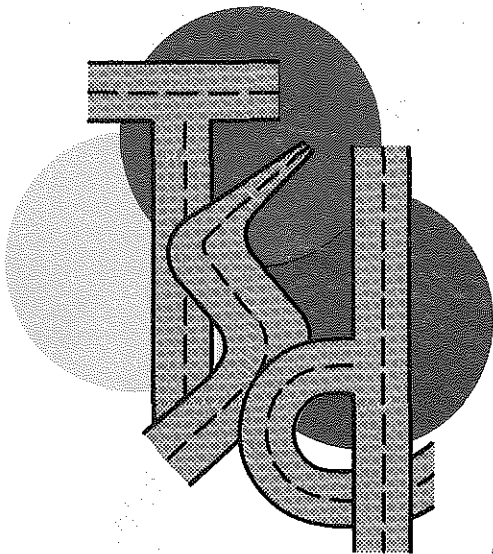


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A TRAFFIC ACCIDENT ANALYSIS
OF HIGH ACCIDENT LOCATIONS
IN MONTMORENCY COUNTY

Report TSD-SS-143-70



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by

ROBERT G. LARIVIERE

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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

"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 the hazards at the location so identified.

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

SCOPE

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

STUDY PROCEDURES

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

Since a portion of the data collection phase involves

accident records and reports and since the Michigan Department of State Police is responsible for keeping all accident records in Michigan, the task of identifying and locating high accident locations in Montmorency County (and providing an inventory of those locations) was designated as State Police responsibility. Because of the fact that a modern or automatic system of locating accidents on the county road system is not yet established, the high accident locations for Montmorency County were determined by manually extracting and compiling those locations with the highest number of accidents from the 1968 county accident reports. From this list the ten 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 Montmorency County.

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

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

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

STUDY AREA

Montmorency County is located in the northeastern portion of lower Michigan and is bordered by Alpena County on the east, Oscoda County on the south, Otsego County on the west and Presque Isle County on the north (see Figure 1 on the following page). Montmorency County has a land area of 555 sq. miles and an inland water area of 12 sq. miles. Its 1965 population was 7.4 persons per sq. mile. The town of Atlanta is the county seat while Hillman is the only incorporated village in the county. Lewiston, the only other town in the county, was never incorporated as a village.

The population of Montmorency County has increased steadily since 1940 as can be seen from the population projection in Figure 2. The population increased from 1940 to 1970 by 1,407 people which is approximately 37%. The present rate of increase is expected to at least continue in the future with a possible higher rate of increase occurring in the next 20 years.

Montmorency County has no railroad service at this time nor do they have any major airports. The primary transportation facility then is the automobile. Only two state routes, M-33 in the north-south direction and M-32 in the east-west direction, run through Montmorency County. Thus the county road system is important to the people of Montmorency County.

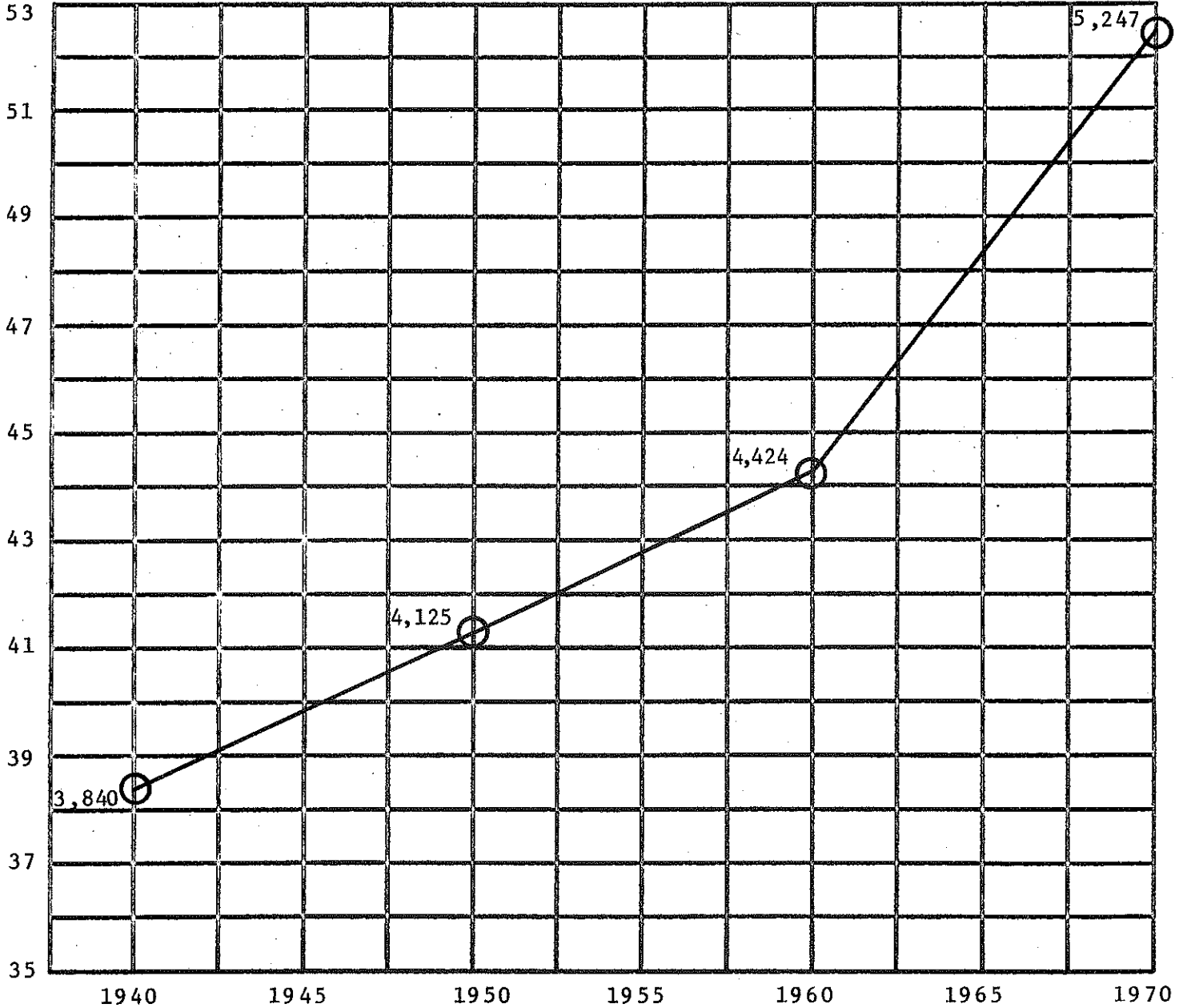
Montmorency County is a productive agricultural, horticultural, livestock and dairy district. The soil is a diversified clay, with a clay subsoil that retains the moisture to a remarkable degree. The loamy soil is warm and rich producing rapid vegetation. This combination of a clay subsoil and a sandy clay loam topsoil is almost a guarantee of good crop production. It is adapted to the cultivation of wheat and corn, rye, barley, oats, peas, grasses, potatoes, sugar beets and the raising of livestock.

Manufacturing in Montmorency County exists on a small

FIGURE 2
POPULATION PROJECTION

Montmorency County: 1940 - 1990

Population:
Hundreds



- Sources:
- a) U. S. Census of Population, 1960, Michigan
 - b) Provisional Estimates of Mid-1965 Population, Health Statistics and Evaluation Center, Michigan Department of Public Health
 - c) Michigan Population, 1960 to 1980, Working Paper No. 1, State Resource Planning Program, Michigan Department of Commerce
 - d) Dr. David Goldberg, University of Michigan, 1965

scale as one can see from Table 1 found on the next page. The lumber industry is easily the leader in the county. Out of the 12 manufacturing plants in the county, eight of them pertain to wood or wood products.

While manufacturing continues to play a small role in the economic activity of Montmorency County, the tourist business continues to grow. Montmorency is a beautiful county of lakes and streams which are favorite resorts of sportsmen and tourists who are looking for fishing and hunting grounds. The lakes are nearly all small and the streams are the headwaters of the Cheboygan and Thunder Bay Rivers. Montmorency County has something to offer the sportsman and tourist through all four seasons. Sheridan Valley, located about midway between Atlanta and Lewiston is one of Michigan's popular ski resorts. There are seven state forest campgrounds in Montmorency County with the campground at Clear Lake being one of the largest in the Lower Peninsula. Also, the white-tailed deer is found in great numbers in this county and is a prize for hunters in the fall.

According to the Eighteenth Annual Progress Report as compiled by the Local Government Division of the Michigan Department of State Highways, Montmorency County has 700.06 miles of highways. This figure does not include the streets and roads within the incorporated Village of Hillman. It does include, however, 55.15 miles of state trunkline, 156.86 miles of county primary roads and 488.05 miles of local roads.

Table 1
MONTMORENCY COUNTY

Research Division
Office of Economic
Expansion
Michigan Department
of Commerce
June, 1967

MANUFACTURING

<u>General Statistics</u>	1963 (\$000)	1958 (\$000)	1954 (\$000)	Change		1954-63 Percent
				1958-63 Number	1958-63 Percent	
Number of establishments	12	11	14	1	9.1	-14.3
Number of employees	114	74	98	40	54.1	16.3
Annual payroll	\$449	\$173	\$268	\$276	159.5	67.5
Value added by manufacture	\$766	\$313	\$748	\$453	144.7	2.4
New capital expenditures	\$ 87	\$ 33	\$ 31	\$ 54	163.6	180.6
Number of establishments by employee size:						
1-19 employees	10	11	13			
20-99 employees	2	-	1			

SIC Code	Manufacturing Industries - 1963	All Plants (No.)	Number of plants with employment of					1,000 or more
			1- 19	20- 99	100- 249	250- 499	500- 999	
2121	Cigars	1	1	-	-	-	-	-
2421	Sawmills & planing mills	2	2	-	-	-	-	-
2433	Prefabricated wood products	1	1	-	-	-	-	-
2499	Wood products, n.e.c.	3	2	1	-	-	-	-
2711	Newspapers	1	1	-	-	-	-	-
3273	Ready-mixed concrete	1	1	-	-	-	-	-
3553	Woodworking machinery	1	1	-	-	-	-	-
3569	General industry machines, n.e.c.	1	-	1	-	-	-	-
3694	Engine electrical equipment	1	1	-	-	-	-	-
	TOTAL	12	10	2	-	-	-	-

SOURCES: 1954 Census of Manufactures, Vol. III, Michigan, Tables 3 & 7
1958 Census of Manufactures, Michigan, Tables 3 & 7
1963 Census of Manufactures, Michigan, Tables 4 & 8
1963 Census of Manufactures, Location of Manufacturing Plants,
Part 3

Only about 11% of the miles of county roads are hard surfaced while the remaining mileage is either gravel or unimproved dirt road (see Figure 3 on the following page).

