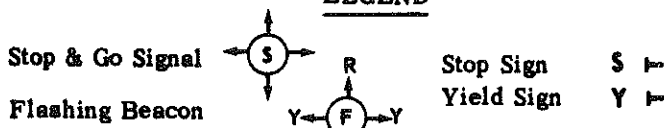


FIGURE 8

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
ST. JOSEPH CO. Description BURR OAK TWP
LAKEVIEW RD. AT WITT + WAIT RDS

Accidents - Total 6 (8)
P.D. 1 Injury 5
Fatal 0

Acc. Rate/mv _____
Acc. Rate/mvm _____
C.S. _____ Miles _____
Drawn DJM Date 5-27-70 Rev. _____
Plan No. LOCATION 8



SOUTHBOUND
LAKEVIEW ROAD
APPROACHING WAIT ROAD



EASTBOUND
WAIT ROAD



NORTHBOUND
LAKEVIEW ROAD
AT WAIT ROAD

FIGURE 8A



NORTHBOUND
LAKEVIEW ROAD
APPROACHING WAIT ROAD



NORTHBOUND
LAKEVIEW ROAD
AT WITT ROAD



WESTBOUND
WITT ROAD

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9. North Angling Road @ Butler Road, Nottawa Township

North Angling Road intersects Butler Road on a skew. The major traffic movements are from the southwest to the east and from the east to the southwest. The south portion of North Angling and the east portion of Butler Road are 20 ft wide bituminous surfaces with three foot shoulders. The other two legs of the intersection are gravel roadways in good condition.

At the time of the field investigation, the traffic control present for southbound North Angling Road and eastbound Butler Road was a yield sign for each roadway. However, the yield signs have been replaced by 24 in. stop signs.

There are also two 30 in. curve signs on the other legs of the intersection; one for westbound Butler Road and another for northbound North Angling Road.

All six of the accidents at this location during the study period happened at night. Five of the accidents could be attributed to the existing alignment of the intersection. The situation is made critical due to the rough pavement at the curve and the high vehicular speeds throughout this rural area.

Recommendations:

We recommend that the existing curve signs for northbound North Angling Road and westbound Butler Road be

replaced by turn signs (W1-1-30, Appendix II, p. 99).

During field investigation, the study team concluded that curve speed panels were necessary at this location. Devil level indicator readings were recorded at various speeds for both directions. The following averages were determined.

	MPH	Devil Level Readings
Westbound	33	28°
	30	24°
	25	12°
	20	10°

	MPH	Devil Level Readings
Northbound	30	28°
	25	12°
	20	10°

Based on the field data and the theory outlined in Appendix II, pps. 111 - 112, we recommend that the new turn signs be supplemented with 25 mph advisory curve speed panels (W12-1-21, Appendix II, p. 111). We also recommend that a target arrow (W1-6-48, Appendix II, p. 104) be erected in target position for northbound North Angling Road.

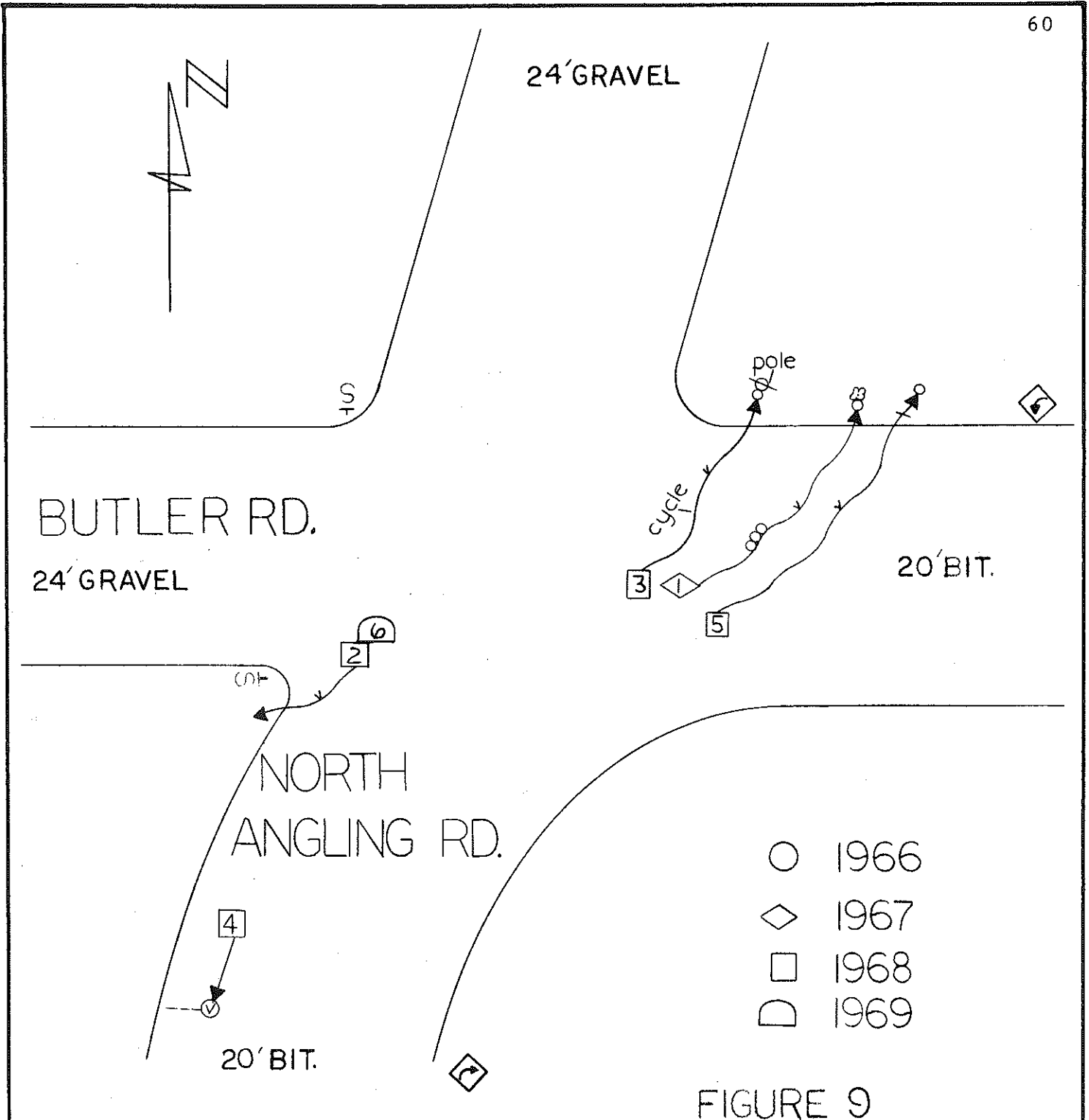
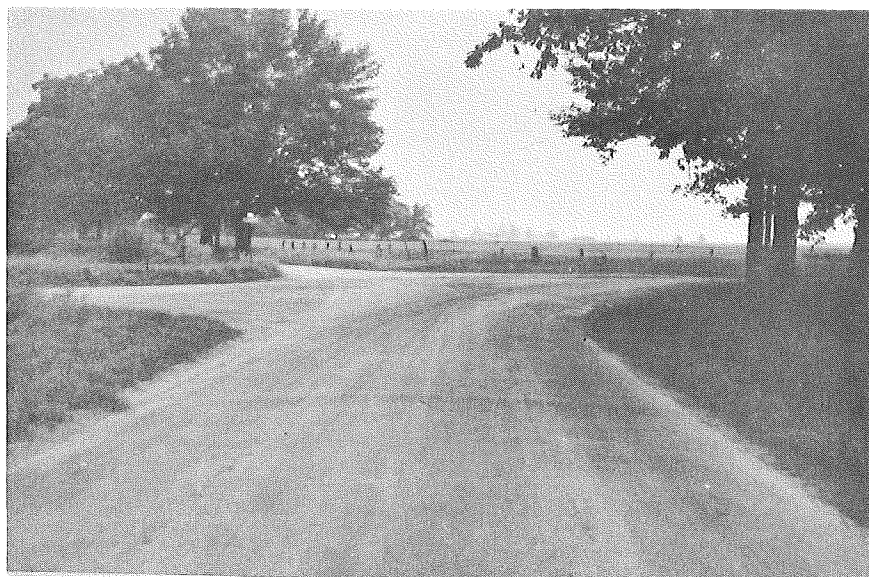


FIGURE 9

MICHIGAN DEPARTMENT OF STATE HIGHWAYS Traffic Division		ACCIDENT STUDY COLLISION DIAGRAM	
LEGEND		Period: <u>1966 THRU 1969</u>	
Stop & Go Signal	Stop Sign	Description: <u>ST. JOSEPH CO. NORTH ANGLING RD. at BUTLER RD.</u>	
Flashing Beacon	Yield Sign	NOTTAWA TWP. Accidents - Total <u>6</u>	
Fatal	Overtaken	P.D. <u>3</u> Injury <u>3</u> (8) Fatal <u>0</u>	
Injury	Backing	Acc. Rate/mv _____ Acc. Rate/mvm _____	
Skidding	Pedestrian	C.S. _____ Miles _____	
Jackknife	Tree	Drawn <u>DVW</u> Date <u>5-27-70</u> Rev. _____	
	Deer	Plan No. <u>LOCATION 9</u>	
	Violator		



NORTHBOUND
NORTH ANGLING ROAD
APPROACHING BUTLER ROAD



NORTHBOUND
NORTH ANGLING ROAD
AT BUTLER ROAD



EASTBOUND
BUTLER ROAD

FIGURE 9A



WESTBOUND
BUTLER ROAD
APPROACHING NORTH
ANGLING ROAD



WESTBOUND
BUTLER ROAD
AT NORTH ANGLING ROAD



SOUTHBOUND
NORTH ANGLING ROAD

FIGURE 9B

10. Buckhorn Road @ Heimbach Road, Park Township

This is a right angle intersection with both legs of Heimbach Road under stop control. Heimbach Road is a 22 ft bituminous roadway which has been recently sealed and is in good condition. Heimbach Road has no shoulders and at the present time doesn't have any centerline markings.

Buckhorn Road is a 22 ft bituminous surface with no shoulders and no centerline markings. At the time of the field investigation, work was being done on the resurfacing of this road.

