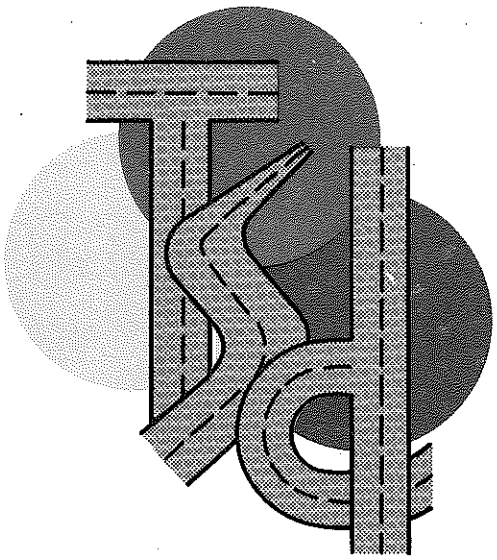
A TRAFFIC ACCIDENT ANALYSIS OF HIGH ACCIDENT LOCATIONS IN THE CITY OF IONIA

Report TSD-SS-144-70



TRAFFIC and SAFETY DIVISION

DEPARTMENT OF STATE HIGHWAYS
STATE OF MICHIGAN

65-8291

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A TRAFFIC ACCIDENT ANALYSIS OF HIGH ACCIDENT LOCATIONS IN THE CITY OF IONIA

Report TSD-SS-144-70

by

ROBERT G. LARIVIERE

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June, 1971

PREPARED BY THE

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Michigan Department of State Highways

in cooperation with

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

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Captain Amthor
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CITY OF IONIA

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Allan Rushlow - Superintendent

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NHTSA PROJECT #IS-69-3-002

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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 Department of State Police 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 Depart-

ment of State Police is responsible for keeping all accident records in Michigan, the task of identifying and locating high accident locations in the City of Ionia (and providing an inventory of those locations) was designated at State Police responsibility. Because of the fact that an automated system of locating accidents has not yet been established on a statewide basis, the high accident locations (city streets only) for the City of Ionia were determined by manually extracting and compiling those locations with the highest number of accidents from the 1968 city accident reports. From this list the 12 highest accident locations on city streets 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 the City of Ionia.

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.

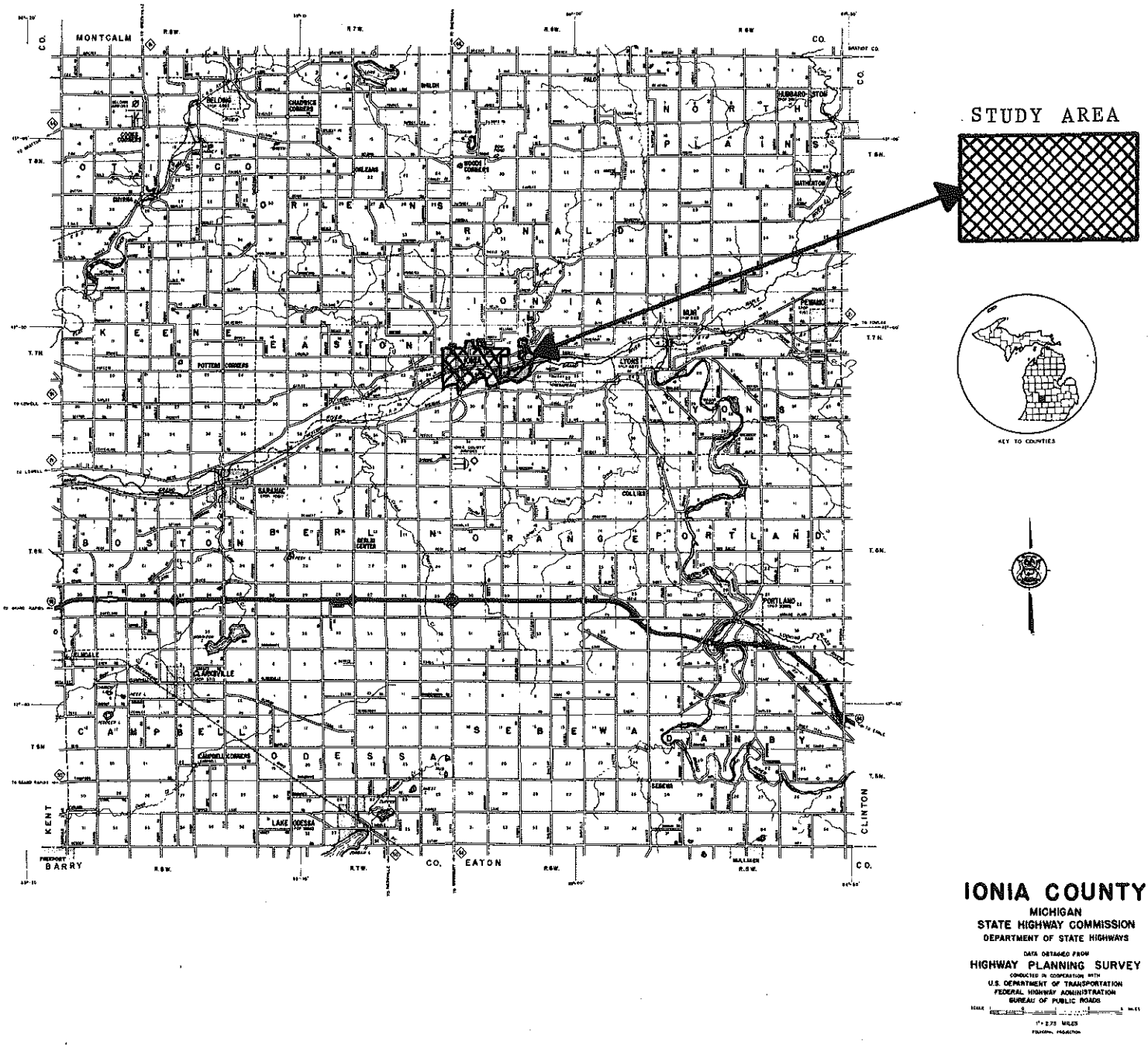
The accident analysis phase involves the analysis of the summarized facts and field data from the viewpoint of a highway traffic engineer with special attention focused on the effect which the highway environment may have had on the accident. Thus at each high accident location, individual accident reports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

The City of Ionia, which is the County Seat of Ionia County, is located about midway between Grand Rapids and Lansing in the scenic Grand River Valley (see Figure 1 on the following page). Ionia is the site of the Ionia State Hospital, the Michigan Reformatory and the Medium Security Correctional Institution. The three institutions employ a total of 850 people throughout the year which is a valuable asset to the business stability of Ionia.

FIGURE 1


STUDY AREA
KEY TO COUNTIES
MONTCALM CO.
KENT CO.
BARRY CO.
EATON CO.
CLINTON CO.
IONIA 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
1" = 2.73 MILES

Ionia has two active railroads, the Grand Trunk Western and the Chesapeake & Ohio. The Ionia County airport, located three miles to the south of Ionia, is well rated and permits private and some commercial air service operations throughout the year. Two state highways, M-21 and M-66, pass through the city providing north-south and east-west access. The I-96 Freeway passes east-west through the county only six miles south of Ionia, putting Ionia residents only minutes away from Grand Rapids and Lansing.

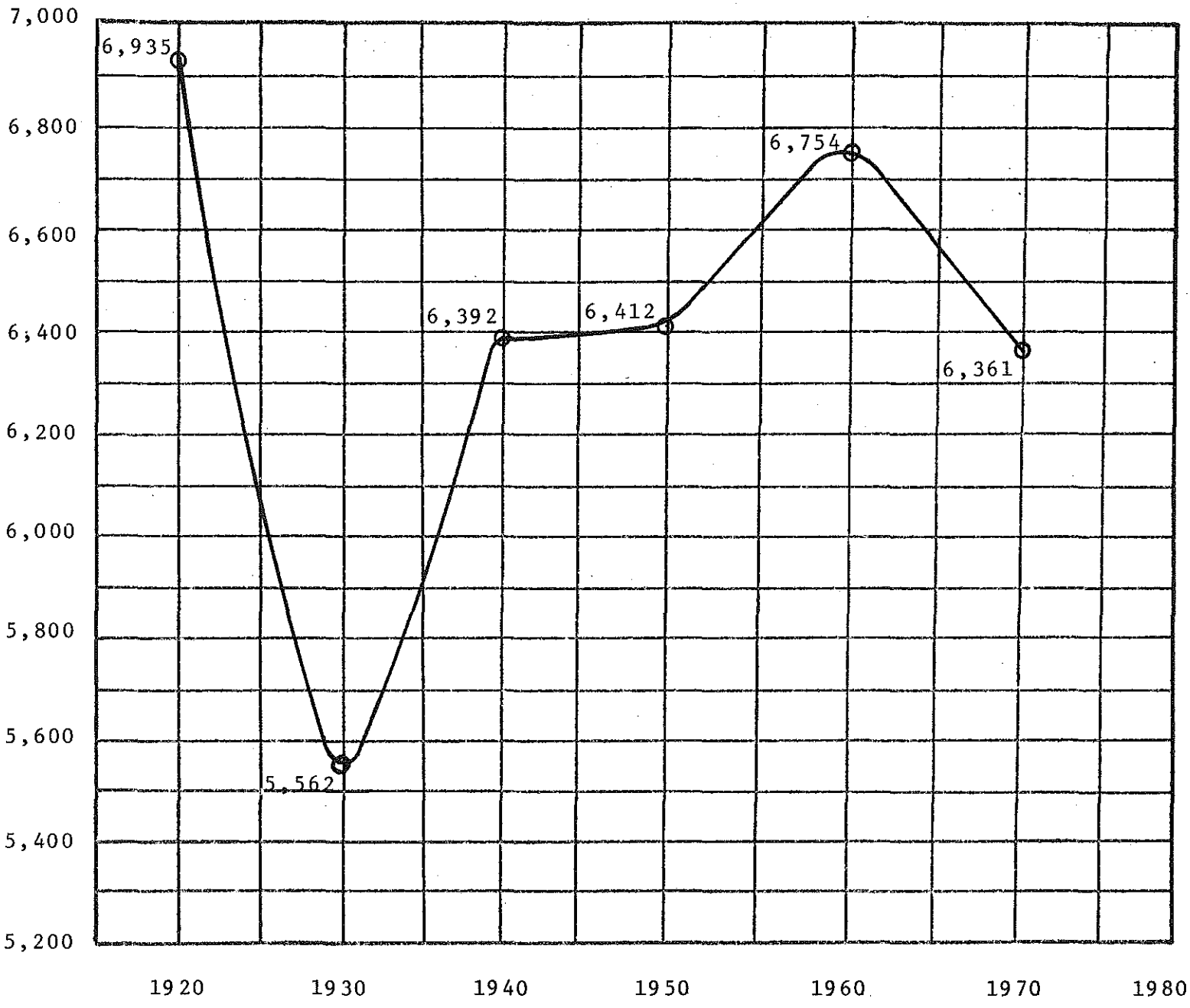
The population change for the City of Ionia has been inconsistent as one can see from the population projection in Figure 2. The greatest fluctuation occurred between 1920 and 1930 when the population went from its highest peak to its lowest peak. The total change over the fifty year period from 1920 to 1970 was a decrease of 574 people (8%). The population in the future should increase due to the probable industry that is expected in the area.

