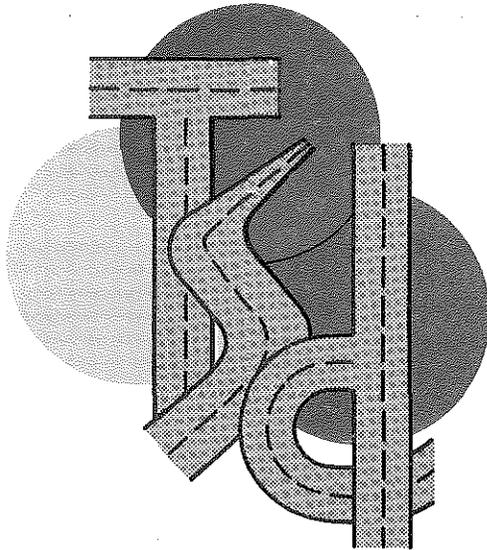


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TRAFFIC ACCIDENT ANALYSIS
AND TRAFFIC CONTROL DEVICES
INVENTORY IN LENAWEЕ COUNTY

Report TSD-ES-218-73



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TRAFFIC ACCIDENT ANALYSIS
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Report TSD-ES-218-73

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and
The U. S. Department of Transportation
National Highway Traffic Safety Administration

"The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the State or U.S. Department of Transportation, 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. Highway safety standards were then developed to assure the orderly implementation of the Act.

Highway Safety Standard 4.4.13, Traffic Engineering Services, is one of those standards. The purpose of Standard 4.4.13 is to assure the full and proper application of modern traffic engineering principles and uniform standards for traffic control to reduce the likelihood and severity of traffic accidents.

This standard includes the identification of 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 practices that will eliminate or reduce the hazards at the locations so identified. It also provides for an orderly inventory of all traffic control devices, which include those signs, signals, markings and devices placed on, over, or adjacent to a street or highway to regulate, warn and guide vehicular and pedestrian traffic.

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

SCOPE

The intent of this program is to improve traffic safety on all Michigan streets and roads by expanding the traffic engineering evaluation of factors causing accidents, and by providing uniform standards for traffic control to reduce the likelihood and severity of traffic accidents.

STUDY PROCEDURES

The study procedures for this project involve a review of high accident locations and an inventory of traffic control devices. The review of high accident locations includes: basic data collection, identifying and locating high accident locations, technical evaluation of previously compiled facts, and consequent remedial recommendations.

The traffic control devices inventory includes: surveying traffic control devices, tabulating the field data, determining priorities for replacement of traffic control devices and computing a cost estimate for this replacement.

STUDY AREA

Lenawee County is located in the southeast corner of the state (Figure 1). It is bordered by Washtenaw and Jackson Counties on the north, Hillsdale County on the west, Monroe County on the east and the Ohio Counties of Fulton and Lucas on the south.

The population of Lenawee County in 1970 was 81,609. This is an increase of 4.9 percent over the 1960 census. This increase corresponds to the county's increasing population trend since 1920 as shown by the population chart (Figure 2). The City of Adrian, located within the county, makes up 25 percent of the county's total population.

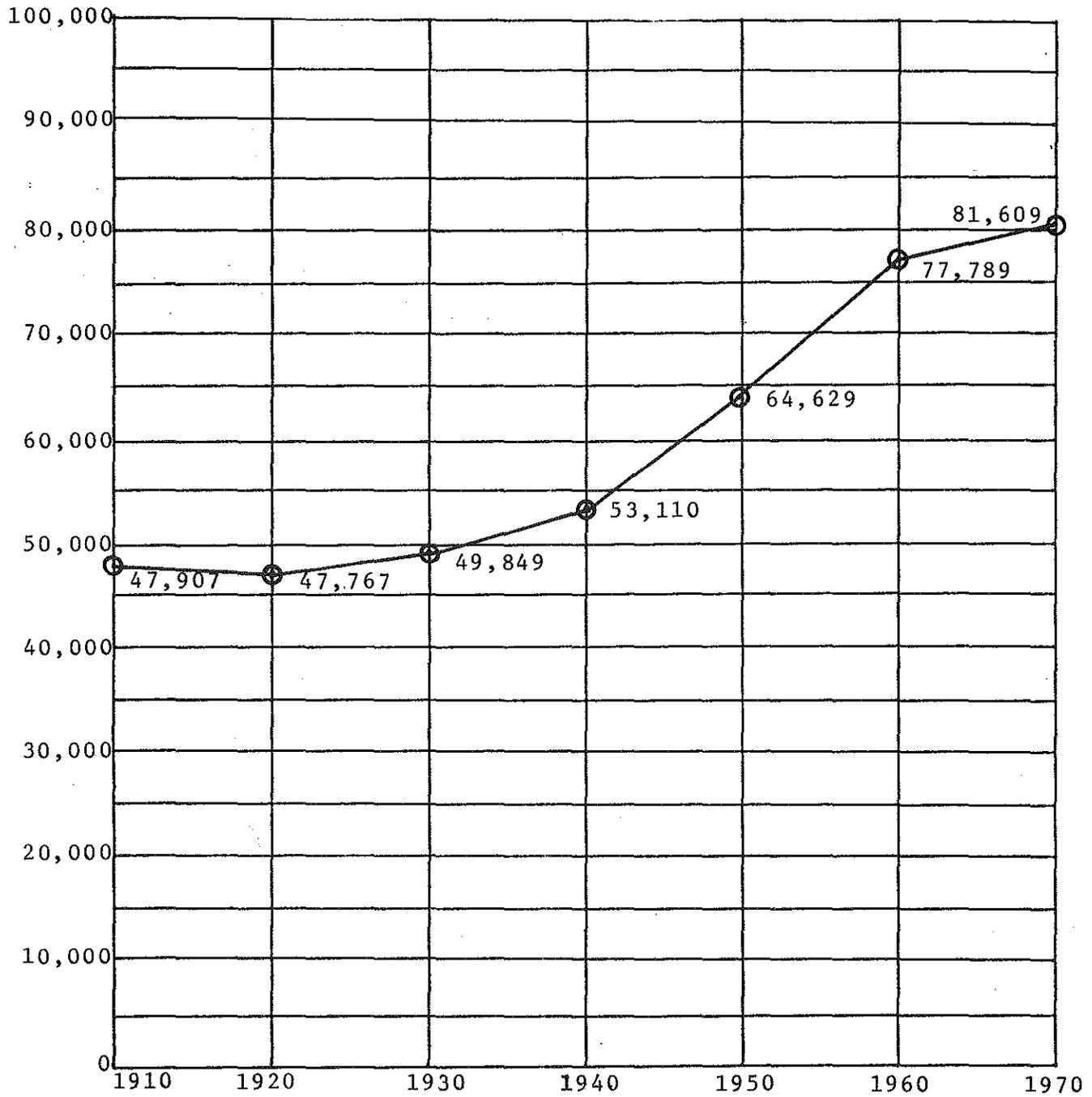
The road system in Lenawee County, according to the Twentieth Annual Progress Report as compiled by the Local Government Division of the Michigan Department of State Highways, is made up of 147.68 miles of state trunkline, 480.02 miles of county primary roads, and 1,024.88 of county local roads for a total of 1,652.58 miles of roadway (Figure 3).

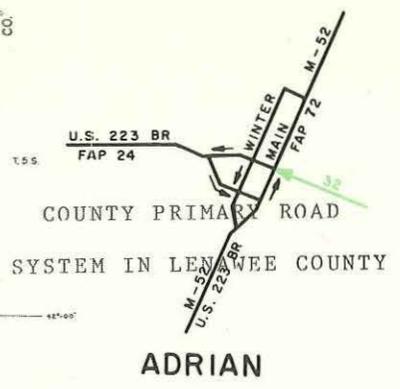
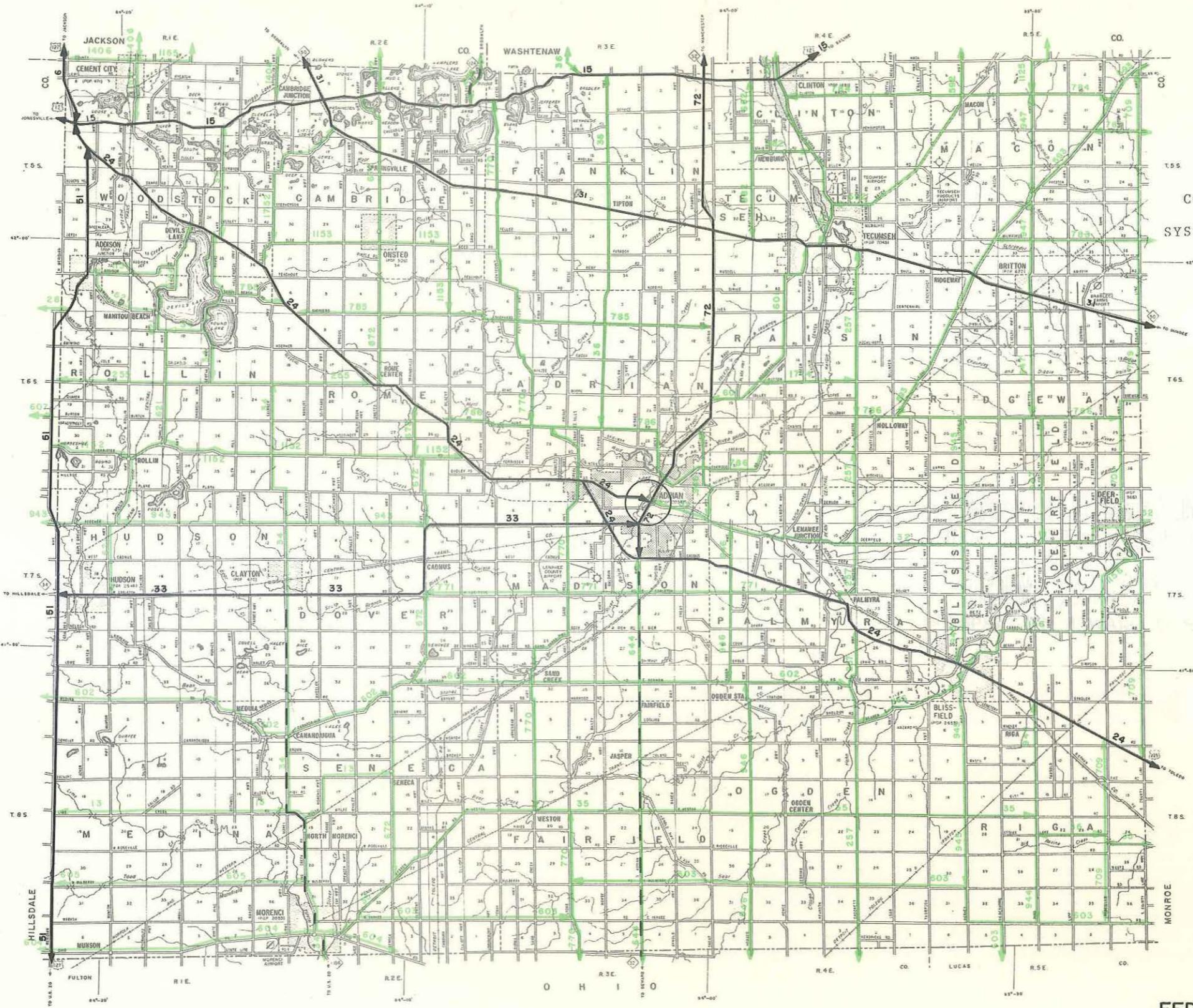
FIGURE 1



STUDY AREA

FIGURE 2
Lenawee County
Population Growth
1910 - 1970





LEGEND

APPROVED FEDERAL AID SYSTEM	PROPOSED REVISIONS
PRIMARY	ADDITION TO _____ SYSTEM
SECONDARY (STATE)	DELETION FROM _____ SYSTEM
SECONDARY (COUNTY)	

REVISED TO JANUARY 1, 1970

FIGURE 3

FEDERAL AID SYSTEMS
LENAWEE 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
PHOTOCOPY PROJECTION

TRAFFIC ENGINEERING ANALYSIS

Control Devices Inventory

Collection of Field Data - In the traffic control devices inventory, all county-maintained control devices on the County Primary Road System including the Federal-Aid Secondary routes within Lenawee County were surveyed. All county-maintained signs on this system were inventoried, including "Stop", "Yield" and advanced warning signs on other roads which intersect with the inventoried routes. Traffic control devices which are adequate in their present state were tabulated by the field crews and are included on the inventory sheets. Additional traffic control devices and those in need of replacement were also located on the inventory sheets by establishing their distance in miles from a major crossroad, city or village limit, or the county line.

All signs on the County Primary Road System were inventoried by driving west to east or south to north, depending on the basic direction of the route. In the case of two intersecting inventoried routes, the "Stop" and "Yield" signs at such intersections were inventoried on their respective routes.

Traffic Control Orders for speed, parking prohibitions and restriction zones on the County Primary Road System were checked with the Department of State Police. All areas along the inventoried routes were checked to ensure compliance with these Traffic Control Orders, as well as the "Michigan Manual of Uniform Traffic Control Devices".

Conversion of Field Data - Two simple forms (Inventory Sheets and Quantity Sheets) were developed upon which to record the collected field data. This should enable the Lenawee County Road Commission's personnel to determine the necessary work which must be done per route and countywide.

Inventory Sheets - The Inventory sheets are 11" x 16" ozalid reproductions that show existing traffic controls and those controls that are needed in order to bring the inventoried route up to standards.

Those signs which are adequate in their present state are merely shown on these sheets. At locations where alterations in the present signing are necessary, a description of these alterations is shown on the Inventory sheets. A

numeral or letter is circled at each location where work must be done. This numeral or letter designation shows the priority by which the work should be completed. There are five different priorities and these are as follows:

Sign Work

- (1) Work which should be completed as soon as possible.
- (2) Work which should be completed when existing signs are in need of maintenance.
- (3) Work that would be beneficial to the guidance of traffic, although if not completed, would not specifically affect traffic safety.
- (0) Traffic Control Device which is adequate in its present condition.

Sign Support Work

- (A) Work which should be completed as soon as possible.
- (B) Work that would be beneficial to the guidance of traffic, although if not completed, would not specifically affect traffic safety.

Quantity Sheets - The Quantity sheets (these sheets are in a separate book) indicate the total number of signs by type throughout the county. The total number of signs includes those signs which are needed and are not presently in place, replacement of existing signs, and signs requiring no change. The quantity sheet further lists those signs which are in poor condition, signs which are obsolete, signs that are needed, and the total number of signs which must be replaced by type throughout the county.

Maintenance of Inventory - The Inventory sheets (both the ozalid and cronaflex base) show those signs which should be erected, those which must be removed and those which are adequate and presently in place. It is recommended that all unnecessary notes and priority numbers be erased (from the cronaflex base copies) as each portion of work is completed. When all of the work has been completed and the necessary erasures made on the Inventory sheets (cronaflex base), the signs remaining will be those which are in place on the road system. It is recommended that the Lenawee County Road Commission make the necessary corrections to the inventory as future signs are installed, removed or altered.

Signs

It is expected that the revised edition of the "Michigan Manual of Uniform Traffic Control Devices" will be published in July 1973 and will be in accordance with the 1971 National Manual of Uniform Traffic Control Devices. Therefore, it is recommended that placement of signs not be undertaken until receipt of the revised Michigan Manual.

Regulatory

A comprehensive study of traffic control devices on the Lenawee County Primary Road System has established a need for installation or maintenance of approximately 38 percent of the required regulatory signs. The primary reason for this deficiency was the lack of "Stop" (R1-1), "Yield" (R1-2), Speed Limit (R2-1), "Speed Zone Ahead" (R2-5c) and "No Parking At Any Time" (R7-1) signs.

There is one location along the inventoried routes where speed control signs are in place, but are not legal, due to the lack of the necessary Traffic Control Order. It was noted on the Inventory sheets that the signs relating to this illegal speed restriction be removed. However, it is our opinion that if these speed control signs are necessary, the Lenawee County Road Commission should contact the Department of State Police and pursue the legal requirements for determining and establishing these speed restrictions. The area in question is:

County Primary: Woerner Road - from Geneva Road to Hallenbeck Road (30 mph) (2 signs).

It is recommended that these speed control signs be installed at approximately one-half mile intervals within the speed control zones to confirm the speed of that zone.

There is one location along the inventoried routes where parking control signs are in place, but are not legal, due to the lack of the necessary Traffic Control Order. It was noted on the Inventory sheets that the signs relating to the illegal parking restrictions be removed. However, it is our opinion that if these parking control signs are necessary, the Lenawee County Road Commission should contact the Department of State Police and pursue the legal requirements for determining and establishing these parking restrictions. The area in question is:

F.A.S. 1404 (Brooklyn Highway) from US-12 to
County Line Road ("No Parking At Any Time")
(19 signs).