The traffic control is a 24 in. stop sign for each direction of traffic on Heimbach Road. There was a total of six accidents at this location over the study period 1966 through 1969. Westbound traffic on Heimbach Road failed to yield the right of way causing three of the reported accidents. Overall visibility at the intersection is very good.

Recommendation:

We recommend that stop ahead signs (W3-1-30, Appendix II, p.109) be erected for each direction of traffic on Heimbach Road.

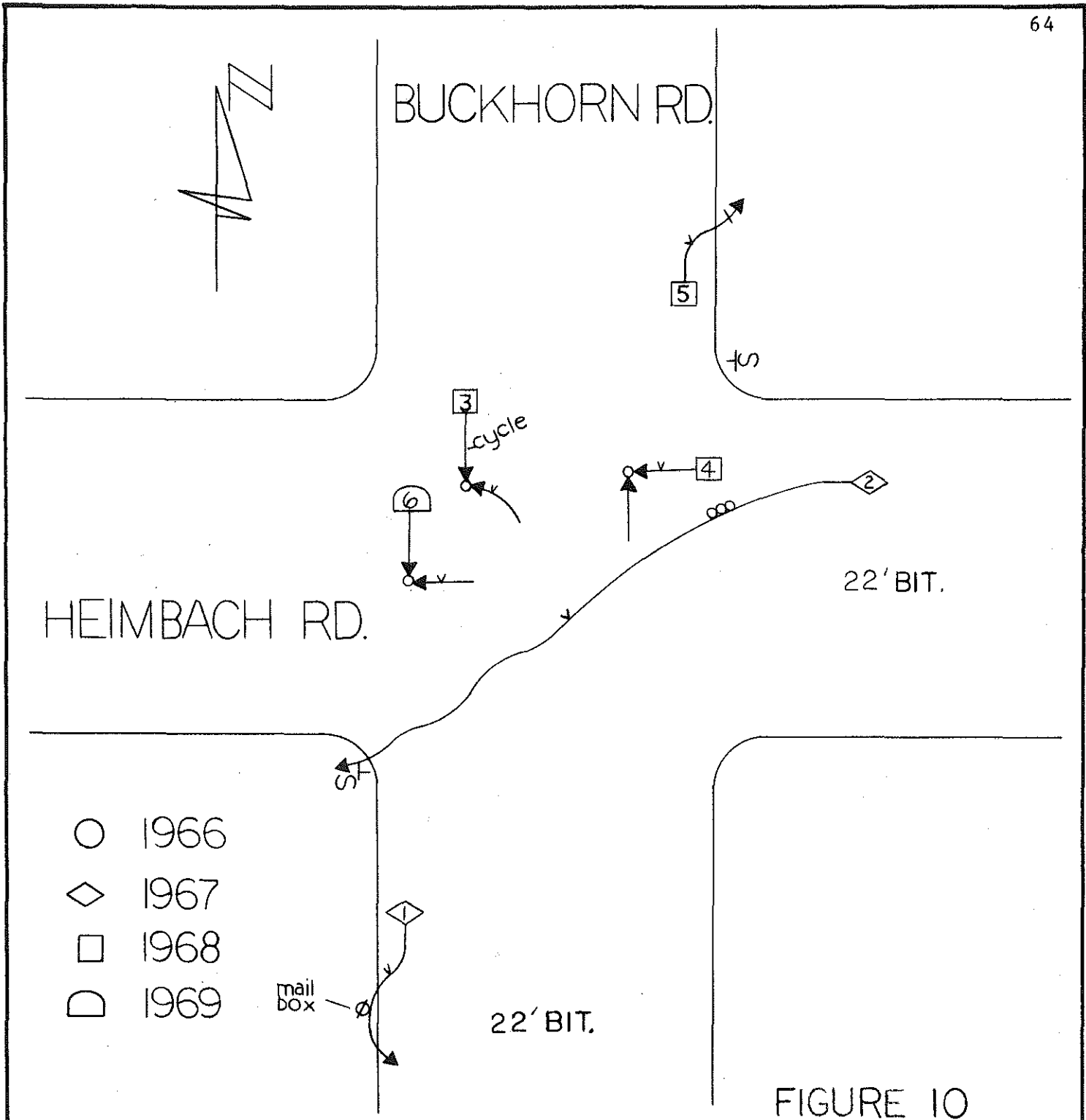


FIGURE 10

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal		Stop Sign	
Flashing Beacon		Yield Sign	

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

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969

ST. JOSEPH CO. Description BUCKHORN RD. at HEIMBACH RD.

PARK TWP

Accidents - Total 6 (8)

P.D. 3 Injury 3

Fatal 0 ()

Acc. Rate/mv _____

Acc. Rate/mvm _____

C.S. _____ Miles _____

Drawn DVW Date 5-28-70 Rev. _____

Plan No. LOCATION 10



WESTBOUND
HEIMBACH ROAD



NORTHBOUND
BUCKHORN ROAD



EASTBOUND
HEIMBACH ROAD

FIGURE 10A

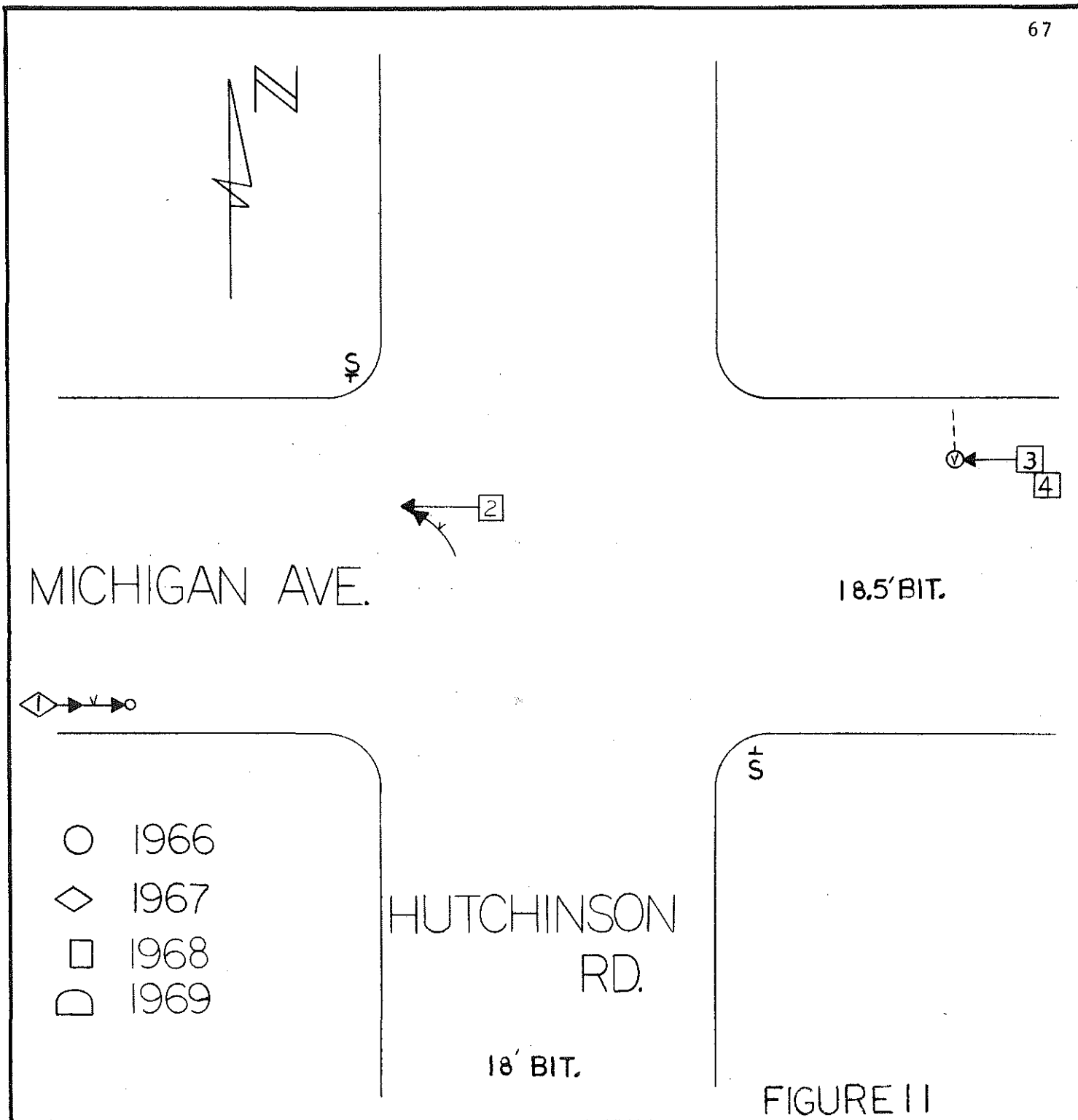
11. Michigan Avenue @ Hutchinson Road, Park Township

Hutchinson Road intersects Michigan Avenue at right angles forming a typical rural intersection with Michigan Avenue having the right of way. Michigan Avenue is a 18.5 ft bituminous roadway with five foot grass and sand shoulders and centerline markings. Hutchinson Road is an 18 ft bituminous roadway with two foot shoulders.

There is a 24 in. stop sign for each direction of traffic on Hutchinson Road. There were 4 accidents at this location during the study period 1966 through 1969. Two of the accidents were car-deer accidents. After field investigation, the study team concluded that no serious condition exists at this location. Overall visibility is very good with the exception of visibility of the stop sign on southbound Hutchinson Road.

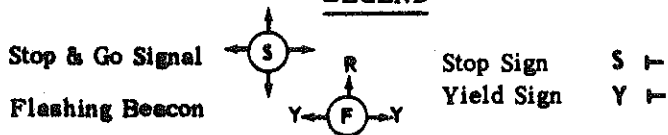
Recommendation:

We recommend that the existing stop sign for southbound Hutchinson Road be raised to the standard five foot bottom height. This should improve its visibility to oncoming traffic.



MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969

ST. JOSEPH CO. Description _____

MICHIGAN AVE. at HUTCHINSON

Accidents - Total 4

P.D. 3 Injury _____ ()

Fatal 0 ()

Acc. Rate/mv _____

Acc. Rate/mvm _____

C.S. _____ Miles _____

Drawn DVW Date 5-28-70 Rev. _____

Plan No. LOCATION 11



NORTHBOUND
HUTCHINSON ROAD



EASTBOUND
MICHIGAN AVENUE



SOUTHBOUND
HUTCHINSON ROAD

FIGURE 11A

12. Burr Oak Road @ Palmer Road, Colon Township

Palmer Road is offset at its intersection with Burr Oak Road. Burr Oak Road between the north and south junctions of Palmer Road goes in a northeasterly direction for 0.34 miles before curving to the north. Burr Oak Road is 22 ft wide bituminous with three to five foot grass shoulders. The west leg of Palmer Road is a 22 ft wide bituminous roadway with three foot grass shoulders. The east leg is a 22 ft gravel roadway.

Traffic controls for Palmer Road are a 24 in. stop sign for the west leg (eastbound traffic) and a 30 in. yield sign on the east leg (westbound traffic). The 30 in. yield sign is smaller than the minimum size required by the Manual and consideration should be given to bring this sign to standards whenever the condition of the sign requires its replacement. Traffic controls for northbound Burr Oak are a 30 in. curve sign and a 24 in. x 48 in. target arrow for the first curve encountered by northbound traffic. The second curve encountered by northbound traffic has a 30 in. curve sign.

Traffic control for southbound Burr Oak Road is a 30 in. curve sign for each curve.

There were five accidents at this location over the study period 1966 through 1969. One accident resulted in personal injury and the others in property damage.

Recommendation:

We recommend that a 24 in. x 48 in. target arrow (W1-6-48, Appendix II, p. 104) be erected in target position for the first curve encountered by southbound Burr Oak traffic (east junction).

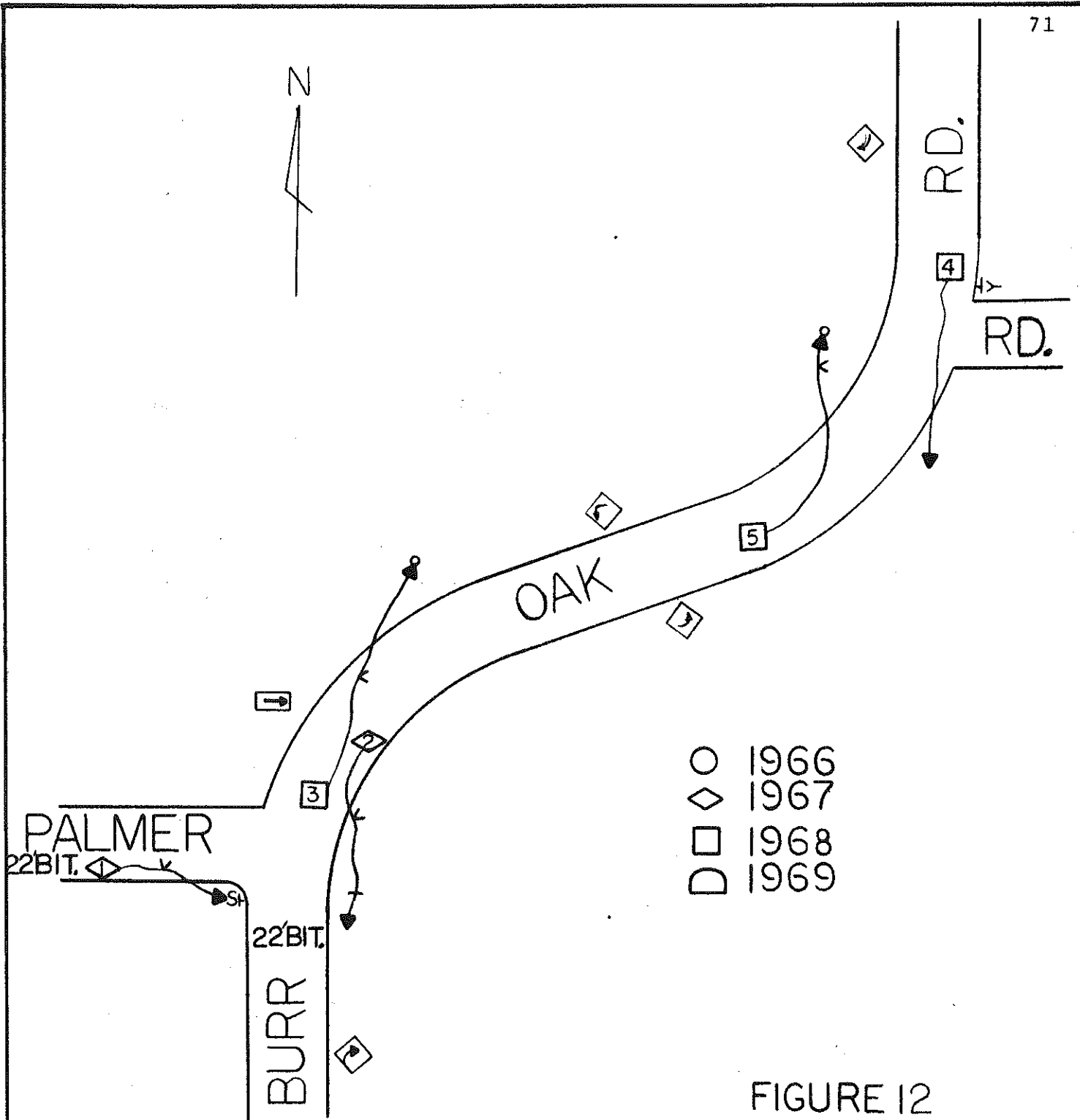


FIGURE 12

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

- | | | | |
|------------------|--|----------------|--|
| Stop & Go Signal | | Stop Sign | |
| Flashing Beacon | | Yield Sign | |
| Fatal | | Overtuned | |
| Injury | | Backing | |
| Skidding | | Pedestrian | |
| Jackknife | | Tree | |
| | | Out of Control | |
| | | Driver Intent | |
| | | Deer | |
| | | Violator | |

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
 ST. JOSEPH CO. Description COLON TWP.
 PALMER RD. AT BURR OAK RD.

Accidents - Total	5	
P.D.	3	Injury 2 (2)
Fatal	0	()

Acc. Rate/mv _____
 Acc. Rate/mvm _____

C.S. _____ Miles _____
 Drawn DJM. Date 9-1-70 Rev. _____
 Plan No. LOCATION 12



NORTHBOUND BURR OAK ROAD
(AT THE WEST INTERSECTION)



EASTBOUND PALMER ROAD
(AT THE WEST INTERSECTION)



SOUTHBOUND BURR OAK ROAD
(AT THE WEST INTERSECTION)

FIGURE 12A

13. Findley Road @ Mackale Road, Burr Oak Township

Mackale Road forms a "T" intersection with Findley Road. In the vicinity of the intersection, Mackale Road is an 18 ft wide bituminous roadway with no shoulders. However, one block south of the intersection Mackale Road is a narrow gravel roadway. Findley Road is an 18 ft bituminous roadway with three foot shoulders and centerline markings. It is characterized by curves east and west of the intersection.

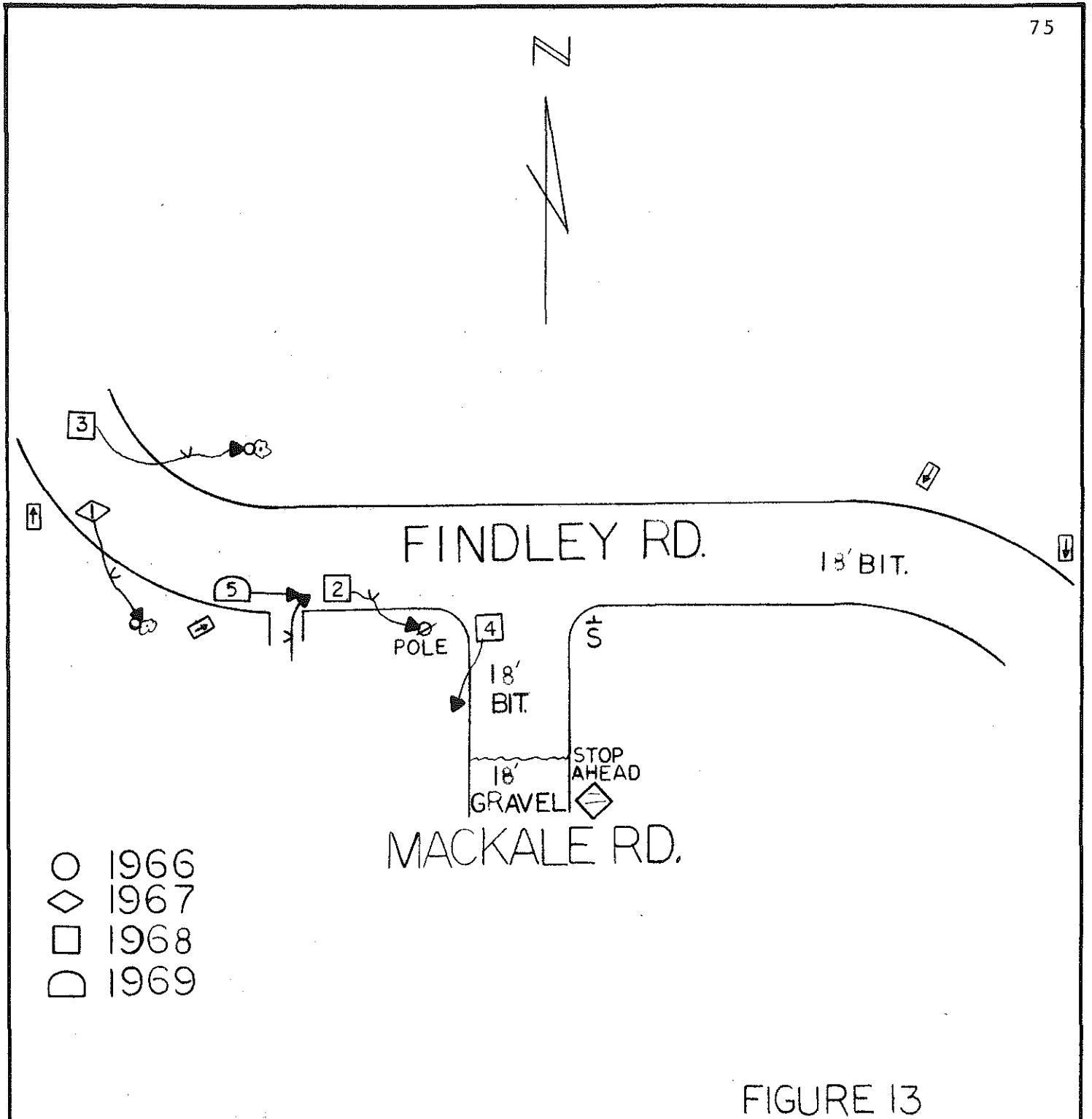
Traffic controls for Mackale Road consist of a 24 in. stop ahead sign and a 24 in. stop sign. Visibility of the stop ahead sign is very limited and the sign itself has lost its reflective properties. Traffic controls for eastbound Findley Road (west of the junction) are a 36 in. winding road sign and a 24 in. x 48 in. target arrow. Eastbound Findley Road also has another target arrow east of the junction. Traffic controls for westbound Findley Road are two 24 in. x 48 in. target arrows; one in target position for each curve. A 25 mph speed zone for both directions of traffic on Findley Road is also present throughout this location.