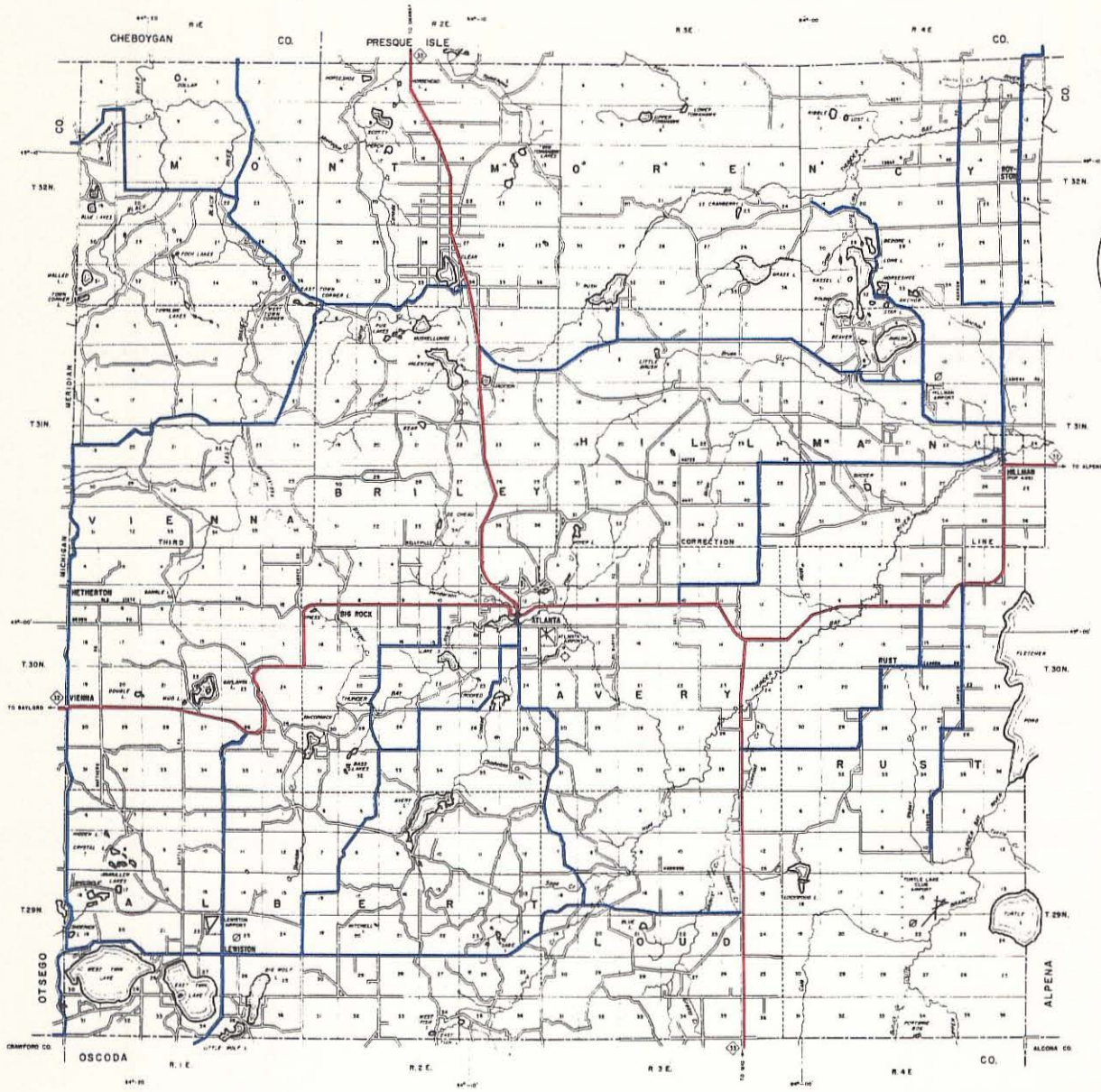


FIGURE 3

- STATE TRUNKLINE
- COUNTY PRIMARY
- COUNTY LOCAL

MONTMORENCY COUNTY

MICHIGAN
 STATE HIGHWAY COMMISSION
 DEPARTMENT OF STATE HIGHWAYS

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

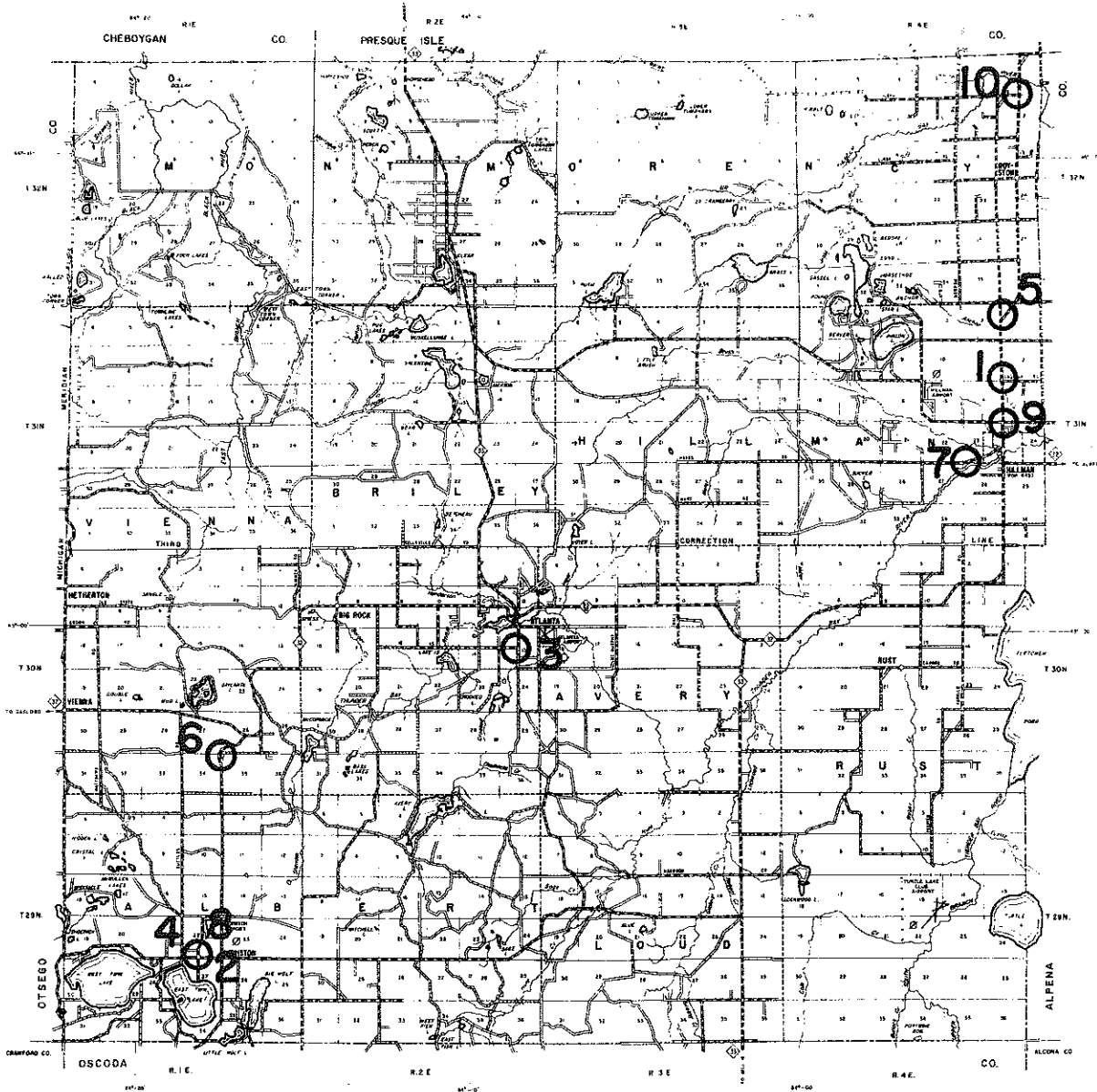
SCALE 1" = 2.75 MILES
 MERCATOR PROJECTION

TRAFFIC ENGINEERING ANALYSIS

The traffic engineering analysis phase involves evaluating the summarized facts and field data and prescribing the proper remedial treatment. The basic tools used in this type of analysis are a graphic representation of accidents, either in a collision diagram or strip map which is used to determine accident patterns. An accident pattern is the prevalence of one or more types of accident occurrence. The pattern indicates the type of corrective action. Accident causes, however, are numerous and often difficult to determine. An accident pattern does not always exist. In this case, the collisions may involve one or more serious driving hazards such as slippery pavement, snow or fog, drinking drivers, defective equipment, excessive speed and inadequate traffic control. In many cases these hazards may be eliminated or at best controlled. In some cases the accident causes may lie in factors outside the jurisdiction of the traffic engineer such as enforcement. In this instance he can offer specific information to the police or other responsible agencies and request their cooperation.

In Montmorency County the traffic engineering analysis began when the State Police, after compiling the accident data for Montmorency County, transmitted to the Michigan Department of State Highways ten high accident locations

(see spot map on the following page). After our analysis, it was apparent that no recommendations would be feasible for four of these locations. There were no accident patterns at these locations, no present serious driving hazards that could be eliminated or controlled and no potential hazards or trouble areas that could be eliminated before accident occurrence. Consequently, this report will discuss in detail only the remaining six locations. The collision diagrams and pictures for each of these will be found on the page following the discussion. The collision diagrams and pictures for the remaining four locations are found in Appendix I.



NOTE: LOCATIONS 2, 4 AND 8 ARE LOCATED IN LEWISTON

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SPOT MAP
 FOR
 HIGH ACCIDENT
 LOCATIONS



KEY TO COUNTIES

GENERAL HIGHWAY MAP
MONTMORENCY COUNTY

MICHIGAN
 STATE HIGHWAY COMMISSION
 DEPARTMENT OF STATE HIGHWAYS

DATA OBTAINED FROM
 HIGHWAY PLANNING SURVEY

INDUCED IN COOPERATION WITH
 U.S. DEPARTMENT OF TRANSPORTATION
 FEDERAL HIGHWAY ADMINISTRATION
 BUREAU OF PUBLIC ROADS

FIGURE 4

1:25,000 SCALE
 1" = 2.5 MILES
 PUBLISHED 1958

1. County Road 451 (F.A.S. 189), 1 mile north of County Road 624 (F.A.S. 1489) at Cadieux Road, Hillman Township

County Road 451 at Cadieux Road is a "T" intersection. County Road 451 has a 20 ft bituminous surface with six foot gravel shoulders. It is also centerline marked and is in an unrestricted passing zone. Cadieux Road has a two lane, 18 ft gravel roadway with five foot shoulders. There are no existing traffic controls at this location.

There were seven accidents at this "T" intersection during the four-year study period. Four of these accidents were the ran-off roadway type, two were rear-end accidents and the last accident was a sideswipe. Excessive speed reportedly played a major role in six of the seven accidents.

Recommendations:

We recommend that a stop sign (see Part I, Section B, p. 14 of the Michigan Manual of Uniform Traffic Control Devices - Appendix II, p. 65) be placed on Cadieux Road at its intersection with County Road 451. Also, a 48 in. x 24 in. bi-directional target arrow (see Part I, Section C, p. 89 of the Manual - Appendix II, p. 72) should be placed at the end of Cadieux Road.

CADIEUX RD.