The rich farming territory surrounding Ionia is recognized as an important asset to the overall prosperity of the community, balancing the existing business and industry. Long known as one of the richest agricultural counties in Michigan, Ionia County farmers plant and till over 55,000 acres of corn, 38,000 acres of hay, 30,000 acres of wheat and 28,000 acres of oats. The dairy industry, however, actually proves to be the largest single source of

FIGURE 2

POPULATION PROJECTION

CITY OF IONIA: 1920 - 1980



Source: U. S. Bureau of the Census

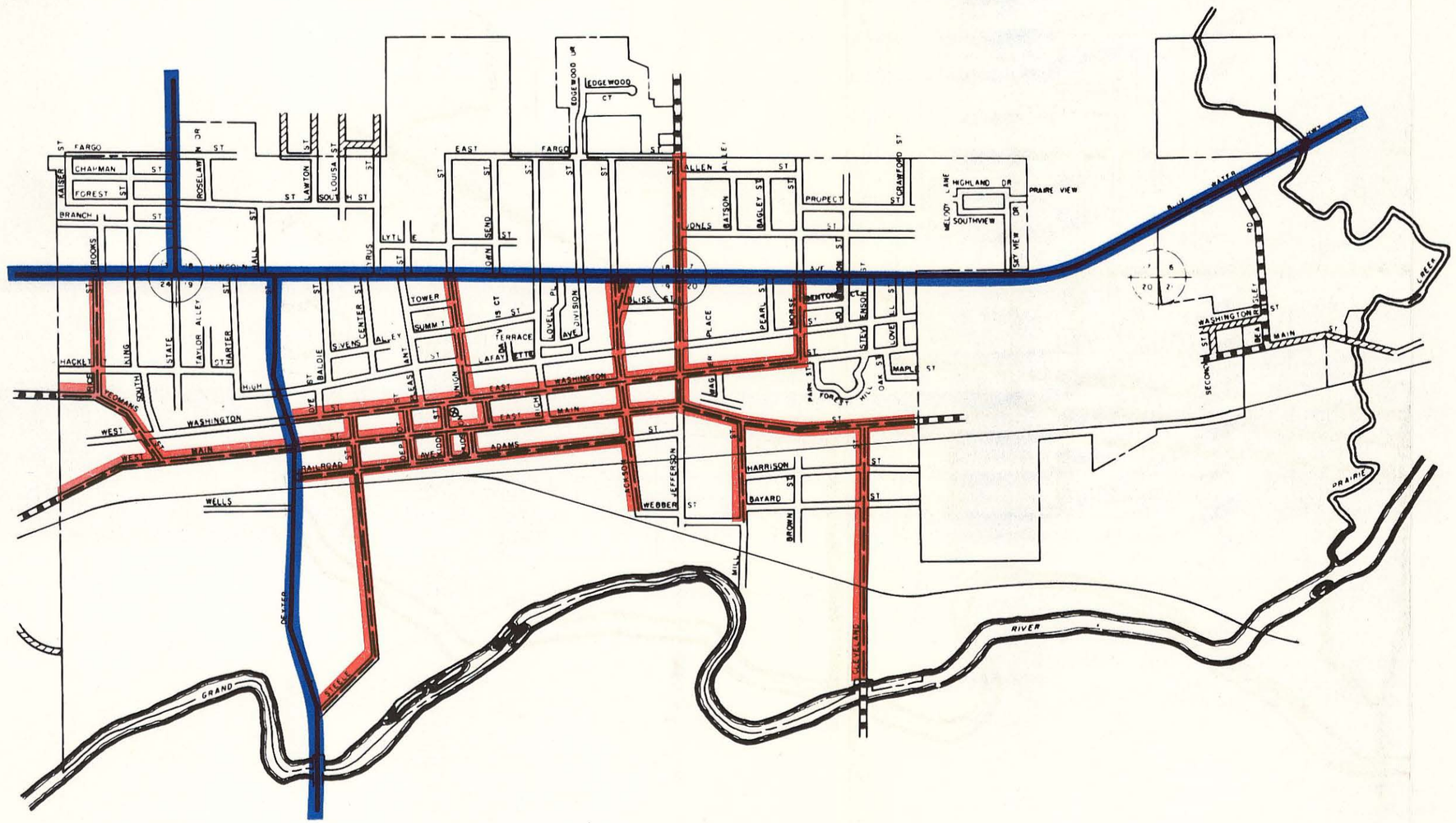
farm income in Ionia County. In addition to this, beef cattle production on Ionia County farms has taken on new importance. Fruit production in the northern part of the county has steadily increased and has led to the creation of some of the largest and most modern fruit storage facilities to be found. Farming in Ionia County is a $12 million a year business.

Industrial development in the City of Ionia has been inconsistent. In the past ten years the city has lost its two biggest industries. Despite this, Ionia is looking ahead to the future. With an eye to recent predictions which indicate that the next decade will bring unprecedented growth to the Great Lakes Region, the people of Ionia are seeking real industrial and business development. Ionia has set aside hundreds of acres of choice sites for new industry and is ready to assist anyone seeking a new location. A very cooperative relationship exists between Ionia's management and labor which signifies that both parties have benefited from communication and industrial relation programs. With this type of concern on the part of the people of Ionia, sound industrial development should not be too far away.

According to the Eighteenth Annual Progress Report as compiled by the Local Government Division of the Michigan Department of State Highways the City of Ionia has 25.97 miles of streets. This figure includes 3.06 miles of

state trunklines, 7.30 miles of major city streets and 15.61 miles of local city streets. A map showing these road types can be found on the following page.

FIGURE 3



STATE OF MICHIGAN

DEPARTMENT OF STATE HIGHWAYS

Prepared by

DIVISION OF TRANSPORTATION PLANNING

For Needs Study

CITY OF

IONIA

IONIA COUNTY

T. 7 N. – R. 6 W.

POP. 6,754 – 1960 CENSUS

REVISED 5-9-68

N

SCALE

TRAFFIC ENGINEERING ANALYSIS

The traffic engineering analysis phase of our study involves evaluating the summarized facts and field data and prescribing the proper remedial treatment. One of the basic tools used in this type of analysis is a graphic representation of accidents either on a spot collision diagram or strip map which is used to locate the accident and determine accident patterns. This is one of the engineering techniques used in trying to eliminate the causes of accidents. 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 controls. 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 the City of Ionia the traffic engineering analysis began when the State Police, after compiling the accident data for the city streets in Ionia, transmitted to the Michigan Department of State Highways 12 high accident locations (see spot map on the following page). An analysis of these locations indicated that parking accidents contributed heavily

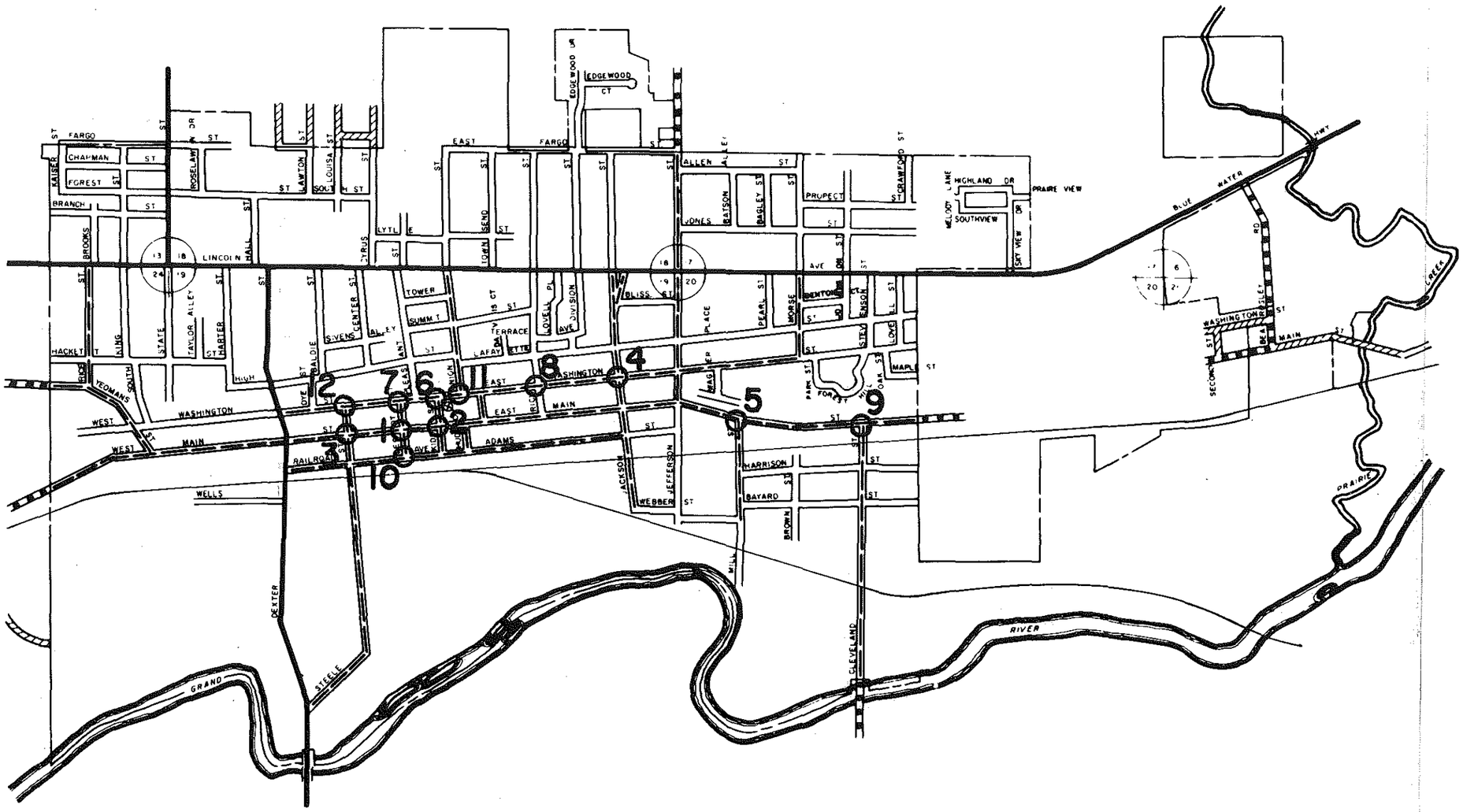
FIGURE 4

SPOT MAP

FOR

HIGH ACCIDENT

LOCATIONS



STATE OF MICHIGAN 12

DEPARTMENT OF STATE HIGHWAYS

Prepared by

DIVISION OF TRANSPORTATION PLANNING

For Needs Study

CITY OF

IONIA

IONIA COUNTY

T. 7 N. – R. 6 W.

POP. 6,754 – 1960 CENSUS

ROAD SYSTEM

STATE TRUNKLINE	
COUNTY PRIMARY	
COUNTY LOCAL	
ADJACENT COUNTY OR CITY	
CITY OR VILLAGE MAJOR ST.	
CITY OR VILLAGE LOCAL ST.	
CITY OR VILLAGE OFFICES	⊗

REVISED 5-9-68

N

SCALE

to the total number of accidents over the four-year study period. Eighty-eight accidents or approximately 48% of the total of 185 involved parked vehicles. In late 1968 the City of Ionia changed from angle parking on Main Street to parallel parking. We feel this change was extremely important for the following reasons:

1) The conflict between vehicles backing from their stalls and Main Street through traffic was eliminated.
2) A center lane for left turns was created.

We believe that the change from angle parking to parallel parking that was instituted on Main Street will be directly responsible for eliminating many accidents. Thus, we recommend that all angle parking in the City of Ionia be eventually phased out and replaced by parallel parking. This change would greatly help in reducing the high percentage of parking accidents throughout the city.

An example of a city that incorporated similar parking changes with favorable results is the City of Lansing. Lansing had extensive angle parking and also a high number of parking-related accidents. The angle parking was gradually removed in favor of parallel parking. The results for a three-month period over a nine block area of Washington Avenue and East Michigan Avenue appear in Figure 5. We suggest that the accident reports along Main Street in the City of Ionia since the parking change be checked to see if there is similar reductions in the parking-related accidents.

FIGURE 5

CITY OF LANSING

TRAFFIC DEPARTMENT

ACCIDENT COMPARISON - ANGLE PARKING AND PARALLEL PARKING

WASHINGTON AVENUE - NINE BLOCKS - GENESEE TO LENAWEE

	ALL MID-BLOCK ACCIDENTS				
	ANGLE PARKING				PARALLEL PARKING
WASHINGTON AVENUE	1954	1955	1956	1957	1958
JUNE	22	10	21	18	2
JULY	9	17	17	15	3
AUGUST	25	16	23	10	1
3 MONTH TOTALS	56	43	61	43	6

	ALL MID-BLOCK ACCIDENTS				
	ANGLE PARKING				PARALLEL PARKING
EAST MICHIGAN AVENUE	1954	1955	1956	1957	1958
MAY	3	6	9	10	1
JUNE	8	5	7	5	0
JULY	7	3	3	7	1
AUGUST	6	5	5	4	2
4 MONTH TOTALS	24	19	24	26	4

COMPILED BY: ALLEN T. HAYES, CITY TRAFFIC ENGINEER

From

Official Lansing Police Department Accident Reports

Our analysis of the 12 locations also showed that the first parking stalls from the intersections in many cases abuted the crosswalks. According to the Michigan Vehicle Code, Section 257.674 of Act 300, Public Acts of 1949 as amended (MSA 9.2374), "No person shall park a vehicle, except when necessary to avoid conflict with other traffic or in compliance with law or the directions of a police officer or traffic control device, within 20 ft of a crosswalk, or if none, then within 15 ft of the intersection of property lines at an intersection of highways". We strongly recommend that the Vehicle Code Law concerning crosswalks be implemented as soon as possible.