Warning

The inventory indicates a need for the installation of approximately 65 percent of the required warning signs. The most evident deficiency is the need for additional Turn (W1-1), Target Arrow (W1-6), Bi-Directional Target Arrow (W1-7), "Stop Ahead" (W3-1) signs and a lack of Curve Speed (W13-1) panels.

The traffic control devices inventory also revealed a need for many Type III Object Marker panels at locations in Lenawee County where the clear roadway over a structure is less than 19 feet wide or where culverts or bridge railings are four feet or less from the pavement edge. It is permissible to use reflective liquids in place of the Type III Object Markers where the obstruction would not be hidden by weeds growing along the road. For the purpose of estimating costs, it is assumed that Lenawee County will use the Type III Object Markers at all locations.

Guide

The Guide signing in Lenawee County consists mainly of Street Name (D3-1) signs. Most of these Street Name signs are reflectorized.

The cost estimate for Priority 3 work provides for placement of County Road Direction (D1-1, D1-2, D1-2a, D1-3, and D1-3a) signs and Advance Road Name (D3-2 and D3-2a) signs. The 1973 Michigan Manual states that these signs are required to have either a white legend on a green background or black legend on a white background.

No-Passing Zones

It was noted that there were approximately 586 no-passing zones designated by signs and/or markings on the County Primary Road System in Lenawee County. A no-passing zone is defined as a section of roadway having insufficient passing sight distance. It is recommended that, as time and resources of the County Road Commission permit, a field survey be completed on all sections of hard-surfaced roads where sight distances are restricted. Such a field survey should result in any necessary corrections being

made to the limits of existing no-passing zones and the establishment of new zones where necessary.

After the field survey is completed, no-passing zones should be indicated by solid yellow lines applied along the limits established by the survey. Then "DO NOT PASS" (R4-1) and "PASS WITH CARE" (R4-2) signs may (at the option of the County Road Commission) be placed at the limits of the no-passing zones; however, when either of these signs are used, they shall both be erected.

Also, it should be noted that Public Act 224 of the Public Acts of 1971 refers to no-passing zones and states, in part, "...beginning January 1, 1973, a sign shall be placed to the left of the roadway on those portions of a highway WHERE ADDITIONAL NOTICE IS DEEMED NECESSARY". When left-side signs are placed in accordance with this legislation they shall be "NO PASSING ZONE" (W14-3) signs.

Pavement Markings at Railroad Crossings

The approach pavement at several of the railroad crossings is not properly marked. Beginning with the 1973 pavement marking season, the pavement marking in advance of a railroad crossing shall consist of an X, the letters RR, a no-passing marking, and certain transverse lines. They should be placed on all paved approaches to railroad crossings. These markings, if physically feasible, shall be placed at all grade crossings where railroad crossing signals or automatic gates are operating, and at all other crossings when the prevailing speed of highway traffic is 40 mph or greater.

The markings shall also be placed at crossings when engineering studies indicate there is a significant potential conflict between vehicles and trains. At minor crossings or in urban areas, these markings may be omitted if engineering studies indicate that other devices installed provide suitable protection. Such markings shall be white except for the no-passing markings.

Cost Estimate

The cost estimate for the work shown on the Inventory sheets, including materials, labor costs involved in installing signs, sign supports, or straightening signs or supports, is as follows:

Priority 1	\$ 46,979.42
Priority 2	2,953.50
Priority 3	11,762.00

Date of Field Survey

The inventory of all the traffic control devices on the County Primary Road System in Lenawee County was completed in September 1972. The results, including the Inventory sheets and Quantity sheets, are found in a separate book which accompanies this report.

Accident Analysis

Collection of Data - The Department of State Police examined their records and transmitted to the Traffic and Safety Division of the Michigan Department of State Highways 18 high accident locations (county roads only). An automated system of locating accidents on local roads has not yet been established on a state-wide basis; therefore, the high accident locations for Lenawee County were determined by manually extracting and compiling those locations with the highest number of accidents from the 1970 county accident reports.

Once the problem locations were identified, additional accident information for the years 1968 and 1969 was compiled in order to expand the accident base at each location. Upon completion of this portion of the data collection, the Department of State Police documented and transmitted to the Traffic and Safety Division of the Department of State Highways a list, along with the accident reports, of the high accident locations for Lenawee County.

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

The accident analysis portion of the high accident location phase involves the analysis of the summarized facts and field data from the viewpoint of a highway traffic engineer with special attention focused on the effect which the highway environment may have had on the accident. Thus, at each high accident location, individual accident reports

were reviewed in detail and collision diagrams were prepared for each location in order to identify accident patterns and to locate the accident in relation to the intersection or approaches to the intersection.

In Lenawee County the traffic accident analysis began when the State Police, after compiling the accident data, transmitted to the Michigan Department of State Highways 18 high accident locations (Spot Map, Figure 4). The 18 high accident locations accounted for 198 accidents during the three-year period. Traffic volumes on the County Primary Road System in Lenawee County vary from moderate in outlying areas to heavy near the cities of Adrian and Tecumseh, and the recreational area in the northwest quadrant of the county. It is understandable then that the high concentration of accidents will be in these areas (Figure 5).

County-Wide Recommendations

Curve Alignment

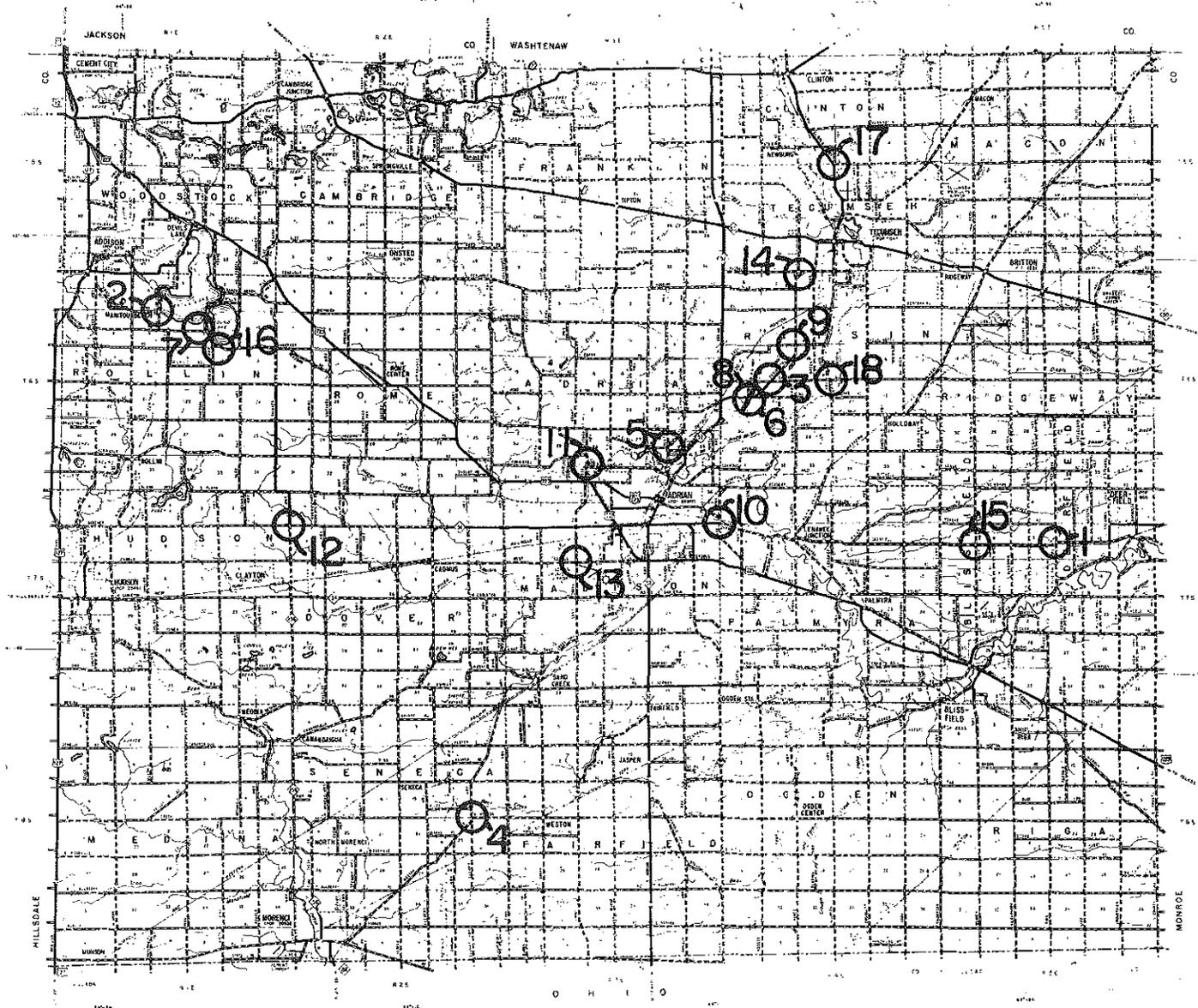
An analysis of the 18 high accident locations indicated that ran-off roadway accidents contributed heavily to the total accident pattern. They accounted for over 40 percent of the accidents at the high accident locations in Lenawee County. The increased use of the Target Arrow sign at these locations should reduce some of the ran-off roadway accidents by alerting motorists of the changing alignment. Therefore, it is recommended that the county initiate a program to erect Target Arrow signs in locations that are potentially hazardous.

Clear Vision Areas

In order to provide ample sight distance at intersections, the corners of these intersections must not be overgrown with foliage nor have any obstructions. Although sometimes buildings or other permanent obstacles create inadequate visibility, most of the time removable objects such as trees, signs, or parked vehicles prohibit adequate sight distances. It is, therefore, recommended that Lenawee County not only establish a program to create clear vision corners at all intersections, but also begin a maintenance program to insure that all corners are kept clear of obstacles.

High Accident Locations

After our analysis was complete, it was apparent that no engineering



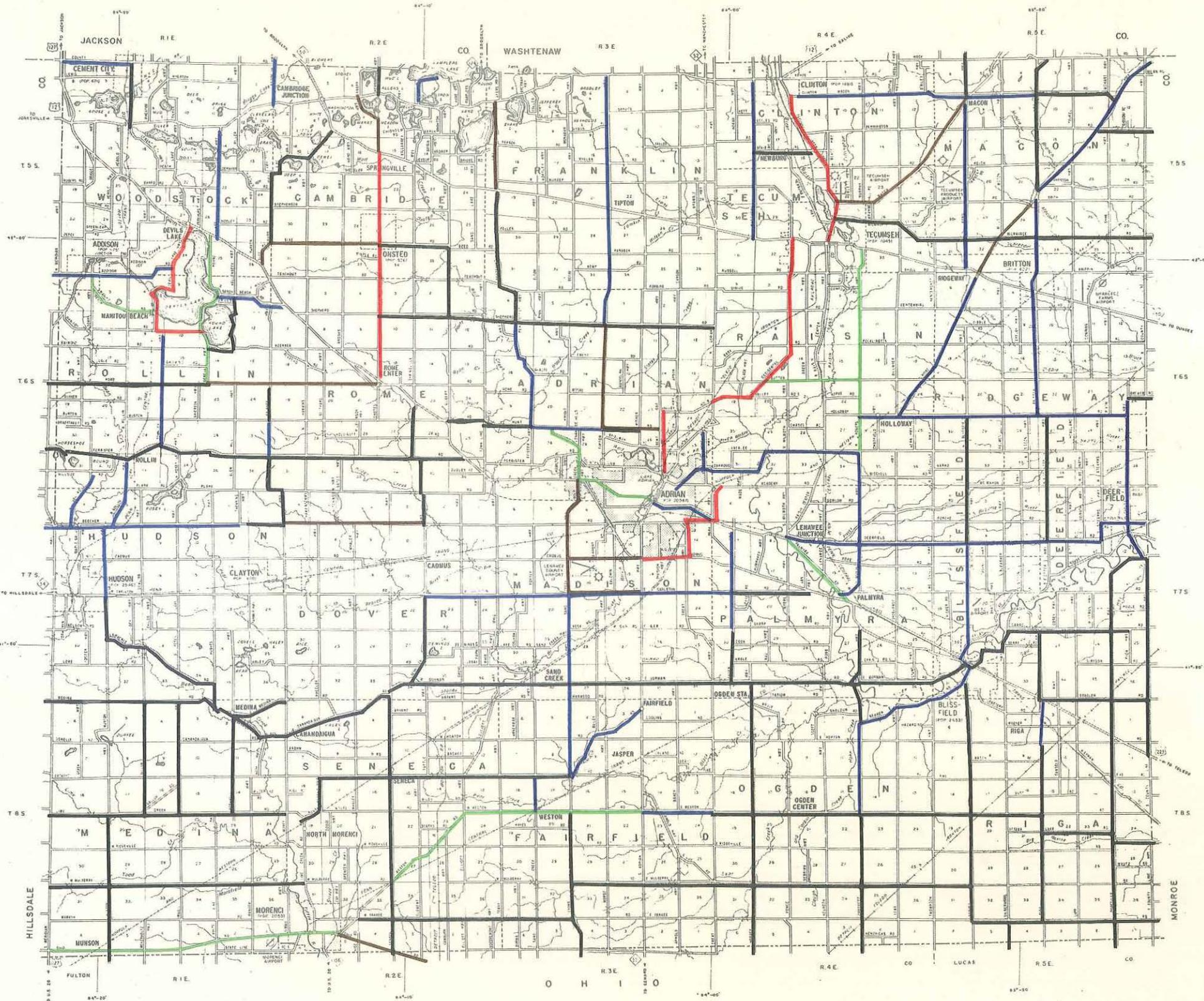
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FIGURE 4

**SPOT MAP
 FOR
 HIGH ACCIDENT
 LOCATIONS**



**GENERAL HIGHWAY MAP
 LENAWEE 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



LEGEND	
—	2000—OVER
—	1500—1999
—	1000—1499
—	500—999
—	0—499

AVERAGE DAILY TRAFFIC MAP OF COUNTY PRIMARY ROADS IN LENAWEE CO.

LENAWEE COUNTY
MICHIGAN
STATE HIGHWAY COMMISSION
DEPARTMENT OF STATE HIGHWAYS

DATA OBTAINED FROM THE HIGHWAY NEEDS STUDY
COMPILED BY THE TRANSPORTATION PLANNING DIVISION,
MICHIGAN 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

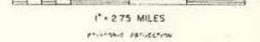


FIGURE 5

TRIANGLES AND CORPORATE LIMITS REVISED JANUARY 1969

recommendations would be feasible for four of the 18 locations. There were no accident patterns at these four locations and no present or potential serious driving hazards that could be eliminated or controlled by traffic engineering. Ten of the remaining 14 locations are located on the County Primary Road System and require only a simple signing addition(s) or deletion(s) which were recommended in the Control Devices Inventory. This report will discuss in detail the four remaining locations. The collision diagrams and pictures for these four locations will be found on the pages following each discussion. The collision diagrams and pictures for the remaining 14 locations are found in Appendix I.

LOCATION 1

DEERFIELD ROAD AT PIOTTER HIGHWAY

The most critical aspect of the above location is the alignment (Figure 6) of Deerfield Road at its intersection with Piotter Highway. This is evident by the high percentage (81.3 percent) of ran-off roadway accidents that occurred at this location during the three-year study period, 1969-1971. Also, 46.1 percent of the ran-off roadway accidents at this location occurred during the night.

Recommendations

It is recommended that the center line pavement marking be continued through the intersection to indicate that the main flow of traffic is on Deerfield Road. Also, it is recommended that pavement edge line markings be applied on Deerfield Road and overhead street lights be installed at this intersection.

Since vehicles traveling on southbound Piotter Highway are compelled to stop at Deerfield Road due to a sight restriction, it is recommended that the existing "Yield" sign be replaced with a 24 in. "Stop" sign. Also, it is recommended that the Bi-Directional Target Arrow sign for westbound Deerfield Road be replaced with a Target Arrow sign.

It is further recommended that 12 in. x 36 in. Obstruction Panels be erected at the culvert west of the intersection, because the culvert headwalls are within four ft of the driving surface.

Finally, in an attempt to provide clear landing areas for vehicles that leave the roadway, it is recommended that all the obstructions (including power poles) be removed from the clear landing zone.