CO. RD. 451

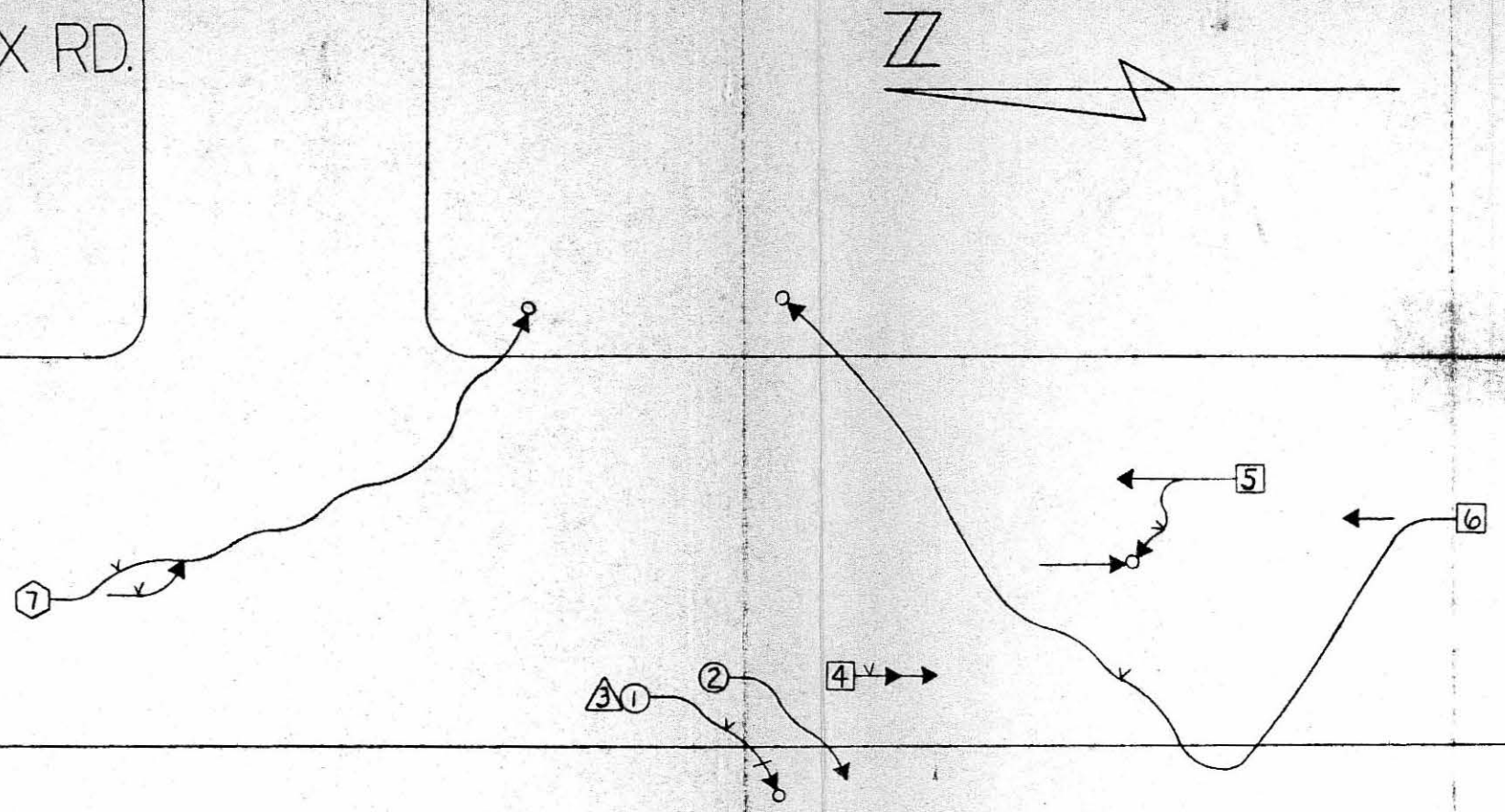


















FIGURE 5.

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  S</p> <p>Flashing Beacon  Yield Sign  Y</p> <p>Fatal  Pedestrian  (X)</p> <p>Injury  Tree  *</p> <p>Skidding  Out of Control  ~~~~~</p> <p>Jackknife  Driver Intent  ~~~~~</p> <p>Overtaken  Deer  (V)</p> <p>Backing  Viator  (V)</p>	<p>Period: <u>1966 THRU 1969</u></p> <p>Accidents - Total <u>7</u></p> <p>P.D. <u>2</u></p> <p>Injury <u>5 (9)</u></p> <p>Fatal <u>0 ()</u></p> <p>ADT _____</p> <p>Rate _____ /100 mv</p> <p>Rate _____ / mv</p>	<p>Location CO. RD. 451, 1 MILE NORTH OF CO. RD. 624, at CADIEUX RD.</p> <p>HILLMAN TWP MONTMORENCY CO.</p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>10-28-70</u></p> <p>Plan No. <u>#1</u></p>		



WESTBOUND
CADIEUX ROAD



SOUTHBOUND
CO. RD. 451



NORTHBOUND
CO. RD. 451

2. County Road 491 (F.A.S. 187) at County Road 612 (F.A.S. 171), Albert Township

The intersection of County Road 491 and County Road 612 is the major intersection in the Village of Lewiston. County Road 612 has a two lane bituminous surface that is in fair condition. The edge of metal is cracked in some spots but is not a problem at this time. County Road 612 has sand shoulders and centerline markings. The speed limit on County Road 612 is 35 miles per hour.

County Road 491 has a two lane 20 ft bituminous surface north of County Road 612 while south of 612 the bituminous surface is 84 ft wide through the business district of Lewiston. The north leg of County Road 491 has sand shoulders but no centerline markings. The south leg of County Road 491 has curb, gutter and sidewalks. The speed limit on County Road 491 is 25 miles per hour.

The existing traffic control consists of an illuminated case stop sign suspended in the center of the intersection giving County Road 612 the right of way. In 1966 and 1967 there was a flashing signal suspended in the center of the intersection giving County Road 491 the right of way. The flashing signal was taken down in 1968 and was replaced by the stop sign. Also, the through street was changed from County Road 491 to County Road 612.

There were six accidents at this location during the

four-year study period. Four of these accidents occurred in 1966 and 1967 with three of them resulting from failure to yield the right of way. Since 1968 when County Road 612 was designated as the through street, there have been no accidents involving failure to yield the right of way. We feel that the problems associated with this type of accident may have been solved when 612 was designated as the through street because County Road 612 is the heavier traveled roadway.

Recommendation:

We recommend that stop signs (see Part I, Section B, p. 14 of the Manual - Appendix II, p. 65) supplement the illuminated case stop sign for County Road 491.

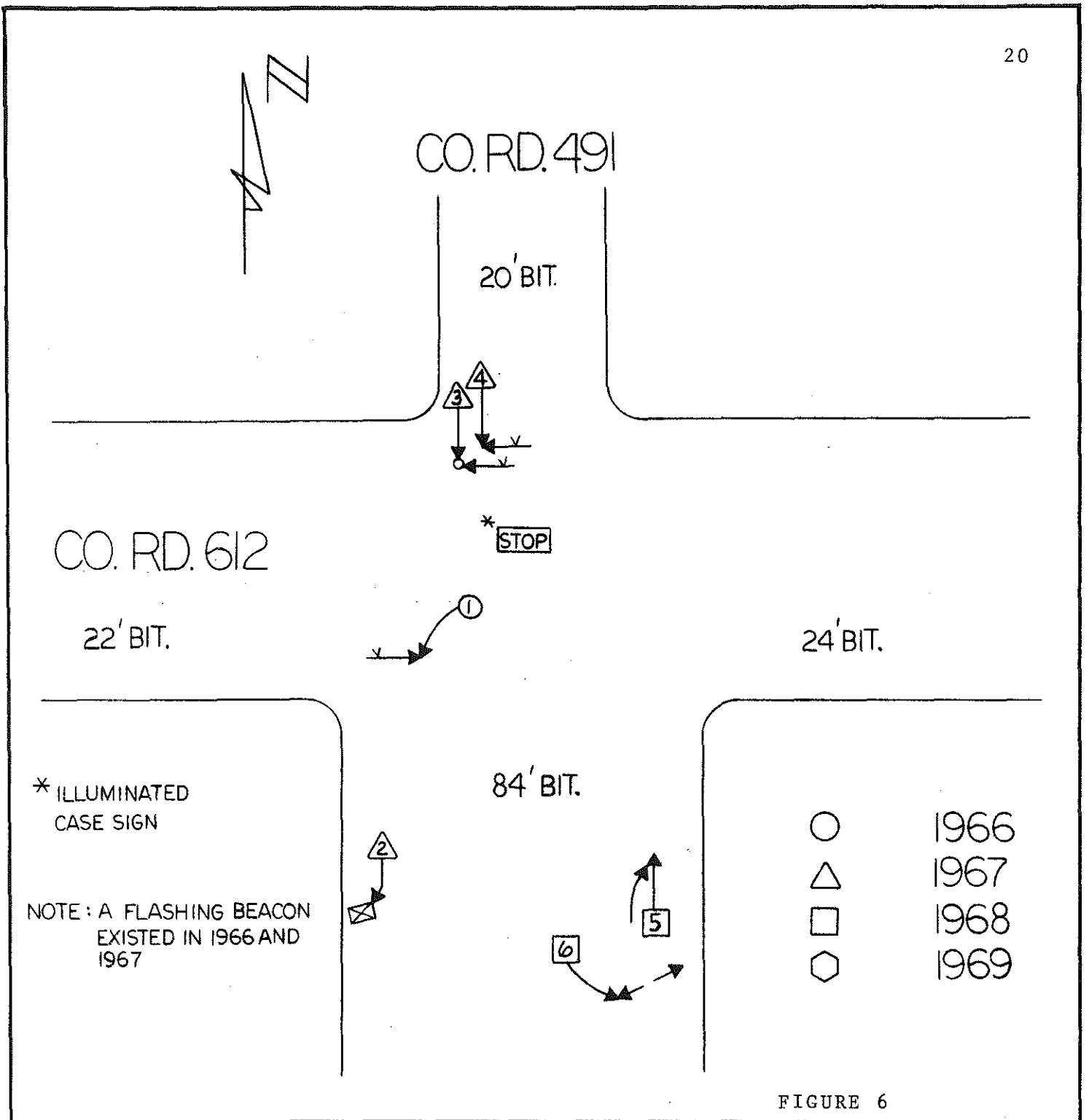
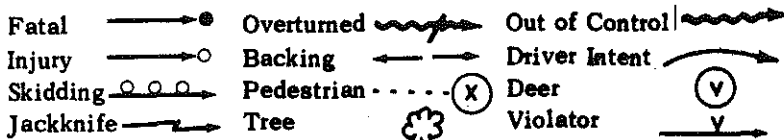
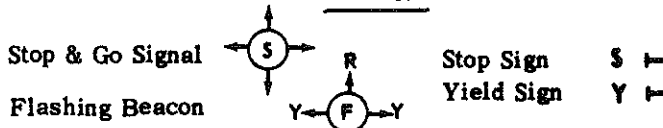


FIGURE 6

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969

ALBERT TWP. Description MONTMORENCY CO.

CO. RD. 612 at CO. RD. 491

Accidents - Total 6 (5)

P.D. 5 Injury 1

Fatal 0 ()

Acc. Rate/mv _____

Acc. Rate/mvm _____

C.S. _____ Miles _____

Drawn DVW Date 11-2-70 Rev. _____

Plan No. #2



SOUTHBOUND
CO. RD. 491



EASTBOUND
CO. RD. 612



NORTHBOUND
CO. RD. 491



WESTBOUND
CO. RD. 612

3. County Road 489 (F.A.S. 633) at County Road 487 (F.A.S. 1490), Briley Township

County Road 489 at County Road 487 is a "T" intersection. County Road 489 has a two lane 20 ft wide bituminous pavement with seven foot shoulders. County Road 487 has a two lane 22 ft wide bituminous pavement also with seven foot shoulders. Both of these roads are in excellent condition.

The present signing consists of a stop sign (R1-1-24, Appendix II, p. 65) located on the south corner of County Road 489 giving County Road 487 the right of way.

There were five accidents during the four-year study period. Three of these accidents were the ran-off roadway type with two of these occurring at the end of County Road 489. Out of these two accidents, one operator reported that he passed out at the intersection and the other operator reported that he did not see the stop sign in time. Both of these accidents happened at night.

Recommendations:

We recommend that a 24 in. x 48 in. bi-directional target arrow (see Part I, Section C, p. 89 of the Manual - Appendix II, p. 72) be placed at the end of County Road 489.

We also suggest that consideration be given to erection of a stop ahead warning sign (see Part I, Section C, p. 94 of the Manual - Appendix II, p. 73) on County Road 489. This sign will give drivers advance warning of the approaching intersection.

