A TRAFFIC ACCIDENT ANALYSIS OF HIGH ACCIDENT LOCATIONS IN TUSCOLA COUNTY

TSD-SS-130-70

TRAFFIC and SAFETY DIVISION

DEPARTMENT OF STATE HIGHWAYS
STATE OF MICHIGAN

65-7440

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

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Prepared by

Safety & Surveillance Section
Traffic & Safety Division
Bureau of Operations

in cooperation with

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

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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 involves several distinct phases. They may be described as follows: basic data collection, identifying and locating high accident locations, a traffic engineering analysis of accidents, technical evaluation of previously compiled facts, and consequent 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 Tuscola County (and providing an inventory of those locations) was designated as State Police responsibility. Because of the lack of a modern or automatic system of locating accidents on the county road system, the high accident locations for Tuscola County were determined by manually extracting and compiling those locations with the highest number of accidents from the current (1968) county accident reports. From this list, the 14 highest accident locations were selected. Once the problem locations were identified, additional accident information for the years 1966 and 1967 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 Tuscola County.

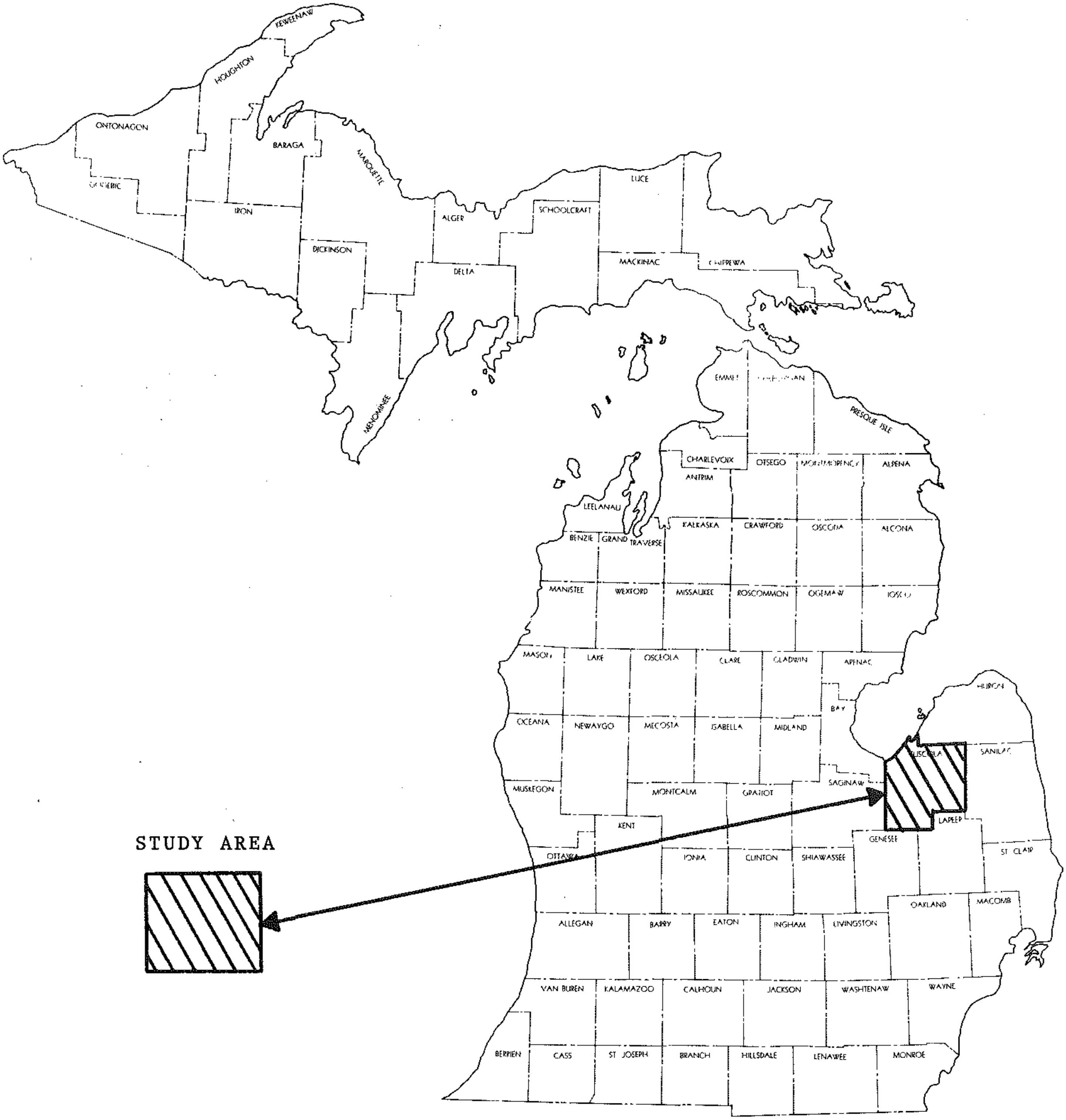
The second portion of the data collection phase, which is the responsibility of the Department of State Highways, involves data collection utilizing the following basic steps: 1) preparation of collision diagrams, and, if necessary, physical condition diagrams for each selected location, 2) obtaining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

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

STUDY AREA

Tuscola County is located in the northwest corner of Michigan's "Thumb" area (see map following page). It is bordered on the west by Saginaw and Bay Counties, the east by Sanilac County, the north by Huron County and on the south by Genesee and Lapeer Counties. Tuscola County has 25 townships as part of its smaller political subdivisions. Well-defined urban areas are situated around Caro and Vassar. The County's 1960 population was 43,305. This was a 13.2% increase over the 1950 census. Population projections for the next decade or so indicate that Tuscola County will continue to grow (see Table I) in keeping with present trends.

Tuscola County is primarily an agricultural county. Its economy depends heavily on this; however, there are serious efforts to attract a variety of industries especially in the urban areas of Caro and Vassar. It is

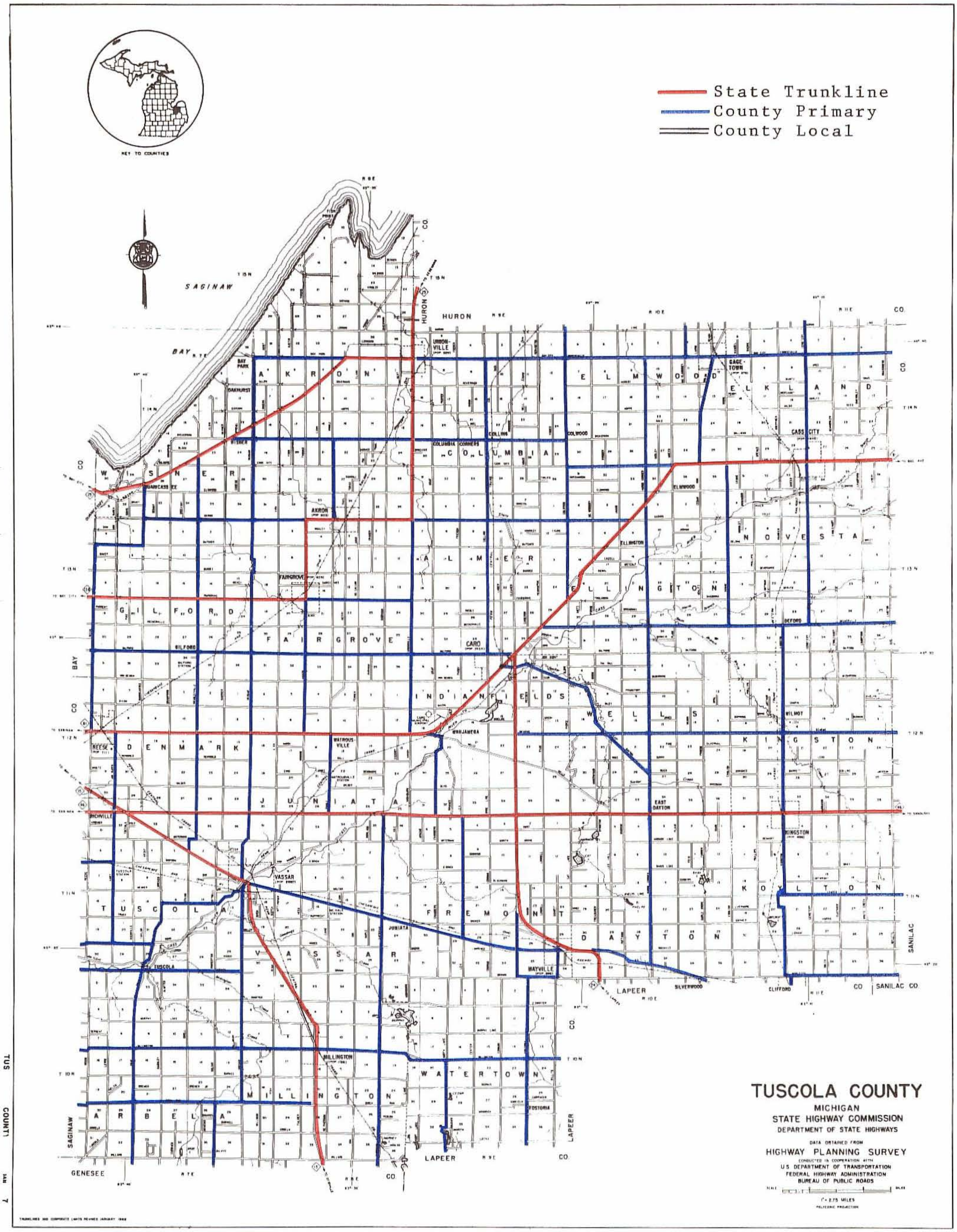

STUDY AREA
KEWEENAW
HOUGHTON
ONTONAGON
BARAGA
MARQUETTE
IRON
DICKINSON
ALGER
SCHOOLCRAFT
LUCE
MACKINAC
CHIPPEWA
DELTA
MENOMINEE
EMMET
PRESQUE ISLE
CHARLEVOIX
OTSEGO
ALPENA
ANTRIM
LEELANAU
KALKASKA
CRAWFORD
OSCODA
ALCONA
BENZIE
GRAND TRAVERSE
MANISTEE
WEXFORD
MISSAUKEE
ROSCOMMON
OGEMAW
MASON
LAKE
OSCEOLA
CLARE
GLADWIN
ARENAC
HURON
BAY
OCEANA
NEWAYGO
MECOSTA
ISABELLA
MIDLAND
SANILAC
MUSKEGON
MONTCALM
GRATIOT
SAGINAW
LAPEER
KENT
GENESEE
ST CLAIR
OTTAWA
IONIA
CLINTON
SHIAWASSEE
OAKLAND
MACOMB
ALLEGAN
BARRY
EATON
INGHAM
LIVINGSTON
VAN BUREN
KALAMAZOO
CALHOUN
JACKSON
WASHTENAW
WAYNE
BERRIEN
CASS
ST JOSEPH
BRANCH
HILLSDALE
LENAWEE
MONROE

noteworthy to recognize that a sizeable amount of Tuscola County's residents are employed outside of Tuscola County (see Table II).

Projections for industrial and manufacturing growth in Tuscola County indicate that its future growth will be less than the statewide average. Most of this type development will be centered around Caro and Vassar. The future growth and development of Tuscola County's major industries will depend to a great degree upon a safe, convenient and economical highway transportation system.

According to the Seventeenth Annual Progress Report as compiled by the Local Government Division of the Michigan Department of State Highways, Tuscola County has 1,744.55 miles of highways excluding city and incorporated village streets and roads. This includes 119.1 miles of state trunkline, 345.89 miles of county primary roads and 1,279.55 miles of local roads. Of the 1,625.44 miles of county roads, 675 are hard surfaced and the remaining mileage is either gravel or unimproved dirt road (see County map following page).

In general, traffic congestion in Tuscola County is not a serious problem. The accident rates on Tuscola County roads are less than the statewide average. However, the statistics as shown in Table III do indicate that from a percentage standpoint there was a substantial increase



State Trunkline
County Primary
County Local
KEY TO COUNTIES
SAGINAW BAY
HURON CO.
SANILAC CO.
LAPEER CO.
BAY CO.
SAGINAW
GENESEE
A K R O N
E L M W O O D
E L K L A N D
W I S N E R
C O L U M B I A
A L M E R
N O V E S T A
G I L F O R D
F A I R G R O V E
E L L I N G T O N
I N D I A N F I E L D S
W E L L S
D E N M A R K
K I N G S T O N
J U N I A T A
T U S C O L A
F R E M O N T
K O Y L T O N
V A S S A R
D A Y T O N
W A T E R T O W N
M I L L I N G T O N
A R B E L A
UNIONVILLE
GAGETOWN
CASS CITY
AKRON
FAIRGROVE
CARO
REESE
VASSAR
KINGSTON
MAYVILLE
MILLINGTON
WAHJAMEGA
EAST DAYTON
SILVERWOOD
CLIFFORD
FOSTORIA
TUSCOLA 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
POLYCONIC PROJECTION

in reported accidents for 1968 over those for the previous two years.

Motor vehicle registration has steadily increased in Tuscola County (see Table III). However, accidents increased at a faster rate.

ACCIDENT ANALYSIS

The various methods of accident analysis are intended to probe into the detailed aspects or facts of automobile accidents. Compared to the millions of vehicle miles traveled, accidents are very rare events. However, they are the only present means available to indicate a failure in the driver-road-vehicle environment. Any one of these three may be a major contributor to an accident. Although we must accept the fact that as highway engineers we have very little responsibility for changing or correcting the motorist's ability to drive (enforcement) or for the condition of the vehicle (manufacturer), we do have, however, the responsibility to construct the road, within feasible economic and design limits, such that the driver can operate his vehicle safely.

In our analysis, we examined the contributing factors from the viewpoint of a highway traffic engineer with special attention to the effect which the highway environment may have had on the accident.

At each high accident location, individual accident reports were reviewed in detail and the accident 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.

These are some of the basic engineering techniques we used in trying to determine the reason for the accident.

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

IV. Annual Accident Summary
V. Monthly & Daily Accident Occurrence
VI. Daily & Hourly Accident Occurrence
VII. Age of Drivers Involved in Accidents
VIII. Residence of Drivers Involved in Accidents
IX. Weather Conditions at Scene of Accidents
X. Pavement Conditions at Scene of Accidents

The information summarized in Table IV shows that during the years 1966 through 1968 a total of 53 accidents occurred at the 14 highest accident locations in Tuscola County. Of these, 28 resulted in personal injury and 21 were property damage. There were 4 fatals during this period.

Table V shows that the peak accident months were November and December accounting for 34% of the accidents. It also shows that Sunday was the peak accident day, with Friday, Saturday and Sunday accounting for over 70% of the total accidents.

The figures in Table VI indicate that the peak accident hours occur between 4 and 6 p.m. The information contained in Tables VII and VIII relates to the age and residence of drivers involved in accidents at the high accident locations during the study period. Table VIII shows that 63% of the drivers involved in accidents at the study locations were local residents. Table IX shows that 93% of the accidents occurred when the weather was clear or cloudy. Table X shows that nearly 70% of the accidents occurred when the pavement was dry.