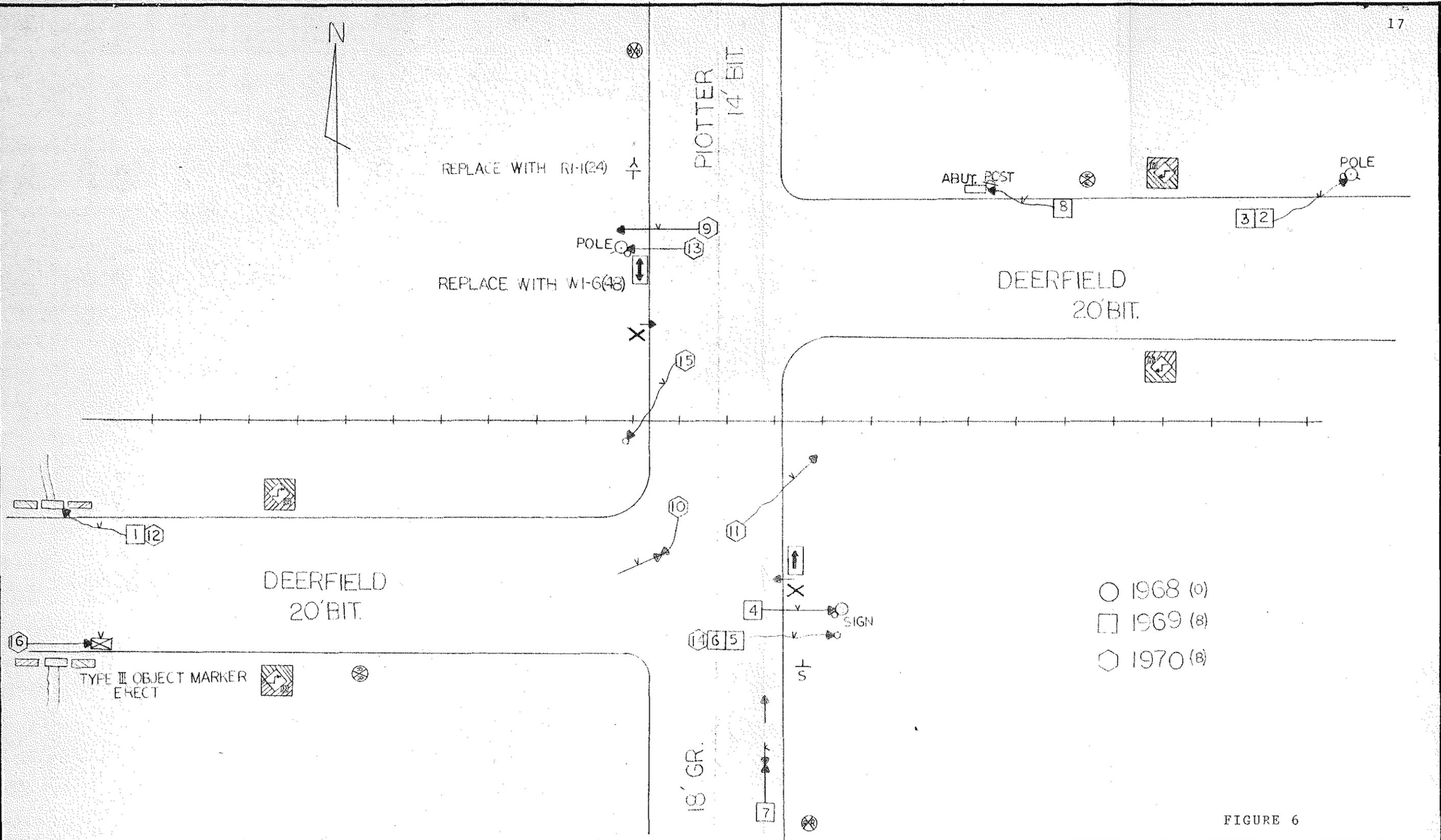


FIGURE 6

LEGEND

- | | | | | | | | |
|-----------|------|----------------|----|------------------|-------|------------|---|
| Fatal | →● | Out of Control | →~ | Pedestrian | →...X | Tree | ☼ |
| Injury | →○ | Driver Intent | →~ | Stop & Go Signal | ←S→ | Stop Sign | S |
| Skidding | →○○○ | Deer | →V | Flashing Beacon | ←F→ | Yield Sign | Y |
| Jackknife | →/ | Violator | →V | | | | |
| Overtaken | →~ | Backing | ←~ | | | | |

Period: 1968 THRU 1970

Accidents - Total 16 P.D. 8

Injury 8 (9) Fatal 0 ()

C.S. _____ Miles _____ Drawn DJM

Plan No. LOCATION 1 Date 8-3-72

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location DEERFIELD AT PIOTTER
DEERFIELD TWP.
LENAWEE CO.



WESTBOUND
DEERFIELD ROAD



WESTBOUND
DEERFIELD ROAD

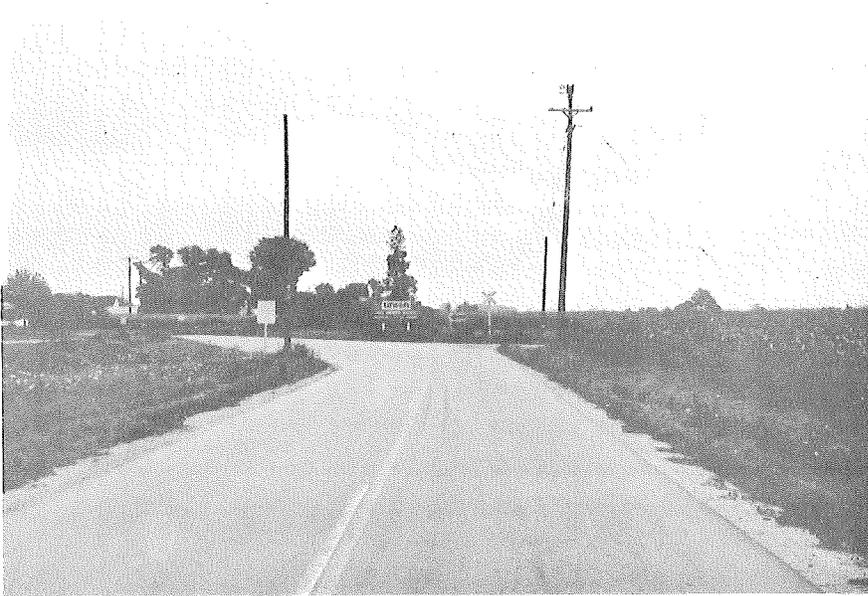


SOUTHBOUND
PIOTTER HWY.

FIGURE 6a



EASTBOUND
DEERFIELD ROAD



EASTBOUND
DEERFIELD ROAD



NORTHBOUND
PIOTTER HWY.

FIGURE 6b

LOCATION 2

DEVILS LAKE ROAD AT MANITOU BEACH ROAD

The critical aspect of this location is the proximity of a railroad grade separation to the intersection. Just west of this "T" intersection, paralleling Devils Lake Road, is a railroad line (Penn-Central Railroad) that passes over Manitou Beach Road via a grade separation. The collision diagram (Figure 7) indicates that five of the ran-off roadway accidents involved vehicles traveling eastbound on Manitou Beach Road at night and 50 percent of the accidents at this location occurred during the period of darkness.

Recommendations

Due to the high percentage of accidents that occurred during darkness, it is recommended that this location be illuminated by using an overhead street light and/or a flashing beacon. It is further recommended that the "T" Symbol sign on eastbound Manitou Beach Road be removed, because this control device is not generally used on roadways that form the stem of the "T" where traffic is required to stop. Also, the "Stop Ahead" sign on eastbound Manitou Beach Road is non-standard (size) according to the Manual and should be increased from a 30 in. to 36 in. sign.

In an effort to emphasize the low bridge, it is recommended that the "Low Clearance" warning sign located on Manitou Beach Road east of the bridge be relocated within 20 ft of the bridge. Another "Low Clearance" warning sign should be erected at the nearest intersection east of this location to permit affected vehicles traveling on this route to turn around. It is also recommended that "Clearance" signs be erected on the bridge's exterior face and that Type III Object Markers be erected to indicate the ends of the bridge.

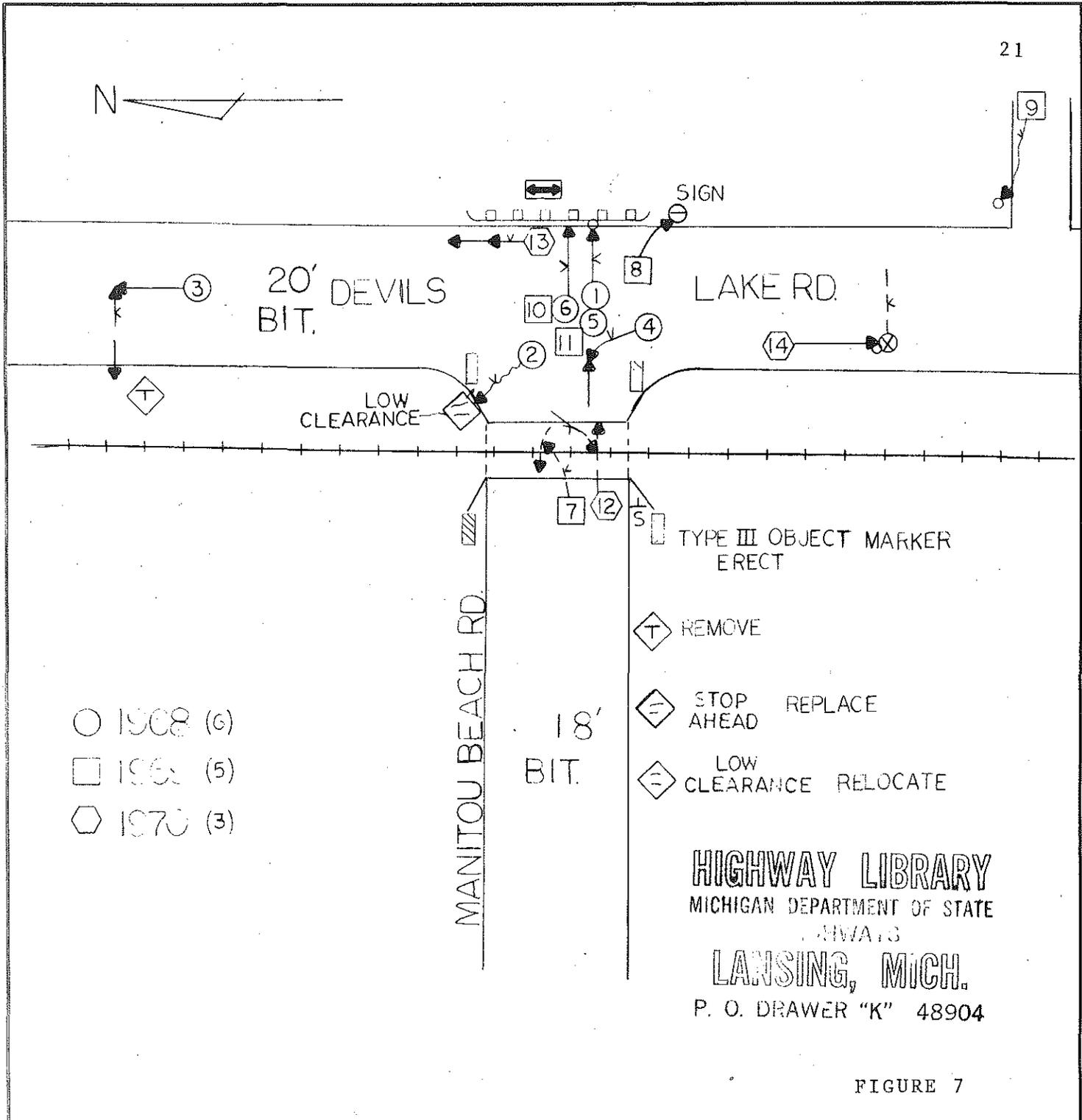


FIGURE 7

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal  Flashing Beacon 	Stop Sign  Yield Sign 	Location DEVILS LAKE RD AT MANITOU BEACH RD. ROLLIN TWP. LENAWEE CO.	
Fatal  Injury  Skidding  Jackknife  Overturned  Backing 	Pedestrian  Tree  Out of Control  Driver Intent  Deer  Violator 	Period: 1968 THRU 1970 Accidents - Total <u>14</u> P.D. <u>9</u> Injury <u>5</u> (8) Fatal <u>0</u> () C.S. _____ Miles _____ Drawn _____ Plan No. <u>LOCATION 2</u> Date <u>8-17-72</u>	



NORTHBOUND DEVILS LAKE ROAD



SOUTHBOUND DEVILS LAKE ROAD

FIGURE 7a



EASTBOUND MANITOU BEACH ROAD



EASTBOUND MANITOU BEACH ROAD

FIGURE 7b

LOCATION 3

OCCIDENTAL HIGHWAY AT SUTTON ROAD

The angle of intersection between these two roadways creates a sight distance problem for vehicles stopped on east and west-bound Sutton Road. The collision diagram indicates that there were six right-angle accidents which occurred at this intersection.

Recommendations

It is recommended that clear vision corners be established at each quadrant of this intersection so that vehicles on Occidental Highway can be seen far enough in advance to provide adequate crossing time for east and westbound Sutton Road traffic. The clear vision area (a triangle formed by the distances 15 ft along the minor road and 300 ft along the major roadway) should be completely void of all obstacles such as trees, shrubs, mounds of earth, tall weeds, etc.

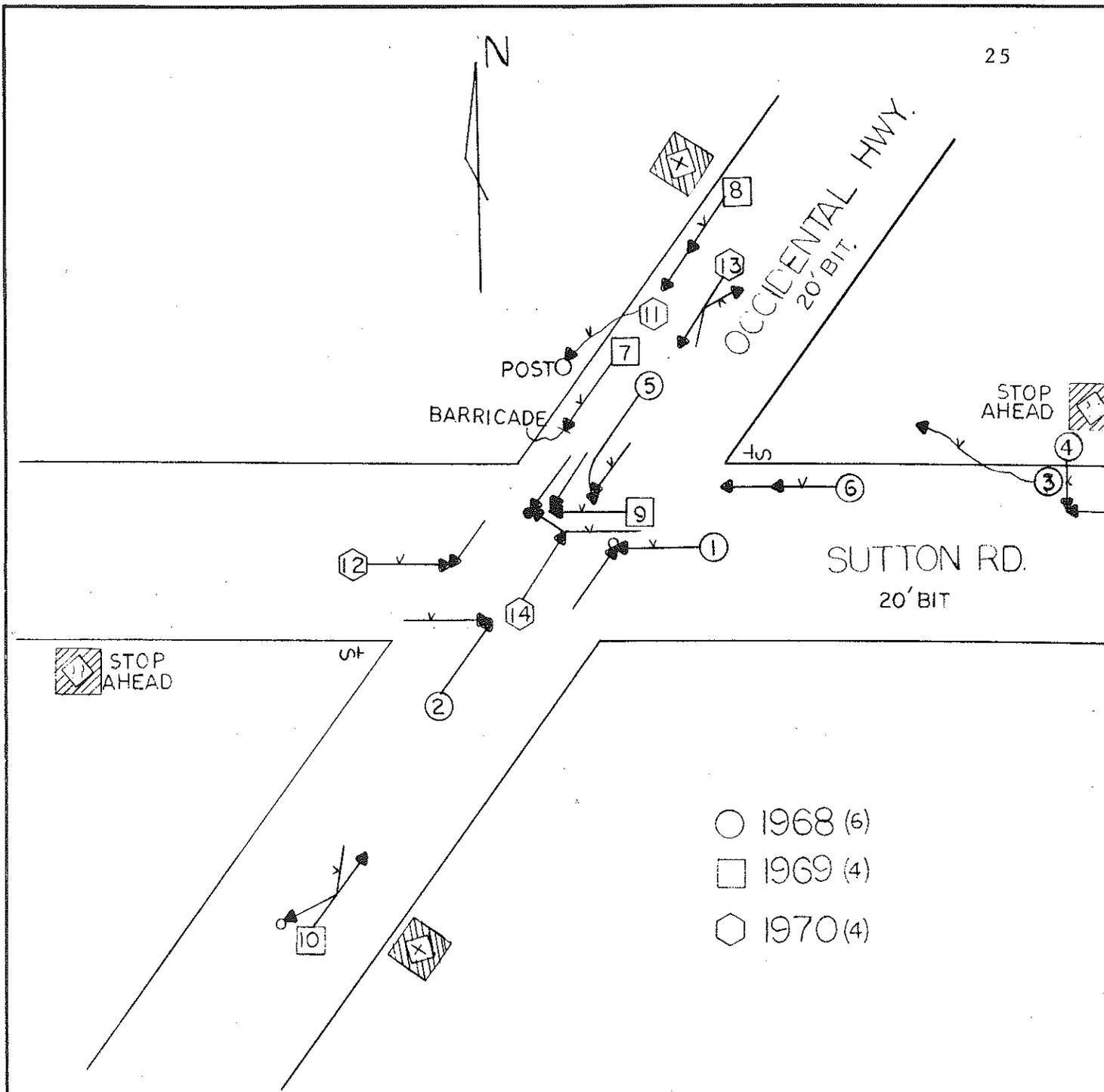


FIGURE 8

<p>LEGEND</p>	<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p>
<p>Stop & Go Signal Stop Sign S T Flashing Beacon Yield Sign Y T</p>	<p>Location OCCIDENTAL AT SUTTON RAISIN TWP LENAWEE CO.</p>
<p>Fatal Pedestrian Injury Tree Skidding Out of Control Jackknife Driver Intent Overtaken Deer Backing Violator Y</p>	<p>Period: 1968 THRU 1970 Accidents - Total <u>14</u> P.D. <u>11</u> Injury <u>2 (2)</u> Fatal <u>1 (3)</u> C.S. _____ Miles _____ Drawn <u>DJM</u> Plan No. <u>LOCATION 3</u> Date <u>8-18-72</u></p>



EASTBOUND
SUTTON ROAD



NORTHBOUND
OCCIDENTAL HWY.