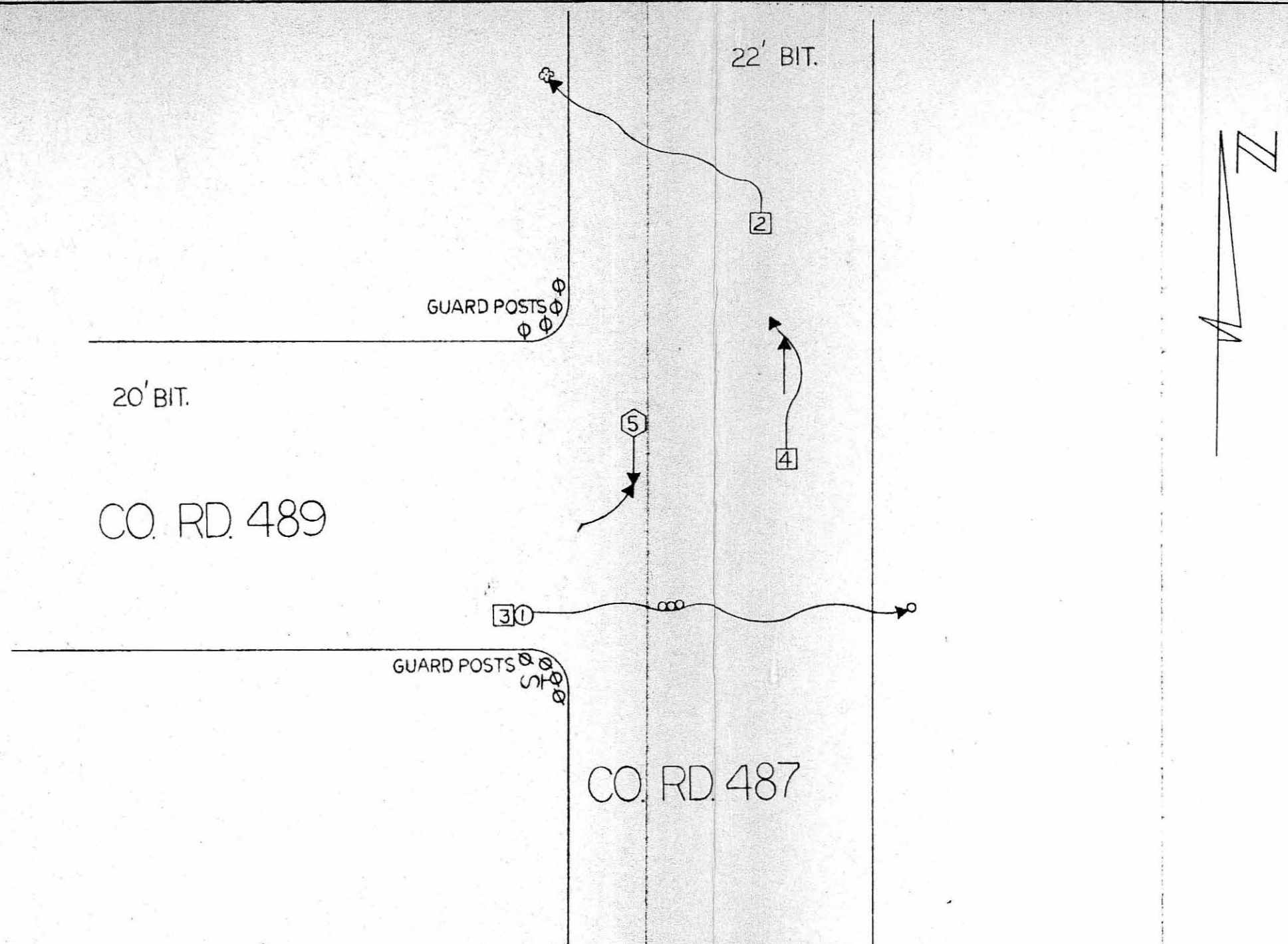








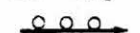

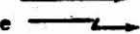







FIGURE 7

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: <u>1966 THRU 1969</u></p> <p>Accidents - Total <u>5</u></p> <p>P.D. <u>3</u></p> <p>Injury <u>2 (2)</u></p> <p>Fatal <u>0 ()</u></p>	<p>ADT _____</p> <p>Rate _____ /100 mvm</p> <p>Rate _____ / mv</p>	<p>Location CO. RD. 487 at CO. RD. 489</p> <p>BRILEY TWP.</p> <p>MONTMORENCY CO.</p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>10-28-70</u></p> <p>Plan No. _____ # <u>3</u></p>



EASTBOUND
CO. RD. 489



SOUTHBOUND
CO. RD. 487



NORTHBOUND
CO. RD. 487

FIGURE 7a

4. County Road 491 (F.A.S. 187) at Hansen Road, Albert Township (see Appendix I, p. 52)

<u>Total</u>	<u>P.D.</u>	<u>Injury</u>	<u>Fatal</u>
4	4	0	0

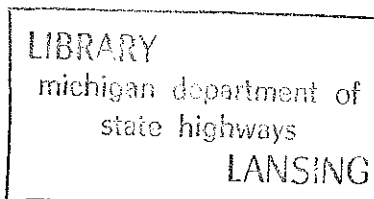
5. County Road 451 (F.A.S. 189) at County Road 452 (F.A.S. 243), Hillman Township (see Appendix I, p. 54)

<u>Total</u>	<u>P.D.</u>	<u>Injury</u>	<u>Fatal</u>
3	1	2	0

6. County Road 491 (F.A.S. 187), 1 mile south of M-32, Vienna Township

County Road 491 is a two lane 20 ft wide bituminous roadway with seven foot gravel shoulders. This location is composed of the first two curves in a series of curves that extend north approximately one mile to M-32. In this area County Road 491 has a minus gradient in the northerly direction. Passing is prohibited in this area and is indicated so by yellow center-line markings. The terrain on the west side of the curve is approximately 25 to 35 ft below the road surface. Consequently, the outside of the curve has a steel guardrail to keep vehicles from running down the embankment.

The existing traffic controls at this location consist of a 24 in. "winding road" sign that is located 1,000 ft south of the series of curves. There is no special speed zone for



this location other than the 65 mile per hour daytime speed set by the State of Michigan.

The accident data for this location shows that three accidents occurred during the four-year study period. All three accidents involved vehicles running off the roadway with two of these accidents occurring at night.

Recommendations:

We recommend that winding road curve signs (see Part I, Section C, p. 87 of the Manual - Appendix II, p. 70) be placed before the series of curves for both northbound and southbound traffic. Also, we recommend that 45 mile per hour advisory speed panels (see Part I, Section C, pps. 132-133 of the Manual - Appendix II, p. 75) accompany the winding road curve signs. The 45 mile per hour speed was selected on the basis of devil level readings that were taken at the most critical curve which in this case is the second curve in the northerly direction. The devil level readings were as follows.

Northerly Curve			
Northbound		Southbound	
Speed	Reading	Speed	Reading
50	12°	50	10°
45	7°	45	8°
40	5°	40	6°

Furthermore, to complement the winding road curve signs,

we recommend that target arrows (see Part I, Section C, p. 88 of the Manual - Appendix II, p. 71) be placed in target position at each curve. We recommended use of the target arrows so that the outline of the curve will be apparent to the motorist at night.

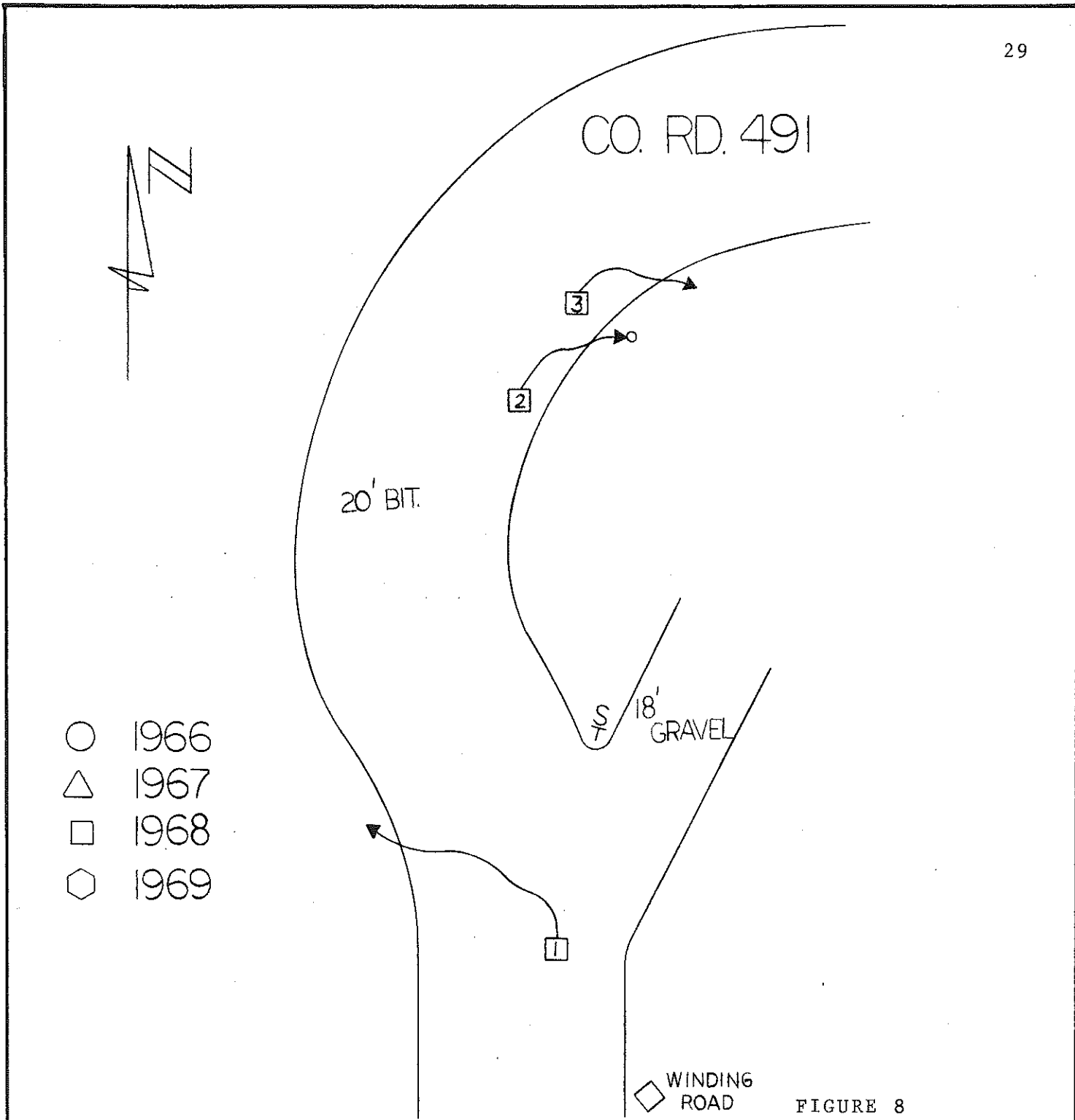
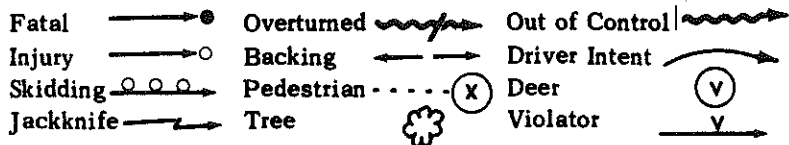
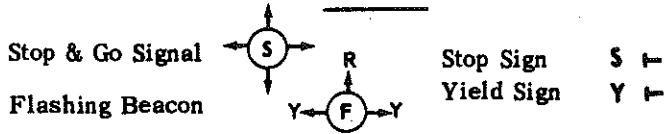


FIGURE 8

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
VIENNA TWP. Description MONTMORENCY CO.
CO. RD. 491, 1 MILE SOUTH OF M-32

Accidents - Total 3
 P.D. 2 Injury 1 ()
 Fatal 0 ()

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

C.S. _____ Miles _____
 Drawn DVW Date 10-29-70 Rev. _____
 Plan No. #6



NORTHBOUND
CO. RD. 491



NORTHBOUND
CO. RD. 491



NORTHBOUND
CO. RD. 491



NORTHBOUND
CO. RD. 491



NORTHBOUND
CO. RD. 491



SOUTHBOUND
CO. RD. 491



SOUTHBOUND
CO. RD. 491



SOUTHBOUND
CO. RD. 491



SOUTHBOUND
CO. RD. 491

7. County Road 487 (F.A.S. 1488), 1 mile west of County Road 451 (F.A.S. 189), Hillman Township

County Road 487 is a two lane bituminous roadway with centerline markings and soft sand shoulders. The bituminous pavement is in good condition while the sand shoulders are in only fair condition due to erosion. County Road 487 at this location is a reverse curve. The curve to the west has guard posts along the southern edge of the curve. There is a delineator at the beginning and at the end of this section of guard posts.