TRAFFIC ENGINEERING ANALYSIS

The first step in the traffic engineering analysis phase of Tuscola County's high accident locations was the preparation of collision diagrams (see figures 1 through 14). It was apparent that no unusually high concentration of accidents existed at any one location. In fact, the highest total at one location for the 3-year study period was six. Consequently, this report will discuss in detail only the four highest accident locations. However, collision diagrams and photographs are included for all 14 of the locations studied. A map showing the 14 locations within the county is included in the Appendix.

1. F.A.S. 128 (Cemetery Road) @ Kelly Road, Novesta Township

This intersection was the scene of a total of six accidents for the years 1966 through 1968, as shown by the collision diagram in figure 1. One of these was a right angle accident and one a head-on left turn accident. The other four accidents cannot be considered intersectional. They occurred from 1/4 to 1/2 miles north of Kelly Road. There is no accident pattern in this grouping and the presently available facts do not indicate a special criticality.

Kelly Road is a 22 foot blacktop road. It intersects Cemetery Road (F.A.S. 128) at approximately right angles. The geometrics at this intersection are adequate for the normal rural-type intersection (see photos in figure 1A). The existing traffic control at this intersection is a 30" reflectorized stop sign for eastbound Kelly Road and a 24" stop sign for westbound Kelly Road.

2. <u>Ormes Road, 1/10 to 3/10 miles East of Lewis Road (F.A.S. 779), Tuscola Township</u>

Ormes Road in the subject area is a 24 foot bituminous road with 5 foot shoulders. The critical aspect of this short section of roadway is its horizontal alignment (see figures 2A and 2B). The existing traffic controls along this stretch of road are a series of warning signs (see figures 2A and 2B). There were a total of 6 reported accidents for this section of roadway for the years 1966 through 1968 (see figure 2). Five of these accidents were ran-off the road type accidents and two occurred at night. However, it is apparent that the sharpness of the existing curves was a major contributing factor to the occurrence of accidents at this location. Based on a yearly average of two accidents per year, we do not consider the accident problem at this location serious. The existing signing as prescribed and erected by the County Road Commission meets the minimum standards of the Manual of Uniform Traffic Control Devices for the erection and location of those warning signs governing horizontal alignment changes.

Recommendation:

We recommend, however, that the curve signs be supplemented with the appropriate speed panels (See Section C, Warning Signs - Michigan Manual of Uniform Traffic Control Devices in Appendix II of this report). We further recommend that target arrows (also see Section C in Appendix II) be placed in target position at the second curve for east and westbound Ormes Road.

3. Frankenmuth Road, 1/2 mile N. of Cottrell Road, Tuscola Township

Frankenmuth Road is a county primary road connecting the City of Vassar with the southwest portion of the county. Frankenmuth Road in the subject area is a 22 foot bituminous road with 5 foot shoulders. The critical aspect of this section of roadway is its horizontal alignment (see figures 3A and 3B). There are several sharp curves in this area. The predominantly rural nature of the area probably contributes to high vehicular speeds. The Tuscola County Road Commission has erected warning signs showing a change in the horizontal alignment.

The accident experience for this section of roadway for the years 1966 through 1968 was 6 accidents, 4 injury and two property damage (see figure 3). Based on the accident experience for those years, the problems at the subject location are not deemed to be serious.

Recommendation:

We recommend that the existing curve signs be supplemented with target arrows for northbound and southbound Frankenmuth Road.

We further recommend that the same sign (turn or curve) be used with the 30 MPH advisory speed panel (see photo 1, figure 3A and photo 3, figure 3B).

We note that the 40 MPH speed sign (see photo 3, figure 3A) is not located at the point of speed zone change, which we understand is the south city limits of Vassar. We recommend that this sign be relocated to coincide with this point.

4. <u>Fostoria Road, (F.A.S. 127) @ Barnes Road, Water Township</u>

This intersection was the scene of a total of five accidents for the years 1966 through 1968, as shown on figure 4. Three of the accidents which occurred at this intersection were of the angle variety; however, all of the angle type accidents occurred in different years.

Fostoria Road is a 24 foot bituminous road with 5 foot shoulders. It intersects Barnes Road at approximately right angles. Barnes Road is a 22 foot bituminous road with 5 foot shoulders. The geometrics at this intersection are typical of the normal rural intersection (see figure 4A). The existing traffic control is two 24" stop signs located on Barnes Road. Based on the accident experience at this location for the past three years, the problem at this location is not considered critical.

Remaining 10 Locations

Based on the accident experience at the 10 remaining locations, we have no specific suggestions for any changes.

These remaining high accident locations are as follows:

	Location	Total	P.D.	Inj.	Fat.
5.	Hurds Corner Road @ East Dayton, Wells Township	4	2	2	
6.	Waterman @ Kirk Road, Vassar Township	4	2	2	
7.	Deckerville Road, approximately 3/10 mile West of Murray Road, Ellington Township	3		2	1
8.	Colwood @ Elmwood Road, Ellington Township	3	1	2	
9.	Kern @ Dixon Road, Denmark Township	3	2	1	
10.	Millington @ Oak Road, Millington Township	3	3		
11.	Murray @ Deckerville Road Ellington Township	3	3		
12.	Fairgrove @ Merry Road Fairgrove Township	2		1	1
13.	Bray @ Birch Run Road, Arbella Township	2		2	
14.	Millington Road, approximately 4/10 - 5/10 miles East of Sheridan Road, Millington Township	2		2	

SUMMARY

There were a total of 1,098 reported traffic accidents on Tuscola County roads during the study period 1966 through 1968 for an average of 366 accidents per year.

Our analysis of the accident problem on county roads in Tuscola County, in relationship to spot or high accident locations, reveals that there are no critical problems which could be eliminated by the modest engineering means usually related to a spot improvement program.

However, the accident information summarized in Tables IV through X may yield some basic information needed by those agencies interested in highway safety from the standpoint of driver education and law enforcement. For instance, Table VI, Daily and Hourly Accident Occurrence, shows that the peak accident hours are between 4:00 p.m. and 6:00 p.m. It further shows that a notable percentage of accidents occurred between the hours 12:00 midnight to 3:00 a.m. This information may be helpful to law enforcement agencies in determining manpower needs for street patrol activities.

APPENDIX I

TABLE I

POPULATION INVENTORY AND FORECAST

Year	Tuscola County	Michigan
1940	35,694	5,256,106
1950	38,258	6,371,766
1960	43,304	7,823,194
1990	53,344	11,233,000
PERCENTAGE CHANGE		
1940-50	7.2	21.2
1950-60	13.2	22.8
1960-90	23.2	43.6

Source: United States Department of Commerce
Bureau of the Census

TABLE II

TUSCOLA COUNTY PLACE OF WORK AND RESIDENCE

Place of Work 1960

Residence 1960	Flint	Genesse County	Saginaw	Saginaw County	Bay City	Bay County	Tuscola County	Huron County	Sanilac County	Lapeer County	St. Clair County	Oakland County	Balance of Detroit SMSA	Elsewhere	Not Reported
Akron Township	4	4	22	8	74	12	275	–	–	–	–	–	–	–	24
Almer Township	0	12	32	8	8	0	664	4	4	4	–	–	–	4	4
Arbila Township	219	44	29	25	0	0	193	0	0	3	–	–	–	–	39
Columbia Township	0	4	16	15	49	8	358	21						8	16
Dayton Township	12	0	8	0	0	0	187	0	38	24	–	32	12	–	16
Denmark Township	4	–	126	182	11	–	454	3	–	–	–	–	–	4	35
Elkland Township	–	–	9	24	4	4	1044	31	43	–	–	4	4	4	4
Ellington Township	5	0	25	15	–	–	229	0	8	–	–	–	–	–	8
Elmwood Township	0	0	3	4	15	0	329	24	8	–	–	–	–	–	10
Fairgrove Township	12	8	44	8	12	8	432	–	–	–	–	–	–	8	17
Freemont Township	51	11	27	12	–	–	419	–	–	20	–	26	–	–	12
Gilford Township	8	8	36	33	39	0	166								29
Indianfields Township	12	12	28	3	–	–	336	0	8	3	–	–	–	–	8
Caro Village	4	4	34	16	21	0	1170	4	20	0	0	5	12	8	61
Junita Township	–	–	15	4	0	4	261	–	–	–	–	–	–	–	4
Kingston Township	4	0	11	4	8	0	300	4	58	–	–	–	4	3	16
Koylton Township	–	–	12	–	–	–	115	–	72	3	–	7	–	8	8
Millington Township	210	51	19	38	–	–	479	–	–	20	–	4	–	4	112
Novista	–	–	4	12	–	–	269	4	8	–	–	4	12	–	4
Tuscola Township	34	–	57	69	13	–	415	–	–	–	–	–	–	–	37
Vassar City	68	9	83	56	16	4	714	4	–	–	–	3	4	–	27
Vassar Township	51	16	27	21	4	–	217	–	–	–	–	–	4	16	20
Watertown Township	117	8	–	–	–	–	223	–	–	12	–	21	8	3	51
Wells Township	8	–	4	8	–	–	155	–	11	–	–	5	4	–	4
Wisner Township	3	–	16	–	110	3	111	–	–	–	–	–	–	–	4
	826	191	687	565	384	43	9515	99	278	89	0	107	60	74	570

Tuscola County Residents Employed In Tuscola County	9,515
Tuscola County Residents Employed Outside Tuscola County	3,403
Total Tuscola County Residents Employed	12,918

SOURCE: United States Department of Commerce, Bureau of the Census.

TABLE III

REPORTED TRAFFIC ACCIDENTS IN TUSCOLA COUNTY									
Year	Property Damage	Injury	Fatal	Total	County Road	State Route	Inter-State	Persons Injured	Persons Killed
1966	246	183	25	454	108	346	0	356	28
1967	459	278	25	762	351	411	0	448	26
1968	752	377	26	1,155	639	516	0	661	37

Year	Tuscola Co. Roads	State of Mich. Accidents
1966	108	302,880
1967	351	299,004
1968	639	305,495
	PERCENT CHANGE	
1966-67	225	-1.28
1967-68	82	2.17

VEHICLE REGISTRATIONS								
Year	Pass.	Comm.	Farm Vehicle	Trailer	Trailer Coach	Motor Cycles	Muni-cipal	Total Plates
1966	-	-	-	-	-	-	-	23,595
1967	17,664	3,764	1,322	4,366	417	635	37	28,205
1968	18,029	4,108	1,347	4,575	486	755	30	29,326

ACCIDENT ANALYSIS

Table IV

ANNUAL ACCIDENT SUMMARY

FOURTEEN HIGH ACCIDENT LOCATIONS IN TUSCOLA COUNTY

Period Studied: 1966 THROUGH 1968

* * * * * * * *

Accident Type	Day	Night	Total
Fatal Accident	1	3	4
Personal Injury Acc.	16	12	28
Property Damage Acc.	9	12	21
Total	26	27	53

* * * * * * * *

Month	Fatal		Injury		Prop. Damage		Sub. Total		Total
	Day	Night	Day	Night	Day	Night	Day	Night	
January		1			2	3	2	4	6
February			2				2		2
March		1		1				2	2
April			2		1	1	3	1	4
May			1	2			1	2	3
June			1		1	1	2	1	3
July					2	1	2	1	3
August			3		1		4		4
September			3	1	2	1	5	2	7
October			1	1			1	1	2
November			3	4		2	3	6	9
December	1	1		3		3	1	7	8
S. Total	1	3	16	12	9	12	26	27	53
Total	4		28		21		53		53

ACCIDENT ANALYSIS

Table V

MONTHLY AND DAILY ACCIDENT OCCURRENCE

FOURTEEN HIGH ACCIDENT LOCATIONS IN TUSCOLA COUNTY

Period Studied: 1966 through 1968

* * * * * * * * *

Month	Day of the Week							Monthly Total	% Of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
January				1	1	3	1	6	11.32
February						2		2	3.77
March					1		1	2	3.77
April		1		1			2	4	7.55
May					2		1	3	5.66
June		1			1		1	3	5.66
July				1		2		3	5.66
August	1					2	1	4	7.55
September					3	1	2	6	11.32
October			1			1		2	3.77
November		2	1	1	1	1	3	9	16.98
December	2		2		2		3	9	16.98
Total	3	4	4	4	11	12	15	53	100.00%
% of Total	5.66	7.55	7.55	7.55	20.75	22.64	28.30	100.00%	100.00%

Peak Accident Day: Sunday

Peak Accident Month: Nov. & Dec.

ACCIDENT ANALYSIS

Table VI

DAILY AND HOURLY ACCIDENT OCCURRENCE

FOURTEEN HIGH ACCIDENT LOCATIONS IN TUSCOLA COUNTY

Period Studied: 1966 through 1968

* * * * * * * * * *

Hour	Day of the Week							Hour Total	% of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
12 - 1AM						1	1	2	3.77
1 - 2AM		1	1			1	1	4	7.55
2 - 3AM							2	2	3.77
3 - 4AM									
4 - 5AM						1	1	2	3.77
5 - 6AM					1			1	1.89
6 - 7AM				1				1	1.89
7 - 8AM			1					1	1.89
8 - 9AM									
9 - 10AM			1	1				2	3.77
10 - 11AM					1	1		2	3.77
11 - 12AM					1	1	1	3	5.66
12 - 1PM		1			1	1		3	5.66
1 - 2PM					1	1	2	4	7.55
2 - 3PM					1	1		2	3.77
3 - 4PM						2		2	3.77
4 - 5PM		1	1				2	4	7.55
5 - 6PM		1			1		2	4	7.55
6 - 7PM	1					1	1	3	5.66
7 - 8PM	1				2			3	5.66
8 - 9PM	1					1		2	3.77
9 - 10PM				1			1	2	3.77
10 - 11PM				1	2			3	5.66
11 - 12PM							1	1	1.89
Not Stated									
Total	3	4	4	4	11	12	15	53	100.00%
% of Total	5.66	7.55	7.55	7.55	20.75	22.64	28.30	100.00%	100.00%

Peak Accident Hour: 2 a.m., 2 p.m., 5 p.m., 6 p.m.