Two of the 12 high accident locations were signalized. Both of these locations have only one overhead signal face visible for each approach. According to the Michigan Manual of Uniform Traffic Control Devices, a minimum of one overhead vehicular signal face per approach is required. It is strongly recommended, however, that at least two vehicular signal faces be provided per approach for the following reasons:

1) Two (or more) properly located overhead faces will in almost all cases provide drivers with a signal indication even though trucks or buses may momentarily obscure one signal face
2) Multiple faces provide a safety factor where the signals must compete with a brilliant background such as advertising signs or the sun

3) The occasional lamp failure in one face will not leave an approach without any signal indication

(see Part IV, Section B, pps. 326 - 327 of the Michigan Manual of Uniform Traffic Control Devices, Appendix II, p. 80)

We do realize, however, that the cost of extra signals may not fit into the city's budget at this time. However, we do recommend that second signal heads be employed at all signalized intersections in the City of Ionia when the cost is feasible in the city's budget.

After our analysis was complete, it was apparent that no engineering recommendations would be feasible for four of the 12 locations. There were no accident patterns at these four locations and no present or potential serious driving hazards that could be eliminated or controlled by traffic engineering. Consequently, this report will discuss in detail only the remaining eight 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.

1. Main Street at Depot Street

Main Street at Depot Street is a four legged signalized intersection located in the Central Business District of Ionia. A single signal head is suspended over the center of the intersection. Main Street is a three lane 54 ft wide bituminous roadway at the intersection with a nine foot wide center lane for left turns. The proper lane assignment for turning movements and through movements is indicated by painted arrows. There is also a sign hanging from the signal which says "center lane left turn only". Metered parallel parking is allowed on both sides of Main Street.

Depot Street is a two lane bituminous roadway with a 48 ft width south of Main Street and a 46 ft width north of Main Street. Parallel parking is allowed on the east side of Depot Street while angle parking is allowed on the west side.

There were 48 accidents at this location during the four-year study period. Parking accidents numbered 29 of the total or approximately 60%. Sixteen of these parking accidents involved Main or Depot Street traffic while the remaining 13 parking accidents involved other parked vehicles. There were also 13 rear-end accidents with ten of them involving the signal and the remaining three due to parking maneuvers. The remaining accidents consisted of three head-on left turns, two angle accidents and one failure to yield the right of way. Together the parking and rear-end accidents accounted

for nearly 88% of the total accidents over the four-year study period. From 1966 to late 1968 Main Street had angle parking. Of the 28 accidents on Main Street during this period, 50% or 14 of them were parking accidents. Since late 1968 when the angle parking along Main Street was changed to parallel parking, there have been ten accidents on Main Street with six of these involving a parked vehicle.

Recommendations:

The collision diagram for this location shows that during the four-year study period parking accidents and rear-end accidents were the predominant types. We believe that the change from angle parking to parallel parking that was instituted on Main Street in late 1968 was directly responsible for eliminating many accidents. This change eliminated the conflict that occurred with vehicles backing into traffic, and it also allowed the use of the center of the street for a separate left turn lane. We suggest a further change to decrease the high percentage of parking accidents. We recommend that the first three parking stalls on all four quadrants of Main Street be removed. This change would eliminate the conflict between parked cars and cars stored in the immediate intersection area. It would also create a right turn lane which would enable more vehicles to move through the intersection, possibly reducing the rear-end accidents.

Also, we recommend that this intersection have two overhead signal faces visible for each approach. We realize the cost of the extra signal may not be feasible at this time, but we recommend that two signal faces per approach be adopted as soon as possible.

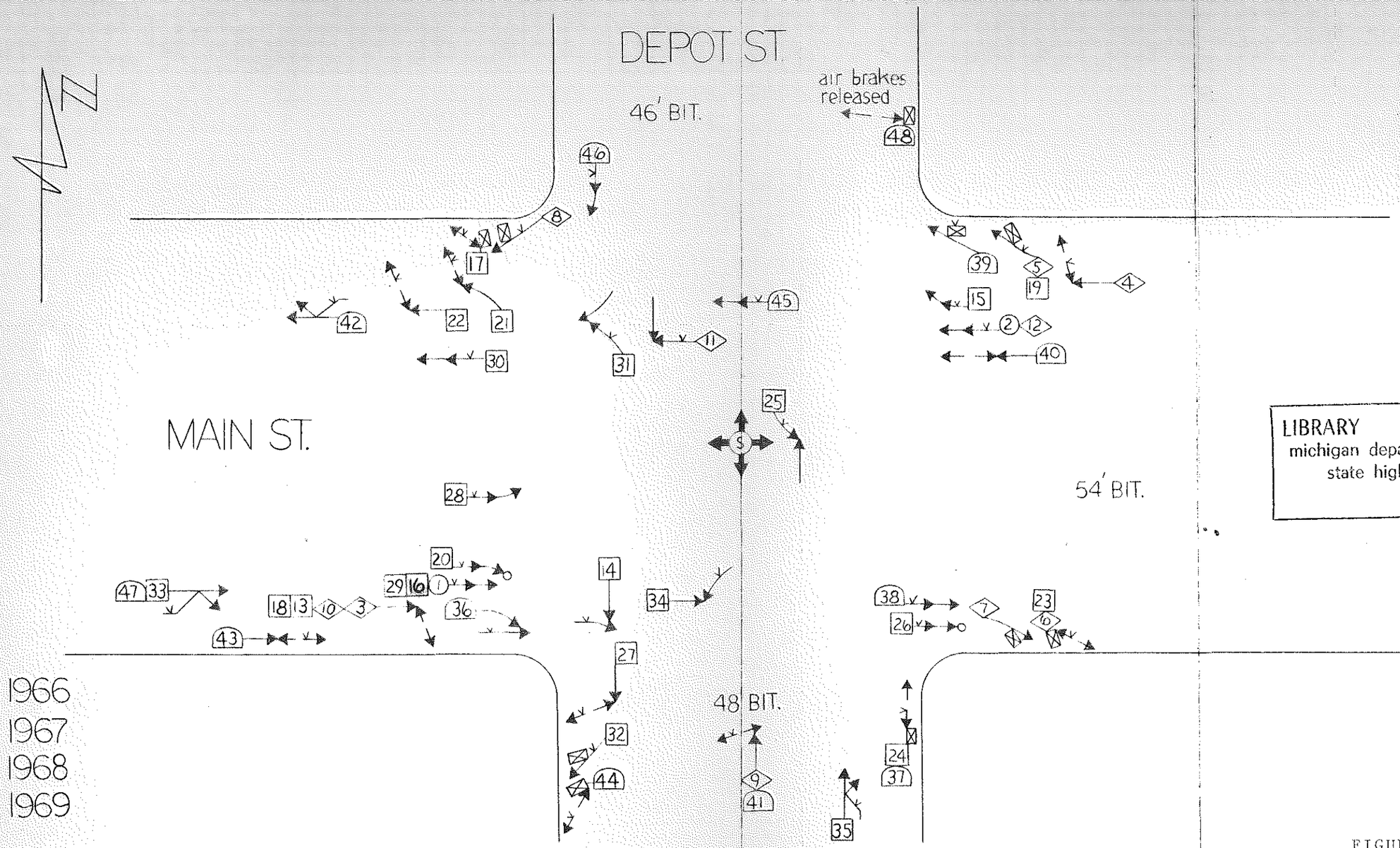


FIGURE 6

REMARKS

NOTE :

LEGEND

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

ACCIDENT STUDY
COLLISION DIAGRAM

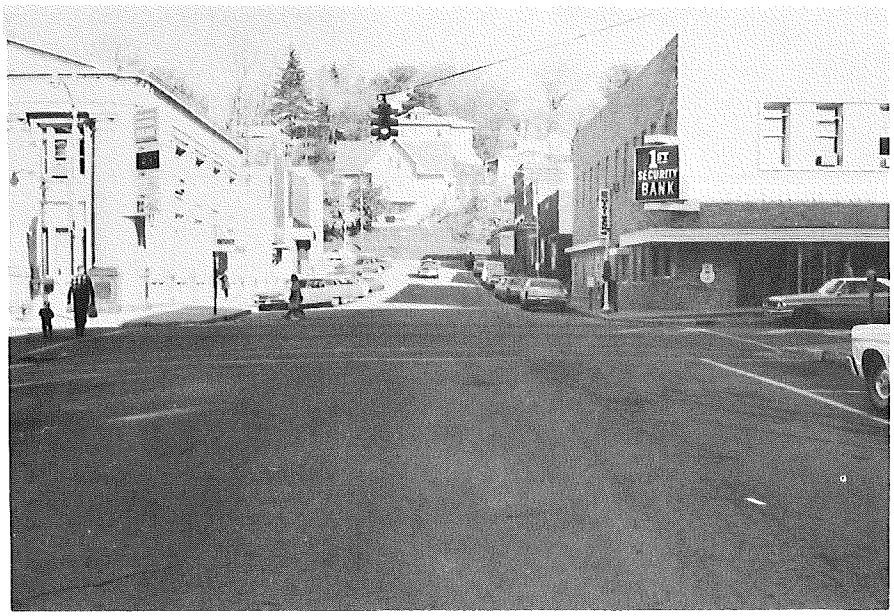
Period: 1966 THRU 1969
Accidents – Total 48
P.D. 46 — ADT
Injury 2 (2) — Rate /100 mvm
Fatal 0 ( ) — Rate / mv

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

Location
MAIN ST. at DEPOT ST.
CITY OF IONIA
IONIA CO.

C.S. — Miles
Drawn DVW — Date 6-30-70
Plan No. #1

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

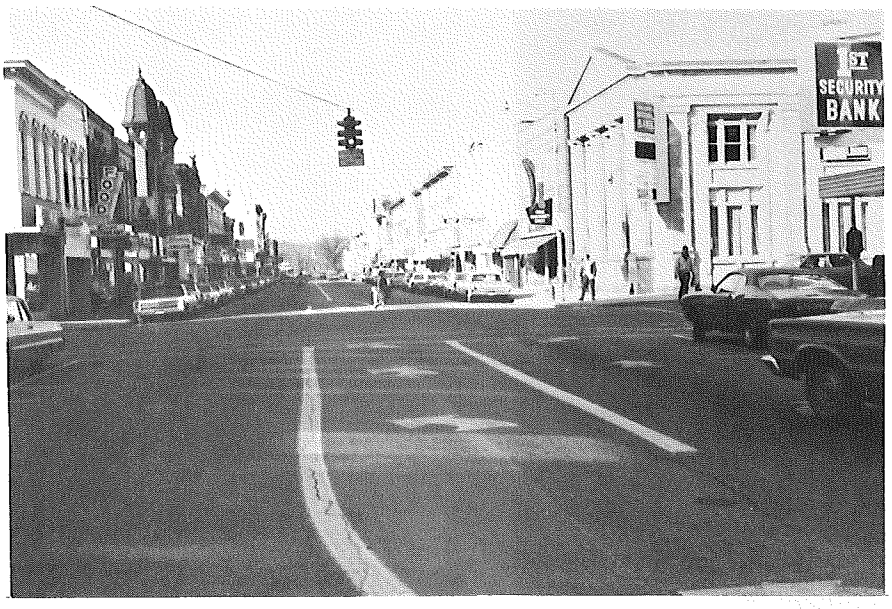


NORTHBOUND

DEPOT STREET

WESTBOUND

MAIN STREET



EASTBOUND

MAIN STREET

FIGURE 6a

2. Main Street at Kidd Street

Main Street and Kidd Street form a standard right angle intersection. The only traffic controls present are two stop signs (R1-1-24, Appendix II, p. 77) for Kidd Street traffic. This intersection is located at the west end of the Central Business District of Ionia.

Main Street west of the intersection has a 54 ft wide three lane bituminous surface while Main Street east of the intersection has a 45 ft wide two lane brick pavement. The left turn lane for that portion of Main Street west of the intersection is marked by painted arrows. Metered parallel parking is allowed on each side of Main Street on both sides of the intersection. Angle parking used to exist on that portion of Main Street west of the intersection until late 1968 at which time it was changed to parallel parking.

Kidd Street is a two lane bituminous roadway 41 ft wide north of the intersection and 45 ft wide south of the intersection. Metered parallel parking is allowed on the east side of Kidd Street while metered angle parking is allowed on the west side.

The accident data for the four-year study period indicates that there were 23 accidents at this location. Thirteen out of the 23 accidents or just a little over 50% were parking accidents. Out of the 13 parking accidents, eight occurred on Main Street and five occurred on Kidd

Street. Six of the eight parking accidents on Main Street happened before the change from angle parking to parallel parking. The remainder of the 23 accidents consisted of four rear-ends, four right angles, one head-on left turn and one accident involving a pedestrian.