The existing traffic controls at this location consist of two curve signs for eastbound traffic. A speed panel of 45 miles per hour accompanies the curve sign to the west, while the curve sign to the east does not have a speed panel. Westbound traffic has one curve sign with a 45 mile per hour speed panel for the second curve. Also, there is a "soft shoulder" sign (W8-4-30, Appendix II, p. 74) located east of the reverse curve.

There were three ran-off roadway accidents at this location during the four-year study period. All three of these accidents occurred at night with two of them reportedly caused by speed too fast for the curve.

Recommendations:

We recommend that an additional curve sign (see Part I, Section C, p. 82 of the Manual - Appendix II, p. 68) be

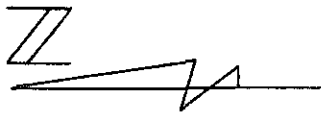
erected for the first curve in the westerly direction. Our devil level readings indicate that no posted advisory speed is necessary for this curve. The readings were as follows.

East Curve			
Eastbound		Westbound	
Speed	Reading	Speed	Reading
50	5 ^o	50	6 ^o
45	4 ^o	45	4 ^o
40	4 ^o	40	4 ^o

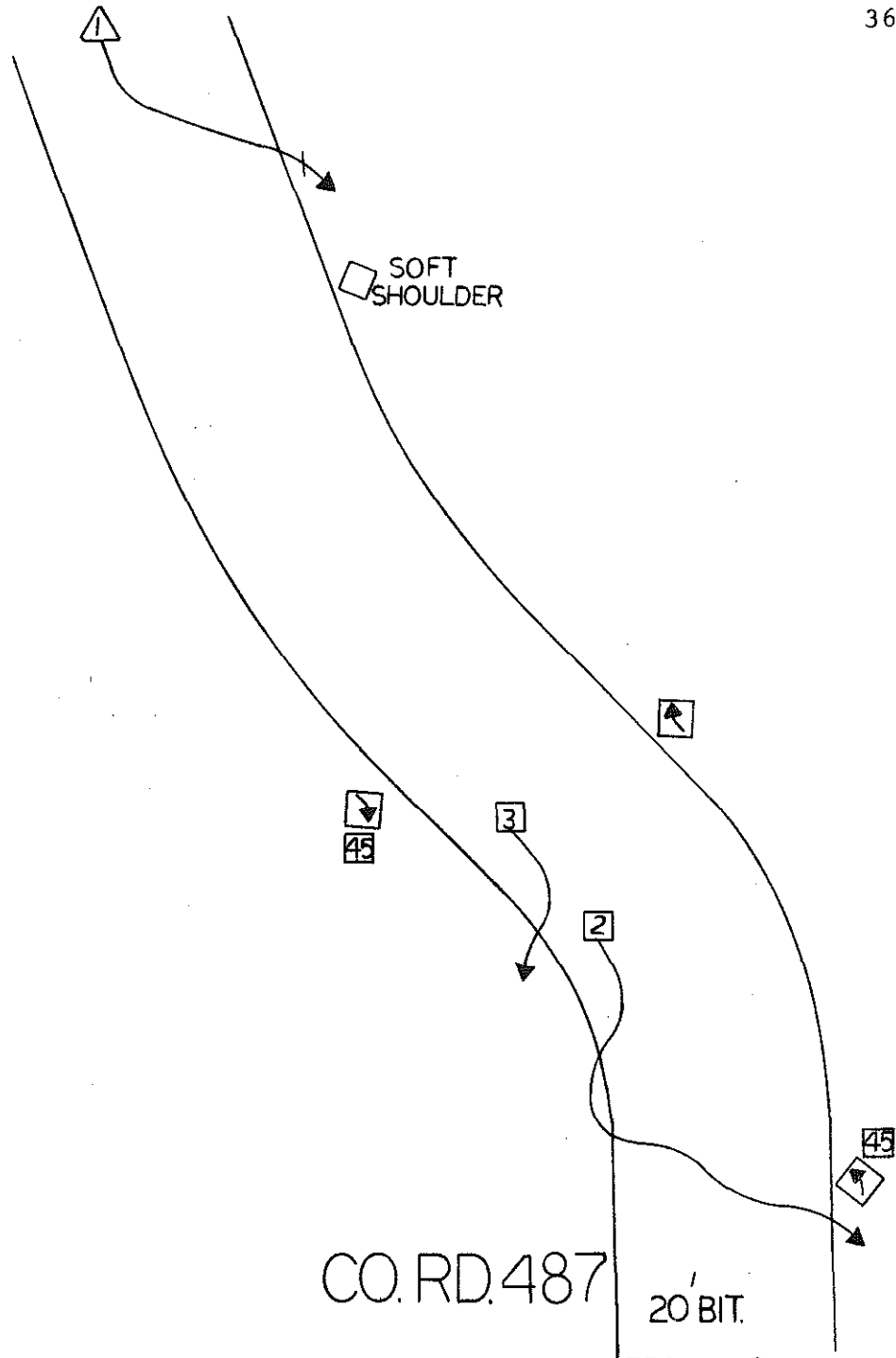
The devil level readings we obtained for the west curve concur with the present 45 mile per hour advisory speed panel. The readings were as follows.

West Curve			
Eastbound		Westbound	
Speed	Reading	Speed	Reading
50	12 ^o	50	12 ^o
45	9 ^o	45	7 ^o
40	5 ^o	40	5 ^o

To complement the curve signs at this location, we recommend the use of target arrows (see Part I, Section C, p. 88 of the Manual - Appendix II, p. 71) in target position at each curve. The target arrows will make the alignment of the curves more visible to the drivers at night.



- 1966
- △ 1967
- 1968
- ◇ 1969



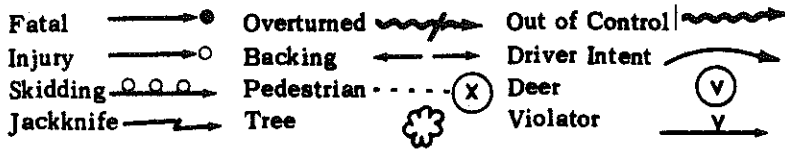
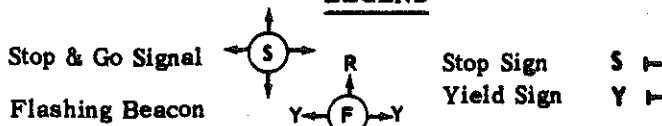
CO. RD. 487

20' BIT.

FIGURE 9

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
 HILLMAN TWP. Description MONTMORENCY CO.
 CO. RD. 487, 1 MILE WEST OF CO. RD. 451
 Accidents 3 Total 3
 P.D. 3 Injury 0
 Fatal 0
 Acc. Rate/mv _____
 Acc. Rate/mvm _____
 C.S. _____ Miles _____
 Drawn DVW Date 10-29-70 Rev. _____
 Plan No. #7



WESTBOUND
CO. RD. 487

WESTBOUND
CO. RD. 487



WESTBOUND
CO. RD. 487



FIGURE 9a



EASTBOUND
CO. RD. 487



EASTBOUND
CO. RD. 487



EASTBOUND
CO. RD. 487

8. Jensen Street at Michelson Street, Lewiston (see Appendix I, p. 57)

<u>Total</u>	<u>P.D.</u>	<u>Injury</u>	<u>Fatal</u>
2	1	1	0

9. County Road 451 (F.A.S. 189) at County Road 624 (F.A.S. 1489), Hillman Township (see Appendix I, p. 60)

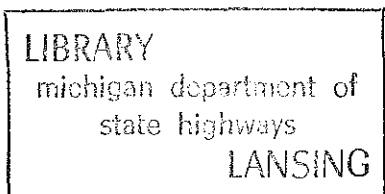
<u>Total</u>	<u>P.D.</u>	<u>Injury</u>	<u>Fatal</u>
2	1	1	0

10. County Road 451 (F.A.S. 189) at Hubert Road, Montmorency Township

County Road 451 and Hubert Road form a "T" intersection. County Road 451 is a two lane 20 ft wide bituminous roadway with seven foot gravel shoulders. Hubert Road is a two lane 18 ft bituminous roadway in the immediate intersection area and a 22 ft gravel roadway beyond the bituminous.

The existing traffic control is a 24 in. stop sign (see Part I, Section B, p. 14 of the Manual - Appendix II, p. 65) for eastbound Hubert traffic. County Road 451 has the right of way.

There were two accidents during the four-year study period from 1966 to 1969 at this location. There was one rear-end accident and one head-on left turn.



Recommendations:

We recommend that a 48 in. x 24 in. bi-directional target arrow (see Part I, Section C, p. 89 of the Manual - Appendix II, p. 72) be placed at the end of Hubert Road. Also, because of the weathered condition of the existing stop sign, we recommend that this sign be replaced.

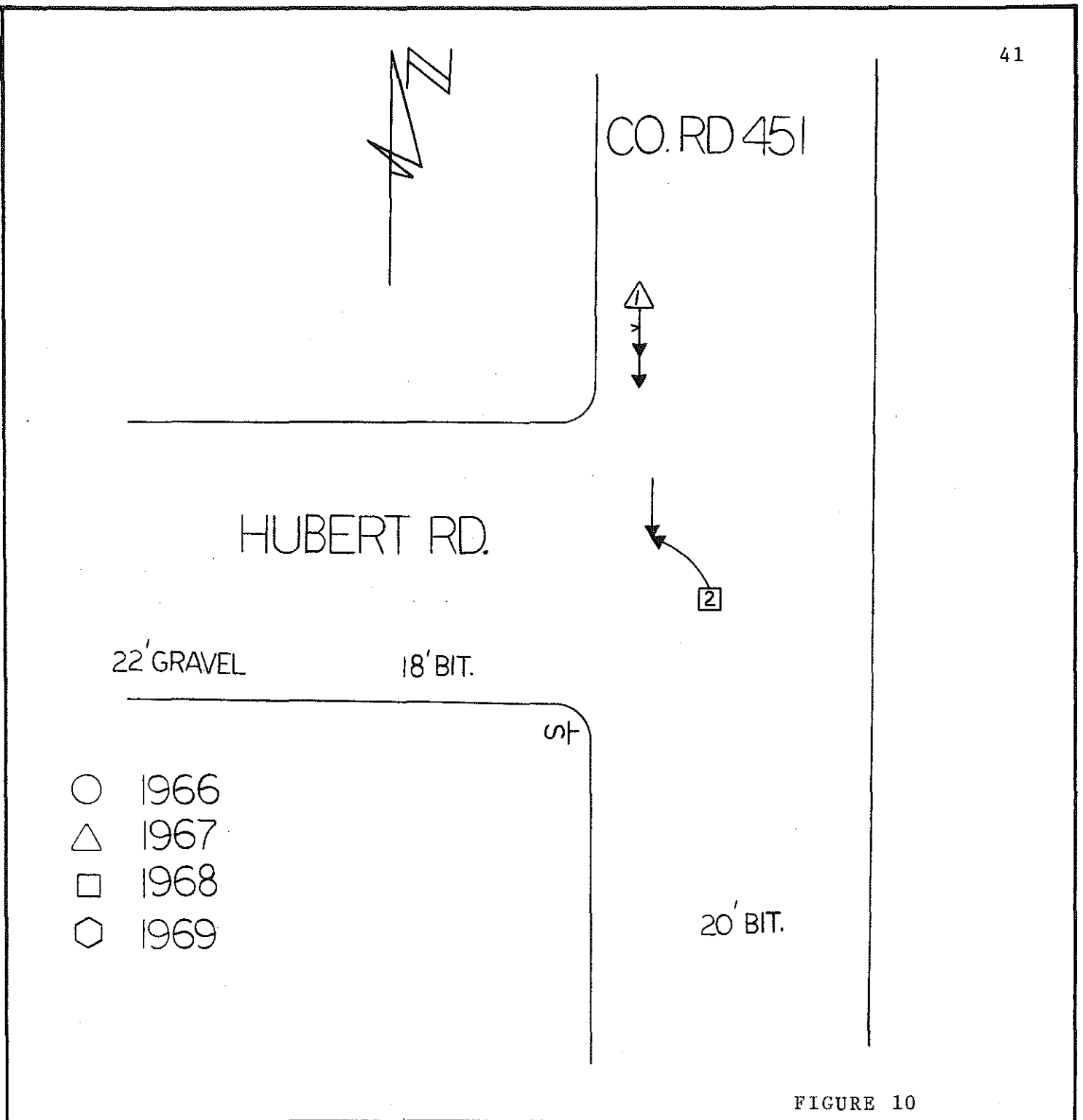
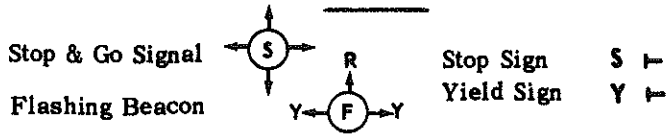


FIGURE 10

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

ACCIDENT STUDY
COLLISION DIAGRAM

LEGEND

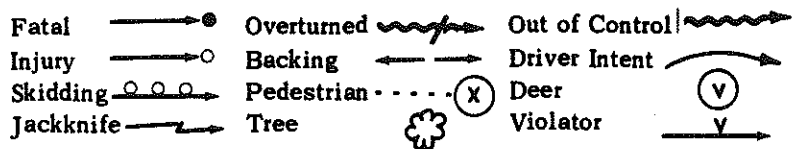


Period: 1966 THRU 1969
MONTMORENCY TWP. Description MONTMORENCY CO.