Peak Accident Day: Sunday

ACCIDENT ANALYSIS

Table VII

AGE OF DRIVERS INVOLVED IN ACCIDENTS

FOURTEEN HIGH ACCIDENT LOCATIONS IN TUSCOLA COUNTY

Period Studied: 1966 through 1968

* * * * * * * * * *

Age Group	Number of Drivers Involved in				Percent
	Fatal	Injury	Prop. Damage	Total	
Under 16		1		1	1.41
16-19	1	3	6	10	14.10
20-24	2	8	6	16	22.50
25-34	1	11	5	17	23.96
35-44	1	7	6	14	19.71
45-54	1	2	1	4	5.64
55-64		3	2	5	7.04
65-74		1	2	3	4.23
75 & Over					
Not Stated		1		1	1.41
Total	6	37	28	71	100.00

* * * * * * * *

Table VIII

RESIDENCE OF DRIVERS INVOLVED IN ACCIDENTS

Residence	Number of Drivers Involved in				Percent
	Fatal	Injury	Prop. Damage	Total	
Local	5	20	20	45	63.40
Michigan	1	17	7	25	35.19
Out of State					
Not Stated			1	1	1.41
Total	6	37	28	71	100.00

ACCIDENT ANALYSIS

Table IX

WEATHER CONDITIONS AT SCENE OF ACCIDENTS

FOURTEEN HIGH ACCIDENT LOCATIONS IN TUSCOLA COUNTY

Period Studied: 1966 through 1968

* * * * * * * * * *

Weather	Severity of Accident				Percent
	Fatal	Injury	Prop. Damage	Total	
Clear or Cloudy	4	25	20	49	92.45
Rain		1		1	1.89
Fog					
Snow or Sleet		2	1	3	5.66
Not Stated					
Total	4	28	21	53	100.00

* * * * * * * * *

TABLE X

PAVEMENT CONDITIONS AT SCENE OF ACCIDENTS

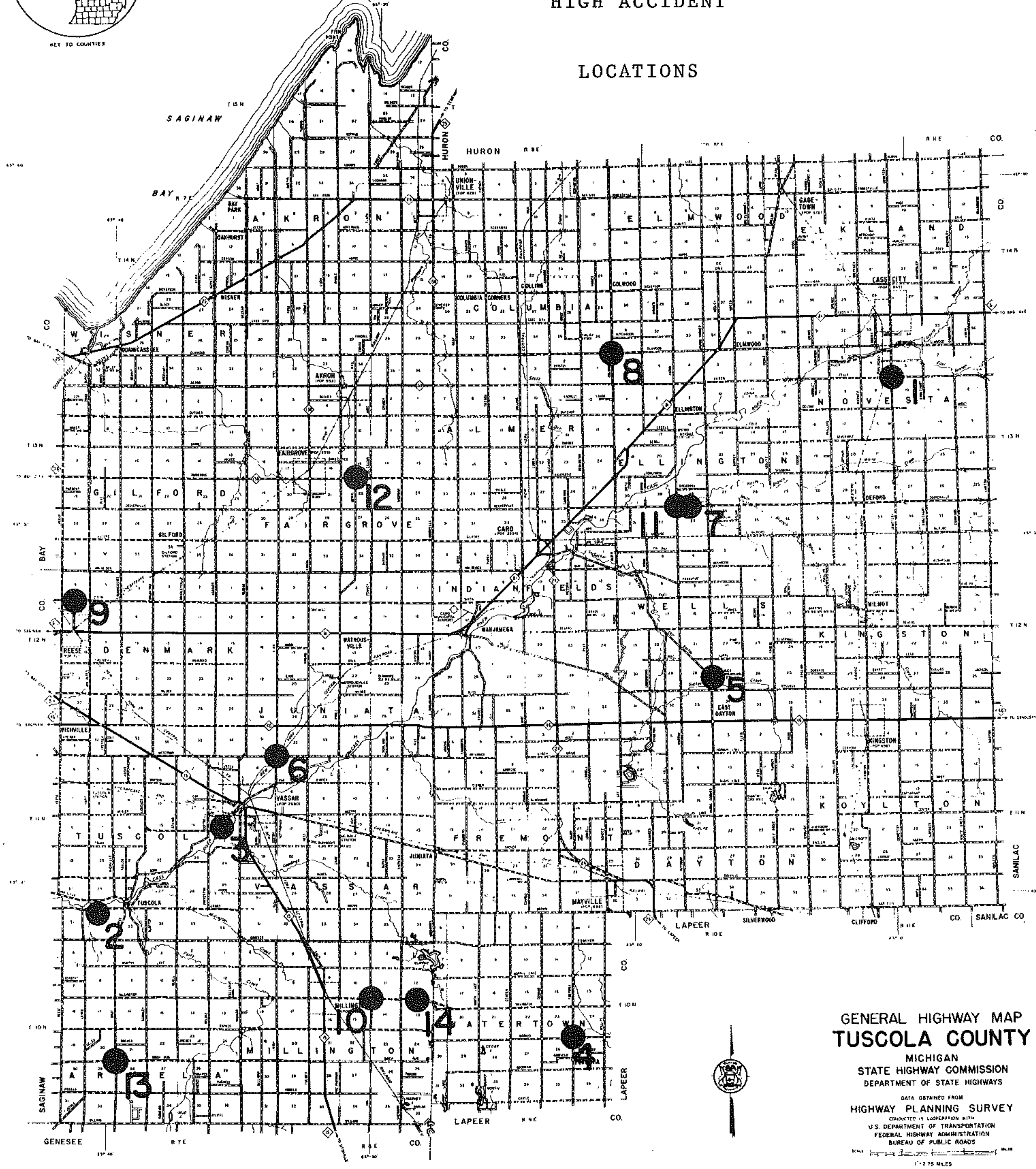
Pavement	Severity of Accident				Percent
	Fatal	Injury	Prop. Damage	Total	
Dry	3	20	14	37	69.78
Wet		4	2	6	11.32
Snowy/Icy	1	5	4	10	18.90
Icy					
Not Stated					
Total	4	29	20	53	100.00

SPOT MAP

FOR

HIGH ACCIDENT

LOCATIONS



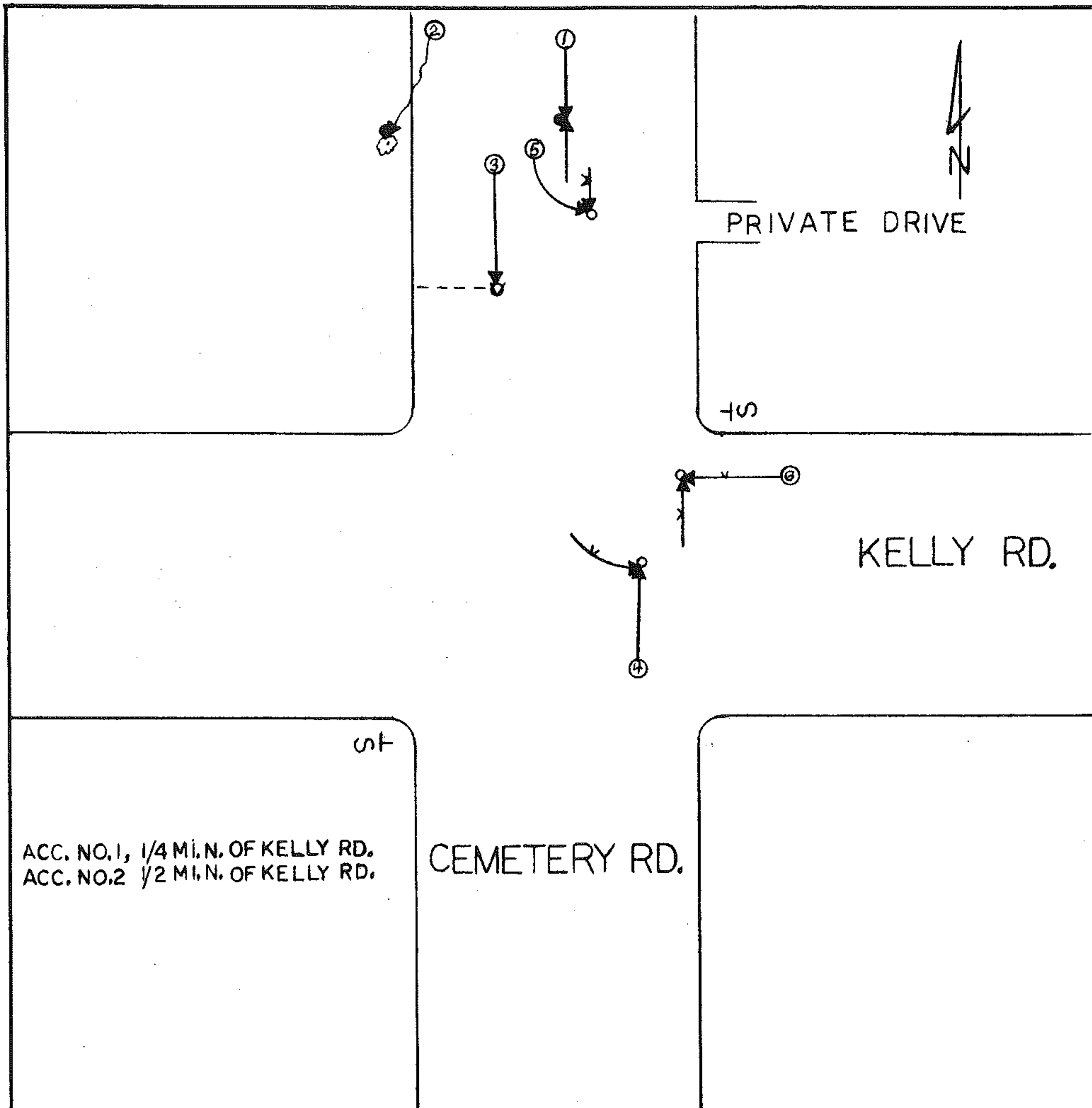


FIGURE 1

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

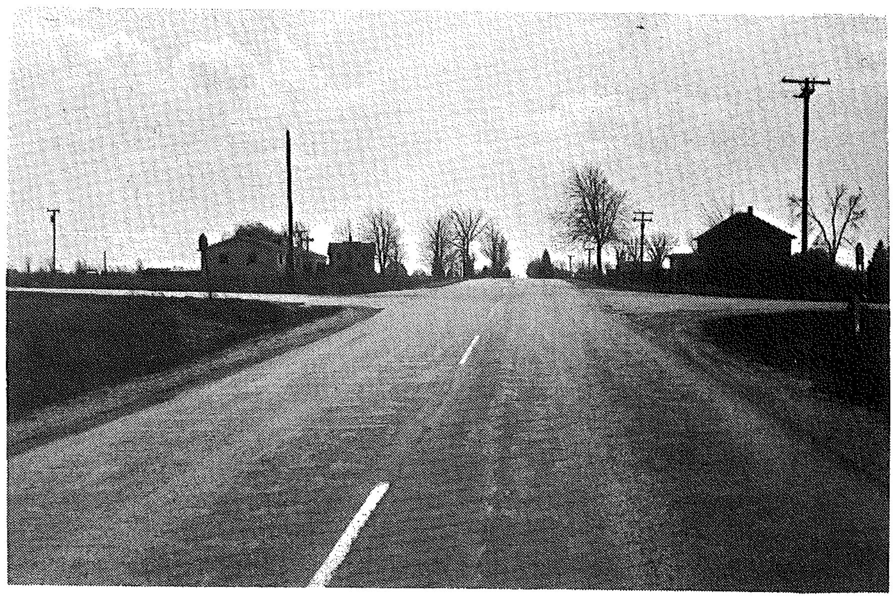
Stop & Go Signal S
Flashing Beacon R Y F Y
Stop Sign S
Yield Sign Y

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

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description NOVESTA TWP.
KELLY RD. AT CEMETERY RD.
Accidents – Total 6
P.D. 1 Injury 3 (11)
Fatal 2 (2)
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DJM Date 3-26-70 Rev.
Plan No. 1

WESTBOUND
KELLY ROAD



SOUTHBOUND
CEMETERY ROAD

EASTBOUND
KELLY ROAD

FIGURE 1A

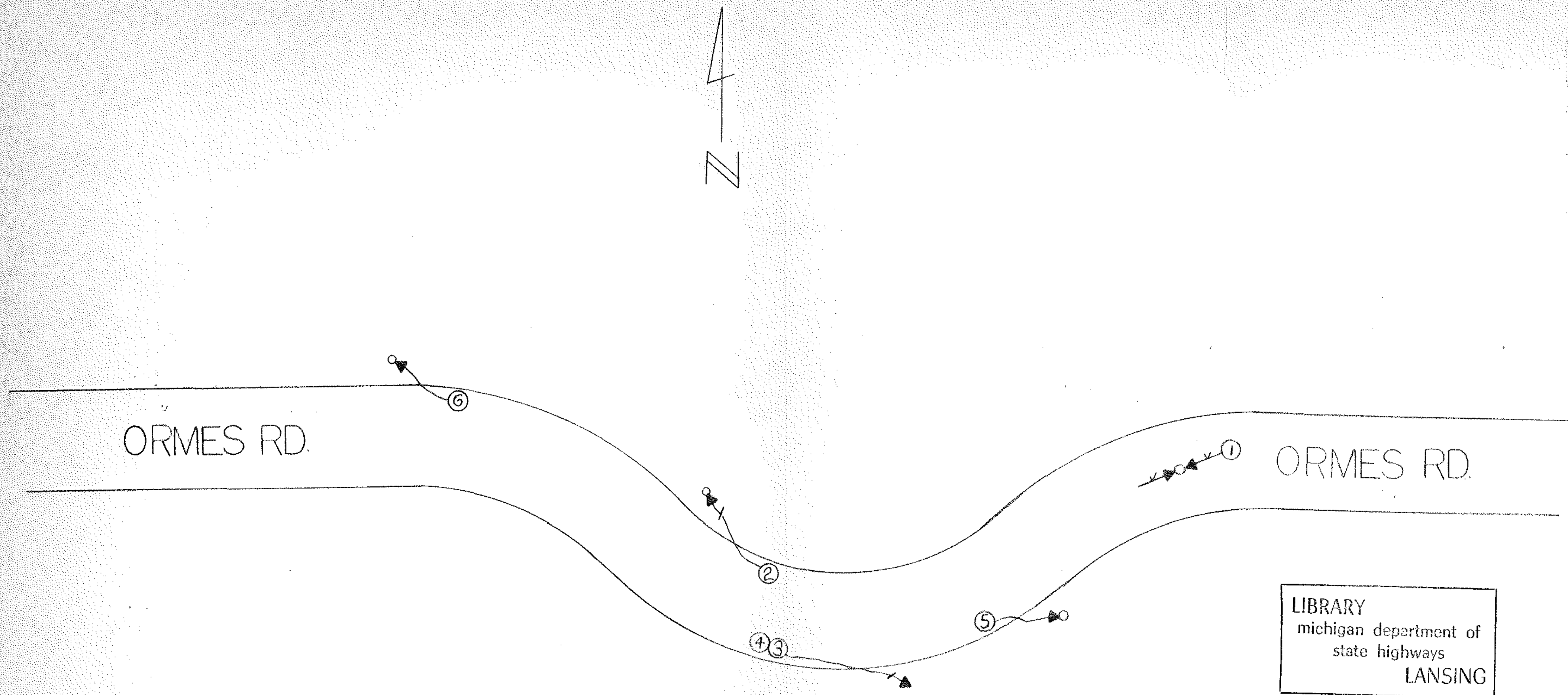


FIGURE 2

REMARKS

ACC. NO. 1 1966
ACC NO. 2-6-1968

LEGEND

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

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968

Accidents – Total 6

P.D. 2 | ADT

Injury 4 (8) | Rate /100 mvm

Fatal 0 ( ) | Rate / mv

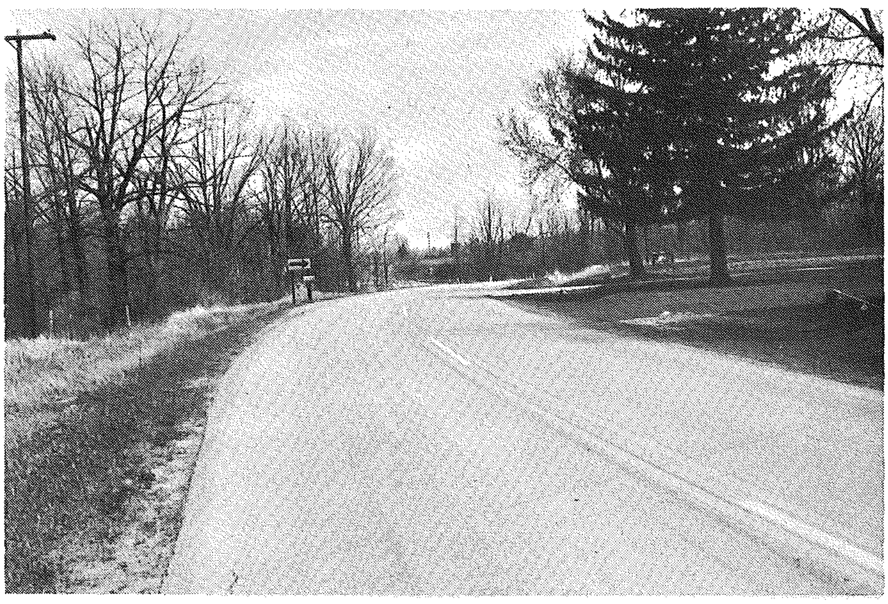
MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location
ORMES RD. .1 TO .3 MI. E. OF LEWIS RD
TUSCOLA TWP.
TUSCOLA CO.