Recommendations:

It is evident from the accident data at this location that parking accidents are the predominate type. We feel, however, that the parking problem on Main Street has been lessened by the change in parking from angle to parallel. Since the change, there has been only two parking accidents as compared with six before the change. We do believe, however, that some adjustments should be made in the parallel parking east of the intersection due to the four right angle accidents. There is restricted sight distance east of the intersection for a motorist attempting to turn onto Main Street or for a motorist attempting to cross Main Street. Two parking stalls have already been removed on the north side of Main Street to improve the sight distance for southbound Kidd traffic. We recommend, however, that one additional parking stall be removed on the north side of Main Street so that parking is not allowed three stalls from the intersection. The removal of the third parking stall will make it easier for southbound Kidd traffic to see westbound Main Street traffic. Furthermore, we recommend

that the first two parking stalls on the south side of Main Street also be removed. This change in parking will greatly improve the sight distance from northbound Kidd Street easterly.

The parking problem on Kidd Street is isolated north of Main Street. There were five parking accidents on this portion of Kidd Street during the four-year study period. Location 6, Washington at Kidd Street (p. 41), which is the "T" intersection located north of the Main - Kidd Street intersection, had four parking accidents on Kidd Street. Thus, nine parking accidents were reported between 1966 and 1969 for that portion of Kidd Street between Main and Washington. Six of these accidents involved angle parking while the other three involved parallel parking. For this reason we recommend that the angle parking along this portion of Kidd Street be changed to parallel parking. This change would erase the conflict caused by vehicles backing into Kidd Street traffic and should improve the parking accident picture at this location.

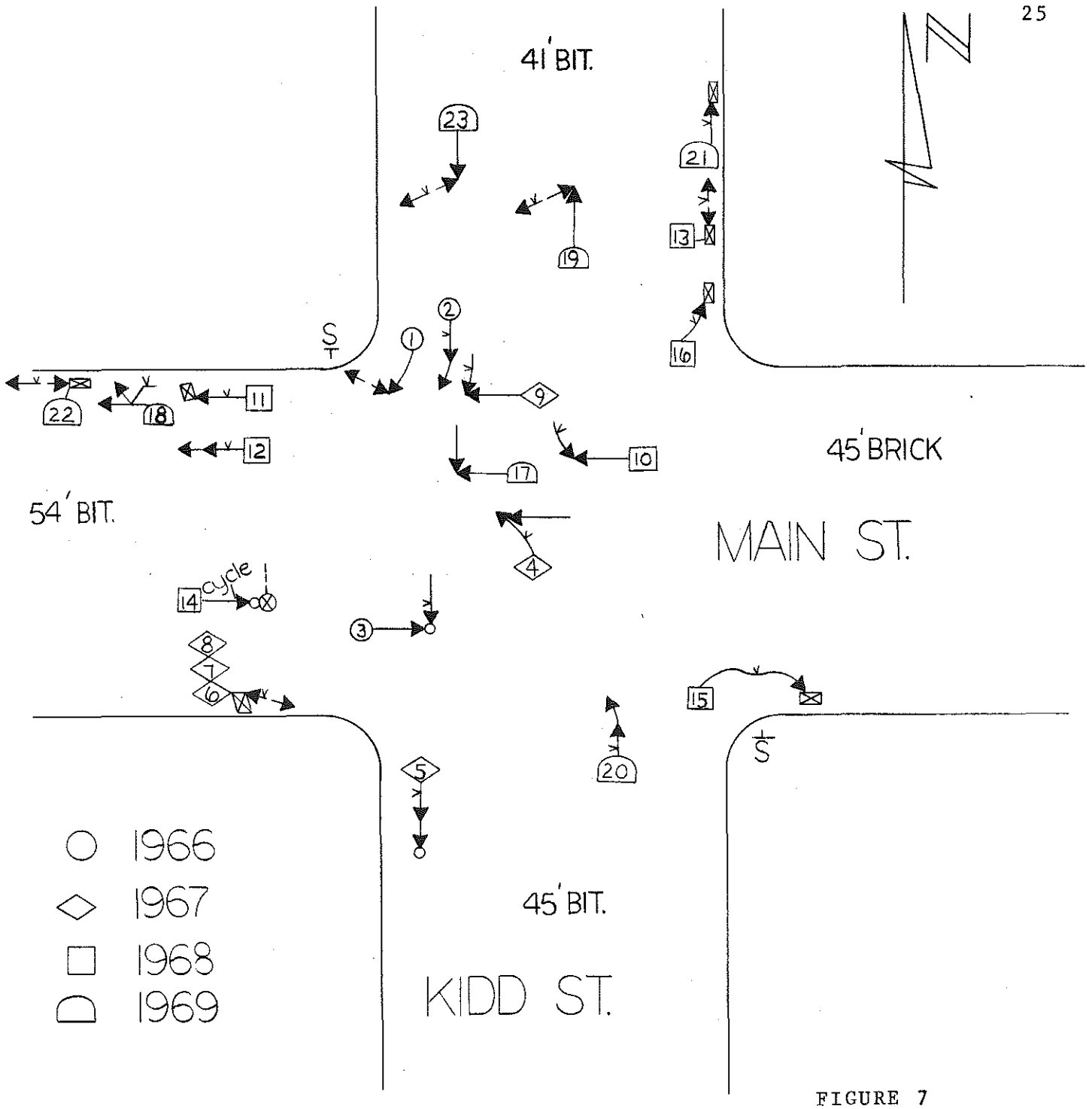


FIGURE 7

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 1969
IONIA CO. Description CITY OF IONIA
MAIN ST. at KIDD ST.
Accidents – Total 23
P.D. 20 Injury 3 (4)
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DVW Date 7-13-70 Rev.
Plan No. #2

NORTHBOUND

KIDD STREET

EASTBOUND

MAIN STREET

WESTBOUND

MAIN STREET

FIGURE 7a

3. Main Street at Steele Street

Main Street at Steele Street is a signalized intersection located in the Central Business District of Ionia. A single signal head is suspended over the center of the intersection. Main Street is a three lane 54 ft wide bituminous roadway at the intersection with an 11 ft wide center lane for left turns. The proper lane assignment for turning movements and through movements is indicated by painted arrows. There is also a sign hanging from the signal which says "center lane left turn only". Metered parallel parking is allowed on both sides of Main Street.

Steele Street is a two lane bituminous roadway with a 49 ft width south of Main Street and a 46 ft width north of Main Street. Parallel parking is allowed on the east side of Steele Street while angle parking is allowed on the west side.

There were 21 accidents at this location during the four-year study period. Parking accidents accounted for 13 of the total or approximately 60%. Eight of these parking accidents involved Main or Steele Street traffic while the five remaining parking accidents involved other parked vehicles. There were also seven rear-end accidents with six of them occurring at the signal and only one involving a parked vehicle. Together the parking and rear-end accidents accounted for nearly 96% of the total accidents over the four-year study period. From 1966 to late 1968 Main Street had angle parking. Of the nine

accidents on Main Street during this period, 67% or six of them were parking accidents. Since late 1968 when the angle parking along Main Street was changed to parallel parking, there have been seven accidents on Main Street with only two of these involving a parked vehicle.

Recommendations:

The collision diagram for this location indicates that during the four-year study period parking accidents and rear-end accidents were the predominate types. We believe that the change from angle parking to parallel parking that was instituted on Main Street in late 1968 was directly responsible for eliminating many accidents. This change eliminated the conflict that occurred with vehicles backing into traffic, and it also allowed the use of the center of the street for a separate left turn lane. We suggest a further change to remove the conflict between parked cars and cars stored in the immediate intersection area. Thus, we recommend that the first three parking stalls on all four quadrants of Main Street be removed. This change would create a right turn lane which will enable more vehicles to move through the intersection which should reduce rear-end accidents.

Also, we recommend that this intersection have two overhead signal faces visible for each approach. We realize

the cost of the extra signal may not be feasible at this time, but we recommend that two signal faces per approach be adopted as soon as possible.

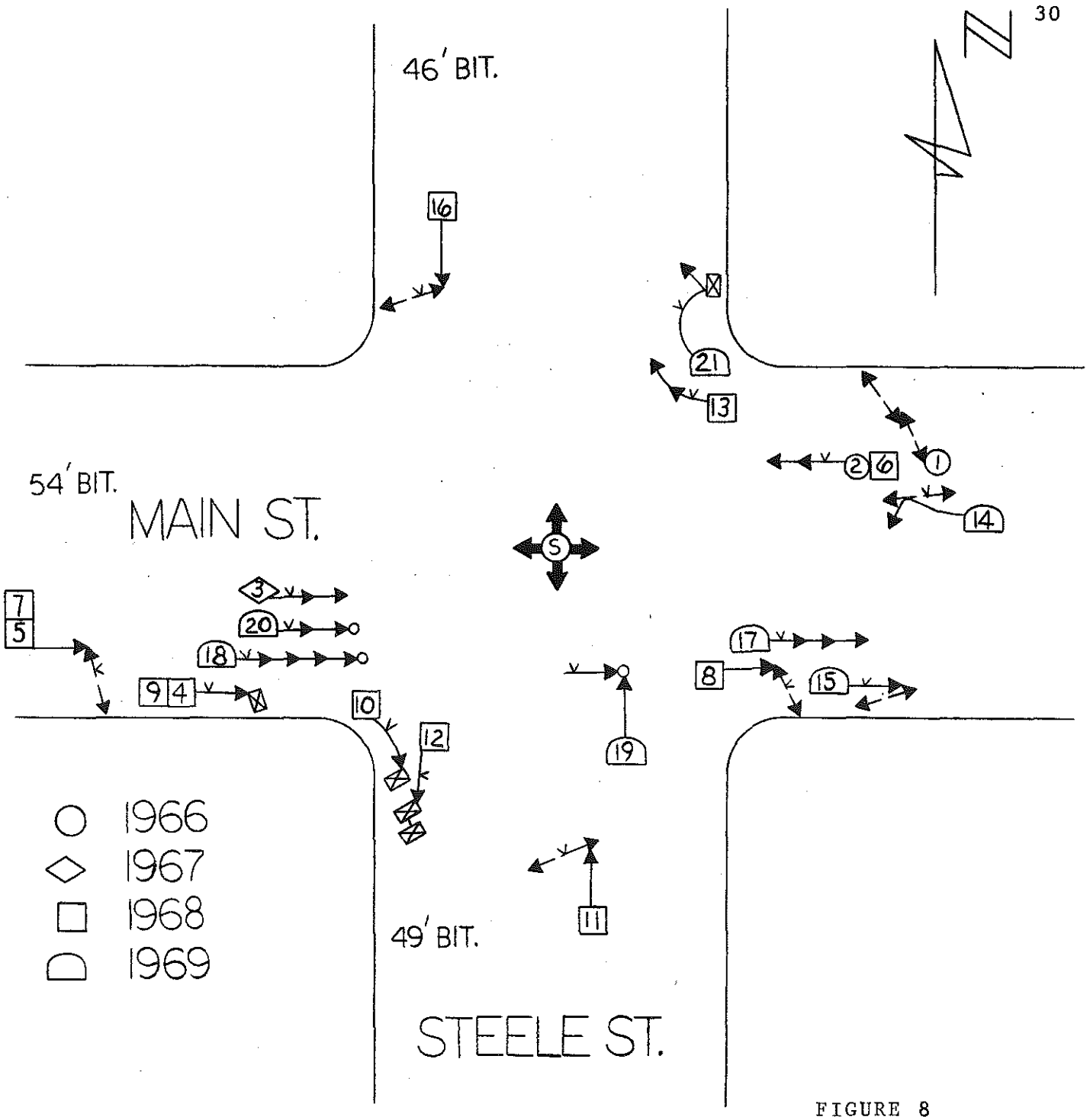


FIGURE 8

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

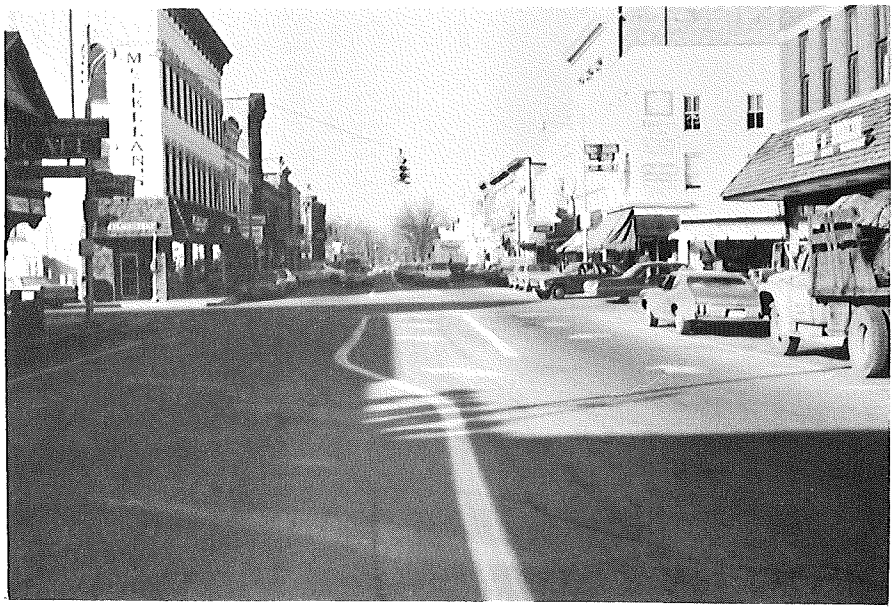
ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
IONIA CO. Description CITY OF IONIA
MAIN ST. at STEELE ST.