WESTBOUND
SUTTON ROAD

FIGURE 8a

LOCATION 4

ELLIOTT HIGHWAY AT WESTON ROAD

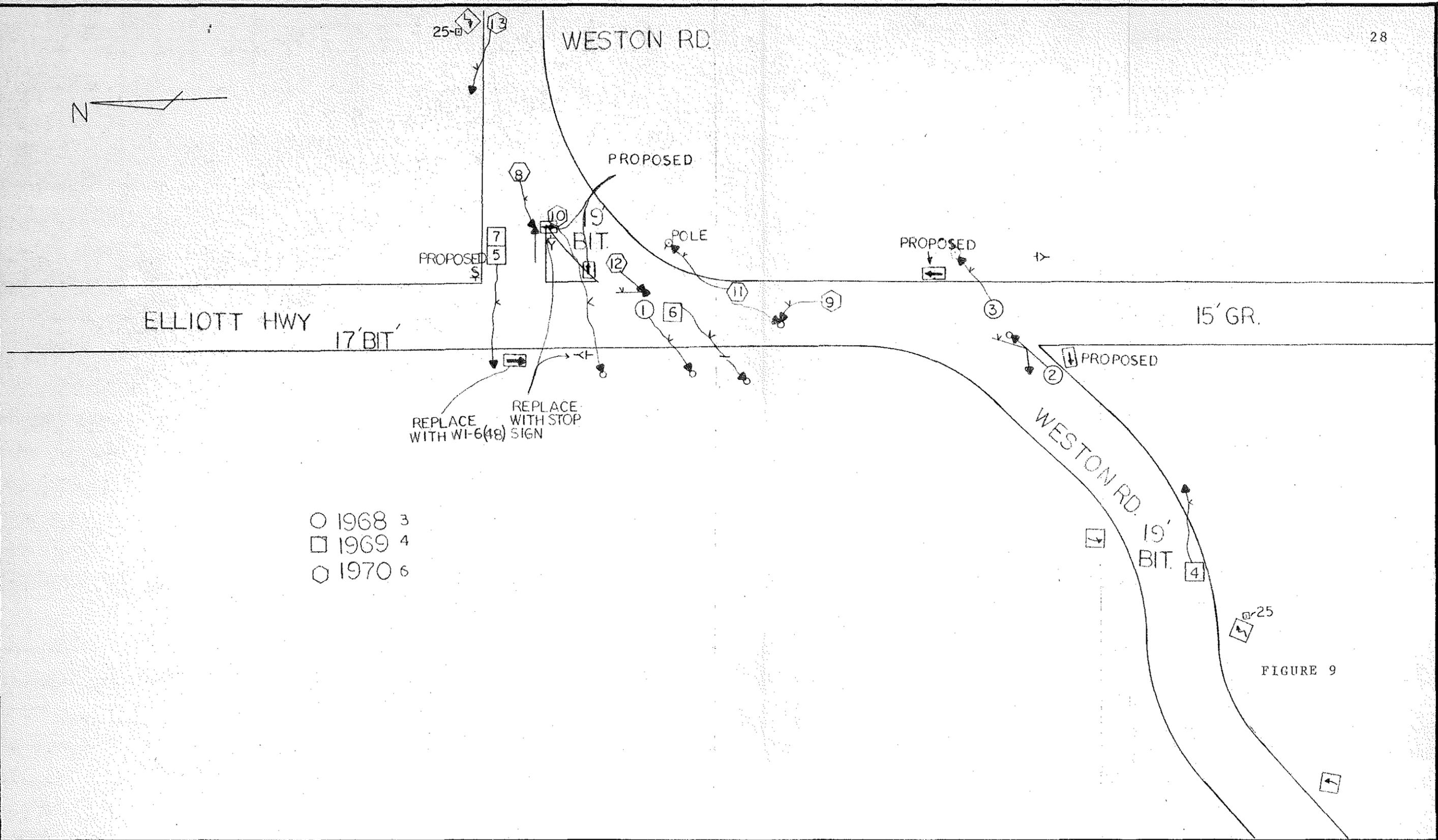
The alignment (Figure 9) of Weston Road at its intersection with Elliott Highway is the prominent problem at this location. This is apparent from the large percentage (69 percent) of ran-off roadway accidents and the large percentage (69 percent) of accidents which occurred during darkness.

Recommendations

It is recommended that four 24 in. x 48 in. Target Arrow signs be erected in target position for east and westbound Weston Road and for north and southbound Elliott Highway (Figure 9). The Target Arrow sign for westbound Weston Road located west of Elliott Highway should be replaced with a Bi-Directional Target Arrow, since traffic approaching this arrow can either turn right or left.

Furthermore, it is recommended that the "Yield" signs on south Elliott Highway and eastbound Weston Road at the channelized "Y" intersection be replaced with 24 in. "Stop" signs. Also, there is no traffic control device at the east leg of Weston Road as it intersects Elliott Highway; therefore, it is recommended that a 24 in. "Stop" sign be erected to control traffic at this intersection.

It is further recommended that the center line pavement marking on Weston Road be continued through this location, and pavement edge markings be applied on Weston Road between the Reverse Turn signs to assist the motorist at night, and that this location be illuminated by overhead street lights.



○ 1968 3
 □ 1969 4
 ○ 1970 6

FIGURE 9

LEGEND

Fatal	→●	Out of Control	→~	Pedestrian	→(X)	Tree	→*
Injury	→○	Driver Intent	→↷	Stop & Go Signal	→(S)	Stop Sign	→S
Skidding	→○○○	Deer	→(V)	Flashing Beacon	→(F)	Yield Sign	→Y
Jackknife	→↯	Violator	→(V)				
Overtaken	→~	Backing	→←				

Period: 1968 THRU 1970

Accidents - Total 13 P.D. 8

Injury 5 (8) Fatal 0 ()

C.S. _____ Miles _____ Drawn UJM

Plan No. LOCATION 4 Date 6-27-72

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
 TRAFFIC AND SAFETY DIVISION

Location ELLIOT AT WESTON
 SENECA TWP.
 LENAWEE CO.



EASTBOUND
WESTON ROAD

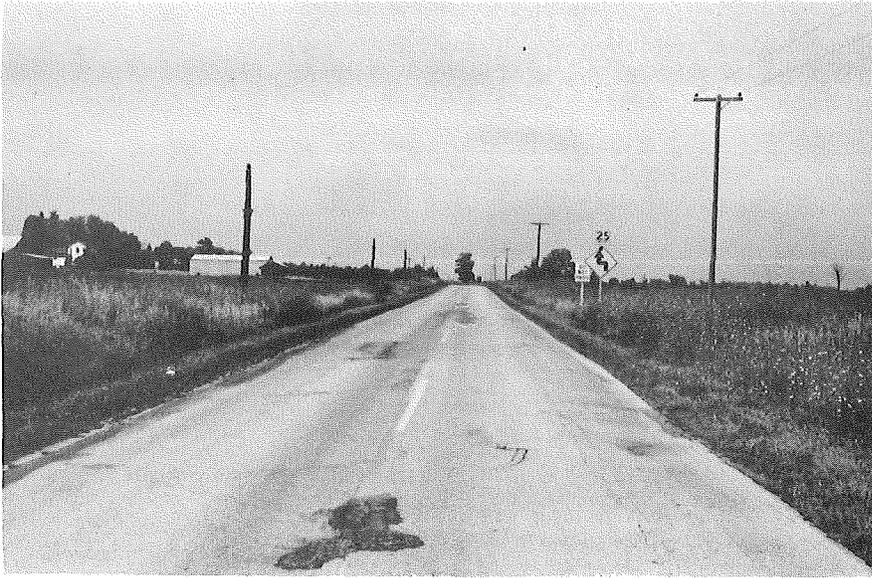


NORTHBOUND
ELLIOTT HWY.



WESTBOUND
WESTON ROAD

FIGURE 9a

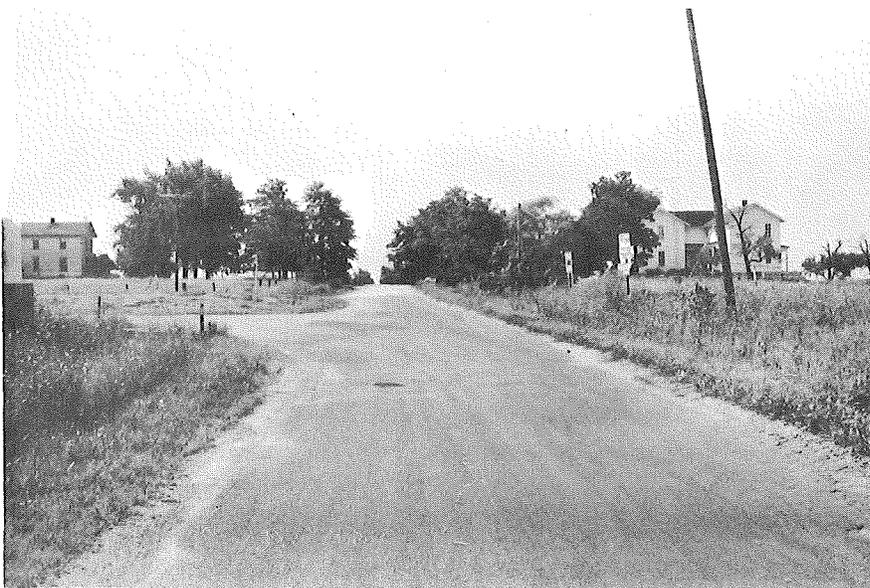


WESTBOUND
WESTON ROAD



WESTBOUND
WESTON ROAD

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



SOUTHBOUND
ELLIOTT HWY.

LOCATION 5

CARSON HIGHWAY, SPIELMAN ROAD, AND
CURTIS ROAD AT BENT OAK HIGHWAY
(See Appendix I, p. 37)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
12	7	4	1

LOCATION 6

VALLEY ROAD AT OCCIDENTAL HIGHWAY
(See Appendix I, p. 40)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
12	7	5	0

LOCATION 7

GENEVA ROAD AND MANITOU ROAD AT
ROUND LAKE ROAD
(See Appendix I, p. 42)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
11	8	3	0

LOCATION 8

VALLEY ROAD AT BLACK HIGHWAY
(See Appendix I, p. 44)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
10	10	0	0

LOCATION 9

OCCIDENTAL HIGHWAY AT GADY ROAD
(See Appendix I, p. 46)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
10	6	4	0

LOCATION 10

PARR HIGHWAY AT DEERFIELD ROAD
AND BEECHER ROAD
(See Appendix I, p. 48)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
9	7	1	1

LOCATION 11 WOLF CREEK HIGHWAY AT COUNTRY CLUB ROAD
 (See Appendix I, p. 51)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
9	3	6	0

LOCATION 12 BEECHER ROAD AT MOREY HIGHWAY
 (See Appendix I, p. 53)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
9	8	1	0

LOCATION 13 CADMUS ROAD AT SAND CREEK HIGHWAY
 (See Appendix I, p. 55)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
8	2	6	0

LOCATION 14 OCCIDENTAL HIGHWAY AT RUSSELL ROAD
 (See Appendix I, p. 57)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
8	4	4	0

LOCATION 15 DEERFIELD ROAD AT BLISSFIELD HIGHWAY
 (See Appendix I, p. 61)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
8	5	3	0

LOCATION 16 WOERNER ROAD AT GENEVA HIGHWAY
 (See Appendix I, p. 63)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
8	6	2	0

LOCATION 17

TECUMSEH-CLINTON HIGHWAY AT ALLEN ROAD
(See Appendix I, p. 65)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
7	5	1	1

LOCATION 18

RAISIN CENTER HIGHWAY AT SUTTON ROAD
(See Appendix I, p. 67)

<u>Total</u>	<u>P.D.</u>	<u>Inj.</u>	<u>Fatal</u>
7	6	1	0

SUMMARY

The Department of State Police submitted 18 high accident locations for Lenawee County to the Michigan Department of State Highways. After an indepth study of these locations, we formulated recommendations for four of them. The recommendations are as follows:

<u>Location Number</u>	<u>Location Description</u>	<u>Quantity</u>	<u>Recommendations</u>
1	Deerfield Road at Piotter Highway	1	Clear Landing Zone W1-6(48)
		4	Type III Object Markers (2) 12-36L & (2) 12-36R Center Line & Pavement Edge Markings Replace R1-2(24) with an R1-1(24) Overhead Street Lighting System
2	Devils Lake Road at Manitou Beach Road	4	Type III Object Markers (2) 12-36L & (2) 12-36R
		1	Remove W2-4(30)
		1	W3-1(36) Overhead Street Lighting System
		1	W12-2(36)
		2	W12-3(Panel I)
3	Occidental Highway at Sutton Road		Clear Vision Corners
4	Elliott Highway at Weston Road	4	W1-6(48)
		3	R1-1(24)
		1	W1-7(48) Center Line & Pavement Edge Markings Overhead Street Lighting System

Furthermore, a few general recommendations were formulated that should be implemented by Lenawee County.

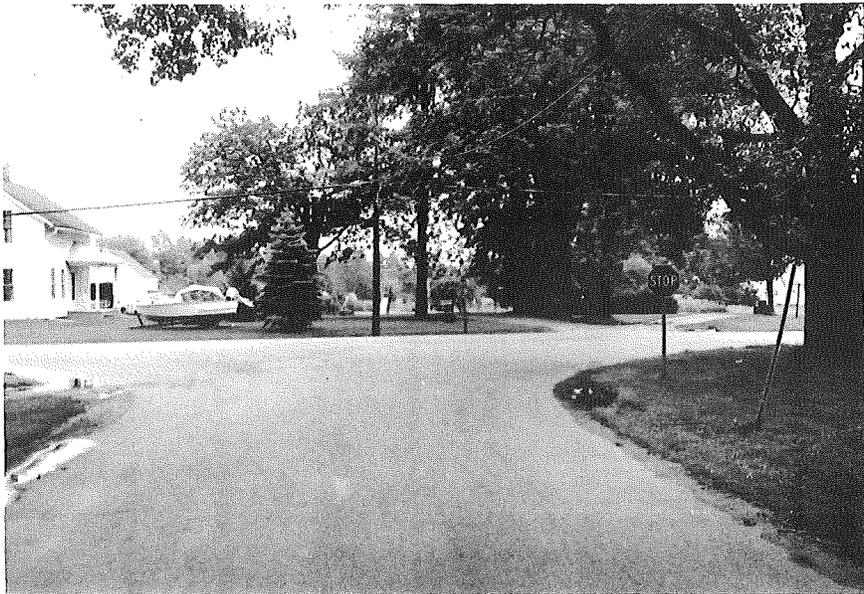
1. A program should be initiated by the county for removing vision obstructions that are located in clear vision areas at intersections throughout the county.

2. A policy concerning the use of Target Arrows on curves should be adopted by Lenawee County.
3. Approximately 38 percent of the required regulatory signs on the Lenawee County Primary Road System are in need of maintenance or new installation.
4. Approximately 65 percent of the required warning signs are in need of maintenance or new installation.
5. The guide signing in Lenawee County consists mainly of "Street Name" signs. Most of these "Street Name" signs are reflectorized. The 1973 Michigan Manual requires this type sign to be either white legend on green background or black legend on white background.

APPENDIX I



NORTHBOUND
BENT OAK HWY.



WESTBOUND
CURTIS ROAD

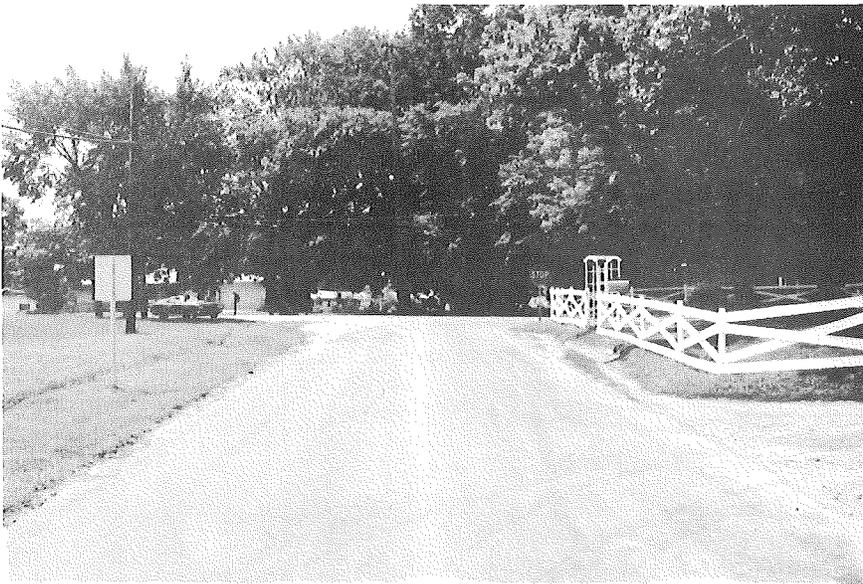


SOUTHBOUND
BENT OAK HWY.