C.S. | Miles
Drawn DJM | Date 2-2-70
Plan No. 2

Form 1547 (Rev. 5/69) Sheet ____ of ____

1



EASTBOUND
ORMES ROAD

2

3 FIGURE 2A

1

WESTBOUND
ORMES ROAD

2

3

FIGURE 2B

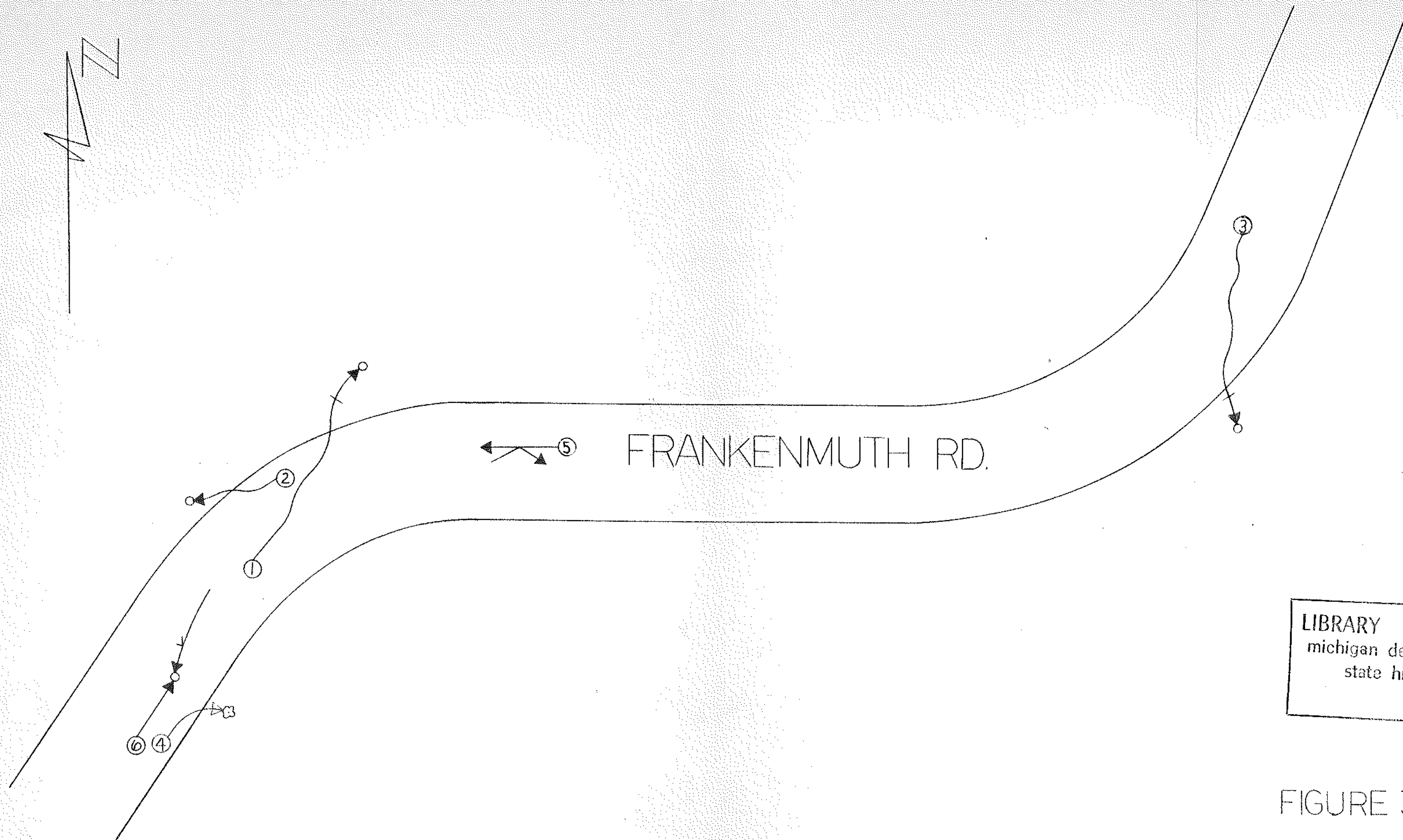


FIGURE 3

REMARKS

ACC. NO. 1 1966

ACC. NO. 2-5 1968

LEGEND

Stop & Go Signal S — Stop Sign S — Flashing Beacon F — Yield Sign Y

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

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968

Accidents – Total 6

P.D. 2 ADT

Injury 4 (4) Rate /100 mvm

Fatal 0 ( ) Rate / mv

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location
FRANKENMUTH RD. 0.5 MI. N. OF COTTRELL RD.
TUSCOLA TWP.
TUSCOLA CO.

C.S. Miles

Drawn DMcD Date 1-30-70

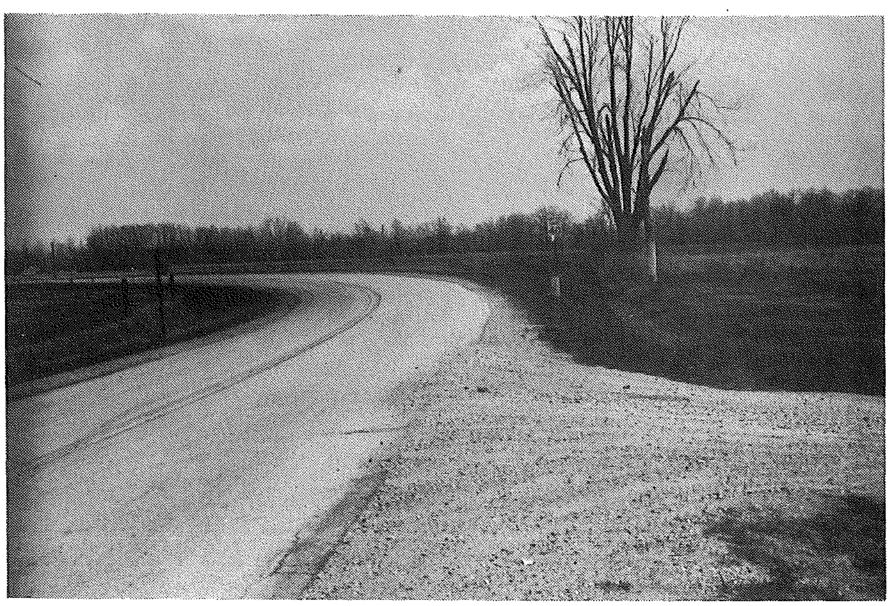
Plan No. #3

Form 1547 (Rev. 5/69) Sheet 1 of 1

1

2

NORTHBOUND
FRANKENMUTH ROAD



3

FIGURE 3A

1

SOUTHBOUND
FRANKENMUTH ROAD

2

3

FIGURE 3B

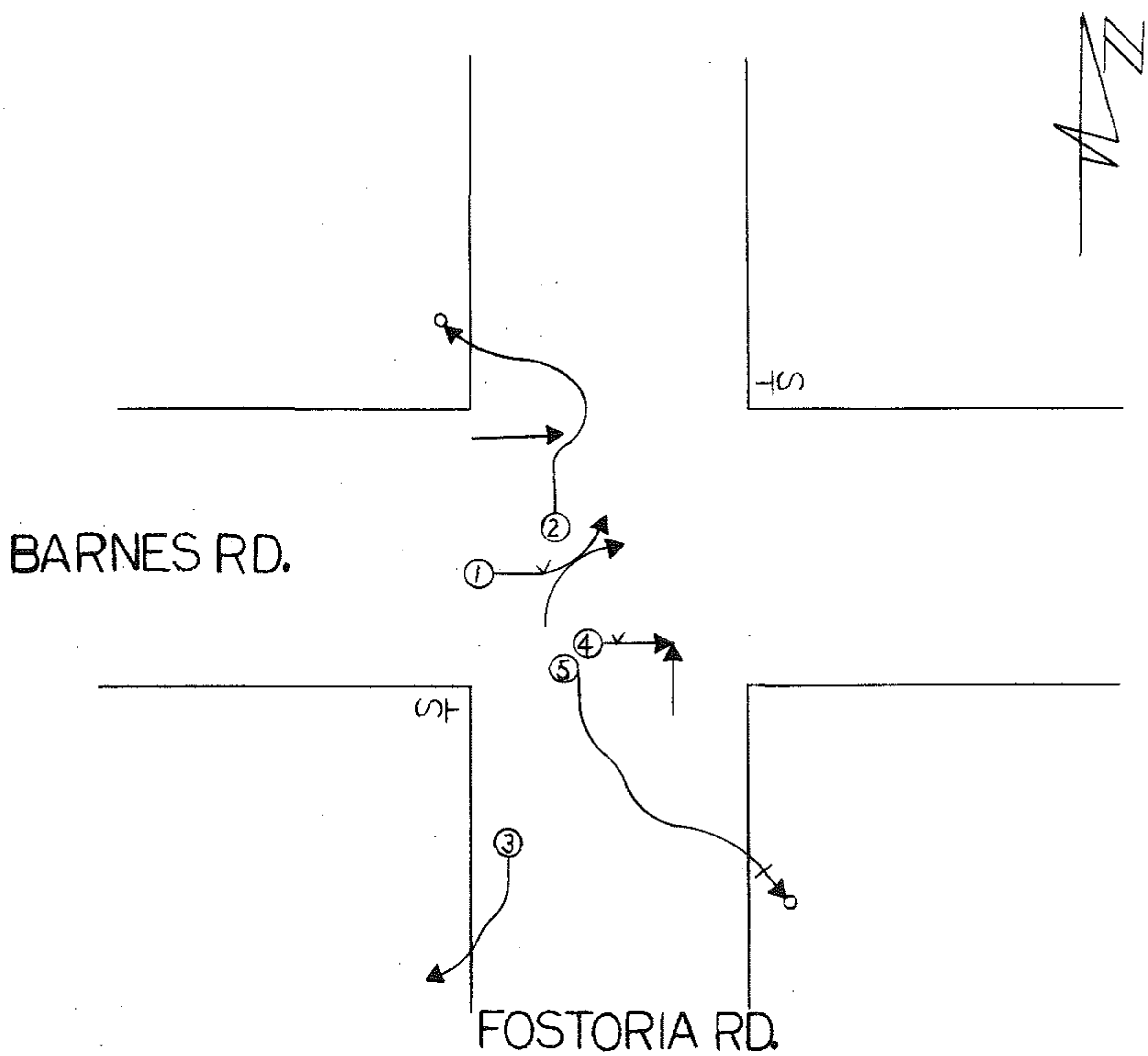


FIGURE 4

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

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

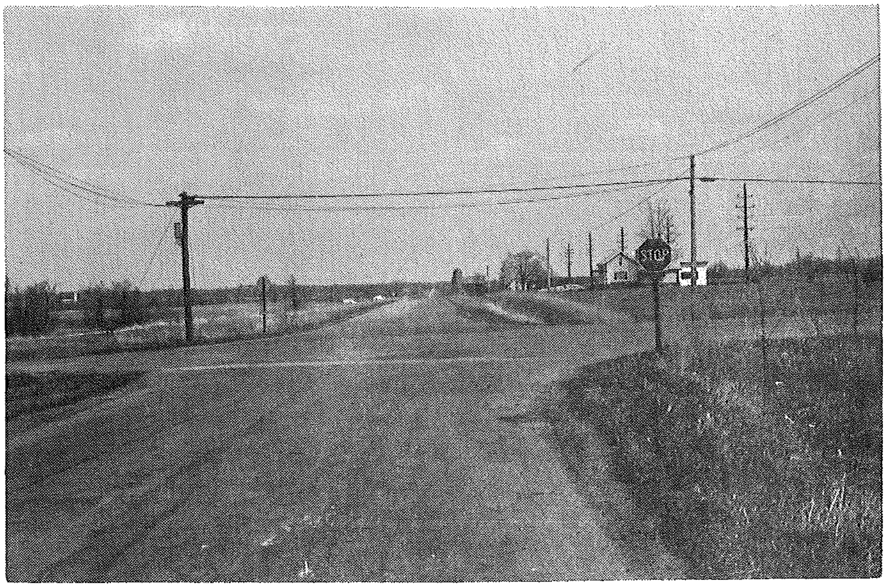
Fatal	Overturned	Out of Control
Injury	Backing	Driver Intent
Skidding	Pedestrian	Deer
Jackknife	Tree	Violator

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description WATERTOWN TWP.
BARNS AT FOSTORIA. RDS.