CO. RD. 451 at HUBERT RD.

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

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



C.S. _____ Miles _____
Drawn DVW Date 10-29-70 Rev. _____
Plan No. _____ # 10



EASTBOUND
HUBERT ROAD

SOUTHBOUND
CO. RD. 451



NORTHBOUND
CO. RD. 451

FIGURE 10a

SUMMARY

There was a total of 333 reported traffic accidents on Montmorency County roads during the study period 1966 through 1969 for an average of 83 accidents per year. The ten high accident locations accounted for 37 of the total reported accidents in the county during the four-year study period. This figure is 11% of the reported accidents. It would appear from these figures that Montmorency County as a whole doesn't experience an alarming accident criticality.

Table 2, found on the following page, contains some interesting data on the reported traffic accidents and vehicle registrations in Montmorency County. Reported traffic accidents decreased in 1967 but increased in both 1968 and 1969. The greatest increase in reported accidents occurred from 1967 to 1968 when the accident totals more than doubled. Vehicle registrations increased each year from 1966 to 1969 for a total increase of 40.8%.

To further document the various facts present at the ten high accident locations, the following tables were prepared to tabulate and chart specific data.

3. Monthly and Daily Accident Occurrence
4. Annual Accident Summary
5. Daily and Hourly Accident Occurrence
6. Age of Drivers Involved in Accidents

TABLE 2

REPORTED TRAFFIC ACCIDENTS IN MONTMORENCY COUNTY

Year	Property Damage	Injury	Fatal	Total	County Roads	State Route	Inter- State	Persons	Persons
								Injured	Killed
1966	55	37	1	93	51	36	0	71	1
1967	62	33	3	98	47	50	0	69	4
1968	181	61	1	243	112	131	0	107	1
1969	194	84	1	279	123	156	0	124	1

COMPARISON OF ACCIDENT FREQUENCY
 Montmorency County Roads Total Accidents
 State of Mich.

1966	51	302,880
1967	47	299,004
1968	112	305,495
1969	123	331,223

PERCENTAGE OF CHANGE FOR THE ABOVE TOTALS

1966-67	-7.8	-1.3
1967-68	138.3	2.2
1968-69	9.8	8.4

VEHICLE REGISTRATIONS IN MONTMORENCY COUNTY

Year	Pass.	Comm.	Farm Vehicle	Trailer	Trailer Coach	Motor Cycles	Muni- cipal	Total Plates
1966	-	-	-	-	-	-	-	2,718
1967	2,430	538	47	454	61	57	7	3,594
1968	2,435	641	44	507	78	67	5	3,777
1969	2,456	656	-	653	-	59	3	3,827

7. Residence of Drivers Involved in Accidents

8. Weather Conditions at Scene of Accidents

9. Pavement Conditions at Scene of Accidents

Table 3 shows that the peak accident month was August which had almost 30% of the accidents. The reported accidents were divided almost equally among the days of the week except for Friday and Saturday which together had 35% of the accidents.

The information summarized in Table 4 shows that of the 37 accidents at the ten high accident locations 13 resulted in personal injury while 24 resulted in property damage. There were no fatalities over the four-year period at the ten high accident locations.

Table 5 shows the peak accident hour as 12:00 to 1:00 a.m. with 12:00 - 1:00 p.m. and 8:00 - 9:00 p.m. running a close second. Tables 6 and 7 contain the age and residence of the drivers involved in the accidents while Tables 8 and 9 show the weather conditions and pavement conditions at the scene of the accidents. These tables could be used by agencies interested in highway safety from the standpoint of driver education and law enforcement.

ACCIDENT ANALYSIS

Table 3

MONTHLY AND DAILY ACCIDENT OCCURRENCE

TEN HIGH ACCIDENT LOCATIONS IN MONTMORENCY COUNTY

Period Studied: 1966 through 1969

* * * * *

Month	Day of the Week							Monthly Total	% Of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
January	1				1		1	3	8.1
February									
March									
April	1		1					2	5.4
May		1						1	2.7
June	1						1	2	5.4
July		2				2	1	5	13.5
August	2	1		4	3	1		11	29.8
September					2	2		4	10.8
October		1	1			1	1	4	10.8
November			1	1				2	5.4
December			1			1	1	3	8.1
Day Total	5	5	4	5	6	7	5	37	100.0
% of Total	13.5	13.5	10.8	13.5	16.2	18.9	13.5	100.0	100.0

Peak Accident Day: Saturday

Peak Accident Month: August

ACCIDENT ANALYSIS

Table 4

ANNUAL ACCIDENT SUMMARY

TEN HIGH ACCIDENT LOCATIONS IN MONTMORENCY COUNTY

Period Studied: 1966 through 1969

* * * * *

Accident Type	Day	Night	Total
Fatal Accident			
Personal Injury Acc.	6	7	13
Property Damage Acc.	11	13	24
Total	17	20	37

* * * * *

Month	Fatal		Injury		Prop. Damage		Sub. Total		Total
	Day	Night	Day	Night	Day	Night	Day	Night	
January					1	2	1	2	3
February									
March									
April				2				2	2
May			1				1		1
June				1		1		2	2
July				1	2	2	2	3	5
August			3	2	4	2	7	4	11
September				1	1	2	1	3	4
October			1		2	1	3	1	4
November						2		2	2
December			1		1	1	2	1	3
S. Total			6	7	11	13	17	20	
Total			13		24		37		37

ACCIDENT ANALYSIS

Table 5

DAILY AND HOURLY ACCIDENT OCCURRENCE

TEN HIGH ACCIDENT LOCATIONS IN MONTMORENCY 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	2	1	5	13.5
1 - 2AM			1				1	2	5.4
2 - 3AM					1			1	2.7
3 - 4AM	1							1	2.7
4 - 5AM							1	1	2.7
5 - 6AM									
6 - 7AM									
7 - 8AM									
8 - 9AM									
9 - 10AM				1				1	2.7
10 - 11AM							1	1	2.7
11 - 12AM			1		1			2	5.4
12 - 1PM	1	1		1	1			4	10.8
1 - 2PM				1			1	2	5.4
2 - 3PM	1	1						2	5.4
3 - 4PM			1			1		2	5.4
4 - 5PM		1		1		1		3	8.1
5 - 6PM		1				2		3	8.1
6 - 7PM									
7 - 8PM									
8 - 9PM	1				2	1		4	10.8
9 - 10PM	1							1	2.7
10 - 11PM			1	1				2	5.4
11 - 12PM									
Not Stated									
Day Total	5	5	4	5	6	7	5	37	100.0
% of Total	13.5	13.5	10.8	13.5	16.2	18.9	13.5	100.0	100.0

Peak Accident Hour: 12 - 1 a.m.

Peak Accident Day: Saturday

ACCIDENT ANALYSIS

Table 6

AGE OF DRIVERS INVOLVED IN ACCIDENTS
TEN HIGH ACCIDENT LOCATIONS IN MONTMORENCY COUNTY

Period Studied: 1966 through 1969

* * * * *

Age Group	Number of Drivers Involved in				% of Total
	Fatal	Injury	Prop. Damage	Total	
Under 16					
16-19		3	8	11	19.0
20-24		3	2	5	8.6
25-34		1	8	9	15.5
35-44		5	5	10	17.2
45-54		3	4	7	12.1
55-64		2	5	7	12.1
65-74		1	1	2	3.4
75 & Over			3	3	5.2
Not Stated			4	4	6.9
Total		18	40	58	100.0

* * * * *

Table 7

RESIDENCE OF DRIVERS INVOLVED IN ACCIDENTS

Residence	Number of Drivers Involved in				% of Total
	Fatal	Injury	Prop. Damage	Total	
Local		13	25	38	65.6
Michigan		5	12	17	29.3
Out of State			1	1	1.7
Not Stated			2	2	3.4
Total		18	40	58	100.0

ACCIDENT ANALYSIS

Table 8

WEATHER CONDITIONS AT SCENE OF ACCIDENTS
TEN HIGH ACCIDENT LOCATIONS IN MONTMORENCY COUNTY

Period Studied: 1966 through 1969

* * * * *

Weather	Severity of Accident				% of Total
	Fatal	Injury	Prop. Damage	Total	
Clear or Cloudy		13	22	35	94.6
Rain			1	1	2.7
Fog					
Snow or Sleet			1	1	2.7
Not Stated					
Total		13	24	37	100.0

* * * * *

TABLE 9

PAVEMENT CONDITIONS AT SCENE OF ACCIDENTS

Pavement	Severity of Accident				% of Total
	Fatal	Injury	Prop. Damage	Total	
Dry		12	16	28	75.7
Wet			3	3	8.1
Snowy/Icy		1	4	5	13.5
Icy			1	1	2.7
Not Stated					
Total		13	24	37	100.0