Accidents — Total 21 (7)
P.D. 18 Injury 3
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DVW Date 7-14-70 Rev.
Plan No. #3

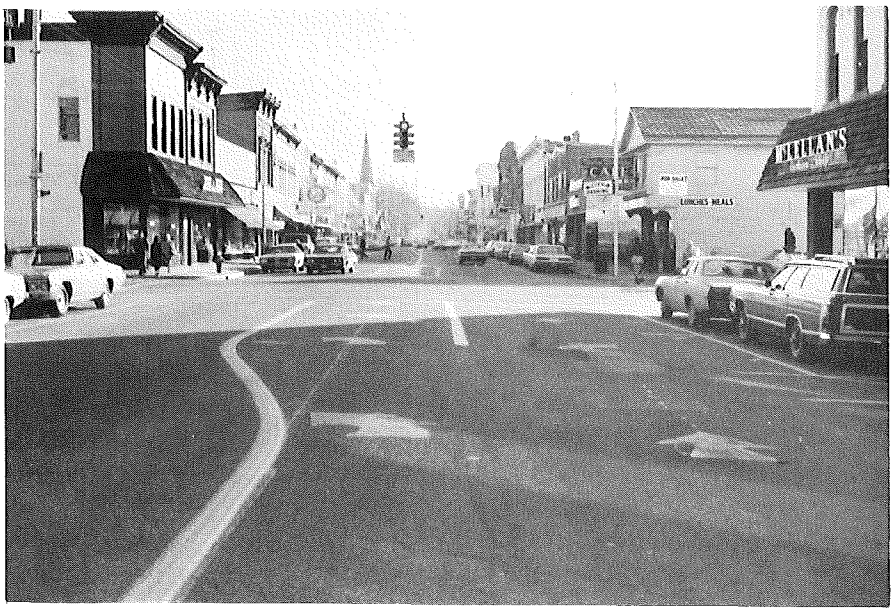
NORTHBOUND

STEELE STREET



WESTBOUND

MAIN STREET



EASTBOUND

MAIN STREET

FIGURE 8a

4. Washington Street at Jackson Street

Washington Street at Jackson Street is a four-way stop intersection in a residential area. This location was converted to a four-way stop intersection December 9, 1969. Before this date Jackson Street was required to stop, giving Washington Street the right of way. The four stop signs at the intersection are all 36 in. signs (R1-1-36, Appendix II, p. 77).

Washington Street is a two lane 30 ft bituminous roadway that is in good condition. Parking is prohibited on the south side of Washington and is allowed on the north side.

Jackson Street is a two lane 30 ft bituminous roadway north of the intersection and a two lane 38 ft concrete roadway south of the intersection. Parking is not prohibited on Jackson Street.

There were 16 accidents at this location during the four-year study period. Eight of the 16 accidents or 50% involved running the stop signs on Jackson Street when Washington Street had the right of way. The remaining eight accidents consisted of two rear-ends, one head-on left turn, one parking accident, one sideswipe and three accidents involving parked cars. The four-way stop street was created in an attempt to reduce the angle accidents at this location. We feel that this was the only course of action short of signalization. We suggest that future accident records be checked at this location to determine the effectiveness of the

additional stop signs for Washington Street.

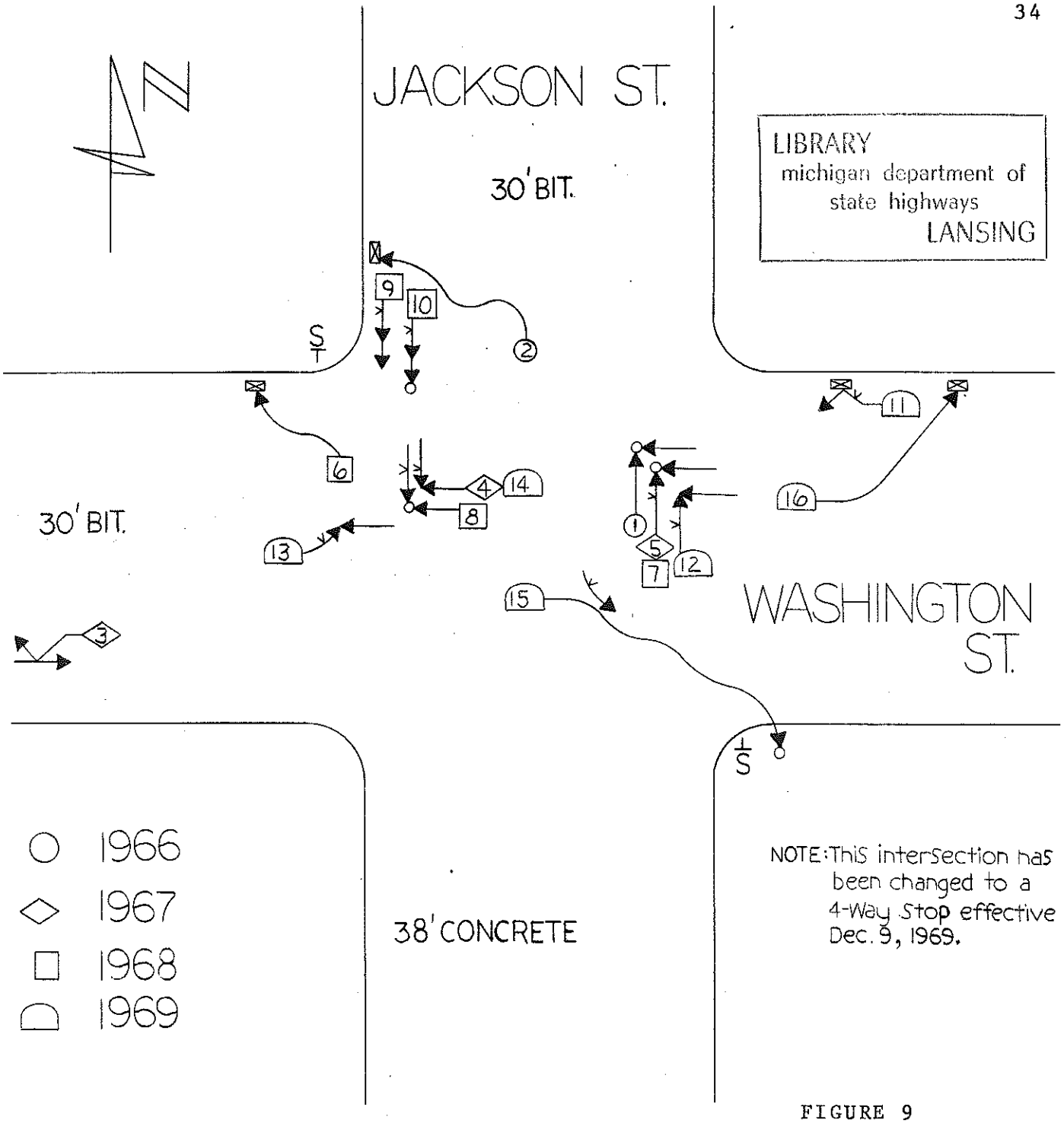


FIGURE 9

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

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

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

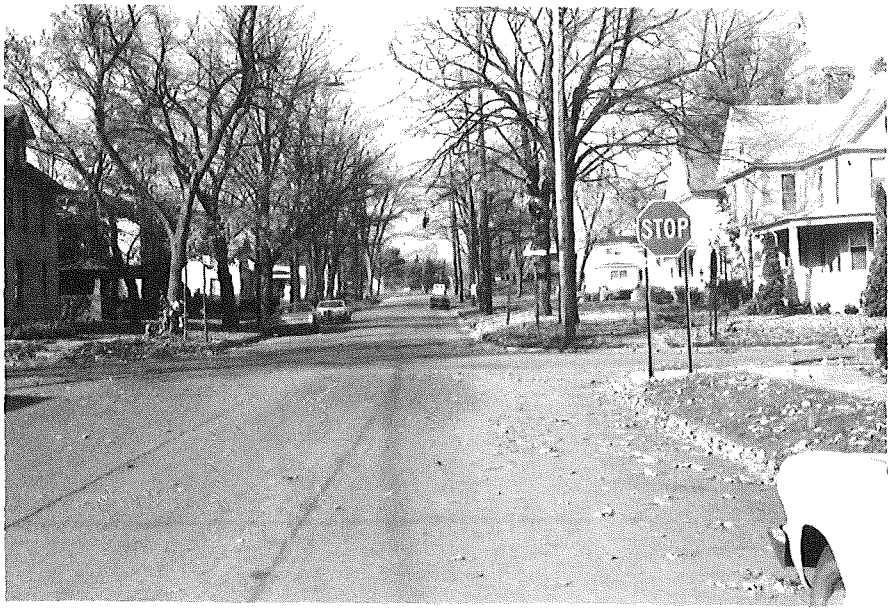
ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969

IONIA CO. **Description** CITY OF IONIA

WASHINGTON ST. at JACKSON ST.

Accidents – Total 16 (9)
P.D. 10 **Injury** 6
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. **Miles**
Drawn DVW **Date** 6-17-70 **Rev.**
Plan No. #4



NORTHBOUND

JACKSON STREET

WESTBOUND

WASHINGTON STREET

FIGURE 9a

5. Main Street at Mill Street

Main Street and Mill Street form a "T" intersection in a residential area. Main Street is a 24 ft wide brick roadway and Mill Street is a two lane 31 ft wide bituminous roadway. A grocery store is located in the southwest quadrant and a parking lot for the store is located in the southeast quadrant. Parking is prohibited on Main Street except for three stalls located in front of the grocery store. Mill Street has angle parking (four stalls) on the west side of the street in conjunction with the parking lot in the southeast quadrant.

The collision diagram for this location indicates 14 reported accidents during the study period. Eight of these accidents or 57% were parking accidents with seven of these involving the angle parking on Mill Street. The remaining six accidents were composed of three rear-ends, one ran-off roadway, one head-on left turn and one accident involving a pedestrian.

Recommendations:

Due to the fact that seven of the 14 reported accidents involved the angle parking next to the grocery store, we recommend that parking be prohibited in this area. We do not feel that there is adequate space for angle or parallel parking in this area. The lack of space creates a conflict

between the parked cars and the traffic on Mill Street. If parking is prohibited in this area, it will affect only four parking stalls. We do not feel this will be a hardship for the grocery store since there is a parking lot located directly across the street.