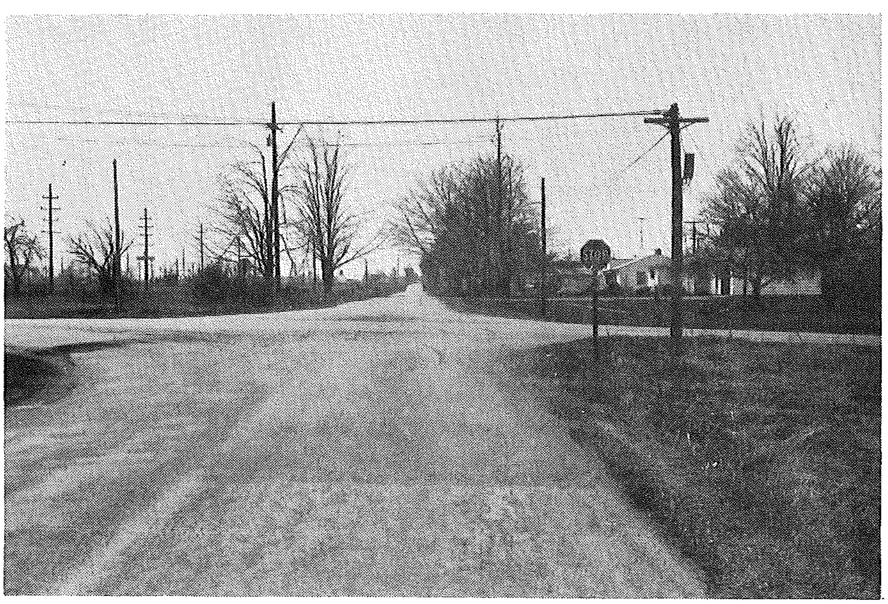
Accidents – Total 5
P.D. 3 Injury 2 (2)
Fatal 0 (0)
Acc. Rate/mv
Acc. Rate/mvm

C.S. Miles
Drawn DJM Date 3-27-70 Rev.
Plan No. 4



EASTBOUND
BARNES ROAD

NORTHBOUND
FOSTORIA ROAD



WESTBOUND
BARNES ROAD

FIGURE 4A

Form 1547

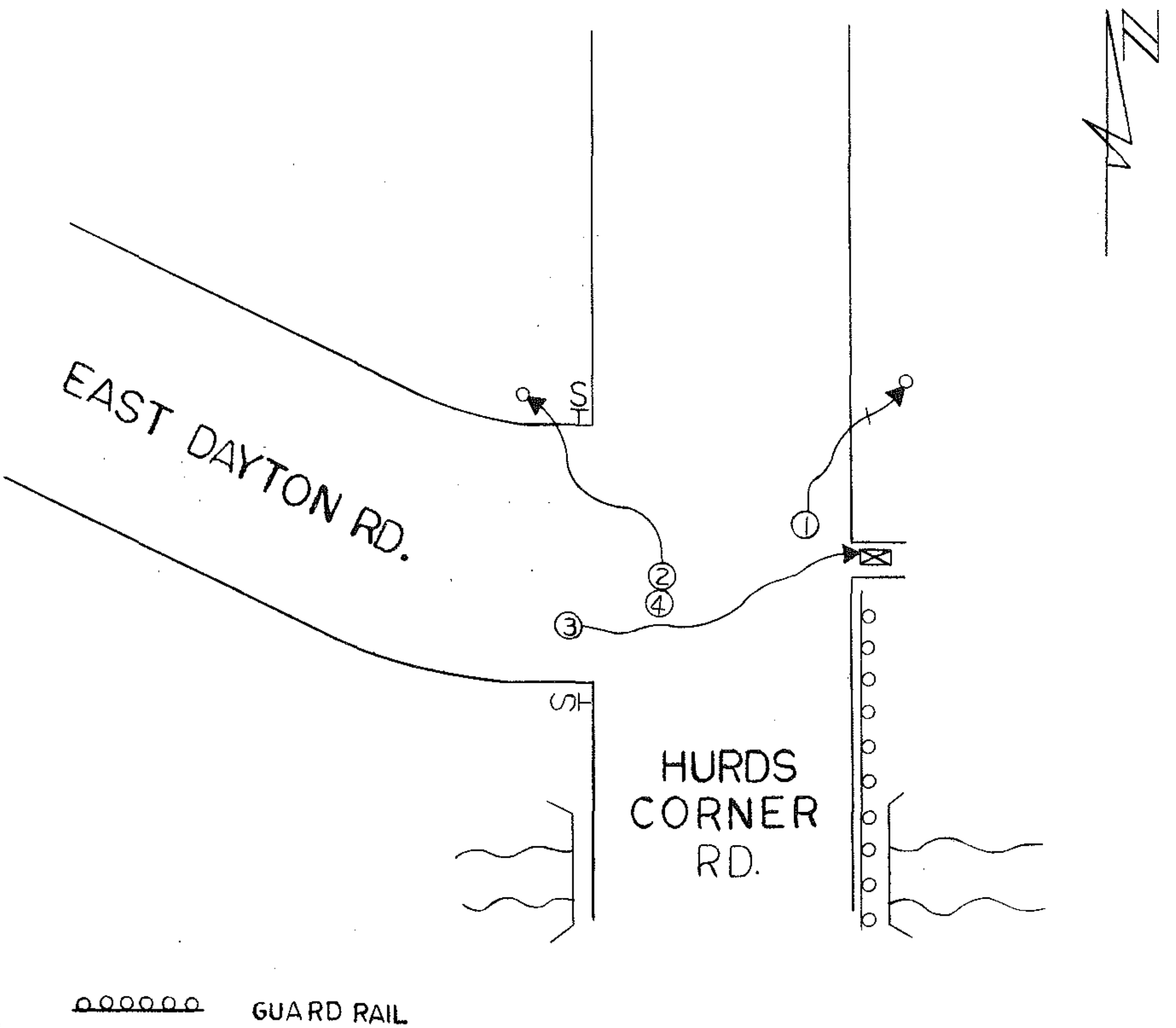


FIGURE 5

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal	S	Stop Sign	S ⊢
Flashing Beacon	R, Y, F, Y	Yield Sign	Y ⊢

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

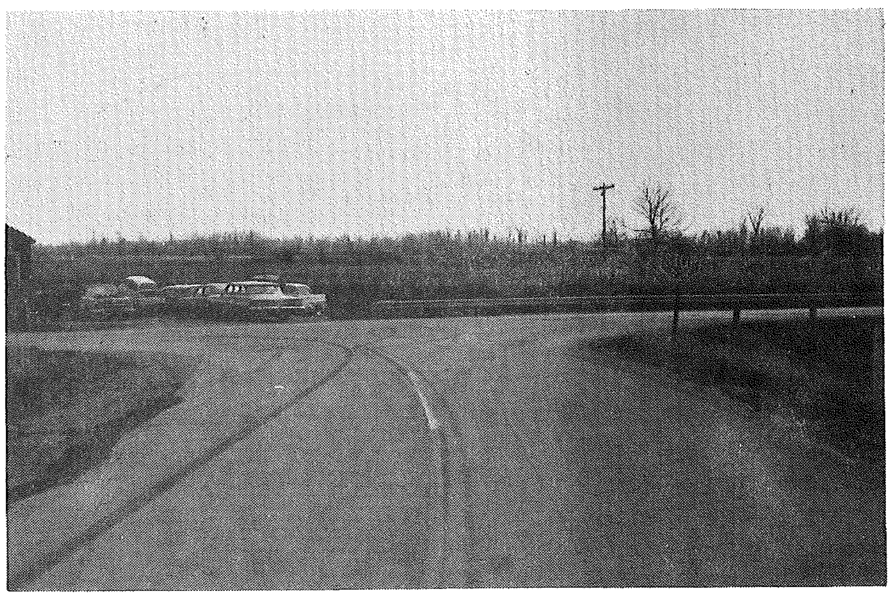
ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description WELLS TWP.
EAST DAYTON AT HURDS CORNER

Accidents – Total 4
P.D. 1 Injury 3 (5)
Fatal 0 (0)
Acc. Rate/mv
Acc. Rate/mvm

C.S. Miles
Drawn D.J.M. Date 3-30-70 Rev.
Plan No. 5

SOUTHBOUND
HURDS CORNER ROAD



EASTBOUND
EAST DAYTON ROAD

NORTHBOUND
HURDS CORNER ROAD

FIGURE 5A

Form 1547

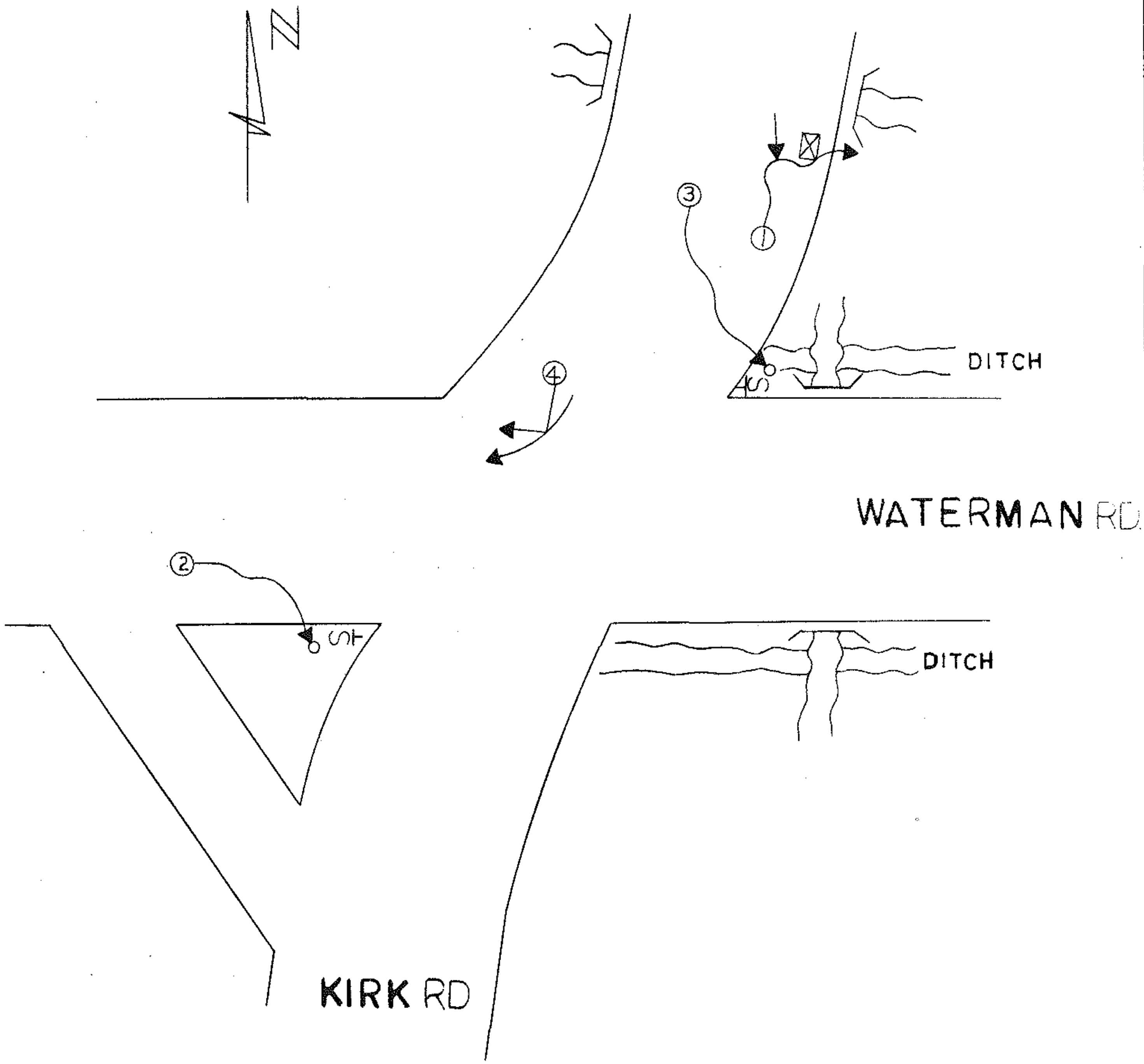


FIGURE 6

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal	S	Stop Sign	S ⊢
Flashing Beacon	Y F Y, R	Yield Sign	Y ⊢

Fatal	Overturned	Out of Control
Injury	Backing	Driver Intent
Skidding	Pedestrian (X)	Deer (V)
Jackknife	Tree	Violator

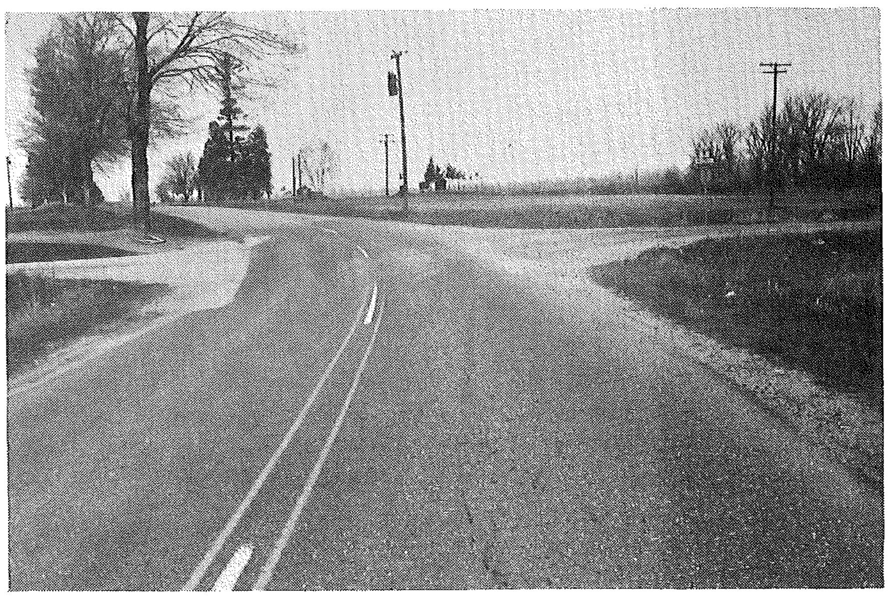
ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description VASSAR TWP.
KIRK AT WATERMAN RDS.