There was a total of five accidents at this location. Four of the accidents were of the ran-off the roadway type and of these three were reportedly caused by speed too high for the conditions.

Recommendations:

We recommend that the existing winding road sign for eastbound Findley Road be replaced by a curve sign (W1-2-30, Appendix II, p.100) and that an additional 30 in. curve sign be erected in advance of the first curve encountered by westbound traffic (east of the Mackale Road and Findley Road intersection).

We further recommend that the stop ahead sign on Mackale Road be replaced by a new sign (W3-1-30, Appendix II, p.109).



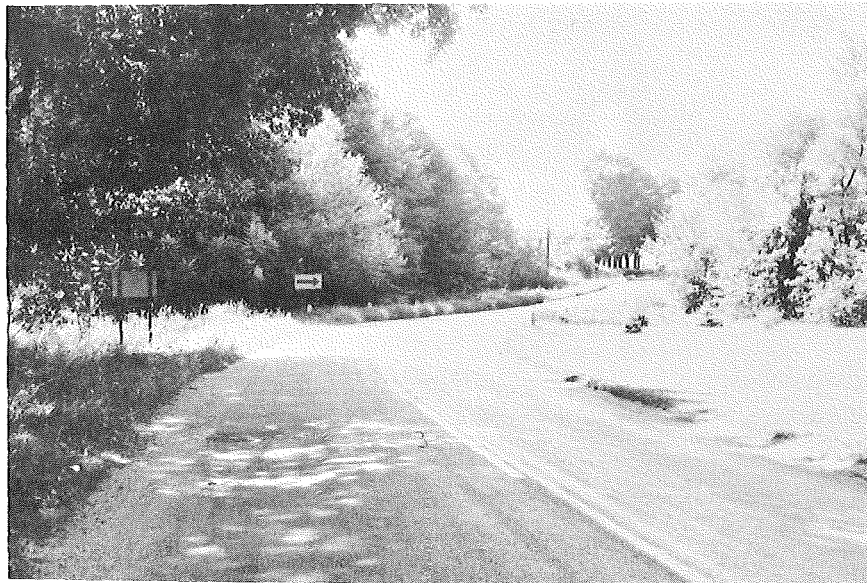
- 1966
- ◇ 1967
- 1968
- ◐ 1969

FIGURE 13

<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS Traffic Division</p> <p style="text-align: center;">LEGEND</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%;">Stop & Go Signal</td> <td style="width: 25%; text-align: center;"></td> <td style="width: 25%;">Stop Sign</td> <td style="width: 25%; text-align: center;">S —</td> </tr> <tr> <td>Flashing Beacon</td> <td style="text-align: center;"></td> <td>Yield Sign</td> <td style="text-align: center;">Y —</td> </tr> </table> <table style="width: 100%; border: none;"> <tr> <td>Fatal</td> <td></td> <td>Overtuned</td> <td></td> <td>Out of Control</td> <td></td> </tr> <tr> <td>Injury</td> <td></td> <td>Backing</td> <td></td> <td>Driver Intent</td> <td></td> </tr> <tr> <td>Skidding</td> <td></td> <td>Pedestrian</td> <td></td> <td>Deer</td> <td></td> </tr> <tr> <td>Jackknife</td> <td></td> <td>Tree</td> <td></td> <td>Violator</td> <td></td> </tr> </table>	Stop & Go Signal		Stop Sign	S —	Flashing Beacon		Yield Sign	Y —	Fatal		Overtuned		Out of Control		Injury		Backing		Driver Intent		Skidding		Pedestrian		Deer		Jackknife		Tree		Violator		<p style="text-align: center;">ACCIDENT STUDY COLLISION DIAGRAM</p> <p>Period: <u>1966</u> THRU <u>1969</u></p> <p>ST. JOSEPH CO. Description <u>BURR OAK TWP</u> <u>FINDLEY RD. AT MACKALE RD.</u></p> <table style="width: 100%; border: none;"> <tr> <td>Accidents - Total</td> <td style="text-align: right;"><u>5</u></td> </tr> <tr> <td>P.D. <u>3</u></td> <td>Injury <u>2</u> (3)</td> </tr> <tr> <td>Fatal <u>0</u></td> <td>()</td> </tr> </table> <p>Acc. Rate/mv _____ Acc. Rate/mvm _____</p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DJM</u> Date <u>6-1-70</u> Rev. _____</p> <p>Plan No. <u>LOCATION 13</u></p>	Accidents - Total	<u>5</u>	P.D. <u>3</u>	Injury <u>2</u> (3)	Fatal <u>0</u>	()
Stop & Go Signal		Stop Sign	S —																																				
Flashing Beacon		Yield Sign	Y —																																				
Fatal		Overtuned		Out of Control																																			
Injury		Backing		Driver Intent																																			
Skidding		Pedestrian		Deer																																			
Jackknife		Tree		Violator																																			
Accidents - Total	<u>5</u>																																						
P.D. <u>3</u>	Injury <u>2</u> (3)																																						
Fatal <u>0</u>	()																																						



WESTBOUND FINDLEY ROAD
AT MACKALE ROAD



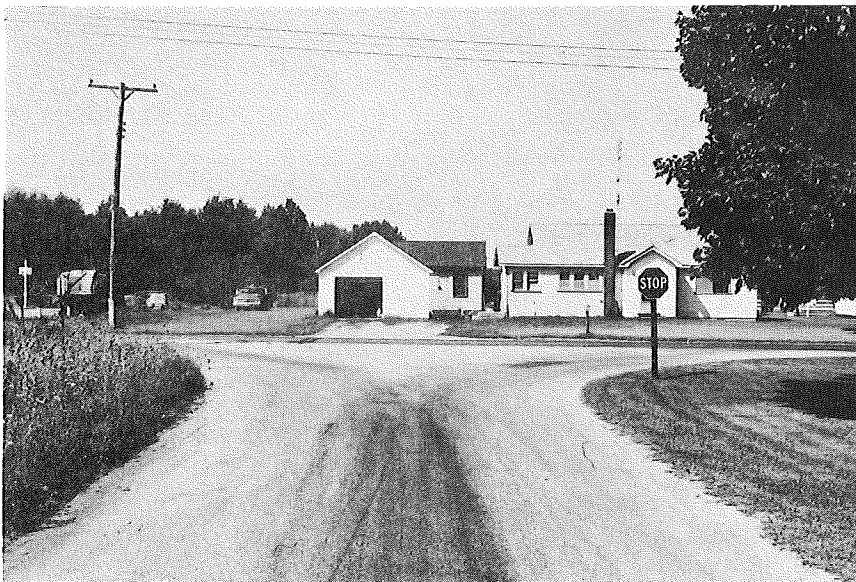
WESTBOUND FINDLEY ROAD
(WEST OF THE INTERSECTION)



EASTBOUND
FINDLEY ROAD



EASTBOUND
FINDLEY ROAD
AT MACKALE ROAD



NORTHBOUND
MACKALE ROAD

14. Youngs Prairie Road, 0.5 miles east of Breck Chapel,
Constantine Township

This section of Youngs Prairie Road is gently rolling and on a curve. Youngs Prairie is an 18 ft wide bituminous roadway which has been recently resealed and has three foot grass shoulders but no centerline markings.

The existing traffic control is a 30 in. curve sign for each direction of traffic on Youngs Prairie Road. This location was the scene of three accidents during the study period. Two of the accidents were caused by deer and resulted in no injury to the occupants of the vehicles. The other accident occurred under snowy conditions.

Judging by the current accident picture and the existing signing, no recommendations are being made for this location.