FIGURE 10a



EASTBOUND
SPIELMAN ROAD

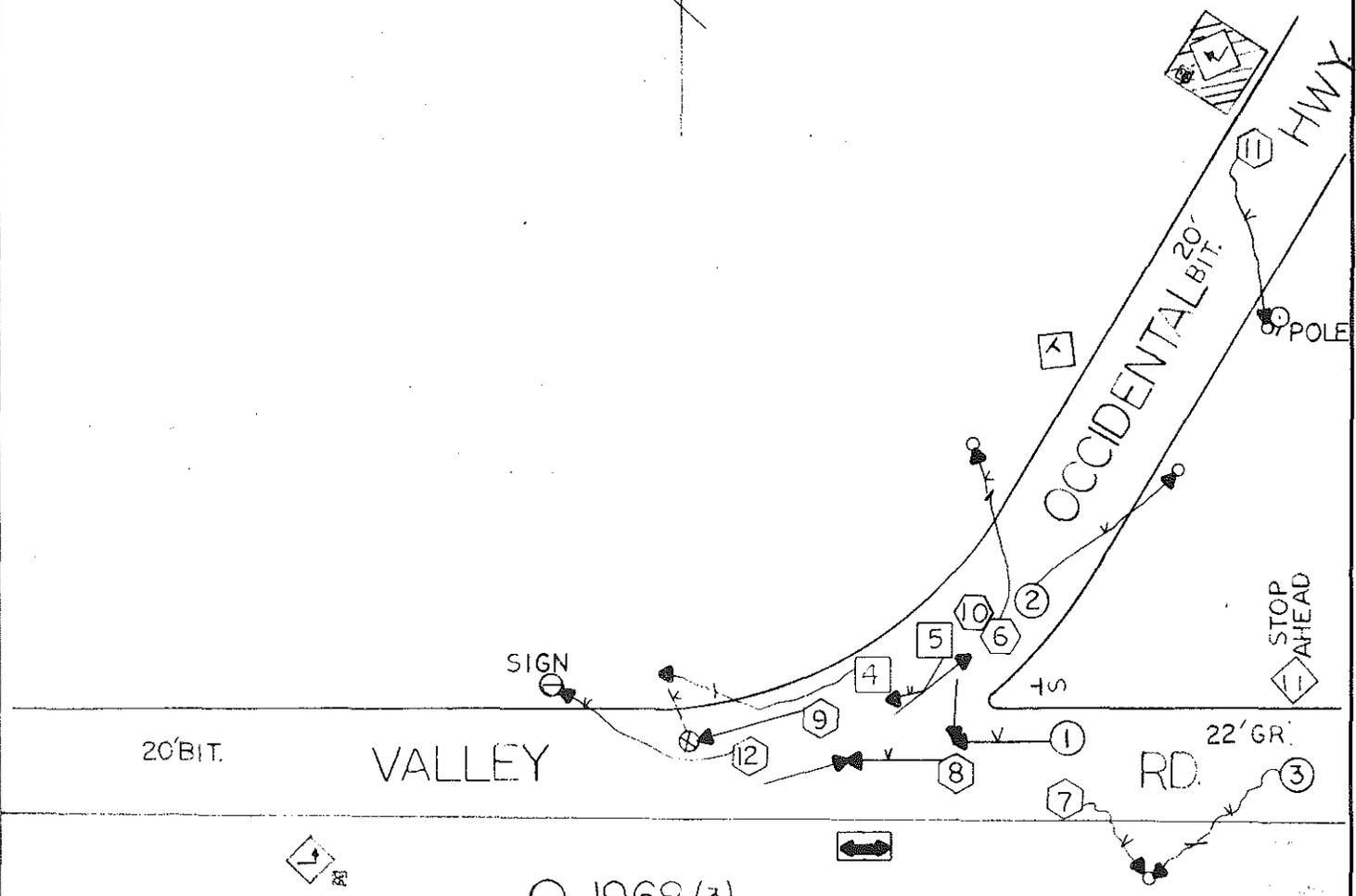


WESTBOUND
CARSON HWY.



SOUTHBOUND
BENT OAK HWY.

FIGURE 10b



- 1968 (3)
- 1969 (2)
- ⬡ 1970 (7)

FIGURE 11

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal Flashing Beacon	Stop Sign Yield Sign	Location VALLEY AT OCCIDENTAL RAISIN TWP LENAWEE CO.	
Fatal Injury Skidding Jackknife Overturned Backing	Pedestrian Tree Out of Control Driver Intent Deer Violator	Period: 1968 THRU 1970 Accidents - Total <u>12</u> P.D. <u>7</u> Injury <u>5</u> (<u>7</u>) Fatal <u>0</u> (<u> </u>) C.S. <u> </u> Miles <u> </u> Drawn <u>DJM</u> Plan No. <u>LOCATION 6</u> Date <u>8-17-72</u>	



EASTBOUND
VALLEY ROAD



WESTBOUND
VALLEY ROAD



SOUTHBOUND
OCCIDENTAL HWY.

FIGURE 11a

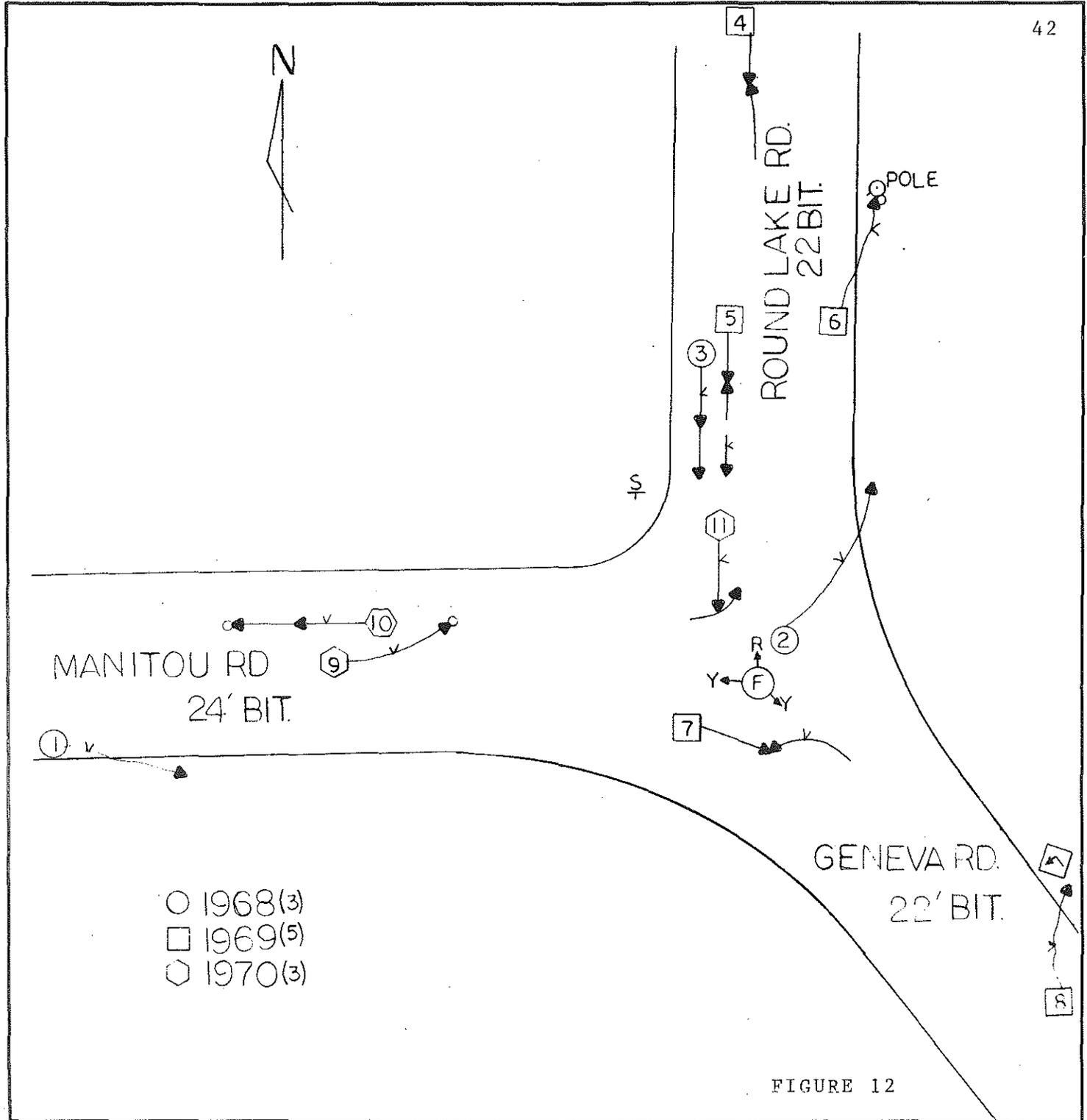


FIGURE 12

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal	Flashing Beacon	Stop Sign	Yield Sign
Fatal	Injury	Skidding	Jackknife
Overtaken	Backing	Pedestrian	Tree
Out of Control	Driver Intent	Deer	Violator
Location MANITOU RD AT ROUND LK. RD. ROLLIN TWP. LENAWEE CO.		Period: 1968 THRU 1970 Accidents - Total 11 P.D. 8 Injury 3 (3) Fatal 0 () C.S. _____ Miles _____ Drawn DJM Plan No. LOCATION 7 Date 6-28-72	



EASTBOUND
MANITOU BEACH ROAD



SOUTHBOUND
ROUND LAKE HIGHWAY



NORTHBOUND
GENEVA HIGHWAY

FIGURE 12a

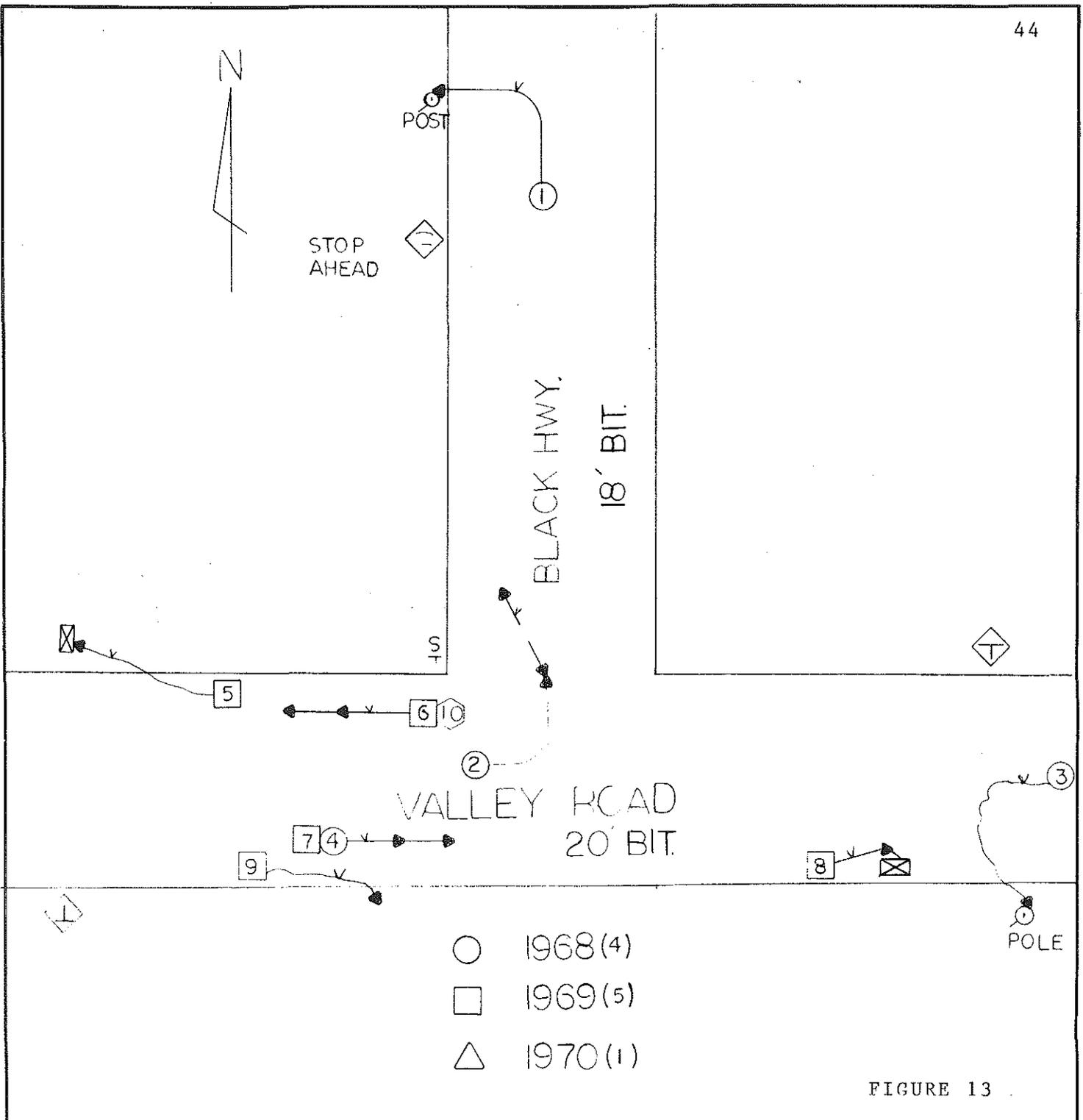
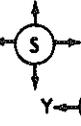


FIGURE 13

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal  Flashing Beacon 	Stop Sign  Yield Sign 	Location VALLEY RD. AT BLACK HWY. RAISIN TWP. LENAWEE CO.	Location VALLEY RD. AT BLACK HWY. RAISIN TWP. LENAWEE CO.
Fatal  Injury  Skidding  Jackknife  Overturned  Backing 	Pedestrian  Tree  Out of Control  Driver Intent  Deer  Violator 	Period: 1968 THRU 1970	Accidents - Total 10 P.D. 10
		Injury 0 () Fatal 0 ()	Injury 0 () Fatal 0 ()
		C.S. _____ Miles _____ Drawn DJM	C.S. _____ Miles _____ Drawn DJM
		Plan No. LOCATION 8	Date 8-9-72



EASTBOUND
VALLEY ROAD

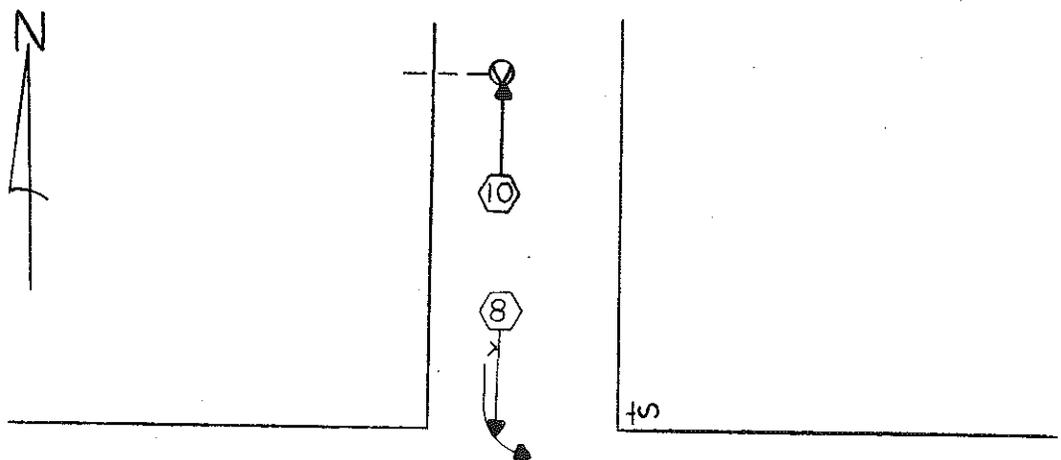


SOUTHBOUND
BLACK HWY.

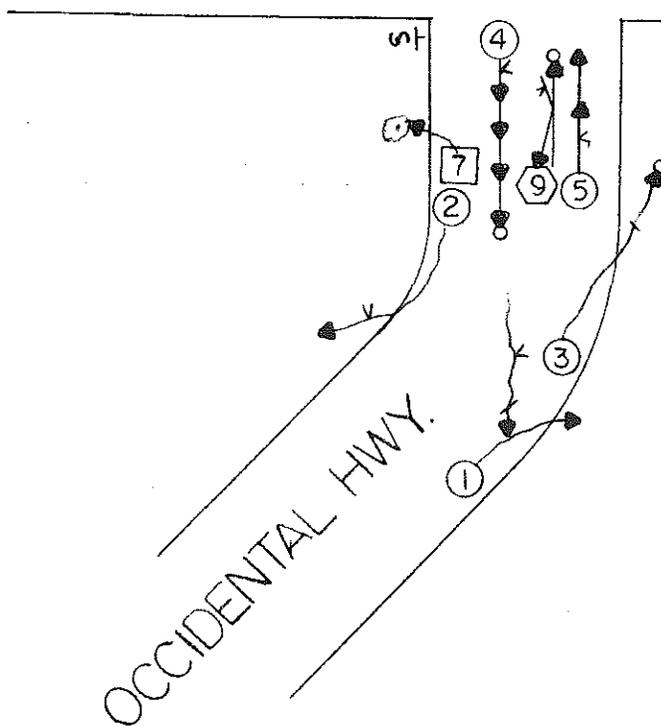


WESTBOUND
VALLEY ROAD

FIGURE 13a



GADY RD.