Accidents – Total 4
P.D. 2 Injury 2 (2)
Fatal 0 (0)
Acc. Rate/mv
Acc. Rate/mvm

C.S. ____ Miles ____
Drawn DJM Date 3-31-70 Rev. ____
Plan No. 6

EASTBOUND
WATERMAN ROAD



NORTHBOUND
KIRK ROAD

WESTBOUND
WATERMAN ROAD

FIGURE 6A

Form 1547

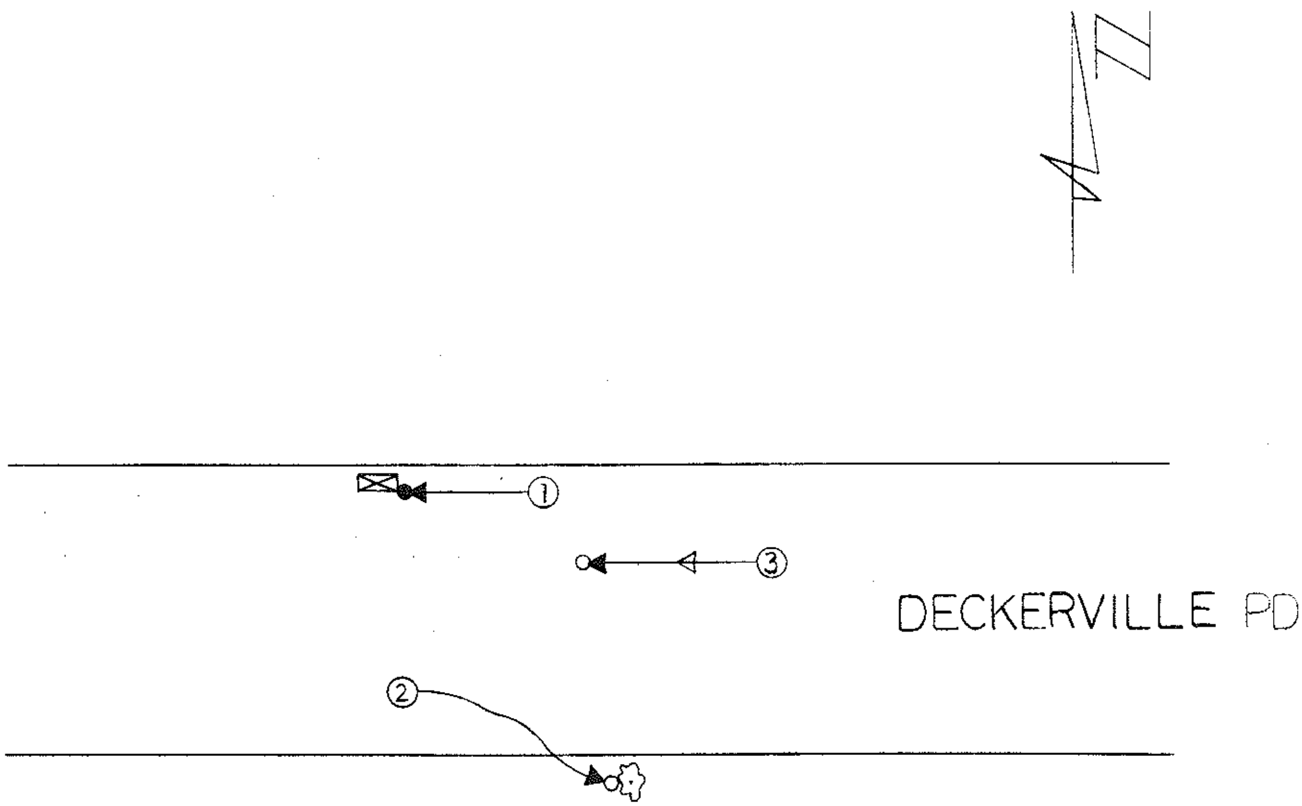


FIGURE 7

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal (S)
Flashing Beacon (F) R Y Y
Stop Sign S
Yield Sign Y

Fatal
Injury
Skidding
Jackknife
Overturned
Backing
Pedestrian (X)
Tree
Out of Control
Driver Intent
Deer (V)
Violator V

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description ELLINGTON TWP
DECKERVILLE RD.
Accidents – Total 3
P.D. 0 Injury 2 (7)
Fatal 1 (1)
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DJM Date 3-31-70 Rev.
Plan No. 7

EASTBOUND
DECKERVILLE ROAD

WESTBOUND
DECKERVILLE ROAD

FIGURE 7A

Form 1547

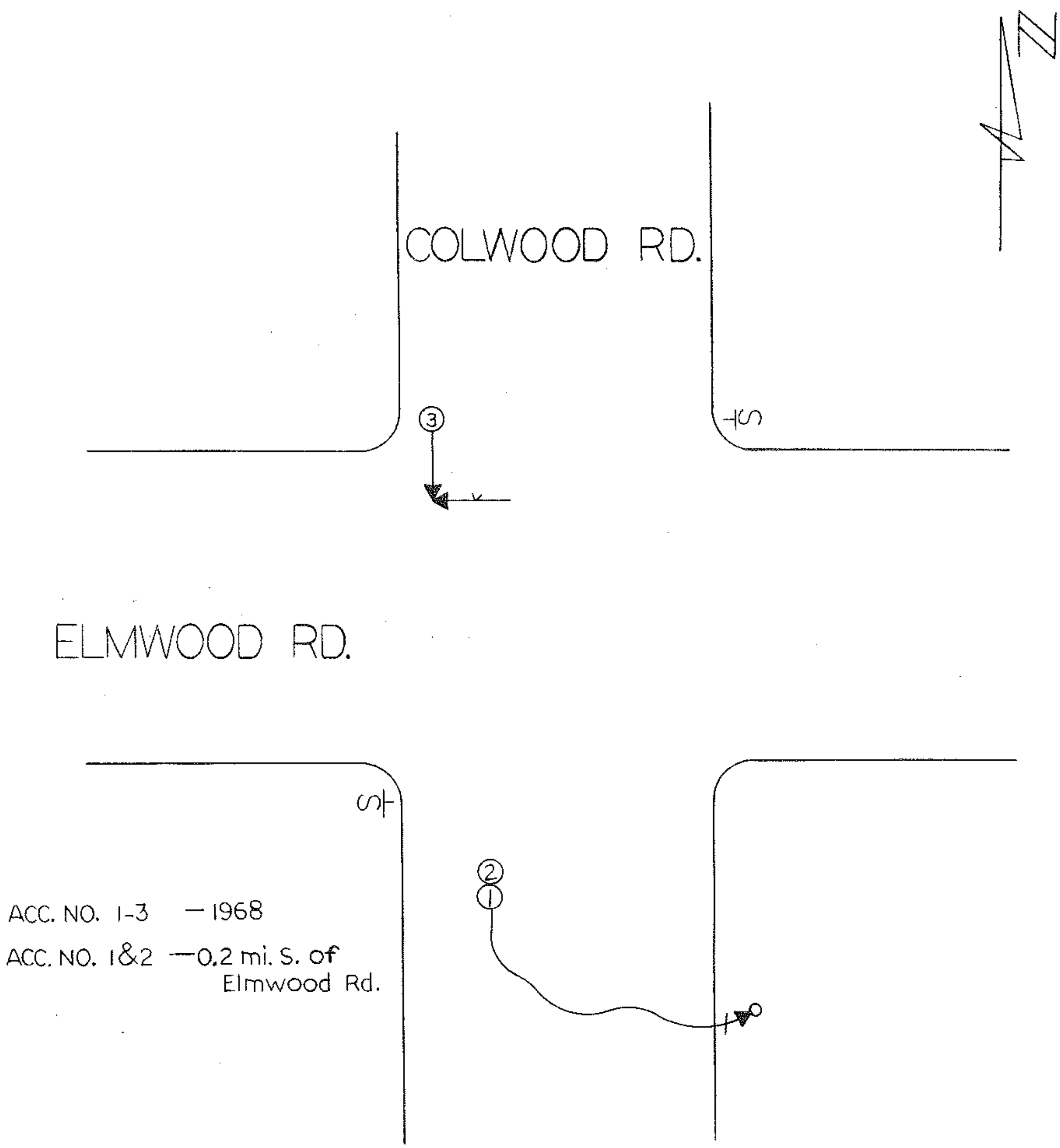


FIGURE 8

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

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

Fatal — Injury — Skidding — Jackknife — Overturned — Backing — Pedestrian (X) — Tree — Out of Control — Driver Intent — Deer (V) — Violator

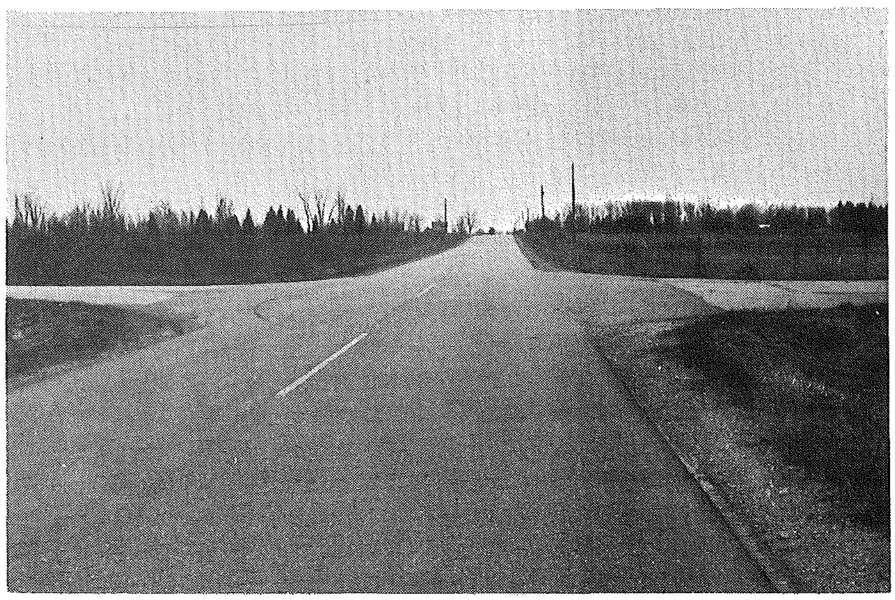
ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description Ellington Twp.
COLWOOD AT ELMWOOD

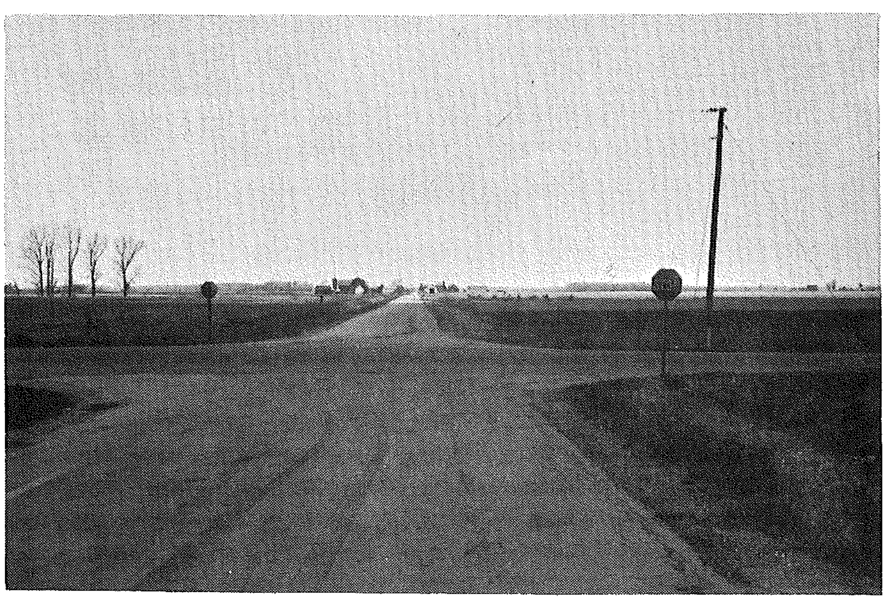
Accidents – Total 3
P.D. 1 Injury 2 (3)
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DJM Date 12-30-69 Rev.
Plan No.

8

EASTBOUND
ELMWOOD ROAD



SOUTHBOUND
COLLWOOD ROAD



WESTBOUND
ELMWOOD ROAD

FIGURE 8A

Form 1547

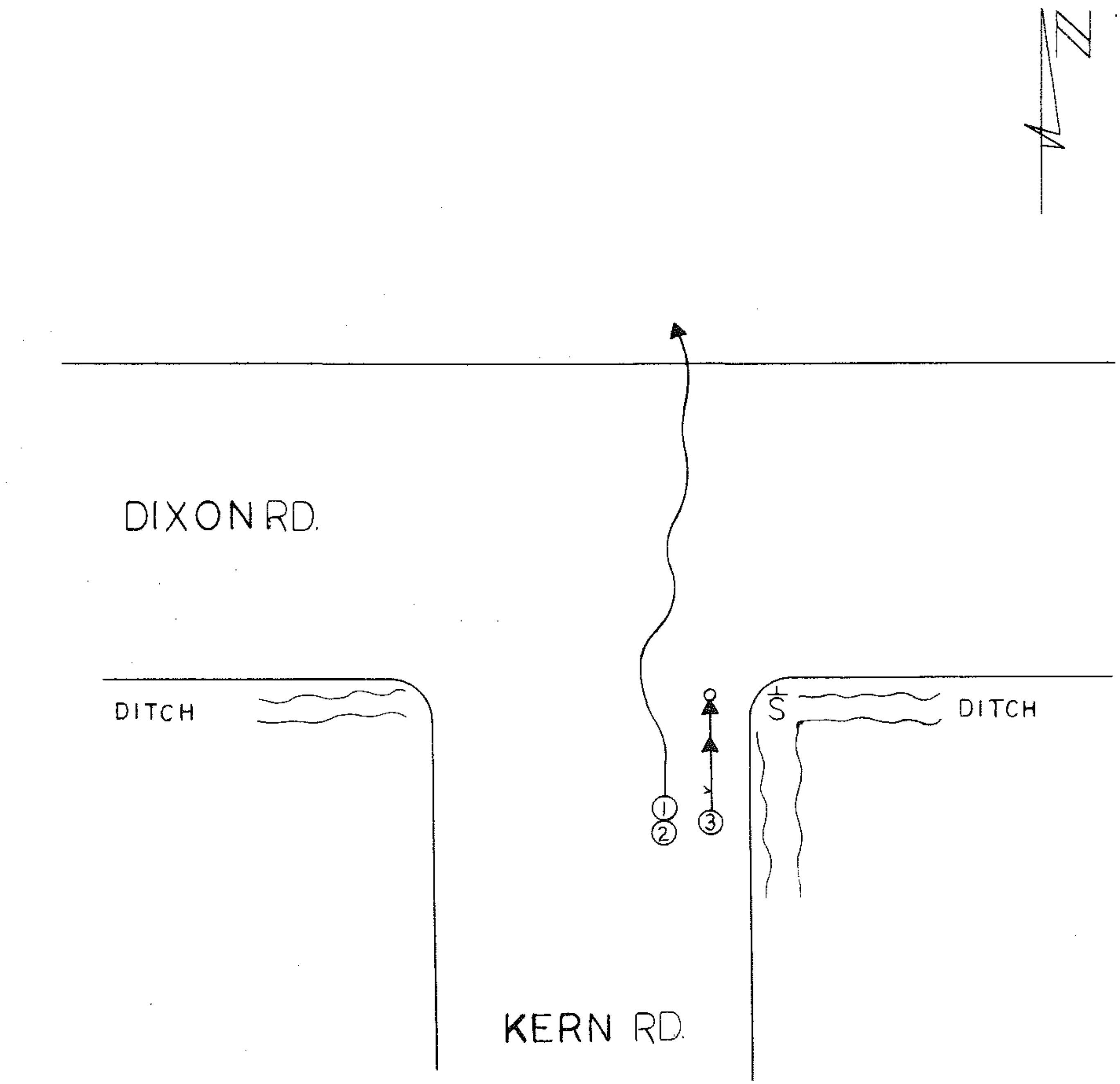


FIGURE 9

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

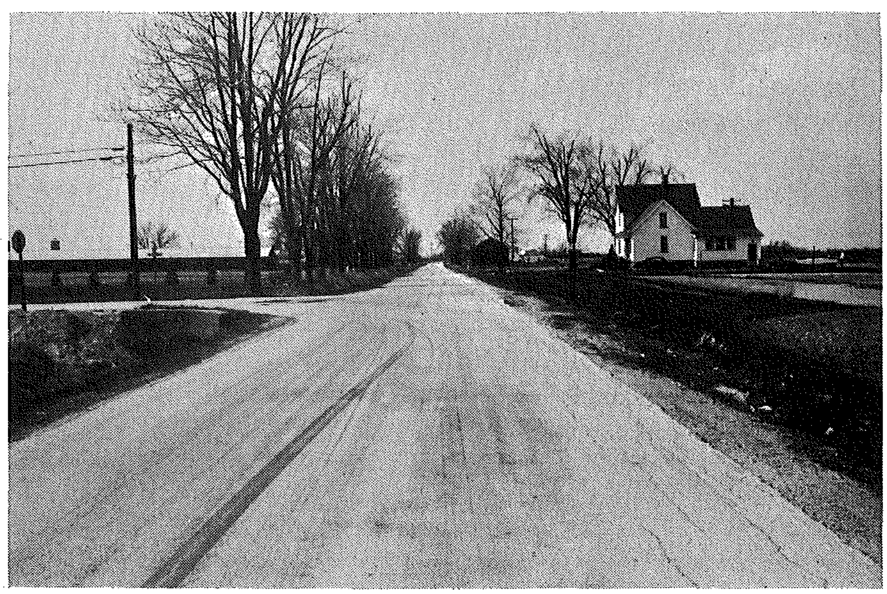
Stop & Go Signal
Flashing Beacon
Stop Sign S
Yield Sign Y