APPENDIX I

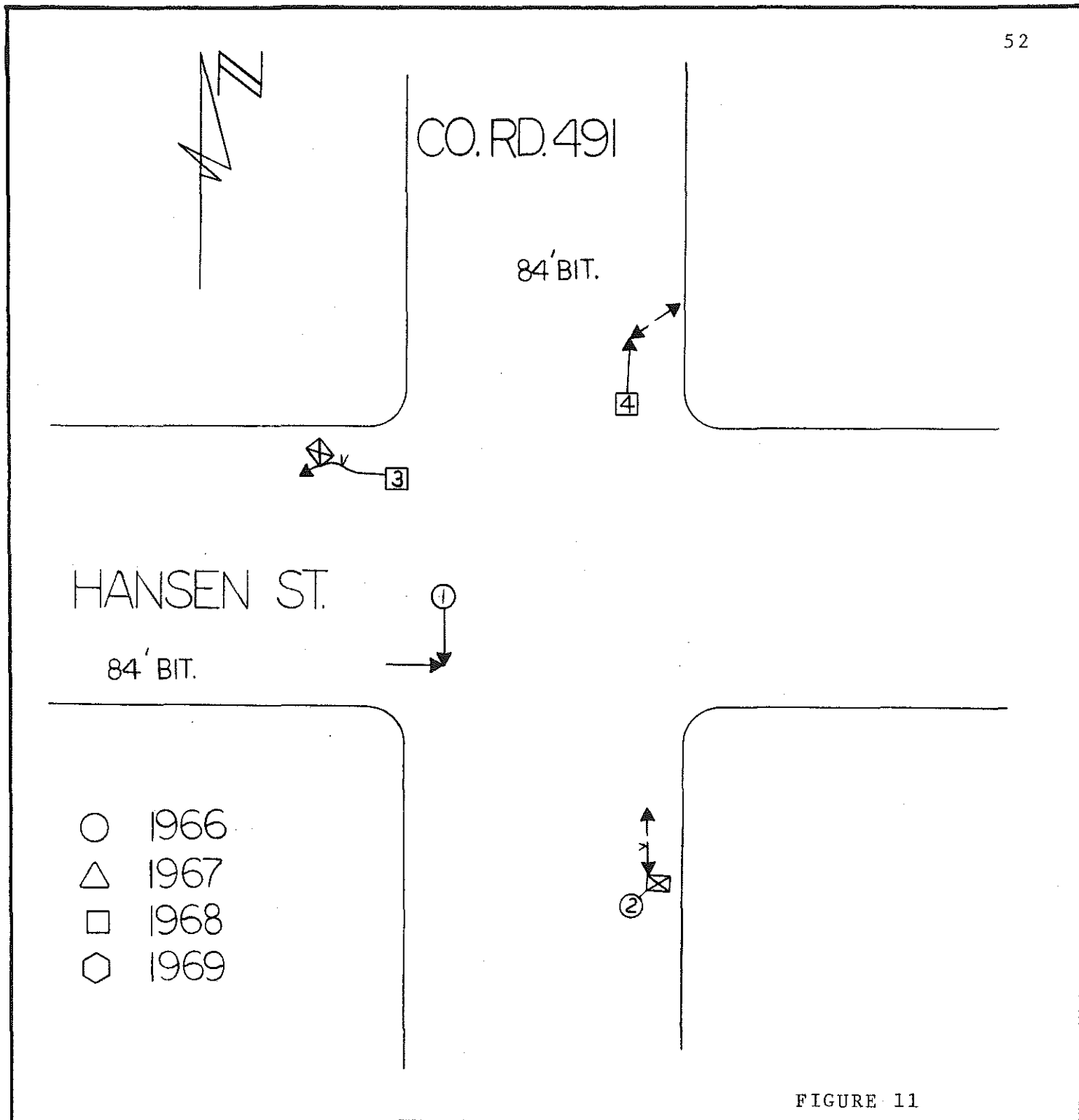


FIGURE 11

<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS Traffic Division</p>	<p>ACCIDENT STUDY COLLISION DIAGRAM</p>
<p>Period: <u>1966 THRU 1969</u></p>	
<p>TOWN OF LEWISTON Description <u>MONTMORENCY CO.</u></p>	
<p>CO. RD. 491 at HANSEN ST.</p>	
<p>Accidents - Total <u>4</u></p>	
<p>P.D. <u>4</u> Injury <u>0</u> ()</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>10-29-70</u> Rev. _____</p>	
<p>Plan No. <u># 4</u></p>	



SOUTHBOUND
CO. RD. 491

WESTBOUND
HANSEN STREET



NORTHBOUND
CO. RD. 491

FIGURE 11a

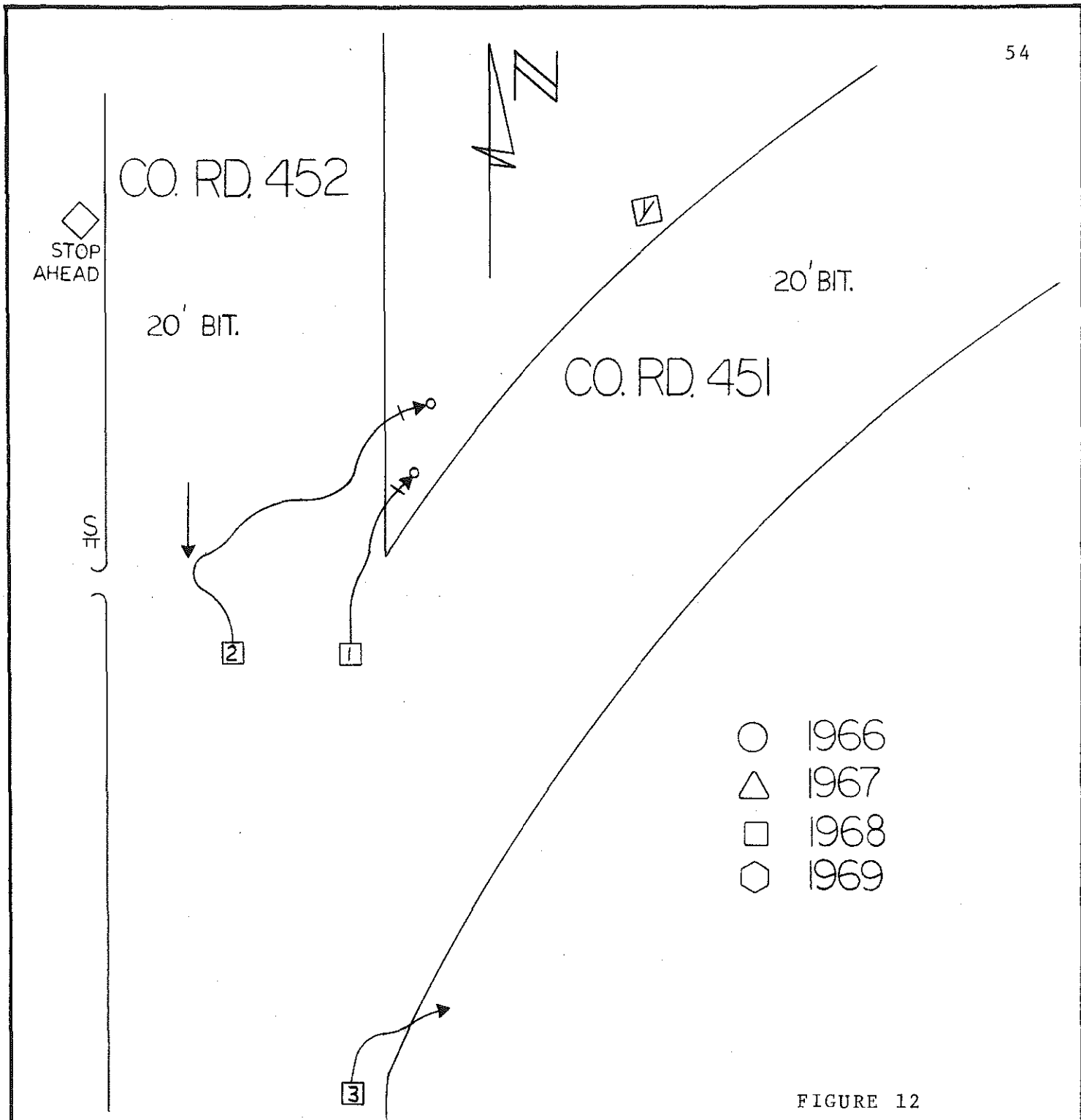
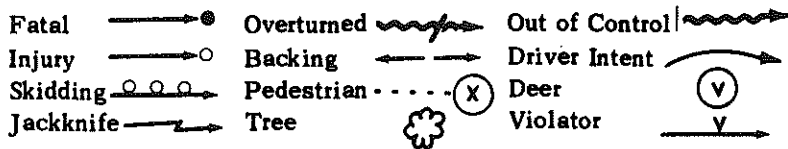
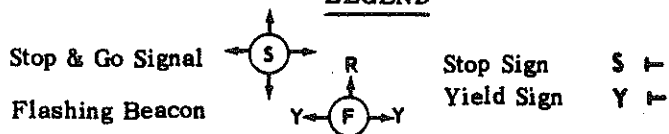


FIGURE 12

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND



ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
 HILLMAN TWP. Description MONTMORENCY CO.
 CO. RD. 451 at CO. RD. 452

Accidents - Total 3
 P.D. 1 Injury 2 (3)
 Fatal 0 ()

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

C.S. _____ Miles _____
 Drawn DVW Date 10-28-70 Rev. _____
 Plan No. #5



SOUTHBOUND
CO. RD. 452



SOUTHBOUND
CO. RD. 451



SOUTHBOUND
CO. RD. 451

FIGURE 12a



SOUTHBOUND

CO. RD. 451



NORTHBOUND

CO. RD. 451

LIBRARY
michigan department of
state highways
LANSING

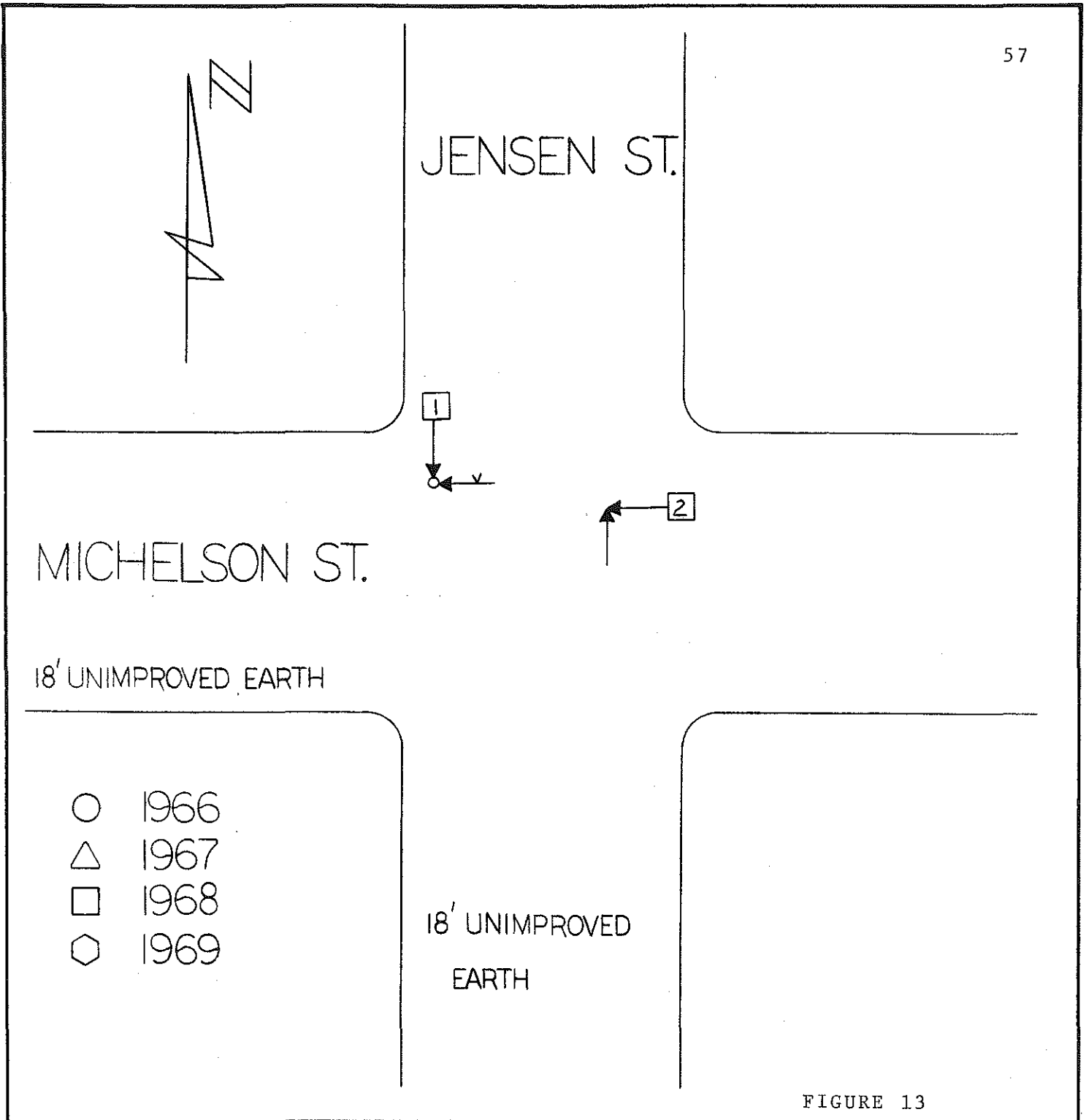


FIGURE 13

<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS Traffic Division</p>	<p>ACCIDENT STUDY COLLISION DIAGRAM</p>
<p>LEGEND</p> <p>Stop & Go Signal Stop Sign S</p> <p>Flashing Beacon Yield Sign Y</p>	<p>Period: <u>1966 THRU 1969</u></p> <p>TOWN OF <u>LEWISTON</u> Description <u>MONTMORENCY CO</u></p> <p>JENSEN ST. at MICHELSON ST.</p> <p>Accidents -- Total <u>2</u></p> <p>P.D. <u>1</u> Injury <u>1</u> ()</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>10-29-70</u> Rev. _____</p> <p>Plan No. <u>#8</u></p>
<p>Fatal Overtuned Out of Control </p> <p>Injury Backing Driver Intent </p> <p>Skidding Pedestrian Deer </p> <p>Jackknife Tree Violator </p>	