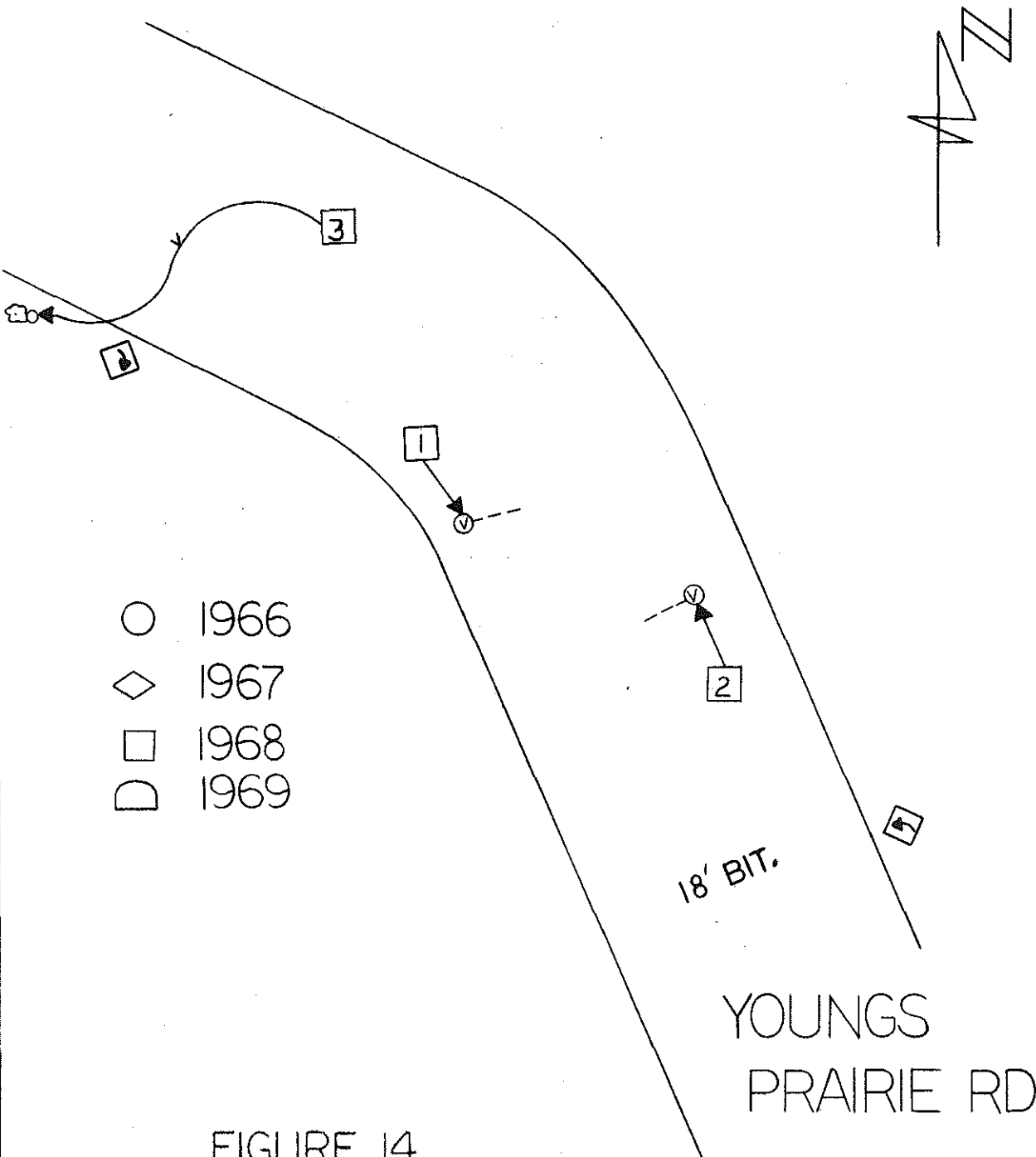
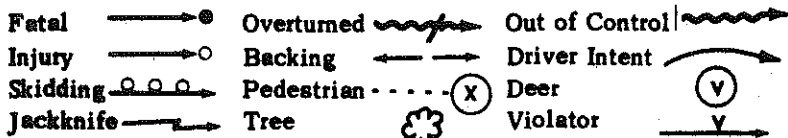
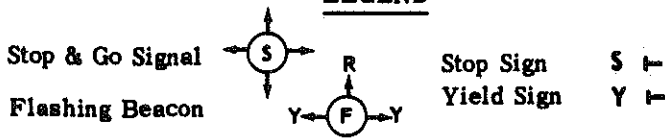


FIGURE 14

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969

ST. JOSEPH CO. Description CONSTATINE TWP
YOUNGS PRAIRIE RD. 0.5 MI. EAST OF
BRECK CHAPEL

Accidents - Total 3
 P.D. 2 Injury ()
 Fatal 0 ()

Acc. Rate/mv _____
 Acc. Rate/mvm _____

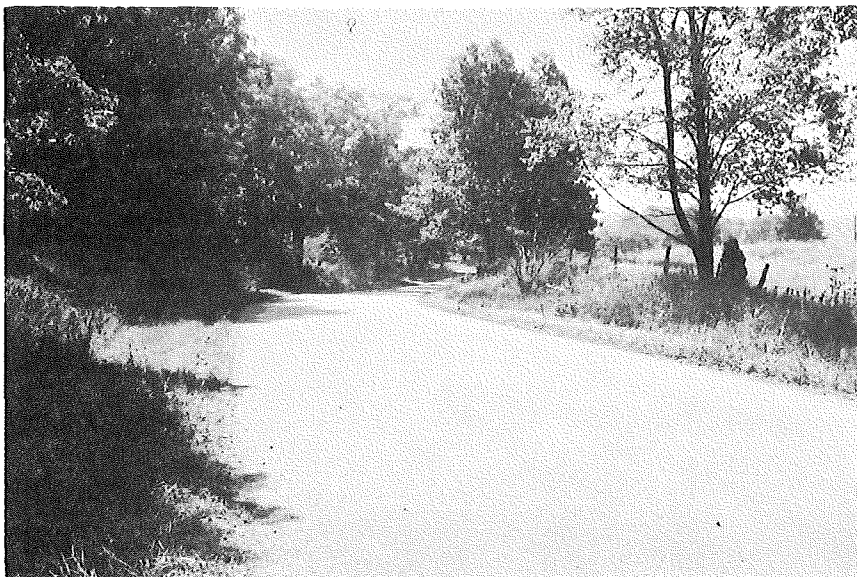
C.S. _____ Miles _____

Drawn DVW Date 6-4-70 Rev. _____

Plan No. #14



EASTBOUND
YOUNGS PRAIRIE ROAD
APPROACHING THE CURVE



EASTBOUND
YOUNGS PRAIRIE ROAD
AT THE CURVE



WESTBOUND
YOUNGS PRAIRIE ROAD
APPROACHING THE CURVE

FIGURE 14A

SUMMARY AND CONCLUSIONS

There was a total of 1,821 reported traffic accidents on St. Joseph County roads during the study period 1966 through 1969 for an average of 456 accidents per year.

The information summarized in Table 4 shows that during the years 1966 through 1969 a total of 116 accidents occurred at the 14 highest accident locations in St. Joseph County. Of these 47 resulted in personal injury and 67 were property damage. There were two fatalities during this period at the locations studied.

Table 5 shows that the peak accident month was December accounting for 14.6% of the accidents. It also shows that Sunday was the peak accident day, with Saturday and Sunday accounting for more than 40% of the total accidents.

The figures in Table 6 indicate that the peak accident hour occurs between 7 and 8 p.m. This hour together with the hours between 10 - 11 p.m. and 11 - 12 p.m. accounted for over 26% of the accidents.

Table 7 shows that 72% of the accidents occurred when the weather was generally clear. As shown in Table 8, 53% of the accidents occurred when the pavement was dry; 34% when the pavement was wet and the rest when it was either snowy or icy.

The information contained in Table 10 shows that 68%

of the drivers involved in accidents at the study locations were local residents.

Our analysis of the accident problem on county roads in St. Joseph County in relationship to spot or high accident locations reveals that there are no critical problems which cannot be eliminated by the modest engineering means related to a spot improvement program.

The accident information summarized in Tables 4 through 10 may yield some basic information needed by those agencies interested in highway safety from the standpoint of driver education, law enforcement and street patrol activities.

APPENDIX I

TABLE I
POPULATION INVENTORY AND FORECAST

Year	St. Joseph County	Michigan
1940	31,749	5,256,106
1950	35,071	6,371,766
1960	42,332	7,823,194
1990	54,659	11,233,000
Percent Change		
1940-50	10.5	21.2
1950-60	20.7	22.8
1960-90	29.1	43.6

ST. JOSEPH COUNTY
PLACE OF WORK AND RESIDENCE (1960)

Table 2

	Kalamazoo City	Balance of Kalamazoo Co.	South Bend City, Ind.	Balance of St. Joseph Co., Ind.	St. Joseph Co., Mich.	Cass Co., Mich.	Van Buren Co., Mich.	Calhoun County, Mich.	Branch Co., Mich.	LaGrange Co., Ind.	Elkhart Co., Ind.	Jackson City	Balance of Jackson Co.	Elsewhere	Places of Work Not Reported
Burr Oak Twp.	-	-	-	-	699	-	-	-	32	8	4	-	-	8	53
Colon Twp.	4	-	-	-	772	-	-	4	33	-	-	-	-	16	52
Constantine Twp.	4	-	-	4	822	4	-	-	-	4	118	-	-	24	17
Fabius Twp.	16	-	4	-	525	21	-	-	16	-	8	-	-	16	116
Fawn River Twp.	-	-	-	-	443	-	-	-	28	4	-	-	-	8	29
Florence Twp.	4	-	4	-	302	4	-	-	-	-	9	-	-	4	29
Flowerfield Twp.	12	36	-	-	169	-	-	4	-	-	-	-	-	-	9
Leonidas Twp.	9	12	-	-	192	-	-	28	20	-	-	-	-	-	42
Lockport Twp.	12	8	-	-	529	4	4	-	-	-	8	-	-	-	49
Mendon Twp.	24	48	-	-	413	-	-	4	-	4	-	-	-	17	96
Mottville Twp.	-	-	4	4	167	-	-	-	-	-	106	-	-	8	37
Nottawa Twp.	13	-	-	4	713	-	-	4	8	-	8	-	-	4	62
Park Twp.	60	44	-	-	389	-	-	-	-	-	8	-	-	8	33
Sherman Twp.	-	-	-	-	609	-	-	-	4	-	8	-	-	8	36
City of Sturgis	-	-	13	-	3,280	8	-	12	32	44	25	-	-	37	84
Sturgis Twp.	-	-	-	-	426	-	-	-	-	14	-	-	-	8	78
City of Three Rivers	52	44	8	-	2,227	15	4	4	-	-	4	4	-	51	329
White Pigeon Twp.	5	-	5	5	811	4	-	-	-	8	97	-	-	20	40
	212	192	38	17	13,488	60	8	60	173	86	595	4	-	237	1,191

Total St. Joseph County 13,488
 Total Out of County 2,873
 TOTAL 16,361

REPORTED TRAFFIC ACCIDENTS IN ST. JOSEPH COUNTY

Year	Property Damage	Injury	Fatal	Total	County Road	State Route	Inter- State	Persons Injured	Persons Killed
1966	987	380	12	1,379	347	778	0	626	13
1967	1,020	404	23	1,447	385	788	0	661	26
1968	1,186	492	25	1,703	537	902	0	849	32
1969	1,319	525	13	1,857	552	1,009	0	829	14