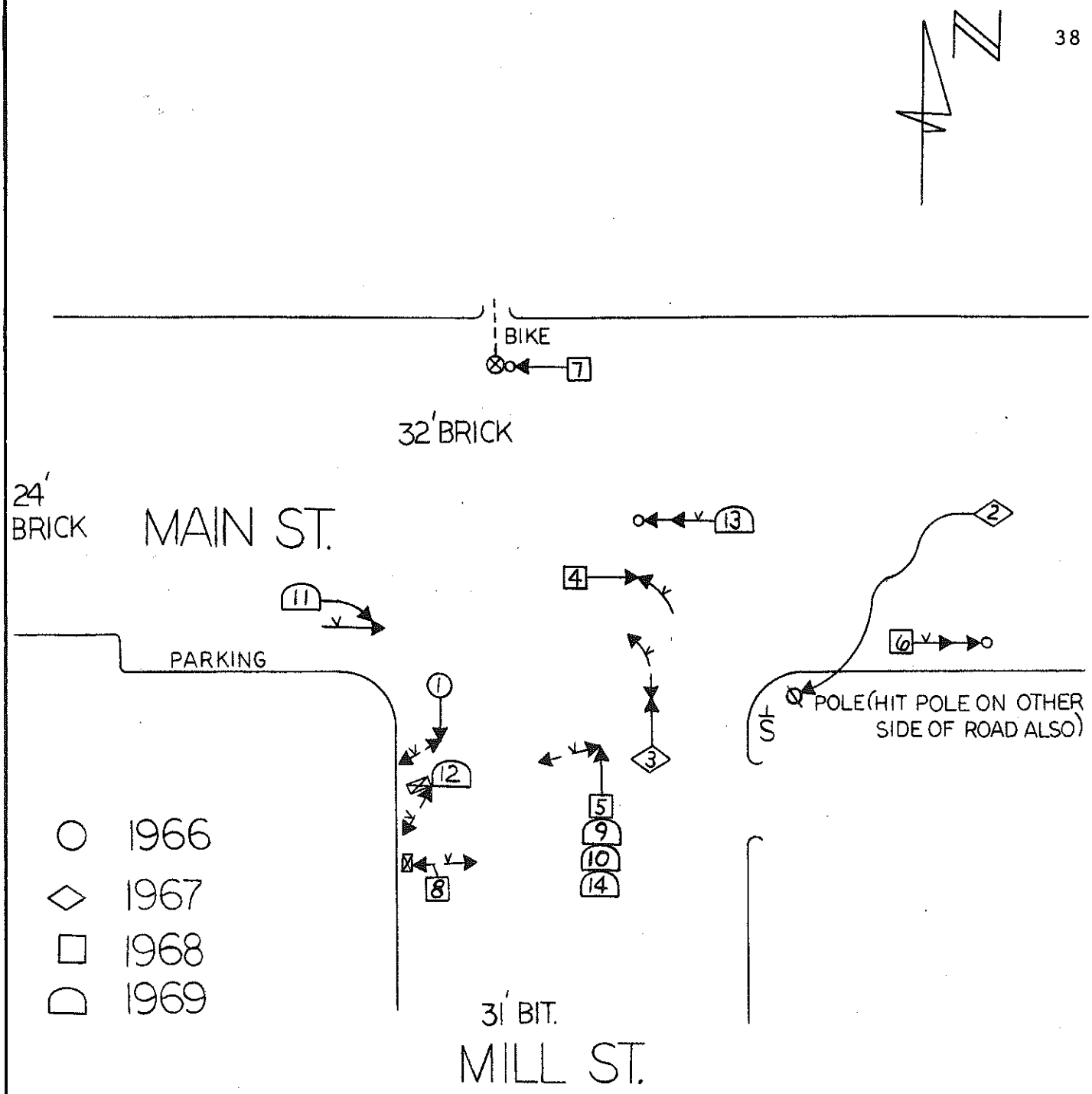


FIGURE 10

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
Deer
Violator
Out of Control
Driver Intent

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
IONIA CO. Description CITY OF IONIA
MAIN ST. at MILL ST.

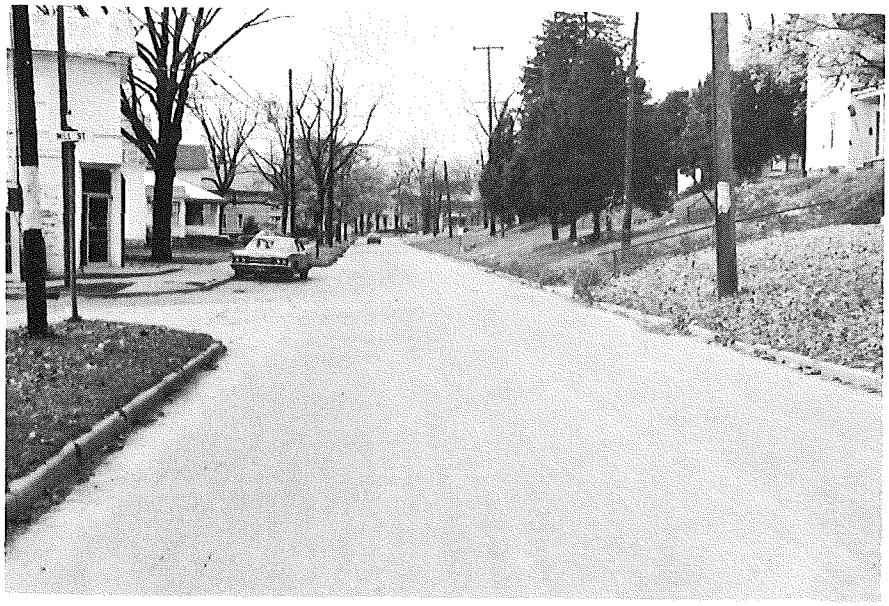
Accidents – Total 14
P.D. 11 Injury 3 (3)
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DVW Date 6-19-70 Rev.
Plan No. #5

NORTHBOUND

MILL STREET

EASTBOUND

MAIN STREET



WESTBOUND

MAIN STREET

FIGURE 10a

LOOKING NORTH
AT ANGLE PARKING
ALONG MILL STREET

LOOKING SOUTH
AT ANGLE PARKING
ALONG MILL STREET

PARKING LOT
ACROSS FROM
GROCERY STORE

FIGURE 10b

6. Washington Street at Kidd Street

Washington Street at Kidd Street is a "T" intersection. Kidd Street is the stop street and has a 24 in. stop sign (R1-1-24, Appendix II, p. 77).

Washington Street is a two lane 29 ft bituminous roadway east of the intersection and a two lane 31 ft bituminous roadway west of the intersection. Parking is prohibited on the north side of Washington Street and on the south side of Washington west of the intersection. Metered parking is allowed on the south side of Washington east of the intersection. This parking creates a sight distance problem for motorists on northbound Kidd Street who want to turn onto westbound Washington.

Kidd Street is a two lane 40 ft wide bituminous roadway that is in excellent condition. Metered angle parking is allowed on the west side of Kidd Street while parking is prohibited on the east side in the immediate intersection area.

The collision diagram for this location shows 12 accidents during the four-year study period. Six of these accidents or 50% involved a parked vehicle. Four of these six accidents occurred on the west side of Kidd Street where there is angle parking. The remaining accidents consisted of three right angle accidents, two rear-ends and one improper turn.

Recommendations:

We have already recommended in conjunction with Location 2 that the angle parking on the west side of Kidd Street be changed to parallel parking. We feel, however, that a further parking recommendation is necessary at this location to improve the sight distance for northbound Kidd Street traffic looking easterly on Washington Street. Thus, we recommend that the first three parking stalls on the south side of Washington Street east of the intersection be removed. There were three accidents at this location during the study period that could be attributed to the restricted sight distance. We feel that removing the three parking stalls will sufficiently improve the sight distance so that future angle or turning accidents at this location will be reduced.

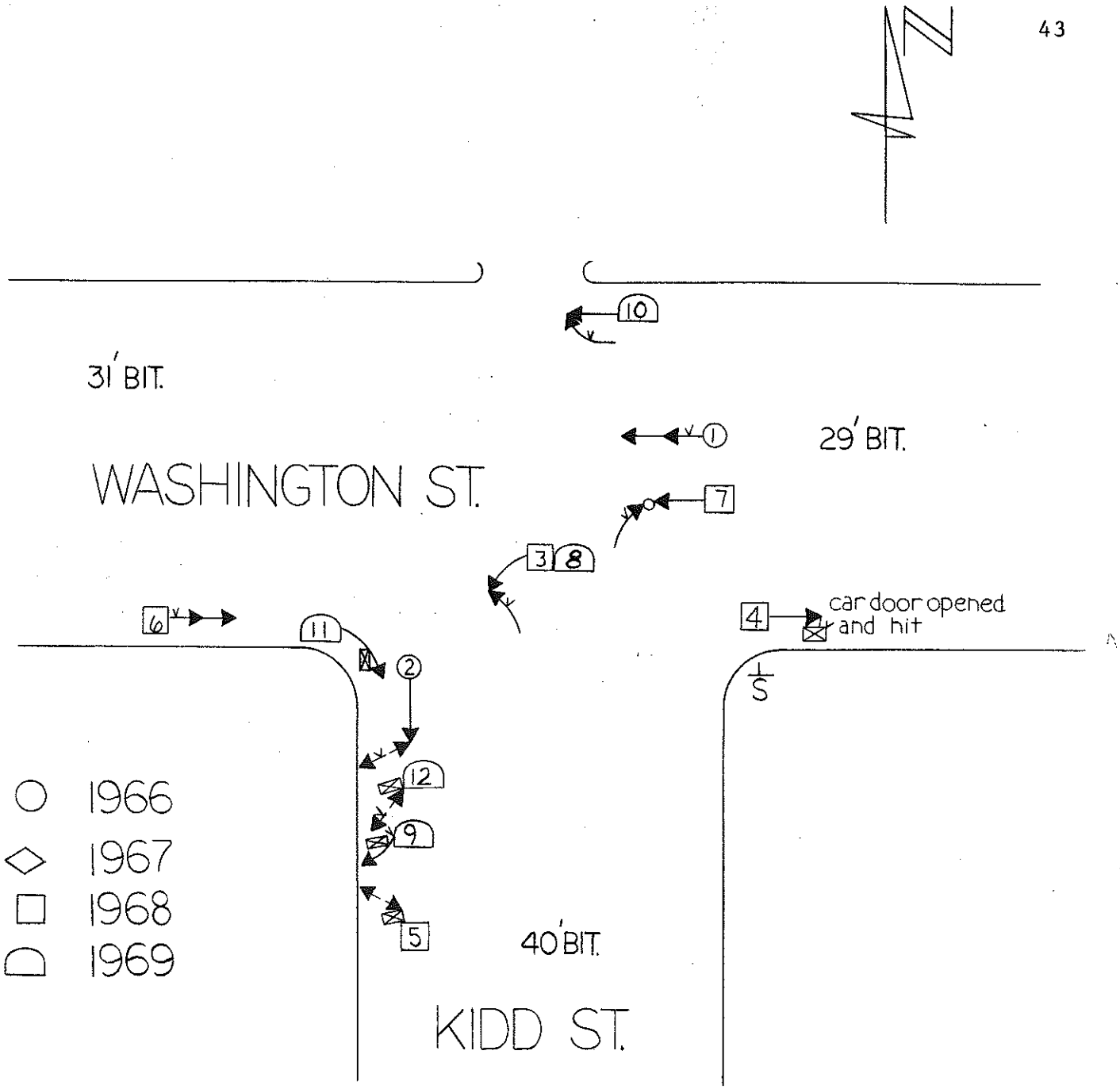


FIGURE 11

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 1969

IONIA CO. Description CITY OF IONIA
WASHINGTON ST. at KIDD ST.

Accidents – Total 12 (1)
P.D. 11 Injury 1
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm

C.S. Miles

Drawn DVW Date 6-19-70 Rev.

Plan No. # 6

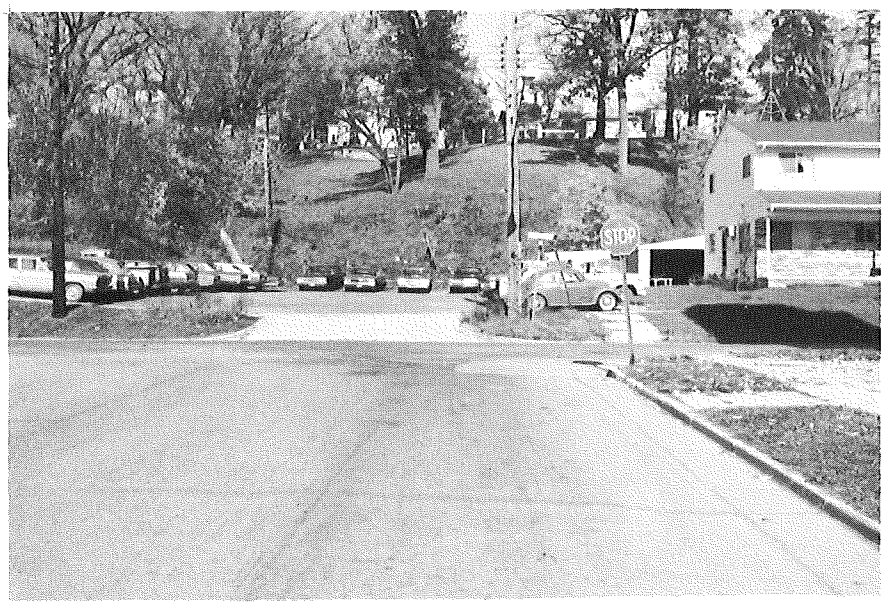
EASTBOUND

WASHINGTON STREET

WESTBOUND

WASHINGTON STREET

FIGURE 11a



NORTHBOUND

KIDD STREET

SOUTHBOUND

FROM PARKING LOT

FIGURE 11b

7. Washington Street at Depot Street

Washington Street at Depot Street is a "T" intersection in the Central Business District of Ionia. Depot Street is the stop street and has a 24 in. stop sign (R1-1-24, Appendix II, p. 77).