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

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description DENMARK TWP.
DIXON AT KERN RDS.
Accidents – Total 3 ( )
P.D. 2 Injury 1 ( )
Fatal ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DJM Date 3 31 70 Rev.
Plan No. 9

NORTHBOUND
KERN ROAD



WESTBOUND
DIXON ROAD

FIGURE 9A

Form 1547

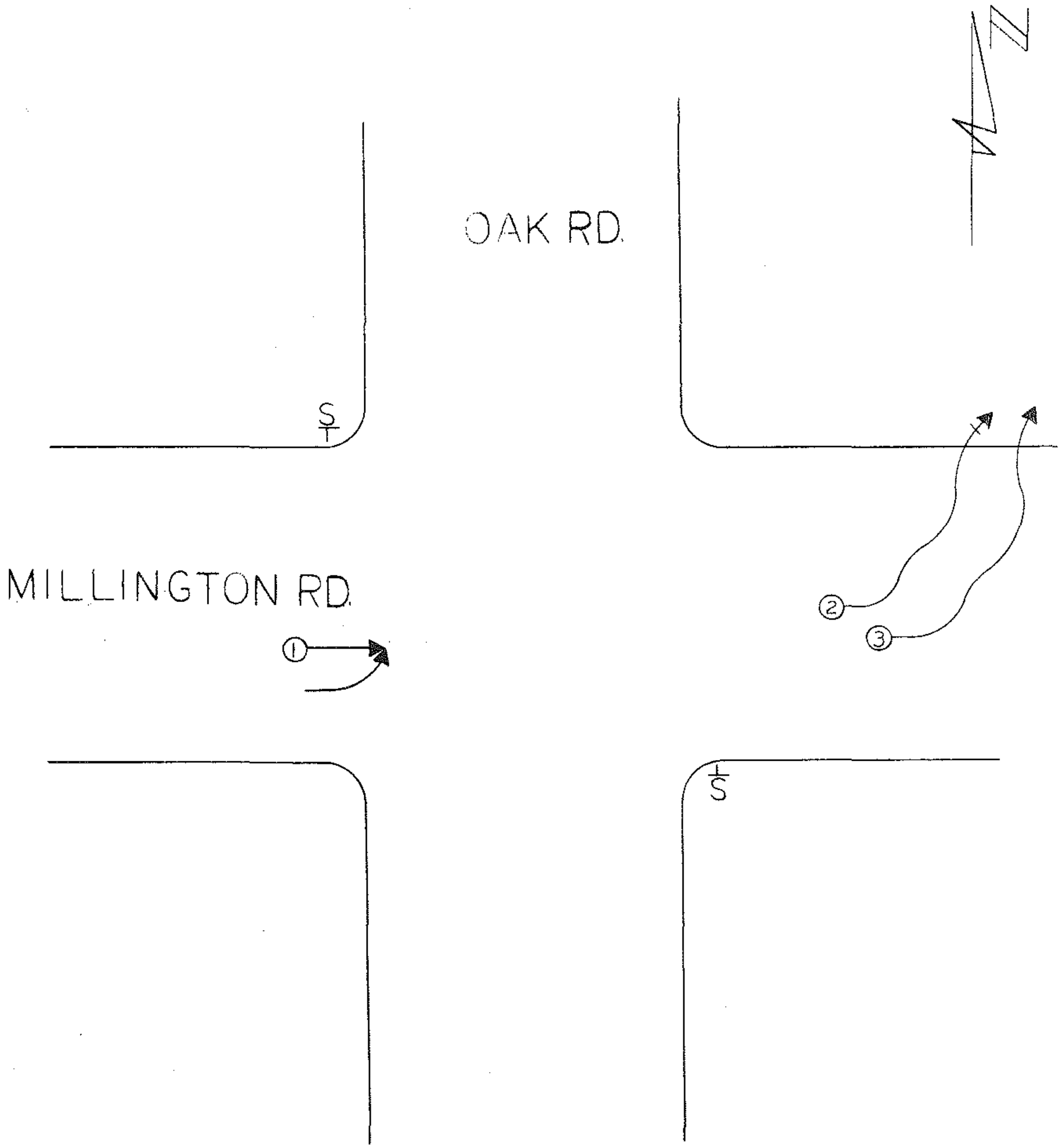


FIGURE 10

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal	S	Stop Sign	S
Flashing Beacon	R, Y, F, Y	Yield Sign	Y

Fatal	Overturned	Out of Control
Injury	Backing	Driver Intent
Skidding	Pedestrian (X)	Deer (V)
Jackknife	Tree	Violator V

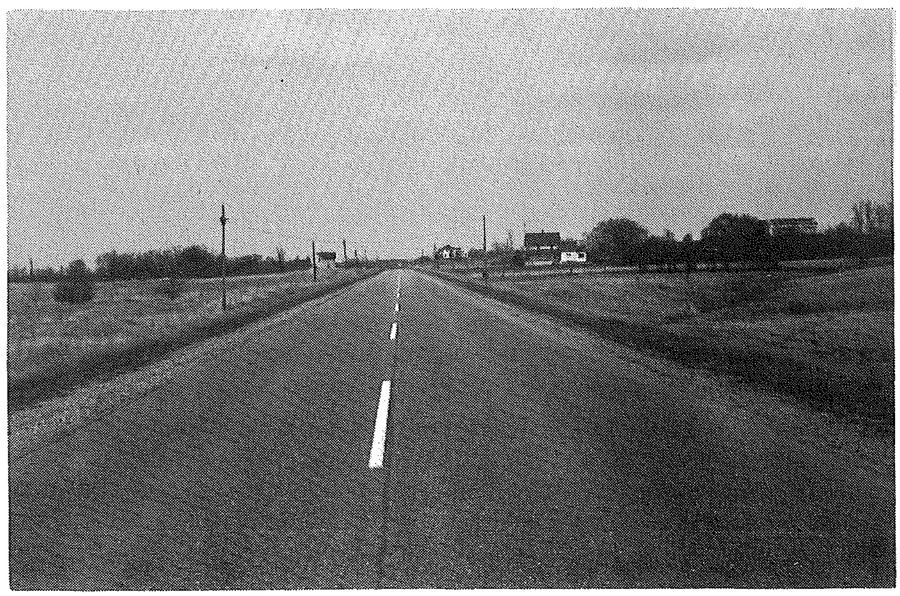
ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description MILLINGTON TWP.
OAK AT MILLINGTON RDS.

Accidents – Total 3 ( )
P.D. 3 Injury 0
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DJM Date 3-30-70 Rev.
Plan No. 11

SOUTHBOUND
OAK ROAD

EASTBOUND
MILLINGTON ROAD



NORTHBOUND
OAK ROAD

FIGURE 10A

Form 1547

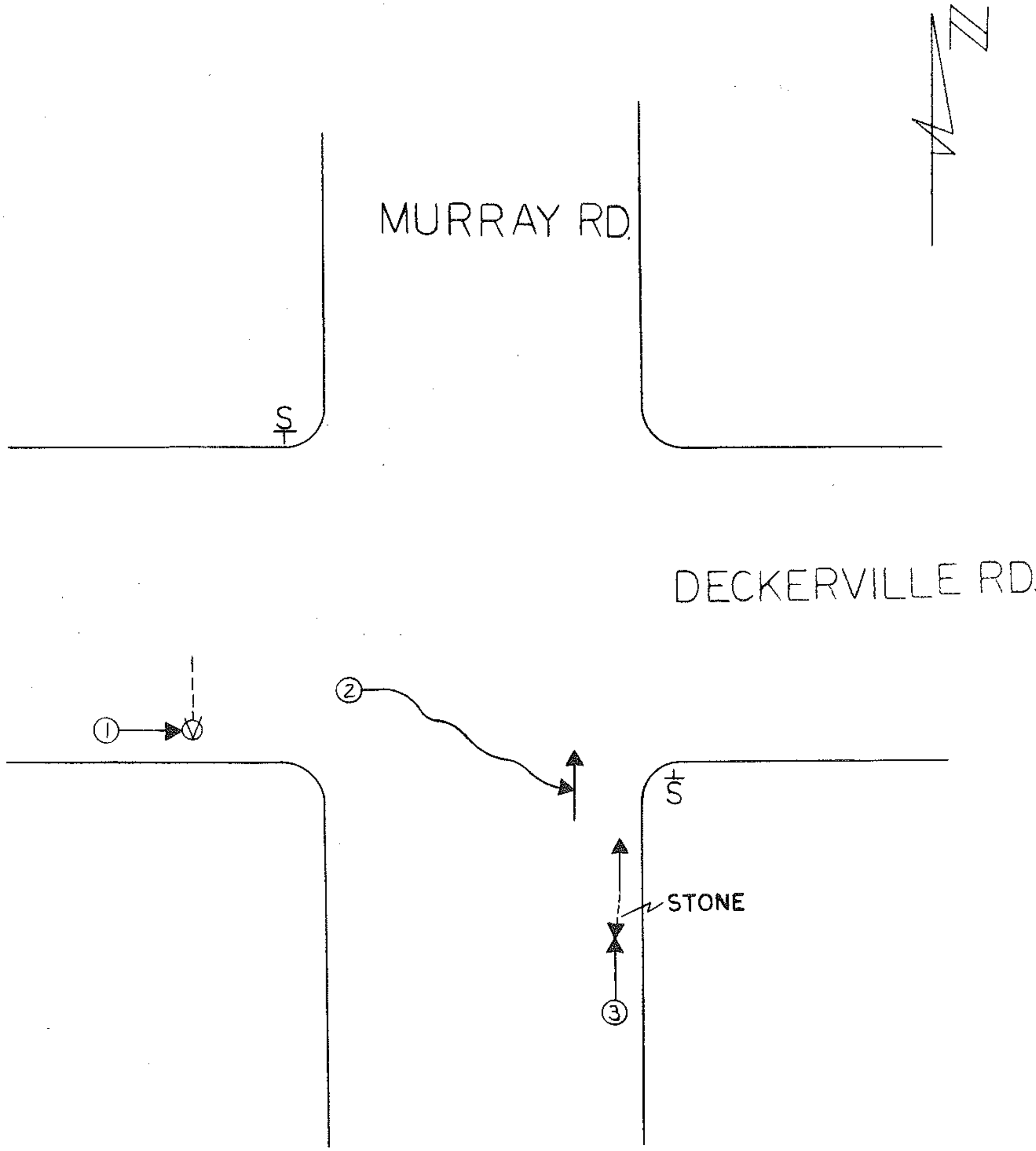


FIGURE 11

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal (S)
Flashing Beacon R Y (F) Y
Stop Sign S
Yield Sign Y

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

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968

TUSCOLA, CO. Description ELLINGTON, TWP

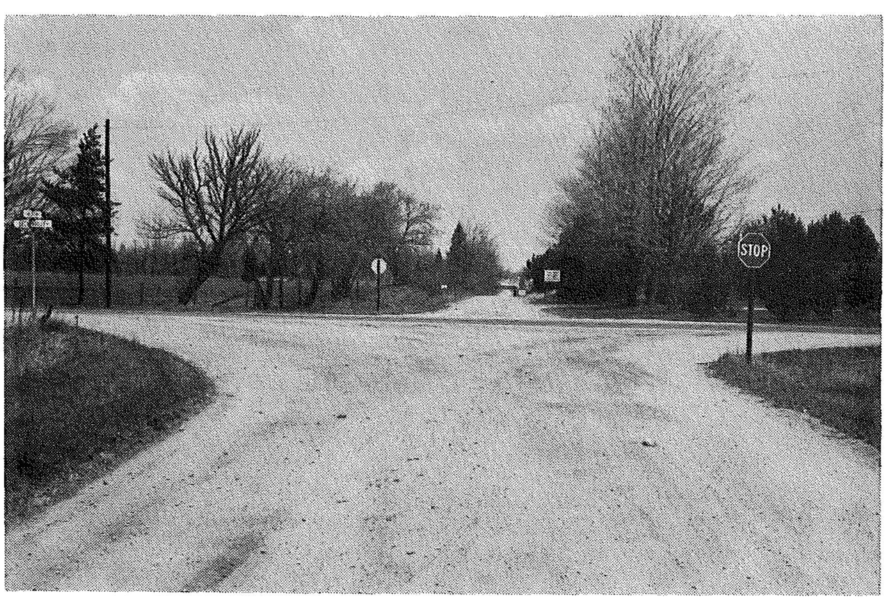
MURRAY AT DECKERVILLE RDS.