St. Joseph County State of Mich.
Roads Accidents

1966	347	302,880
1967	385	299,004
1968	537	305,495
1969	552	331,223

PERCENT CHANGE FOR ABOVE TOTALS

1966-67	11.0	-1.3
1967-68	39.5	2.2
1968-69	2.8	8.4

VEHICLE REGISTRATION IN ST. JOSEPH COUNTY

Year	Pass.	Comm.	Farm Vehicle	Trailer	Trailer Coach	Motor Cycles	Muni- cipal	Total Plates
1966	-	-	-	-	-	-	-	29,940
1967	20,699	4,509	380	3,985	358	612	27	30,570
1968	21,045	4,847	384	3,945	458	709	15	31,453
1969	21,803	5,477	-	4,393	-	715	60	32,448

ACCIDENT ANALYSIS

Table 4

ANNUAL ACCIDENT SUMMARY

FOURTEEN HIGH ACCIDENT LOCATIONS IN ST. JOSEPH COUNTY

Period Studied: 1966 through 1969

* * * * *

Accident Type	Day	Night	Total
Fatal Accident	1	1	2
Personal Injury Acc.	18	29	47
Property Damage Acc.	22	45	67
Total	41	75	116

* * * * *

Month	Fatal		Injury		Prop. Damage		Sub. Total		Total
	Day	Night	Day	Night	Day	Night	Day	Night	
January			2		6	5	8	5	13
February					1	1	1	1	2
March				1	2	6	2	7	9
April			4	5		4	4	9	13
May			2	2	1	2	3	4	7
June			4	4	3	2	7	6	13
July				2	2	1	2	3	5
August				4	1	1	1	5	6
September			3	3		3	3	6	9
October	1		1	3	1	8	3	11	14
November		1	1	1	1	4	2	6	8
December			1	4	4	8	5	12	17
S. Total	1	1	18	29	22	45	41	75	116
Total	2		47		67		116		

ACCIDENT ANALYSIS

Table 5

MONTHLY AND DAILY ACCIDENT OCCURRENCE

FOURTEEN HIGH ACCIDENT LOCATIONS IN ST. JOSEPH COUNTY

Period Studied: 1966 through 1969

* * * * *

Month	Day of the Week							Monthly Total	% Of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
January	3	3	1		2	2	2	13	11.2
February		1	1					2	1.7
March	1		2		2	2	2	9	7.8
April	1	1		3	1	1	6	13	11.2
May	1	2	1			2	1	7	6.0
June	1	2	2		2	1	5	13	11.2
July		1	1	1		2		5	4.3
August	1	1	1	1	1	1		6	5.2
September	1		1	2			5	9	7.8
October	2	3	2	2		3	2	14	12.1
November	1			1	3	2	1	8	6.9
December	1		4	2	3	3	4	17	14.6
Day Total	13	14	16	12	14	19	28	116	100.0
% of Total	11.2	12.1	13.8	10.3	12.1	16.4	24.2	100.0	

Peak Accident Day: Sunday

Peak Accident Month: December

ACCIDENT ANALYSIS

Table 6

DAILY AND HOURLY ACCIDENT OCCURRENCE

FOURTEEN HIGH ACCIDENT LOCATIONS IN ST. JOSEPH COUNTY

Period Studied: 1966 through 1969

* * * * *

Hour	Day of the Week							Hour Total	% of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
12 - 1AM	1	1			1		1	4	3.5
1 - 2AM			2	1		2	2	7	6.0
2 - 3AM	1		1		2	1	1	6	5.1
3 - 4AM	1	1				2	3	7	6.0
4 - 5AM					1			1	.9
5 - 6AM					1			1	.9
6 - 7AM	1	1		3				5	4.3
7 - 8AM			1	1				2	1.8
8 - 9AM			1			2		3	2.6
9 - 10AM						2	1	3	2.6
10 - 11AM	1	1	1		1			4	3.5
11 - 12AM				2				2	1.7
12 - 1PM							2	2	1.7
1 - 2PM						1		1	.9
2 - 3PM	2	1	1		1			5	4.3
3 - 4PM	2	2			1	1	1	7	6.0
4 - 5PM			1		1	1	2	5	4.3
5 - 6PM		1		1		1	1	4	3.5
6 - 7PM			1	1	2	2		6	5.2
7 - 8PM	2	2	4		1	1	3	13	11.2
8 - 9PM	1		1				4	6	5.1
9 - 10PM		1				1	2	4	3.5
10 - 11PM	1	1	1			1	4	8	6.8
11 - 12PM		2	1	3	2	1	1	10	8.6
Not Stated									
Day Total	13	14	16	12	14	19	28	116	100.0
% of Total	11.2	12.1	13.8	10.3	12.1	16.3	24.2	100.0	

Peak Accident Hour: 7 - 8 p.m.

Peak Accident Day: Sunday

ACCIDENT ANALYSIS

Table 7

WEATHER CONDITIONS AT SCENE OF ACCIDENTS

FOURTEEN HIGH ACCIDENT LOCATIONS IN ST. JOSEPH COUNTY

Period Studied: 1966 through 1969

* * * * *

Weather	Severity of Accident				Percent
	Fatal	Injury	Prop. Damage	Total	
Clear or Cloudy	2	35	47	84	72.4
Rain		6	13	19	16.4
Fog		4	5	9	7.8
Snow or Sleet		1	2	3	2.5
Not Stated		1		1	.9
Total	2	47	67	116	100.0

* * * * *

TABLE 8

PAVEMENT CONDITIONS AT SCENE OF ACCIDENTS

Pavement	Severity of Accident				Percent
	Fatal	Injury	Prop. Damage	Total	
Dry	1	26	35	62	53.4
Wet	1	16	23	40	34.5
Snowy/Icy		5	4	9	7.8
Icy			4	4	3.4
Not Stated			1	1	.9
Total	2	47	67	116	100.0

Table 9

AGE OF DRIVERS INVOLVED IN ACCIDENTS

FOURTEEN HIGH ACCIDENT LOCATIONS IN ST. JOSEPH COUNTY

Period Studied: 1966 through 1969

* * * * *

Age Group	Number of Drivers Involved in				% Of Total
	Fatal	Injury	Prop. Damage	Total	
Under 16		1		1	.7
16-19		14	18	32	21.0
20-24		17	22	39	25.7
25-34	1	13	13	27	17.7
35-44	1	7	11	19	12.5
45-54		7	10	17	11.2
55-64	1	5	4	10	6.6
65-74		3	1	4	2.6
75 & Over		1	1	2	1.3
Not Stated			1	1	.7
Total	3	68	81	152	100.0

* * * * *

Table 10

RESIDENCE OF DRIVERS INVOLVED IN ACCIDENTS

Residence	Number of Drivers Involved in				% Of Total
	Fatal	Injury	Prop. Damage	Total	
Local	2	44	58	104	68.4
Michigan		16	17	33	21.7
Out of State	1	8	5	14	9.2
Not Stated			1	1	.7
Total	3	68	81	152	100.0

APPENDIX II

Section B. Regulatory Signs

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

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

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

Regulatory signs are classified in the following groups:

- | | | |
|-----|-----------------|-------------|
| (1) | Right-of-Way | (R1 Series) |
| | a. "STOP" Sign | |
| | b. "YIELD" Sign | |
| (2) | Speed | (R2 Series) |
| (3) | Movement | (R3 Series) |
| | a. Turning | |
| | b. Alignment | |
| | c. One Way | |
| | d. Exclusion | |
| (4) | Parking | (R4 Series) |
| (5) | Pedestrian | (R5 Series) |
| (6) | Miscellaneous | (R6 Series) |

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

STOP SIGN



Reflectorized

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

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

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

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

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

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

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

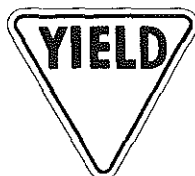
Secondary messages shall not be used on the face of a "STOP" sign. At a four-way stop intersection, each "STOP" sign may

be supplemented by a separate panel reading "4-WAY". Where this panel is used in conjunction with an R1-1-24, it shall be 24" x 9" with 5-inch legend. Where used with an R1-1-30 or R1-1-36, it shall be 30" x 12" with a 7-inch legend. Each panel shall have a black legend and border with a white reflectorized background. No additional sign shall be displayed with a "STOP" sign except one of the following: R3-1, R3-2, R3-3, R3-5, R3-6, or R3-23.

A hand held "STOP" sign may be used by Traffic Regulators as provided in Part II, Section E. Drivers facing the hand held "STOP" sign shall come to a complete stop and remain standing until an indication is given to proceed.

For placement see figures 1-3 and 1-4 and for special interim application see page 409.

YIELD SIGN



Reflectorized

R1-2-36 36" Equilateral Triangle (8", 3" and 2½" letters)

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

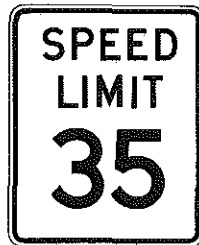
Place at the point where it is desired to have traffic yield or as near thereto as possible at the following locations:

1. At the approach to an intersection where it is necessary to assign right-of-way to the major road, but where a stop is not necessary at all times.
2. At any location where a special problem exists and where an engineering study indicates the problem to be susceptible to correction by use of the Yield sign.

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

For placement see figures 1-3 and 1-4.

SPEED LIMIT SIGN



Reflectorized

R2-1-24 24" x 30" (4" letters and 10" numerals)

R2-1-48 48" x 60" (8" letters and 16" numerals)

The "SPEED LIMIT" sign shall be located at the point of change from one speed limit to another and at additional locations, as just beyond major intersections, where it is necessary to remind motorists of the applicable limit. Where the sign cannot be placed at the exact point of change in limit (such as at the center of an intersection), it shall be placed as near as practicable, but in advance of the point of change for a decrease, and beyond such point for an increase. Signs shall be installed at maximum intervals of $\frac{1}{2}$ mile within any Speed Control Zone to confirm the speed of that zone. On freeways, the R2-1-48 sign shall be used.

For placement see figures 1-5 and 1-35.