Washington Street is a two lane 36 ft wide bituminous roadway. Parking is prohibited on the north side of Washington while metered parking is allowed on the south side. The first two parking stalls on the south side of Washington starting from the southeast corner are restricted to 15 minute parking from 8 a.m. to 8 p.m. due to a loading zone for the Plaza Hotel.

Depot Street is a two lane 47 ft wide bituminous roadway with a plus gradient in the northerly direction. Metered parallel parking is allowed on the east side of Depot Street while metered angle parking is allowed on the west side. The sight distance from Depot Street for a motorist turning onto east or westbound Washington is poor due to parked cars on the south side of Washington.

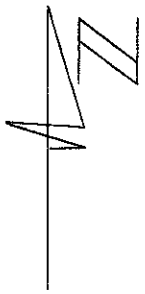
Ten out of the 11 accidents at this location during the four-year study period involved parked cars. The lone remaining accident was a right angle collision. Out of the ten accidents involving parked cars, eight of them occurred on Depot Street. Five of the accidents on Depot Street occurred on the west side (angle parking) and three occurred

on the east side (parallel parking).

Recommendations:

Due to the fact that there were eight parking-related accidents on Depot Street with five occurring where there is angle parking, we recommend that the angle parking be changed to parallel parking. This will eliminate the conflict that exists between Depot Street traffic and vehicles backing out of their parking stalls. Also, because of the extra road width available to Depot Street traffic, there will be less conflict between these vehicles and motorists entering or exiting their parallel parking stalls.

Another problem at this location is the sight distance from Depot Street to east or westbound Washington Street. Although there was only one accident during the four-year study period that could be attributed to this problem, a potential hazard does exist. The sight distance is poor due to the parking stalls on Washington in the immediate intersection area and the plus gradient in the northerly direction. Thus, to help prevent further right angle accidents at this location, we recommend that the first two parking stalls located on Washington Street east and west of Depot Street be removed.



36' BIT.

WASHINGTON ST.

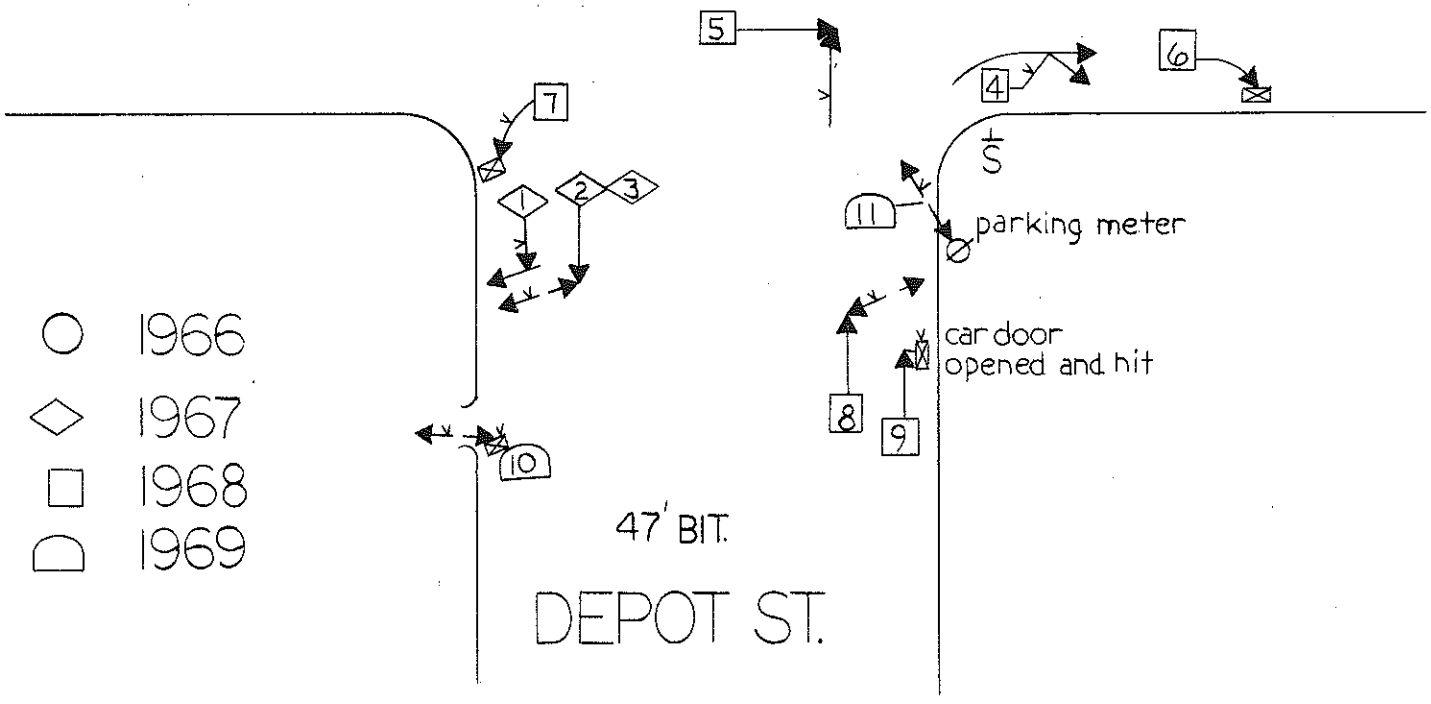


FIGURE 12

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

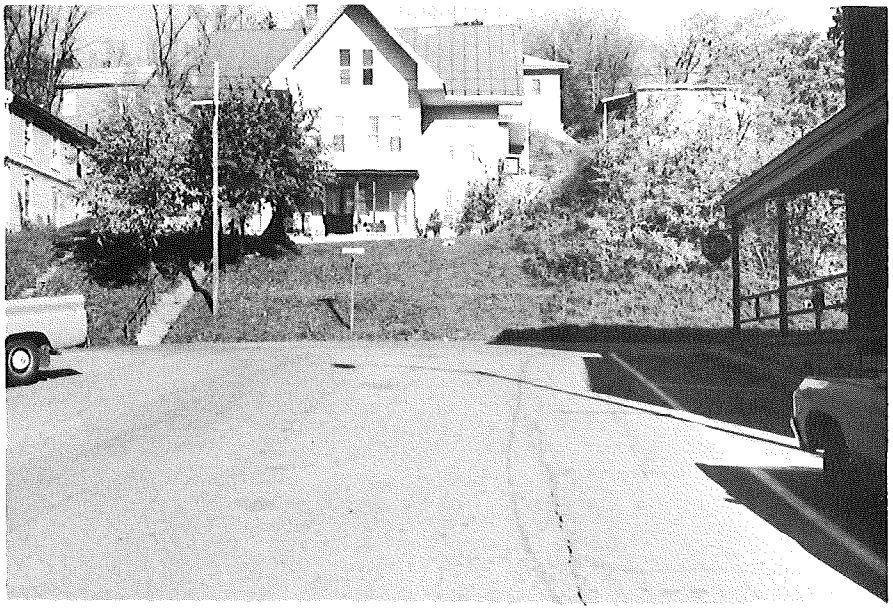
Stop & Go Signal — S — R — Y — F — Y
Flashing Beacon
Stop Sign S
Yield Sign Y

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

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
IONIA CO. Description CITY OF IONIA
WASHINGTON ST. at DEPOT ST.

Accidents – Total 11
P.D. 10 Injury 1 (1)
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DVW Date 6-17-70 Rev.
Plan No. #7



NORTHBOUND

DEPOT STREET

WESTBOUND

WASHINGTON STREET

EASTBOUND

WASHINGTON STREET

FIGURE 12a

8. Washington Street at Rich Street (see Appendix I, p. 67)

Total	P.D.	Inj.	Fatal
9	4	5	0

9. Main Street at Cleveland Street

Main Street and Cleveland Street form a "T" intersection with Main Street having the right of way. Main Street has a two lane 30 ft wide bituminous roadway east of Cleveland Street and a two lane 24 ft wide bituminous pavement west of Cleveland Street. Main Street has curb and gutter which along with the roadway is in excellent condition. Parking is prohibited on both sides of Main Street west of the intersection and on the north side of Main Street east of the intersection. Two hour parking is allowed from 8:00 a.m. to 5:00 p.m. for the south side of Main Street east of the intersection.

Cleveland Street has a two lane 24 ft wide bituminous pavement that is in good condition. There is a railroad crossing 400 ft from the intersection that is marked with railroad crossing signs and flashing signals. Yellow center-line markings extend from the intersection to the railroad tracks.

The existing traffic controls consist of a 24 in stop sign (R1-1-24, Appendix II, p. 77) for northbound Cleveland Street traffic and a 36 in. bi-directional target arrow located at the end of Cleveland Street.

There were nine accidents at this location during the four-year study period. The accidents were composed of three improper backing, two ran-off roadway, one improper turn, one failure to yield, one angle and one accident involving a pedestrian. Both ran-off roadway accidents occurred at the end of Cleveland Street and both happened at night on wet pavement.

Recommendation:

Due to the fact that three of the accidents at this location involved vehicles failing to yield the right of way, we recommend that the 24 in. stop sign be replaced by a 36 in. sign (see Part I, Section B, p. 14 of the Manual - Appendix II, p. 77).