SOUTHBOUND
JENSEN STREET



EASTBOUND
MICHELSON STREET



NORTHBOUND
JENSEN STREET



WESTBOUND
MICHELSON STREET

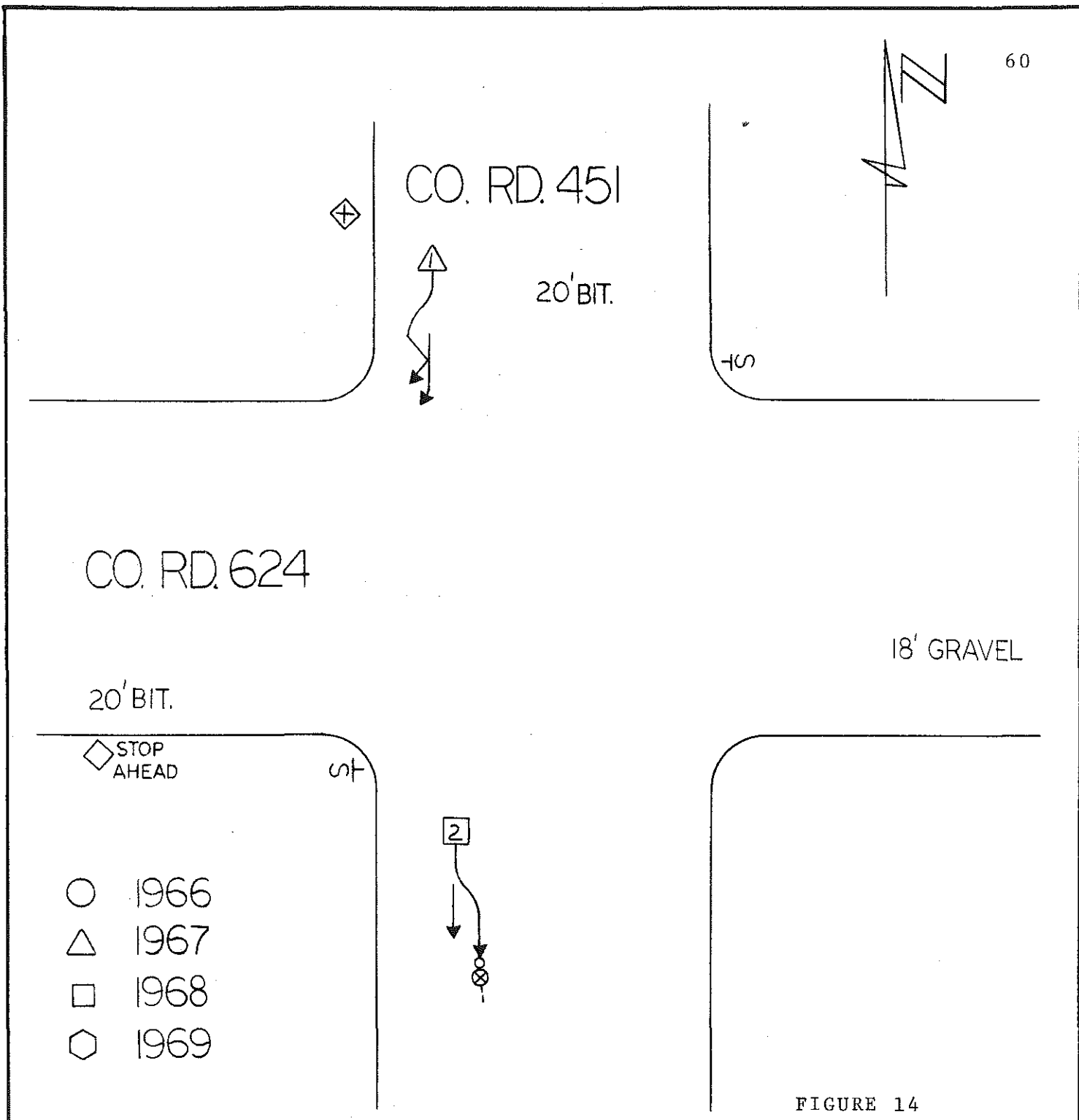


FIGURE 14

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969

HILLMAN TWP. Description MONTMORENCY CO.

CO. RD. 451 at CO. RD. 624

Accidents - Total 2

P.D. 1 Injury (2)

Fatal 0

Acc. Rate/mv _____

Acc. Rate/mvm _____

C.S. _____ Miles _____

Drawn DVW Date 10-28-70 Rev. _____

Plan No. #9

Fatal (arrow to circle with dot)

Injury (arrow to circle with slash)

Skidding (arrow to circles)

Jackknife (arrow to zigzag)

Overtaken (wavy arrow)

Backing (double arrow)

Pedestrian (X)

Tree (flower)

Out of Control (zigzag arrow)

Driver Intent (curved arrow)

Deer (V)

Violator (V)



EASTBOUND
CO. RD. 624



NORTHBOUND
CO. RD. 451



WESTBOUND
CO. RD. 624



SOUTHBOUND
CO. RD. 451

APPENDIX II

Section B. Regulatory Signs

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

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

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

Regulatory signs are classified in the following groups:

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

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

STOP SIGN



Reflectorized

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

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

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

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

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

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

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

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

Section C. Warning Signs

Introduction

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

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

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

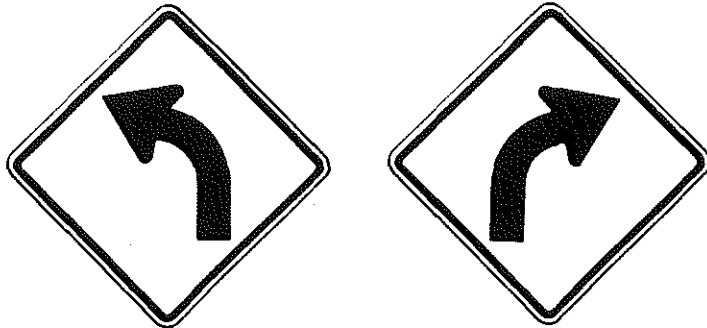
Warning signs with certain exceptions shall be diamond-shaped (square with one diagonal vertical) and shall have a "Highway Yellow" background with black legend. These exceptions are

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

the Railroad Crossing signs, the Target Arrow signs, the Advisory 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.

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 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 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).

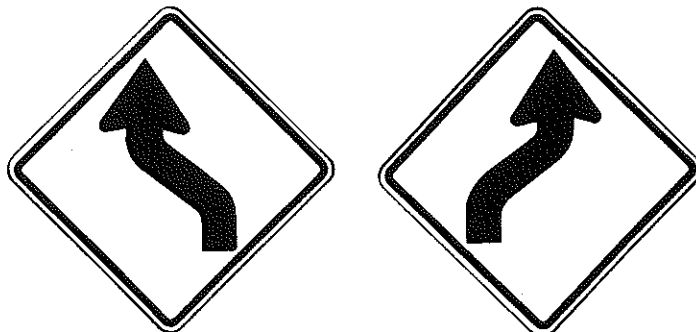
The Curve sign shall be located in advance of the point of curvature at the approximate distance indicated below:

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 CURVE SIGN



Reflectorized

W1-4-30 30" x 30"

W1-4-36 36" x 36"

W1-4-48 48" x 48"

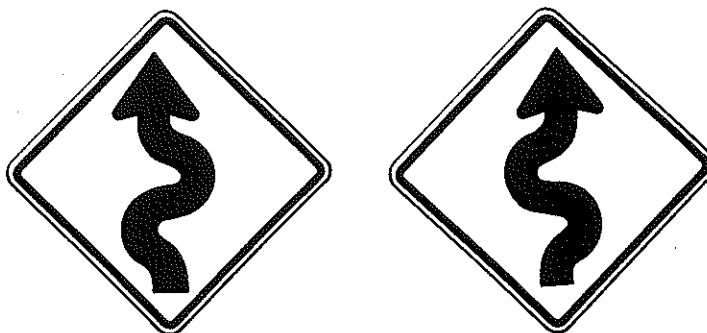
On all roads (except minor roads and streets, where in the judgment of the engineer the use of this sign is unnecessary) where two curves in opposite directions are separated by a tangent of less than 400 feet a Reverse Curve sign shall be used. Additional protection may be provided by use of the Curve 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.

WINDING ROAD SIGN



ReflectORIZED

W1-5-30 30" x 30"

W1-5-36 36" x 36"

W1-5-48 48" x 48"

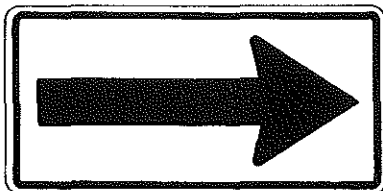
The Winding Road sign shall be used where there is a series of three or more turns or curves, separated by tangent distances of less than 400 feet. Where this sign is warranted, consideration should be given to the use of a Target Arrow (W1-6) in target position at each turn or curve. Additional protection 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.

LIBRARY
 michigan department of
 state highways
 LANSING

TARGET ARROW SIGN

Reflectorized

W1-6-48 48" x 24"

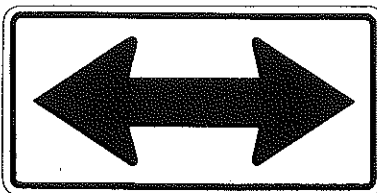
W1-6-96 96" x 48"

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.

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. For low speed minor streets a diamond hazard marker may be used in lieu of the W 1-7.

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 W1-7-48.

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.

SOFT SHOULDER SIGN

ReflectORIZED

W8-4-30 30" x 30" (5" letters)

This sign shall be used along a roadway where a soft shoulder may prove hazardous to motor vehicles. Where used, it shall be located at required intervals to give warning of this potentially hazardous condition. As soon as the shoulder has been adequately stabilized to accommodate motor vehicle traffic, all such signs shall be removed.

Where used, this sign shall be placed five feet to the right of the roadway edge and at a bottom height of five feet.

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 30 or 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.

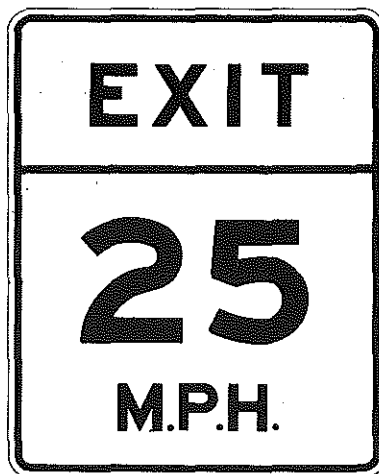
Indicator Reading	Speedometer Reading	Appropriate Panel Legend
10°	60, 59, or 58	60
10°	57, 56, 55, 54, or 53	55
10°	52, 51, 50, 49, or 48	50
10°	47, 46, 45, 44, or 43	45
10°	42, 41, 40, 39, or 38	40
10°	37, 36, 35, 34, or 33	35
12°	32, 31, 30, 29, or 28	30
12°	27, 26, 25, 24, or 23	25

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 (RAMP) — 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 or exists at interchanges where it is necessary to indicate a lower speed. Where deemed appropriate, the word "RAMP" may be used in lieu of "EXIT".

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.