Section C. Warning Signs

Introduction

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

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

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

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

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

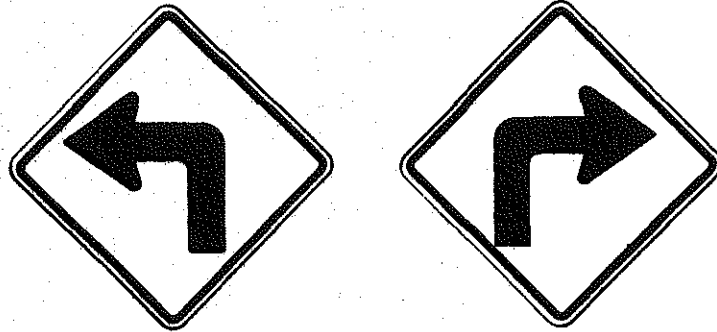
the Railroad Crossing signs, the Target Arrow signs, the Curve Speed panel, the Exit Speed sign, the Obstruction panel, and the Lattice Background. Other exceptions to the diamond shape are provided for in the case of temporary signs for highway construction and maintenance.

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

LIBRARY
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state highways
LANSING

(Rev. 1)

TURN SIGN



Reflectorized

W1-1-30 30" x 30"

W1-1-36 36" x 36"

W1-1-48 48" x 48"

The Turn sign shall be used to denote changes in the horizontal alignment of all roads (except minor roads and streets where in the judgment of the engineer the use of this sign is unnecessary) where a ball bank indicator or Devil Level registers ten degrees or more at a speed of 30 miles per hour or less. Where this sign is warranted, consideration should be given to the use of a Target Arrow (W1-6). Additional protection may be provided by use of the Curve Speed panel (W12-1).

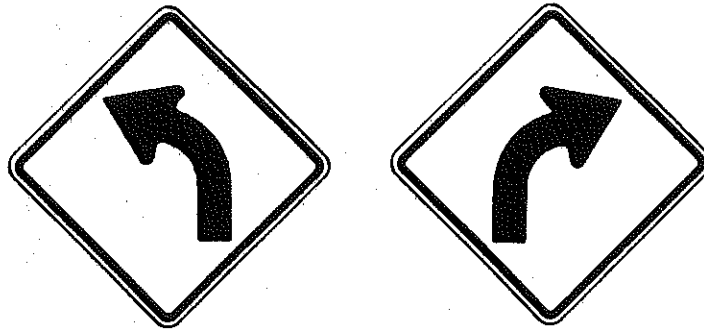
This sign shall be located in advance of the point of curvature at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	46-55	56 & Over
250'	400'	550'	750'

Turns or a turn and a curve that are less than 400 feet apart shall be designated by the W1-3 sign.

For placement see figure 1-11.

(Rev. 1)

CURVE SIGN

Reflectorized

W1-2-30 30" x 30"

W1-2-36 36" x 36"

W1-2-48 48" x 48"

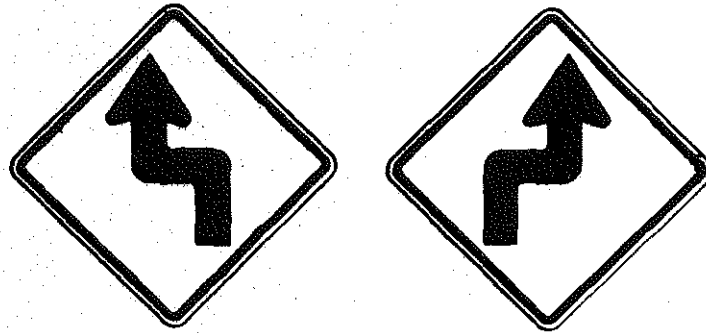
The Curve sign shall be used to denote changes in alignment where a ball bank indicator or Devil Level registers 10° or more at speeds between 30 and 60 miles per hour, and at such other locations where the change in alignment of the roadway is not apparent to the driver. Additional protection may be provided by use of the Curve Speed panel (W12-1).

The Curve sign shall be located in advance of the point of curvature at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	45-55	56 & Over
250'	400'	550'	750'

Curves that are less than 400 feet apart shall be designated by the W1-4 sign.

For placement see figures 1-11 and 1-35.

REVERSE TURN SIGN**Reflectorized**

W1-3-30 30" x 30"

W1-3-36 36" x 36"

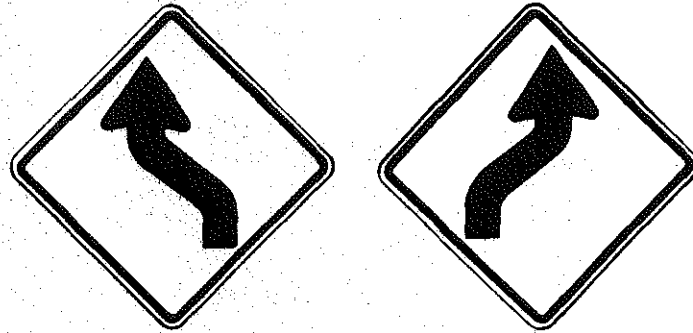
W1-3-48 48" x 48"

Where two turns or a curve and a turn in opposite directions are separated by a tangent of less than 400 feet a Reverse Turn sign shall be used. Where this sign is warranted, consideration should be given to the use of a Target Arrow (W1-6) in target position at each turn or curve. Additional protection may be provided by use of the Curve Speed panel (W12-1). The speed indication displayed shall be that of the slower turn or curve.

This sign shall be located in advance of the point of curvature of the first curve or turn at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	46-55	56 & Over
250'	400'	550'	750'

For placement see figure 1-11.

REVERSE CURVE SIGN**Reflectorized**

W1-4-30 30" x 30"

W1-4-36 36" x 36"

W1-4-48 48" x 48"

On all roads (except minor roads and streets, where in the judgment of the engineer the use of this sign is unnecessary) where two curves in opposite directions are separated by a tangent of less than 400 feet a Reverse Curve sign shall be used. Additional protection may be provided by use of the Curve Speed panel (W12-1). The speed indication displayed shall be that of the slower curve.

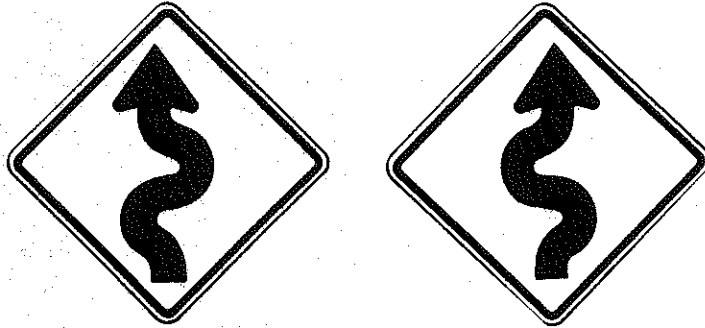
This sign shall be located in advance of the point of curvature of the first curve at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	46-55	56 & Over
250'	400'	550'	750'

For placement see figure 1-11.

(Rev. 1)

WINDING ROAD SIGN



Reflectorized

W1-5-30 30" x 30"

W1-5-36 36" x 36"

W1-5-48 48" x 48"

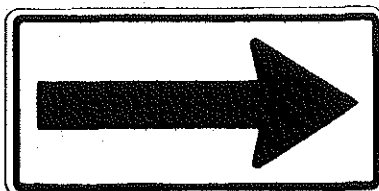
The Winding Road sign shall be used (except on minor roads and streets where in the judgment of the engineer the use of this sign is unnecessary) where there is a series of three or more turns or curves, separated by tangent distances of less than 400 feet. Where this sign is warranted, consideration should be given to the use of a target arrow (W1-6) in target position at each turn or curve. Additional protection may be provided by use of the Curve Speed panel (W12-1). The speed indication displayed shall be that of the slower turn or curve.

This sign shall be located in advance of the point of curvature of the first curve or turn at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	46-55	56 & Over
250'	400'	550'	750'

For placement see figure 1-11.

(Rev. 1)

TARGET ARROW SIGN

Reflectorized

W1-6-48 48" x 24"

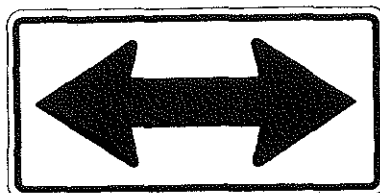
W1-6-96 96" x 48"

This sign may be used as a supplement to a Turn or Curve sign for potentially hazardous turns or curves. To increase its target value and to obscure misleading topography, the sign may be mounted on a Lattice Background (W12-10).

Where further emphasis of the required movement is desired, the W1-6-96 may be used in lieu of the unit consisting of the W1-6-48 and the W12-10.

This sign shall not be used to mark the ends of medians, centerpiers, etc., where there is no change in the direction of travel for all traffic. Further, it shall not be used as a route directional confirmatory marker or in any location where an intersecting street or highway of equal or nearly equal importance presents a choice of movement.

When used, the Target Arrow sign shall be erected in target position and, if possible, mounted high enough to be visible for at least 500 feet. It shall be placed at five feet minimum bottom height and two feet from the edge of the shoulder or curb face.

BI-DIRECTIONAL TARGET ARROW SIGN

Reflectorized

W1-7-48 48" x 24"

W1-7-96 96" x 48"

The Bi-Directional Target Arrow sign may be used at "T" or "Y" intersections to inform the driver of the abrupt changes in highway alignment. To increase its target value and to obscure misleading topography, the sign may be mounted on a Lattice Background (W12-10).

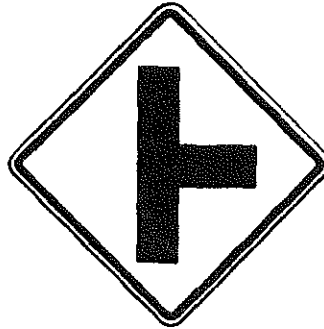
This sign shall not be used to mark the ends of medians, center-piers, etc., where there is no change in the direction of travel for all traffic.

When used, this sign shall be erected in target position and, if possible, it should be mounted high enough to be visible for at least 500 feet. It shall be placed at five feet minimum bottom height and two feet from the edge of the shoulder or curb face.

Where further emphasis of the required movements is desired, the W1-7-96 may be used in lieu of the unit consisting of the W1-7-48 and the W12-10.