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 P. O. DRAWER "K" 48904

- 1968 (5)
- 1969 (2)
- ⬡ 1970 (3)

FIGURE 14

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal		Stop Sign	S T
Flashing Beacon		Yield Sign	Y T
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overtaken		Deer	
Backing		Violator	
		Location GADY AT OCCIDENTAL RAISIN TWP LENAWEE CO.	
		Period: 1968 THRU 1970	
		Accidents - Total 10 P.D. 6	
		Injury 4 (8) Fatal 0 ()	
		C.S. _____ Miles _____ Drawn DJM	
		Plan No. LOCATION 9 Date 4-18-72	



EASTBOUND
GADY ROAD



NORTHBOUND
OCCIDENTAL HWY.



WESTBOUND
GADY ROAD

FIGURE 14a

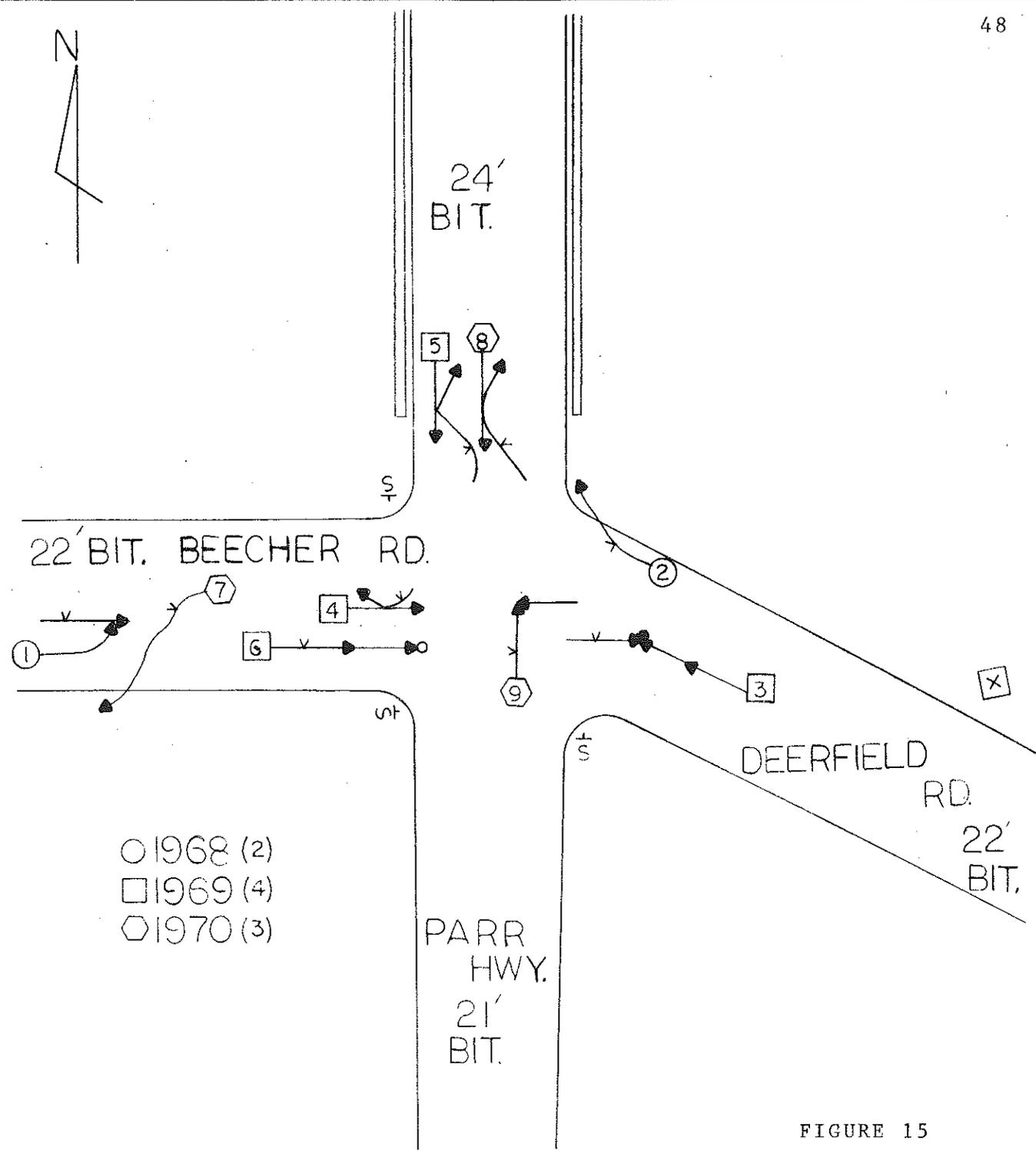
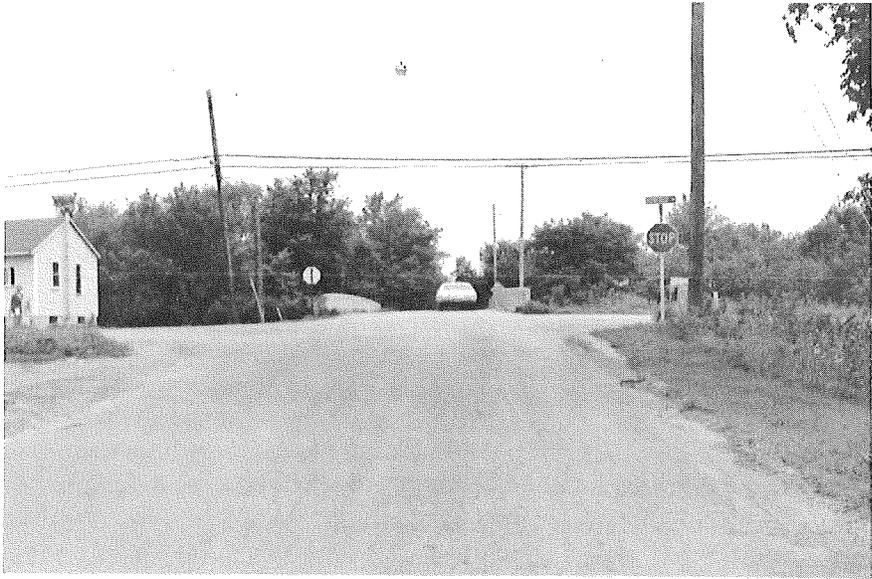


FIGURE 15

<p align="center">LEGEND</p>	<p align="center">MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p>
<p>Stop & Go Signal Stop Sign S </p> <p>Flashing Beacon Yield Sign Y </p>	<p>Location PARR AT DEERFIELD, BEECHER RD. ADRIAN TWP. LENAWEE CO.</p>
<p>Fatal </p> <p>Injury </p> <p>Skidding </p> <p>Jackknife </p> <p>Overtaken </p> <p>Backing </p> <p>Pedestrian </p> <p>Tree </p> <p>Out of Control </p> <p>Driver Intent </p> <p>Deer </p> <p>Violator </p>	<p>Period: <u>1968 THRU 1970</u></p> <p>Accidents - Total <u>9</u> P.D. <u>7</u></p> <p>Injury <u>1</u> (<u>5</u>) Fatal <u>1</u> (<u>1</u>)</p> <p>C.S. <u> </u> Miles <u> </u> Drawn <u>DJM</u></p> <p>Plan No. <u>LOCATION 10</u> Date <u>7-5-72</u></p>



NORTHBOUND PARR HIGHWAY



SOUTHBOUND PARR HIGHWAY



EASTBOUND BEECHER ROAD



WESTBOUND DEERFIELD ROAD



NORTHBOUND
WOLF CREEK HWY.



WESTBOUND
COUNTRY CLUB ROAD



SOUTHBOUND
WOLF CREEK HWY.

FIGURE 16a

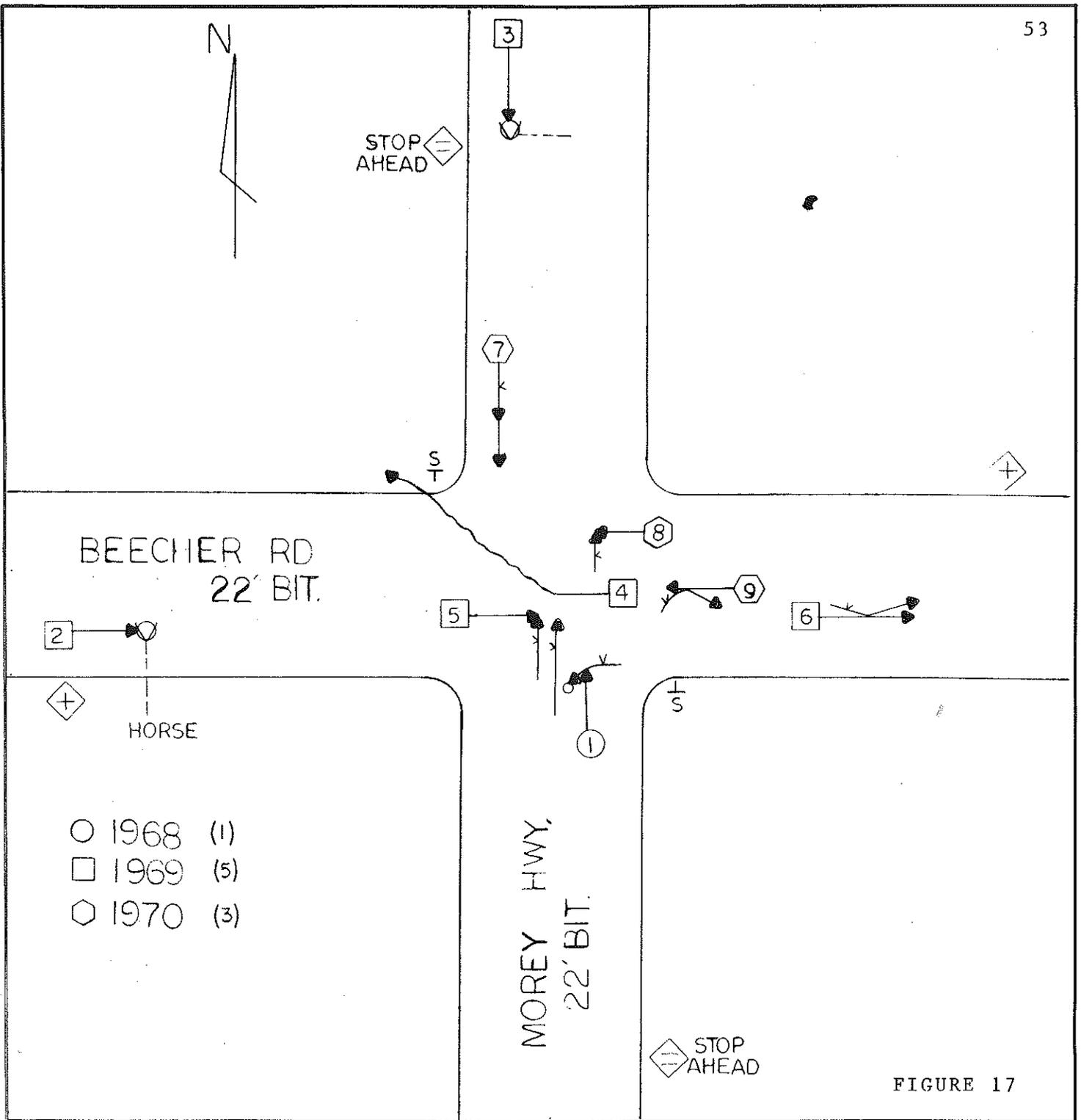
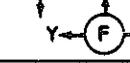
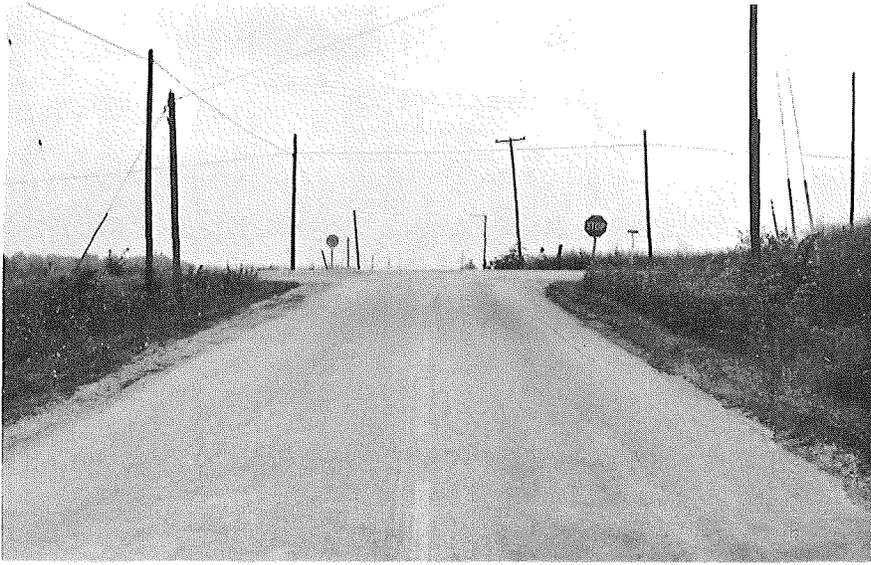


FIGURE 17

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal  Flashing Beacon 	Stop Sign S T Yield Sign Y T	Location BEECHER AT MOREY HUDSON TWP. LENAWEE CO.	
Fatal  Injury  Skidding  Jackknife  Overturned  Backing 	Pedestrian  Tree  Out of Control  Driver Intent  Deer  Violator 	Period: <u>1968 THRU 1970</u> Accidents - Total <u>9</u> P.D. <u>8</u> Injury <u>1 (1)</u> Fatal <u>0 ()</u> C.S. <u> </u> Miles <u> </u> Drawn <u>DJM</u> Plan No. <u>LOCATION 12</u> Date <u>6-27-72</u>	



NORTHBOUND
MOREY HWY.



EASTBOUND
BEECHER ROAD



SOUTHBOUND
MOREY HWY.