Accidents – Total 3 ( )
P.D. 3 Injury 0
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm

C.S. Miles
Drawn DJM Date 3-30-70 Rev.
Plan No. 12

SOUTHBOUND
MURRAY ROAD

WESTBOUND
DECKERVILLE ROAD



NORTHBOUND
MURRAY ROAD

FIGURE 11A

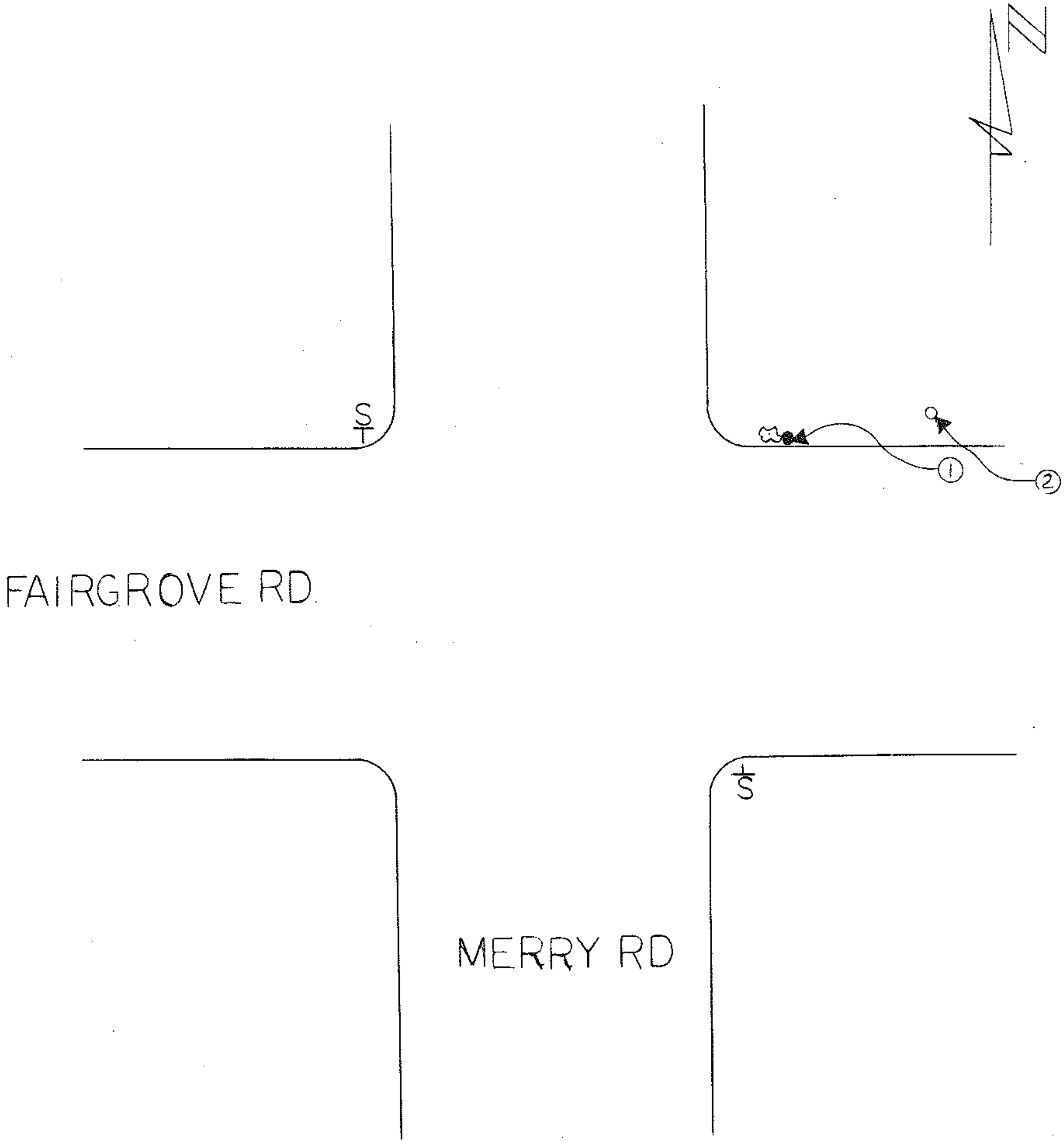


FIGURE 12

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal (S) — Stop Sign S ⊢

Flashing Beacon (F) R Y Y — Yield Sign Y ⊢

Fatal — Overturned — Out of Control

Injury — Backing — Driver Intent

Skidding — Pedestrian (X) — Deer (V)

Jackknife — Tree — Violator V

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968

TUSCOLA CO. Description FA

FAIRGROVE RD at MERRY RD

Accidents – Total 2 (1)

P.D. 0 Injury 1

Fatal 1 (1)

Acc. Rate/mv

Acc. Rate/mvm

C.S. Miles

Drawn DJM Date 3-30-70 Rev.

Plan No. 13

NORTHBOUND
MERRY ROAD

EASTBOUND
FAIRGROVE ROAD

SOUTHBOUND
MERRY ROAD

FIGURE 12A

Form 1547

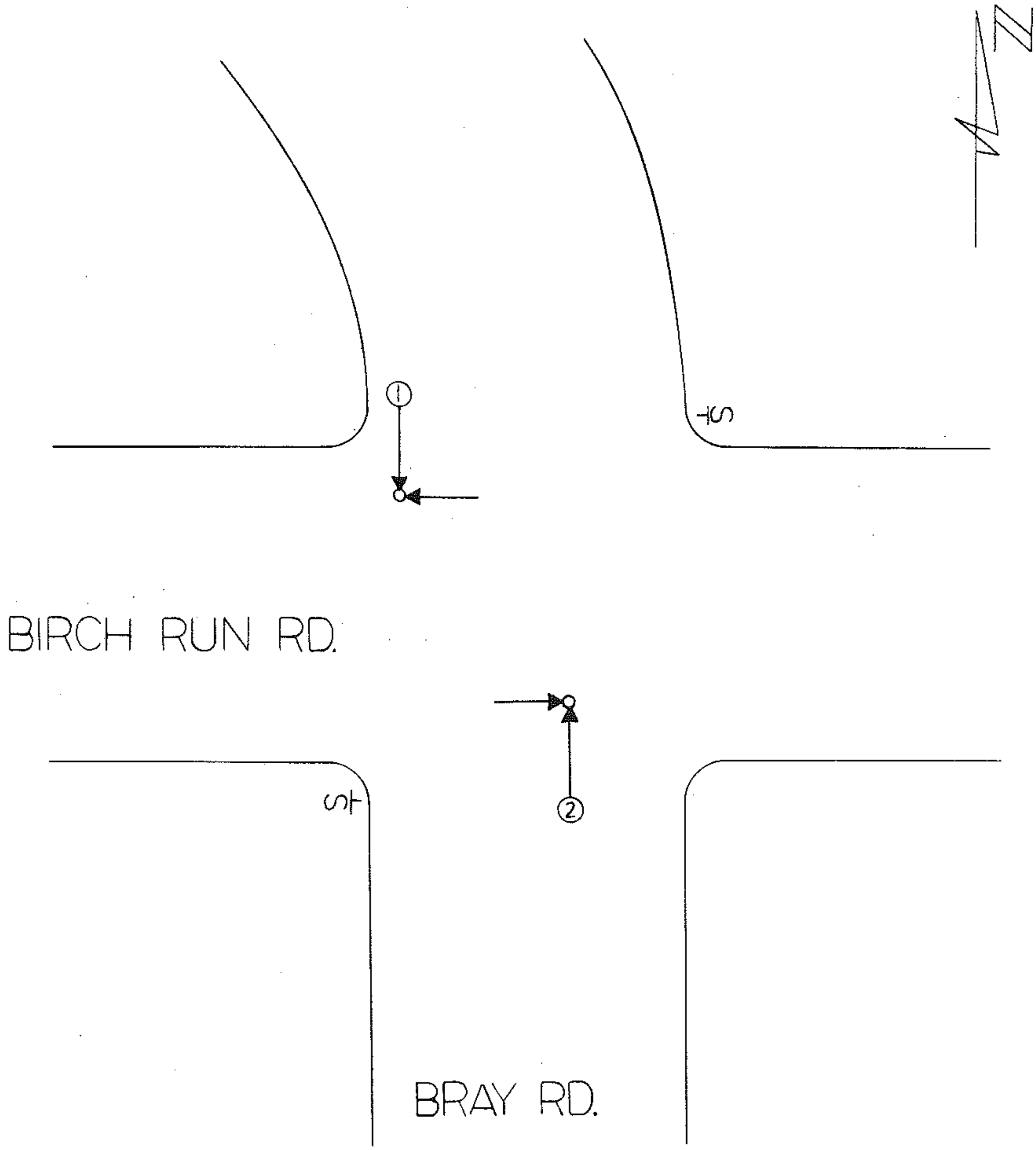


FIGURE 13

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal	S	Stop Sign	S
Flashing Beacon	R Y F Y	Yield Sign	Y

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

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968

TUSCOLA CO. Description Arbella Twp.

BIRCH RUN at BRAY RD.

Accidents – Total 2

P.D. 0 Injury 2 (5)

Fatal 0 ( )

Acc. Rate/mv

Acc. Rate/mvm

C.S. Miles

Drawn DVW Date 1-6-70 Rev.

Plan No. 14

WESTBOUND
BIRCH RUN ROAD

NORTHBOUND
BRAY ROAD

FIGURE 13A

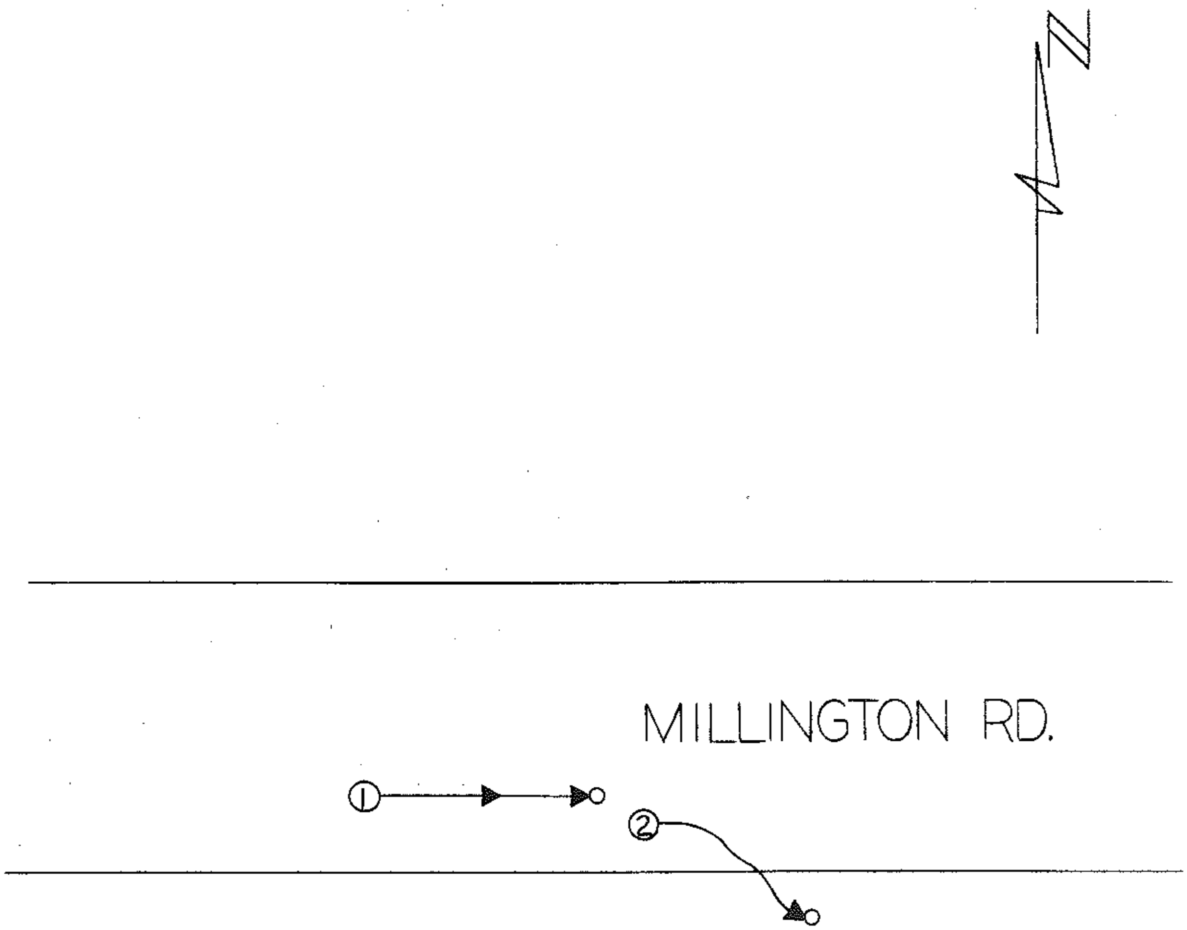


FIGURE 14

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

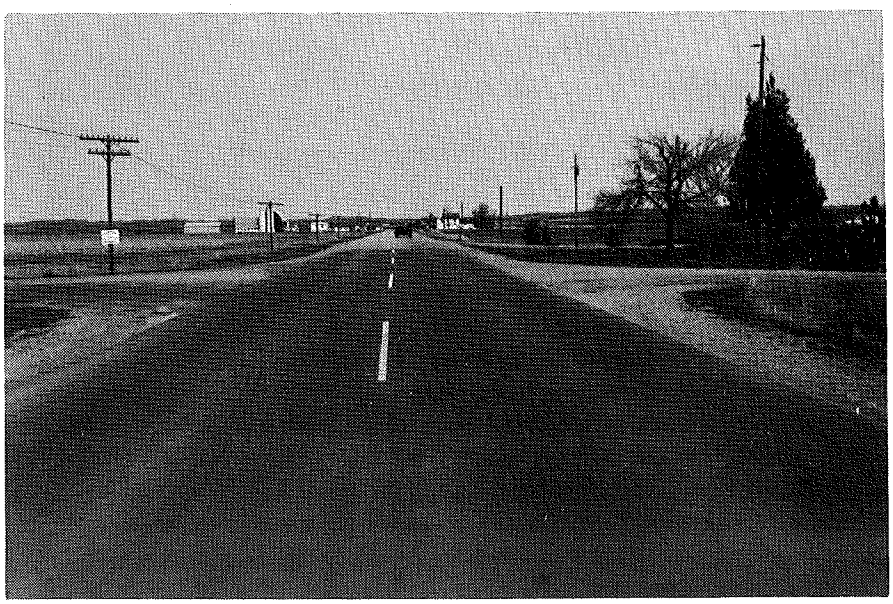
Stop & Go Signal (S)
Flashing Beacon (F) R Y Y
Stop Sign S
Yield Sign Y

Fatal
Injury
Skidding
Jackknife
Overturned
Backing
Pedestrian (X)
Tree
Out of Control
Driver Intent
Deer (V)
Violator V

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1968
TUSCOLA CO. Description Millington Twp.
Millington Rd. 4/10 To 5/10 E. Sheridan Rd.

Accidents – Total 2
P.D. 0 Injury 2 (3)
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DJM Date 1-6-70 Rev.
Plan No.



EASTBOUND
MILLINGTON ROAD

FIGURE 14A

APPENDIX II

Section C. Warning Signs

Introduction

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

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

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

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

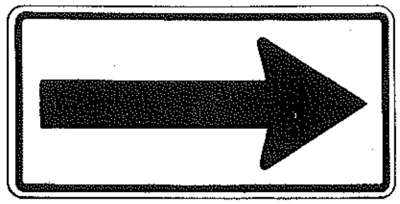
*Special warning signs for highway construction and maintenance projects are to be found in Part II of this Manual.

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

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

(Rev. 1)

TARGET ARROW SIGN



Reflectorized

W1-6-48 48″ x 24″

W1-6-96 96″ x 48″

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

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

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

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

CURVE SPEED PANEL

Reflectorized

W12-1-21 21″ x 21″ (10″ and 3″ letters)
W12-1-24 24″ x 24″ (12″ and 3″ letters)

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

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

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

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