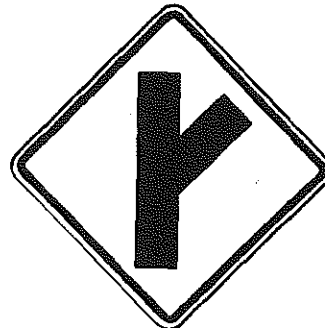
SIDE ROAD SIGN

ReflectORIZED



W2-2-30 30" x 30"

W2-2-36 36" x 36"



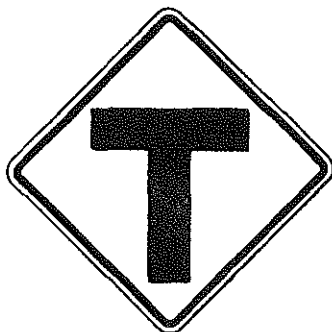
W2-3-30 30" x 30"

W2-3-36 36" x 36"

The Side Road sign, showing a side road symbol, either left or right, and at an angle of either 90 or 45 degrees, may be used in advance of a side road intersection following the same criteria given for the Cross Road sign (W2-1).

The relative importance of the intersecting roads may be shown by different widths of line.

For placement see figure 1-11.

"T" SYMBOL SIGN

Reflectorized

W2-4-30 30" x 30"

W2-4-36 36" x 36"

This sign may be used to warn traffic approaching a "T" intersection on the road that forms the stem of the "T", i.e., where traffic must make a turn either to the right or to the left. This sign should not generally be used on an approach where traffic is required to stop before entering the intersection, nor at a "T" intersection that is channelized by traffic islands, nor where junction signs or advance turn arrows are present.

The relative importance of the intersecting roads may be shown by different widths of line. It may also be desirable to place a Bi-Directional Target Arrow sign (W1-7) at the head of the "T" in target position.

Where used, the "T" symbol sign shall be located in advance of the intersection at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	46-55	56 & Over
250'	400'	550'	750'

For placement see figure 1-11.

"Y" SYMBOL SIGN

Reflectorized

W2-5-30 30" x 30"

W2-5-36 36" x 36"

This sign may be used to warn motorists approaching a "Y" intersection on the road that forms the stem of the "Y" i.e., where traffic must make a turn either to the right or to the left. This sign should not generally be used on an approach where traffic is required to stop before entering the intersection, nor at a "Y" intersection that is channelized by traffic islands, nor where junction signs or advance turn arrows are present.

The relative importance of the intersecting roads may be shown by different widths of line. It may also be desirable to erect a Bi-Directional Target Arrow sign (W1-7) at the fork of the "Y" in target position.

Where used, the "Y" symbol sign shall be located in advance of the intersection at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	46-55	56 & Over
250'	400'	550'	750'

For placement see figure 1-11.

STOP AHEAD SIGN

Reflectorized

W3-1-30 30" x 30" (6" letters)

W3-1-36 36" x 36" (8" letters)

The "STOP AHEAD" sign shall be erected in advance of an intersection where traffic is required to stop and the "STOP" sign is not visible to motorists for a sufficient distance or where emphasis is needed because of poor observance of the stop. The "STOP AHEAD" sign may also be used in advance of a red flashing beacon.

Where required, the W3-1-30 shall be used in advance of a 24-inch "STOP" sign and the W3-1-36 in advance of a 30 or 36-inch "STOP" sign.

Except where used on State trunkline highways at junctions with other State trunkline highways, it shall be located in advance of the required stop at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	46-55	56 & Over
250'	400'	550'	750'

For location on State trunkline highways see figures 1-17 and 1-26.

For placement see figure 1-11.

ONE LANE BRIDGE SIGN



Reflectorized

W5-3-30 30" x 30" (5" letters)

W5-3-36 36" x 36" (6" letters)

This sign shall be used in advance of a bridge structure which has a clear two-way roadway width of 17 feet or less.

Where used, it shall be located in advance of each end of the bridge at the approximate distance indicated below:

85th Percentile Speed			
35 & Below	36-45	46-55	56 & Over
250'	400'	550'	750'

For placement see figure 1-11.

CURVE SPEED PANEL



ReflectORIZED

W12-1-21 21" x 21" (10" and 3" letters)

W12-1-24 24" x 24" (12" and 3" letters)

The Curve Speed panel may be used as a supplement to the W1-1 through W1-5 signs only and shall display a speed legend in increments of five miles per hour. Since this legend is advisory, no Traffic Control Order is required. The W12-1-21 shall only be used with the appropriate 36 inch W1 sign and the W12-1-24 with the appropriate 48 inch W1 sign.

To determine the accurate negotiable speed on a turn or curve by the use of a ball bank indicator or Devil Level, several runs should be made in the same direction to obtain the most accurate reading possible. Readings obtained from several trial runs in the same direction shall determine the curve speed for that respective direction. Since the comfortable turn or curve speed on a specific turn or curve may vary, depending on direction of travel, the same procedure shall be used to obtain the curve speed for the opposite direction.

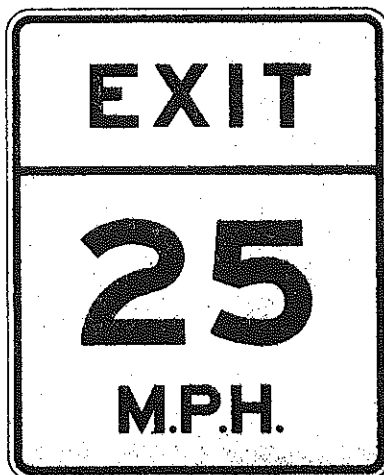
The following table indicates the speed to be used on the Curve Speed panel.

Indicator Reading	Speedometer Reading	Appropriate Panel Legend
10°	60, 59, or 58	60
10°	57, 56, 55, 54, or 53	55
10°	52, 51, 50, 49, or 48	50
10°	47, 46, 45, 44, or 43	45
10°	42, 41, 40, 39, or 38	40
10°	37, 36, 35, 34, or 33	35
12°	32, 31, 30, 29, or 28	30
12°	27, 26, 25, 24, or 23	25

Indicator Reading	Speedometer Reading	Appropriate Panel Legend
14°	22, 21, 20, 19, or 18	20
14°	17, 16, 15, 14, or 13	15
14°	12, 11, or 10	10

The speed legend displayed may equal but never exceed that of the posted speed limit in a Speed Control Zone.
For placement see figure 1-11.

EXIT ____ MILES PER HOUR SIGN



Reflectorized

W12-2-48 48" x 60" (8", 16", and 6" letters)

This advisory sign shall be used only at ramps exiting from freeways where the safe speed of the first curve on the off-ramp, as determined by conditions at each individual location, is found to be less than 70 percent of the design speed for the freeway.

If a safe speed indication is required for a second curve on an off-ramp well beyond the gore, a curve sign with a curve speed panel should be used.

For placement see figure 1-35.

DEER AREA SIGN

Reflectorized

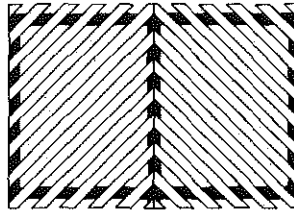
W12-8-36 36" x 36" (8" letters)

This sign may be used in advance of, and at intervals throughout, sections of highway where deer cross in somewhat well defined patterns and evidence exists that such crossings constitute a hazard.

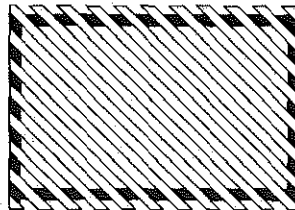
A joint investigation must be made by representatives of the Michigan Department of Conservation and the agency having jurisdiction over the highway before this sign may be installed.

For placement see figure 1-11.

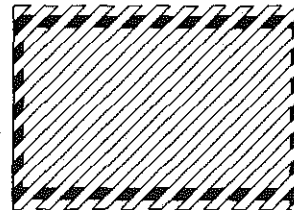
LATTICE BACKGROUND



Bi-directional



Right Directional



Left Directional

Reflectorized

W12-10

The Lattice Background shall only be used in conjunction with a warning or guide sign as outlined herein where greater emphasis is desired.

Where used for advance warning signs, (such as the Curve, Turn, or "STOP AHEAD" signs) an installation may be placed on the right, or both sides, of the roadway (a left directional on the right side and right directional on the left).

Where used in target position (such as for the Large Arrow sign or route marker with route marker arrow) a single installation (left or right directional) with the diagonals pointing down in the direction traffic is required to turn shall be installed. For cases where traffic may proceed in two directions, (where the Large Double Arrow sign or a bi-directional route marker arrow is required) the bi-directional shall be used.

Where used, the Lattice Background shall be placed in such a position that the sign mounted thereon is at the bottom height prescribed under the sign description. The entire unit shall be

placed six feet to the right (left) of the pavement edge where used for advance signs and at a minimum of two feet beyond the usable shoulder or curb face when used for signs in target position.

For location see figure 1-17.

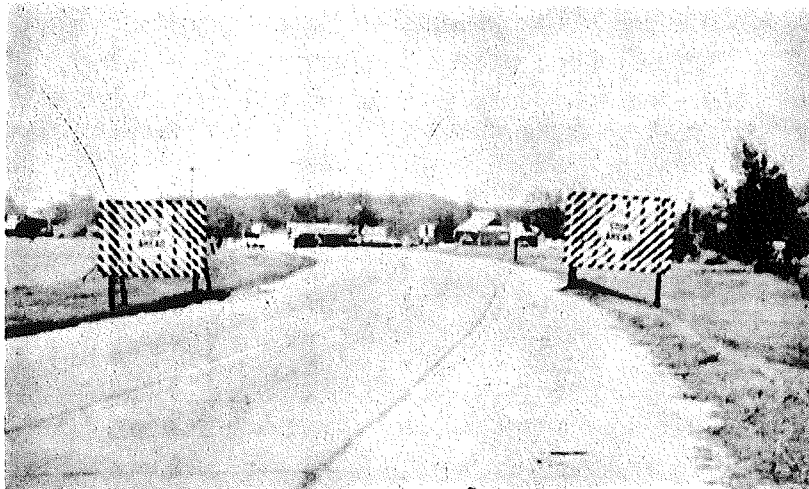


Figure 1-10. The lattice background is one method of providing greater emphasis of warning signs.

PRISON AREA SIGN



Reflectorized

W12-11-30 30" x 30" (5" letters)

The "PRISON AREA" sign may only be used along non-free-ways at maximum security prisons to discourage motorists from