FIGURE 17a

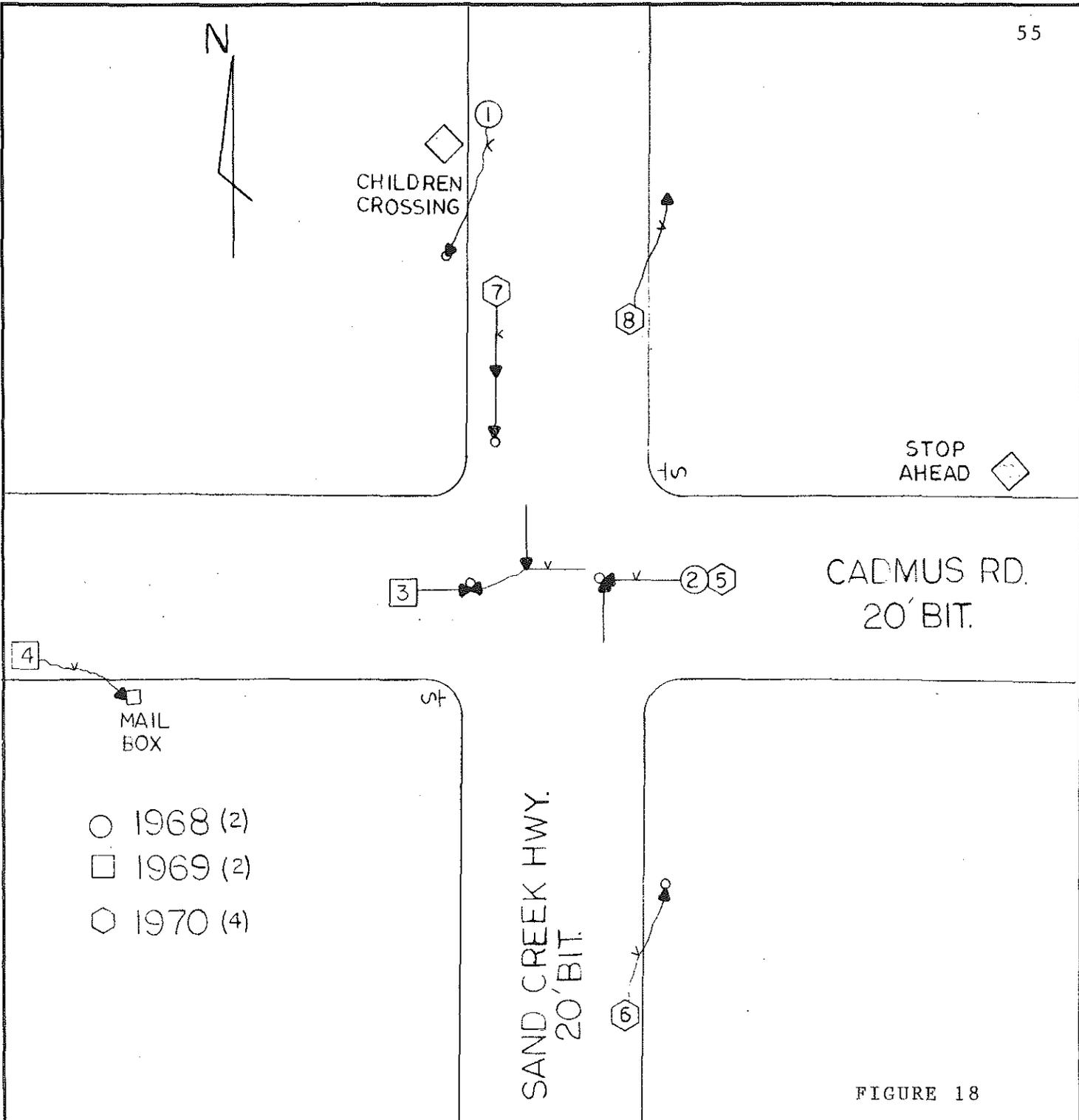


FIGURE 18

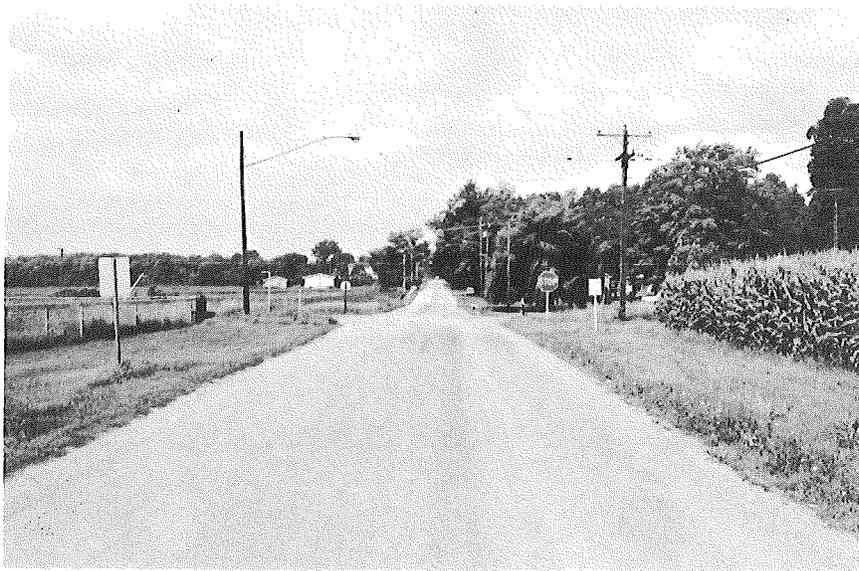
LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal		Stop Sign	S T
Flashing Beacon		Yield Sign	Y T
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overtaken		Deer	
Backing		Violator	
		Location CADMUS AT SAND CREEK HWY. MADISON TWP. LENAWEE CO.	
		Period: 1968 THRU 1970	
		Accidents - Total 8 P.D. 2	
		Injury 6 (13) Fatal 0 ()	
		C.S. Miles Drawn DJM	
		Plan No. LOCATION 13 Date 6-27-72	



EASTBOUND
CADMUS ROAD

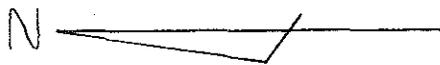


NORTHBOUND
SAND CREEK
HIGHWAY



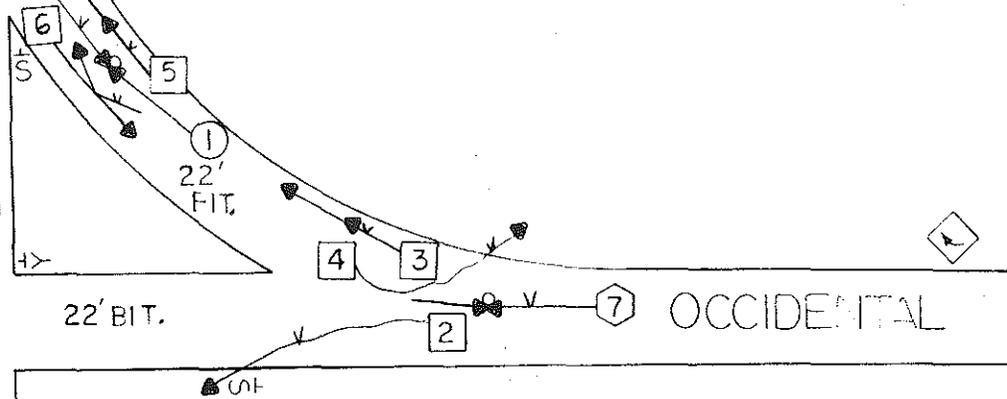
WESTBOUND
CADMUS ROAD

FIGURE 18a



44' BIT. MUNGER RD

RUSSELL RD
21' BIT.



22' BIT.

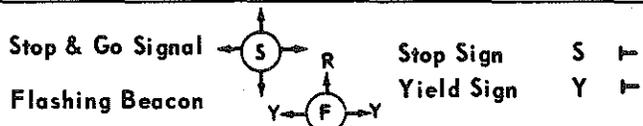
OCCIDENTAL

- 1968(1)
- 1969(5)
- ◇ 1970(2)

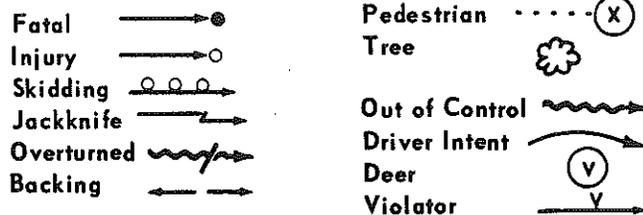
FIGURE 19

LEGEND

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION



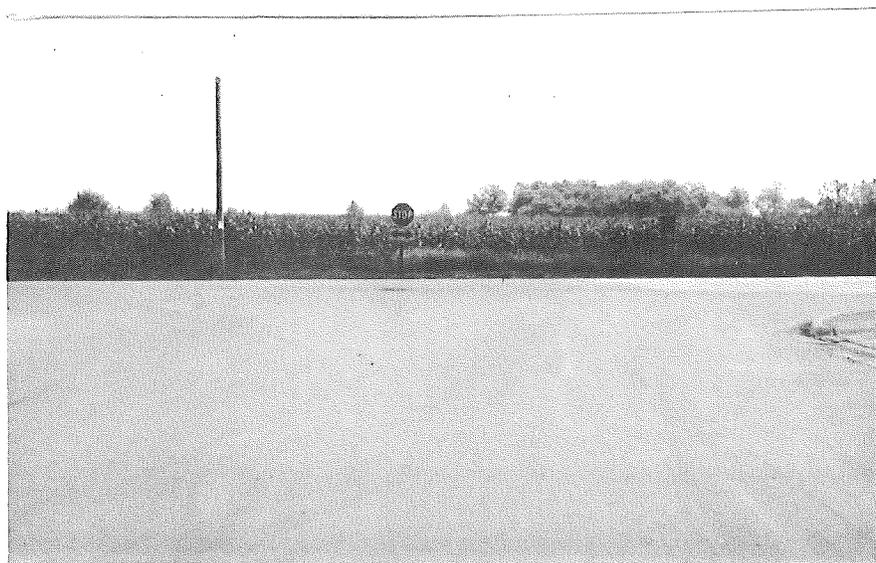
Location RUSSELL AT OCCIDENTAL
RAISIN TWP.
LENAWEE CO.



Period: 1968 THRU 1970
 Accidents - Total 8 P.D. 4
 Injury 4 (8) Fatal 0 ()
 C.S. _____ Miles _____ Drawn DJM
 Plan No. LOCATION 14 Date 8-7-72



EASTBOUND
RUSSELL ROAD



SOUTHBOUND
MUNGER ROAD



WESTBOUND
RUSSELL ROAD

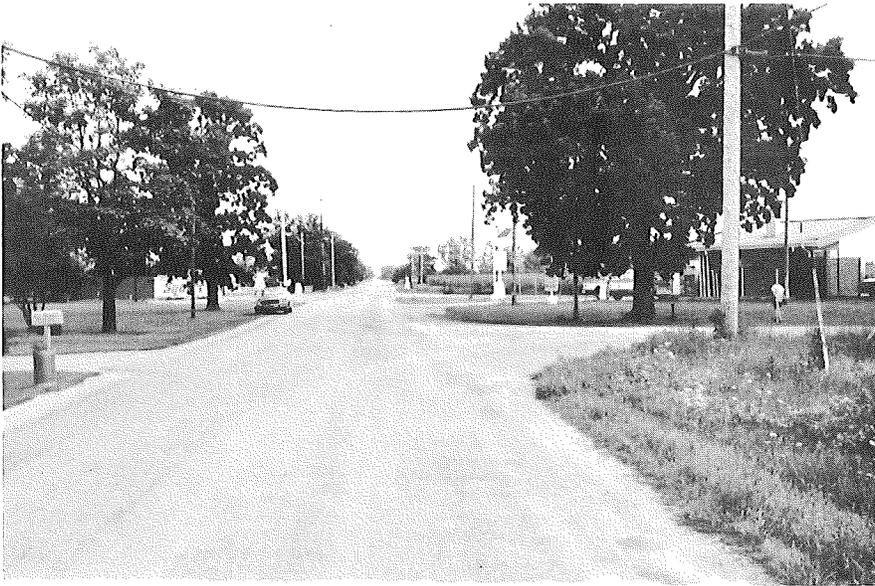
FIGURE 19a



NORTHBOUND OCCIDENTAL HIGHWAY



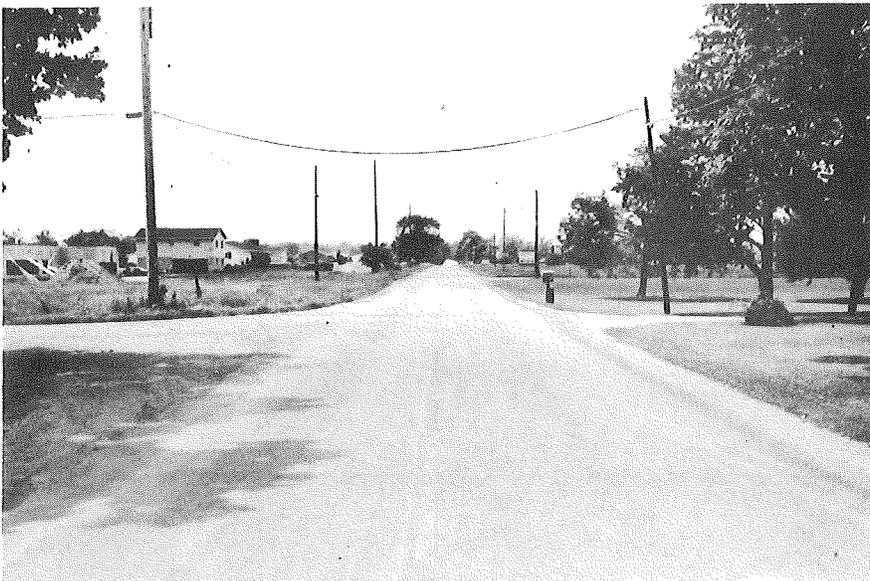
SOUTHBOUND OCCIDENTAL HIGHWAY



EASTBOUND
RUSSELL ROAD

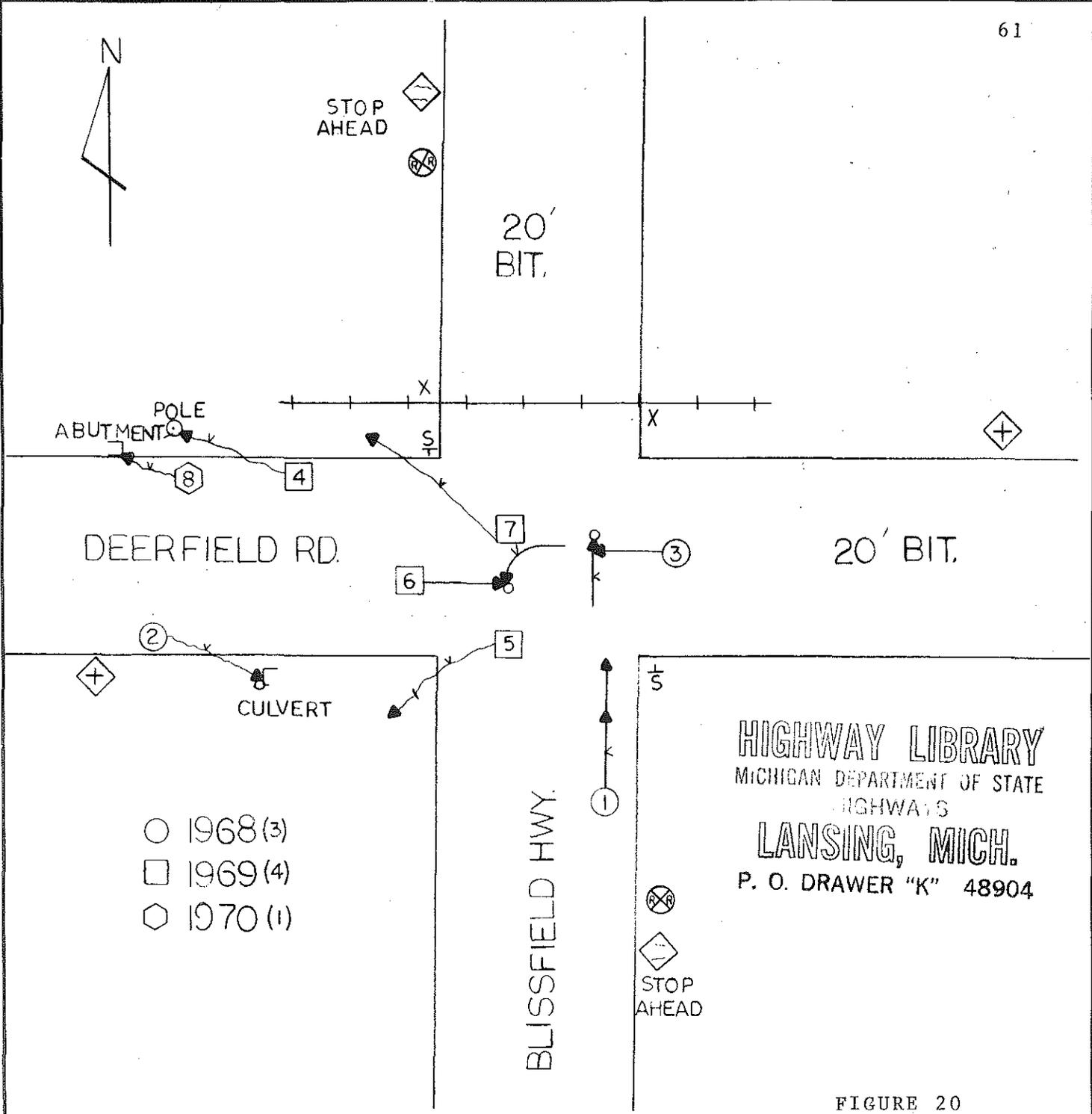


NORTHBOUND
OCCIDENTAL HIGHWAY



WESTBOUND
RUSSELL ROAD

FIGURE 19c



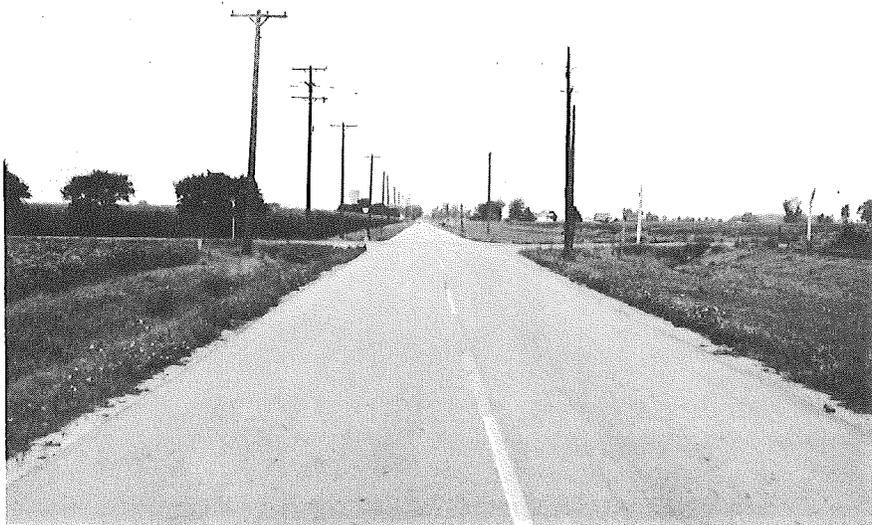
- 1968 (3)
- 1969 (4)
- ⬡ 1970 (1)

FIGURE 20

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal Flashing Beacon	Stop Sign S T Yield Sign Y T	Location DEERFIELD AT BLISSFIELD BLISSFIELD TWP. LENAWEЕ CO.	
Fatal Injury Skidding Jackknife Overturned Backing	Pedestrian Tree Out of Control Driver Intent Deer Violator	Period: <u>1968 THRU 1970</u>	
Accidents - Total <u>8</u> P.D. <u>5</u>		Injury <u>3</u> (4) Fatal <u>0</u> ()	
C.S. _____ Miles _____ Drawn <u>DJM</u>		Plan No. <u>LOCATION 15</u> Date <u>7-6-72</u>	



NORTHBOUND
BLISSFIELD HWY.



WESTBOUND
DEERFIELD ROAD



SOUTHBOUND
BLISSFIELD HWY.

FIGURE 20a

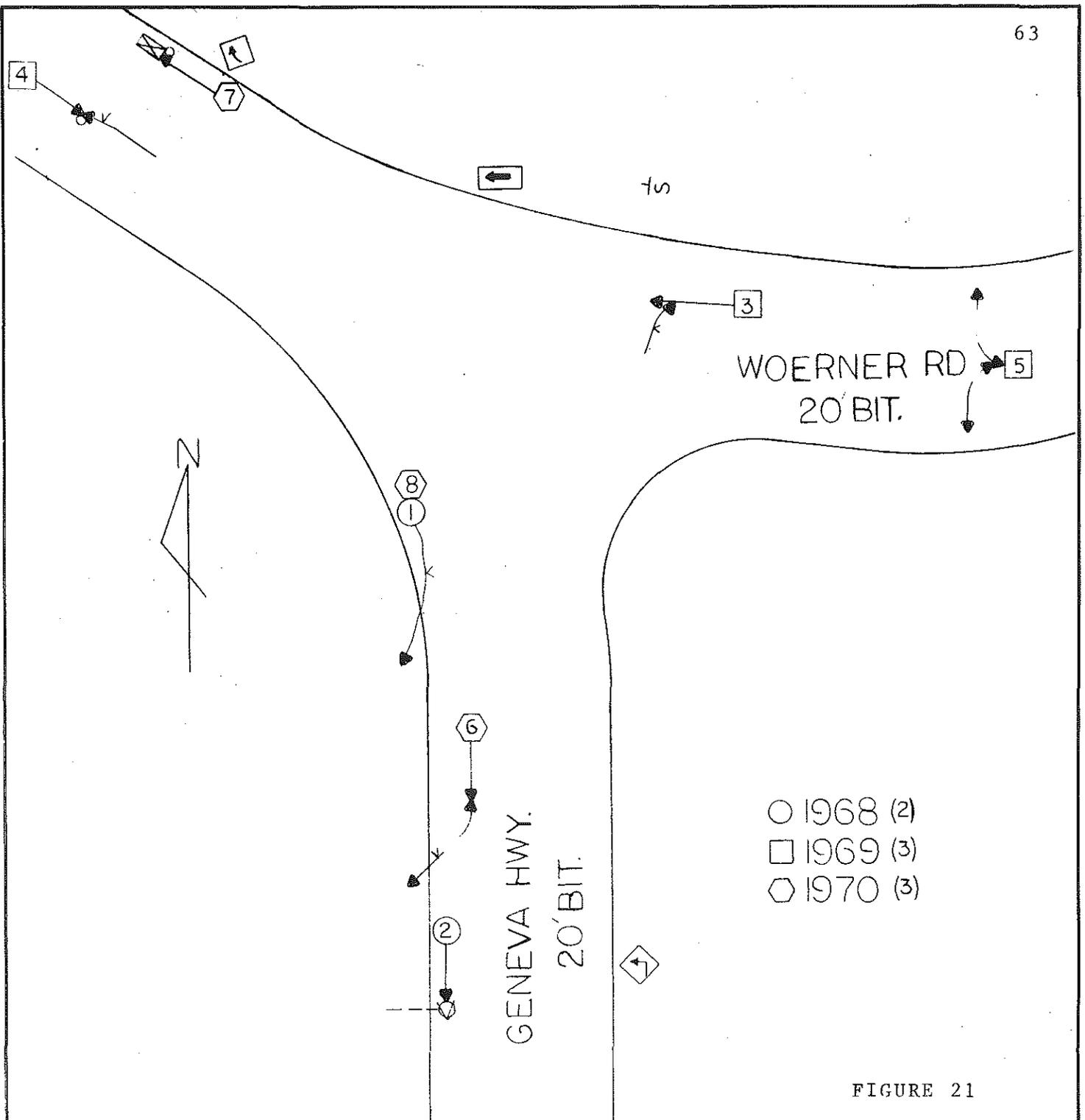


FIGURE 21

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal	Stop Sign	Location WOERNER AT GENEVA	
Flashing Beacon	Yield Sign	ROLLIN TWP.	
		LENAWEE CO.	
Fatal	Pedestrian	Period: <u>1968 THRU 1970</u>	
Injury	Tree	Accidents - Total <u>8</u> P.D. <u>6</u>	
Skidding	Out of Control	Injury <u>2</u> (<u>7</u>) Fatal <u>0</u> (<u> </u>)	
Jackknife	Driver Intent	C.S. <u> </u> Miles <u> </u> Drawn <u>DJM</u>	
Overtaken	Deer	Plan No. <u>LOCATION 16</u> Date <u>6-28-72</u>	
Backing	Violator		



SOUTHBOUND
GENEVA HIGHWAY

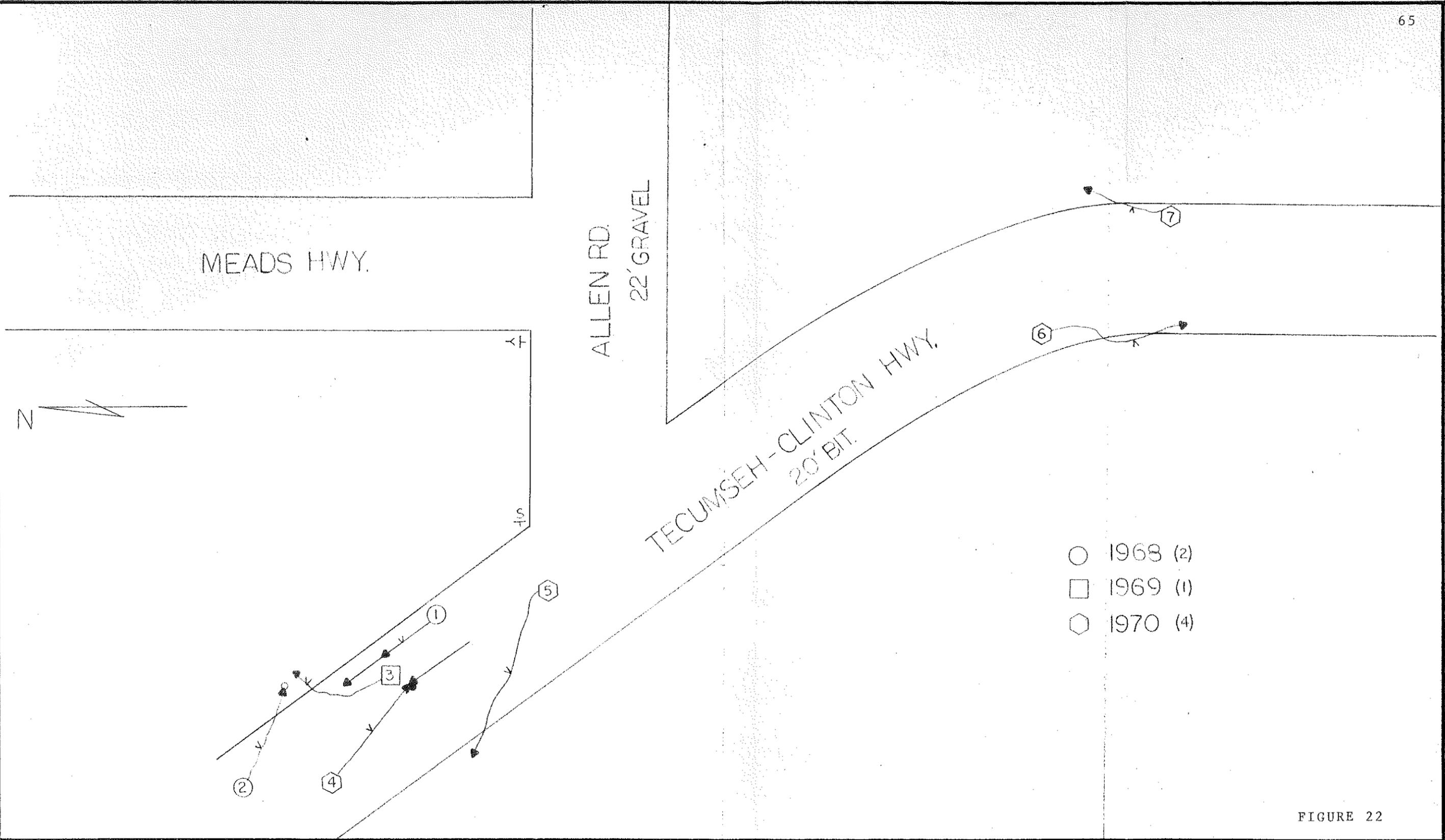


WESTBOUND
WOERNER ROAD



NORTHBOUND
GENEVA HIGHWAY

FIGURE 21a



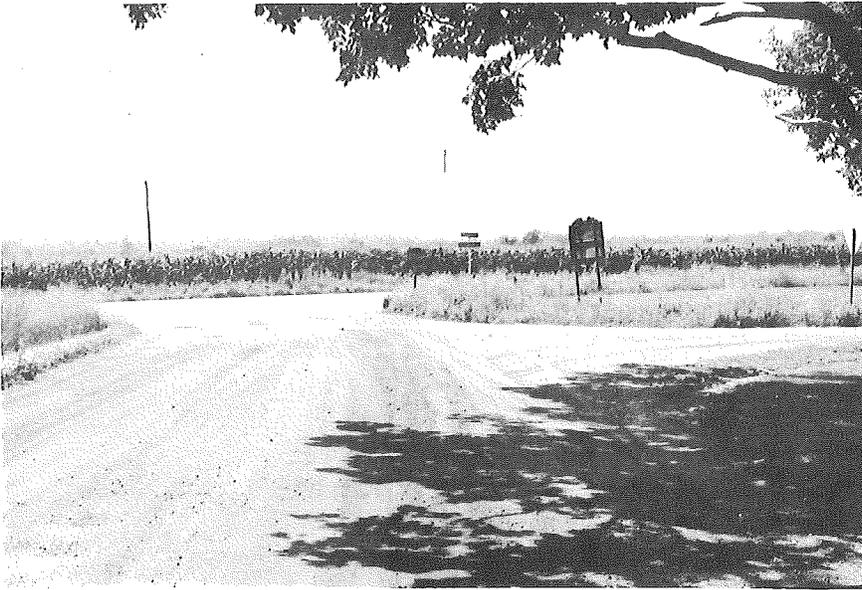
○ 1968 (2)
 □ 1969 (1)
 ⬡ 1970 (4)

FIGURE 22

LEGEND				Period: 1968 THRU 1970		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Fatal	→●	Out of Control	→~	Accidents - Total	7	P.D.	5
Injury	→○	Driver Intent	→(V)	Injury	1 (1)	Fatal	1 (2)
Skidding	→○○○	Deer	→(V)	C.S.	Miles	Drawn	DJM
Jackknife	→/	Violator	→(V)	Plan No.	LOCATION 17	Date	7-10-72
Overturned	→~	Backing	→←	Flashing Beacon	→(F)←	Yield Sign	Y
		Pedestrian	→(X)	Stop & Go Signal	→(S)←	Stop Sign	S
		Tree	✿	Yield Sign	Y	Location	TECUMSEH-CLINTON HWY AT ALLEN RD TECUMSEH, CLINTON TWP. LENAWEE CO.



NORTHBOUND
TECUMSEH-CLINTON HWY.

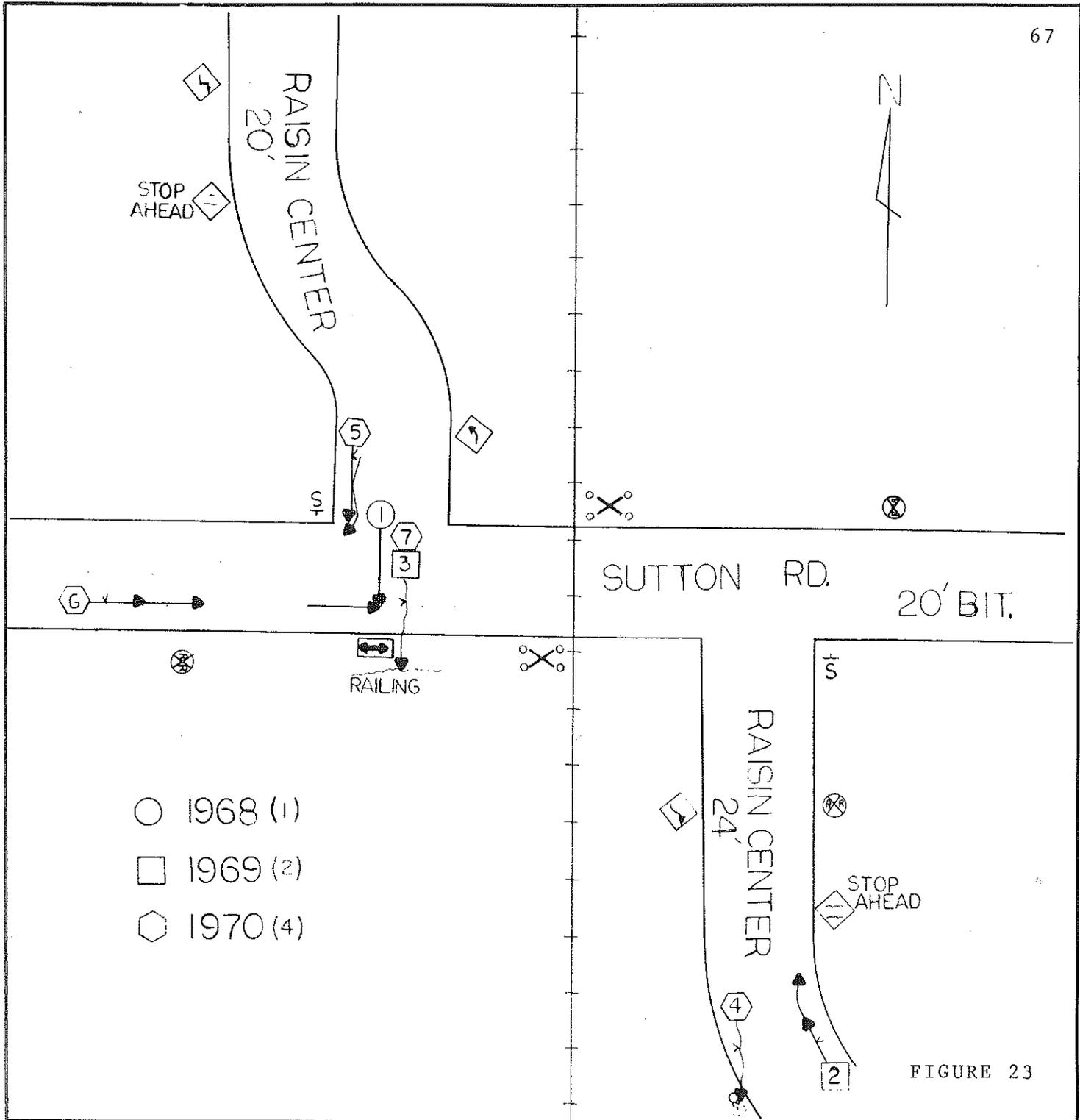


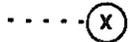
EASTBOUND
ALLEN ROAD



SOUTHBOUND
TECUMSEH-CLINTON HWY.

FIGURE 22a



LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal  Flashing Beacon 	Stop Sign  S T Yield Sign  Y T	Location SUTTON AT RAISON CENTER RAISON TWP. LENAWEE CO.	
Fatal  Injury  Skidding  Jackknife  Overturned  Backing 	Pedestrian  Tree  Out of Control  Driver Intent  Deer  Violator 	Period: 1968 THRU 1970 Accidents - Total <u>7</u> P.D. <u>6</u> Injury <u>1</u> (1) Fatal <u>0</u> () C.S. _____ Miles _____ Drawn <u>DJM</u> Plan No. <u>LOCATION 18</u> Date _____	



NORTHBOUND
RAISIN CENTER HWY.



EASTBOUND
SUTTON ROAD



SOUTHBOUND
RAISIN CENTER HWY.

FIGURE 23a