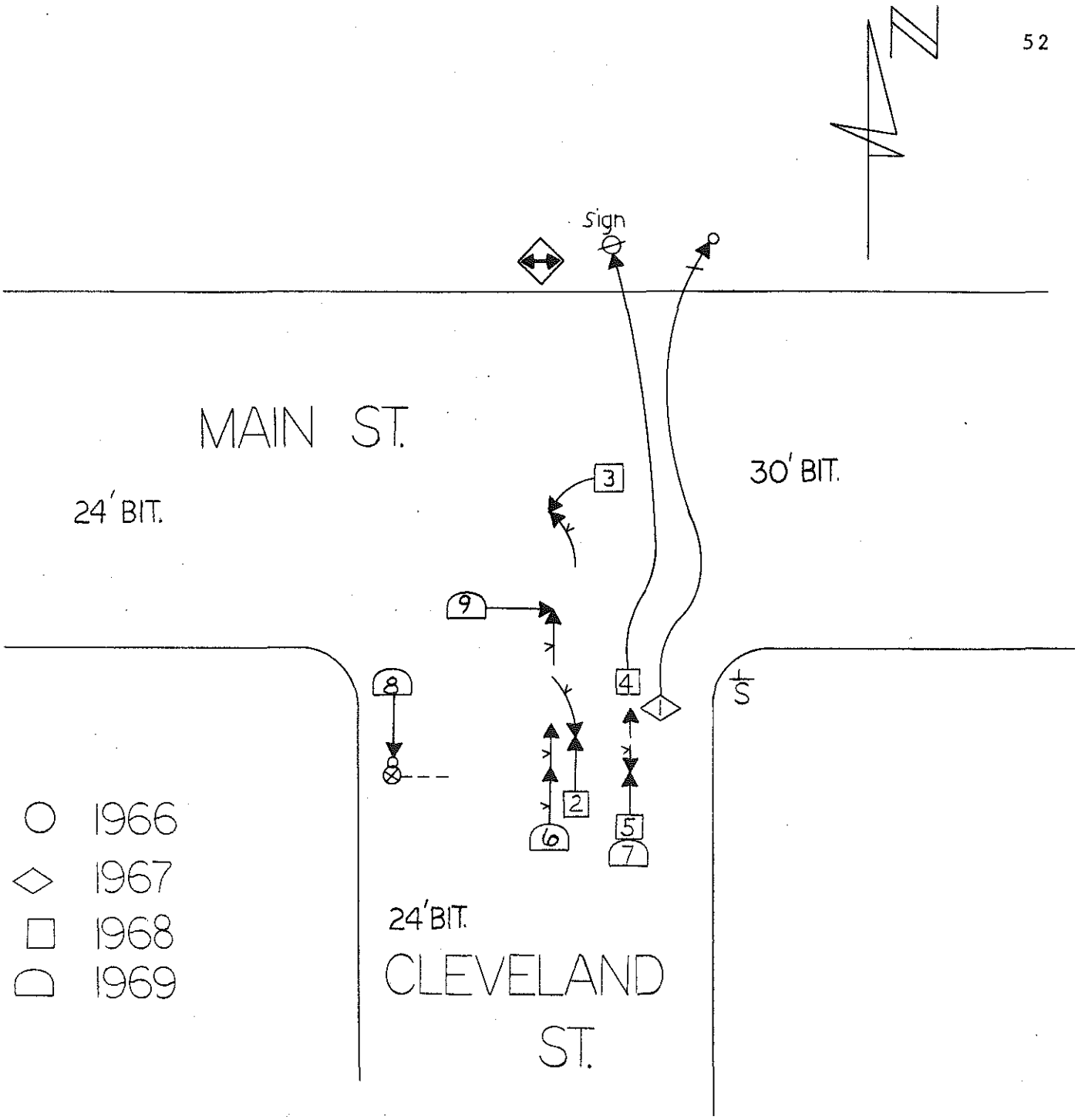


FIGURE 13

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
Traffic Division

LEGEND

Stop & Go Signal — S R Y F Y
Flashing Beacon

Stop Sign S
Yield Sign Y

Fatal —●
Injury —○
Skidding ○○○→
Jackknife —<

Overturned
Backing ← →
Pedestrian - - - - (X)
Tree

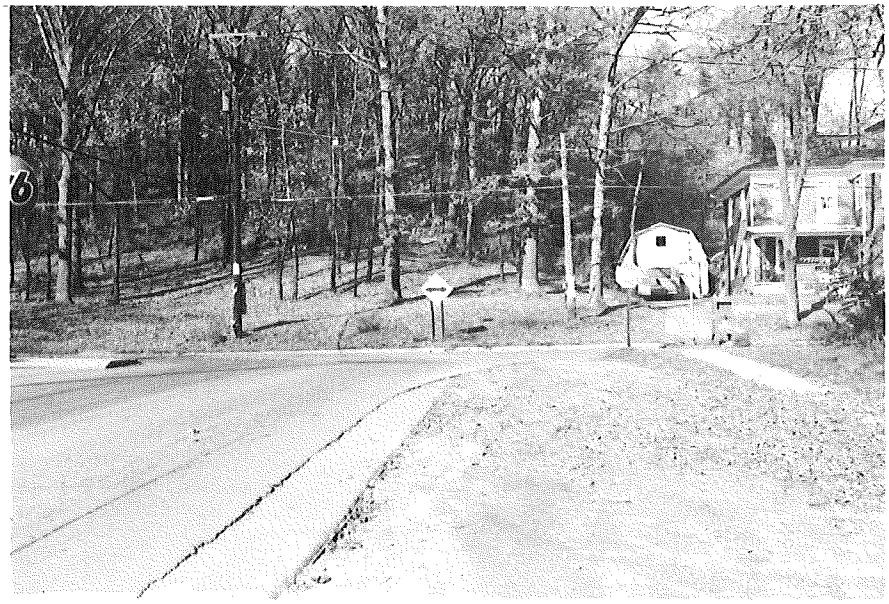
Out of Control
Driver Intent
Deer
Violator (V)

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
IONIA CO. Description CITY OF IONIA

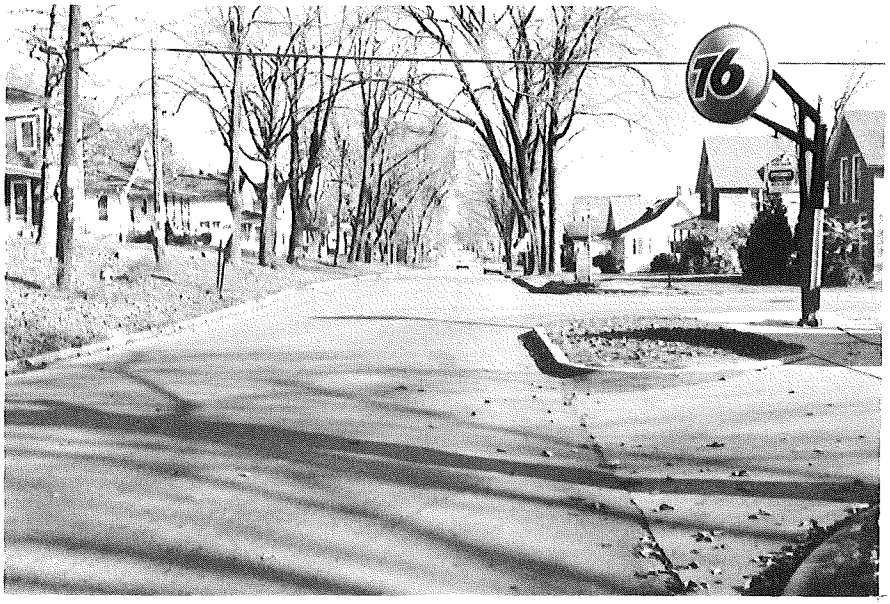
Accidents — Total 9 (3)
P.D. 7 Injury 2
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm

C.S. Miles
Drawn DVW Date 6-22-69 Rev.
Plan No. #9



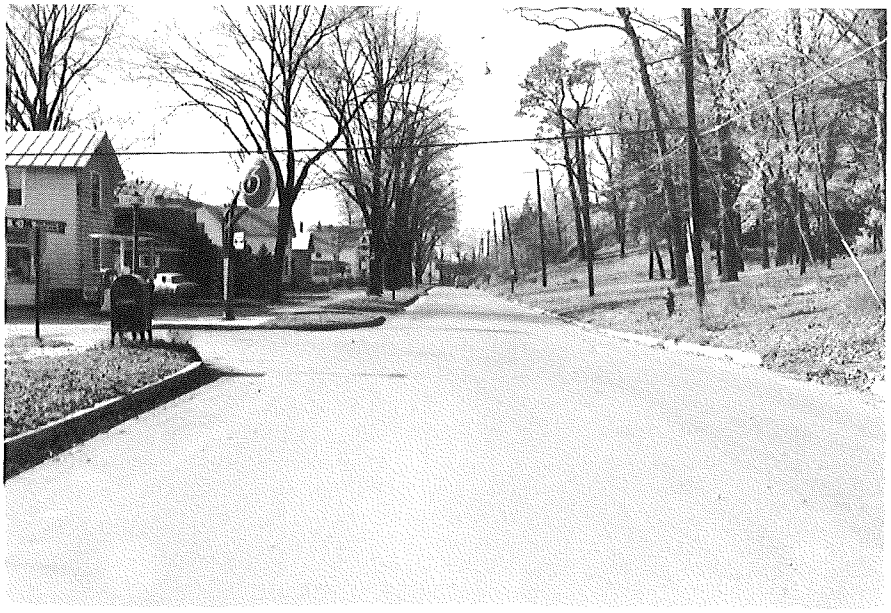
NORTHBOUND

CLEVELAND STREET



EASTBOUND

MAIN STREET



WESTBOUND

MAIN STREET

FIGURE 13a

10. Adams Street at Depot Street (see Appendix I, p. 69)

Total	P.D.	Inj.	Fatal
8	8	0	0

11. Washington Street at Union Street (see Appendix I, p. 72)

Total	P.D.	Inj.	Fatal
8	8	0	0

12. Washington Street at Steele Street

Washington Street at Steele Street is a "T" intersection in the Central Business District of Ionia. Steele Street is the stop street and has a 24 in. stop sign (R1-1-24, Appendix II, p. 77). Washington Street is a two lane 38 ft wide bituminous roadway. Parking is prohibited on the north side of Washington while metered parking is allowed on the south side except for a distance of 35 ft from the southwest corner and 40 ft from the southeast corner. Parking was prohibited along these two short stretches of Washington in an attempt to alleviate the sight distance problem for northbound Steele traffic.

Steele Street has a two lane 48 ft bituminous pavement. Parallel parking is allowed on the east side of Steele while angle parking is allowed on the west side. There is a city parking lot in the southeast corner, a two story building

in the southwest corner and a service station at the end of Steele Street.

The collision diagram for this location indicates six accidents during the four-year study period. The six accidents were broken down as follows: three right angle accidents, two parking accidents and one head-on left turn accident.

Recommendations:

The sight distance for northbound Steele Street traffic attempting to turn onto east or westbound Washington Street is very poor. Contributing factors to the poor sight distance are the building located in the southwest corner and the parking stalls on the south side of Washington in the immediate intersection area. In all three of the reported right angle accidents the motorist on Steele Street said he did not see the vehicle he struck. Even though 35 ft of parking has been removed on the west side of Steele and 40 ft has been removed on the east side, we recommend that a total of 75 ft be removed on both sides. This removal of parking will provide the motorist stopped on Steele Street a better opportunity to see east and westbound Washington traffic.

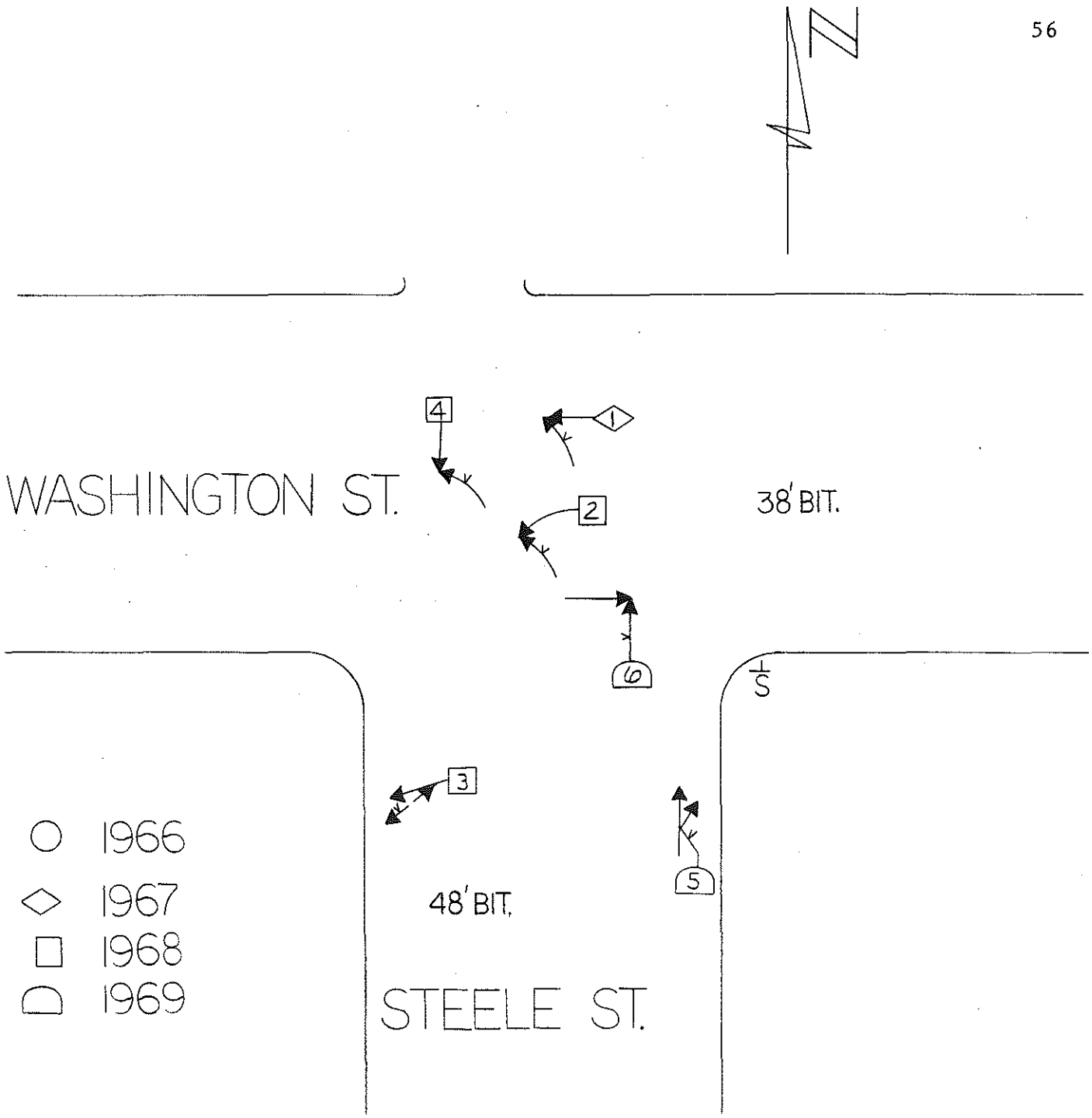


FIGURE 14

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

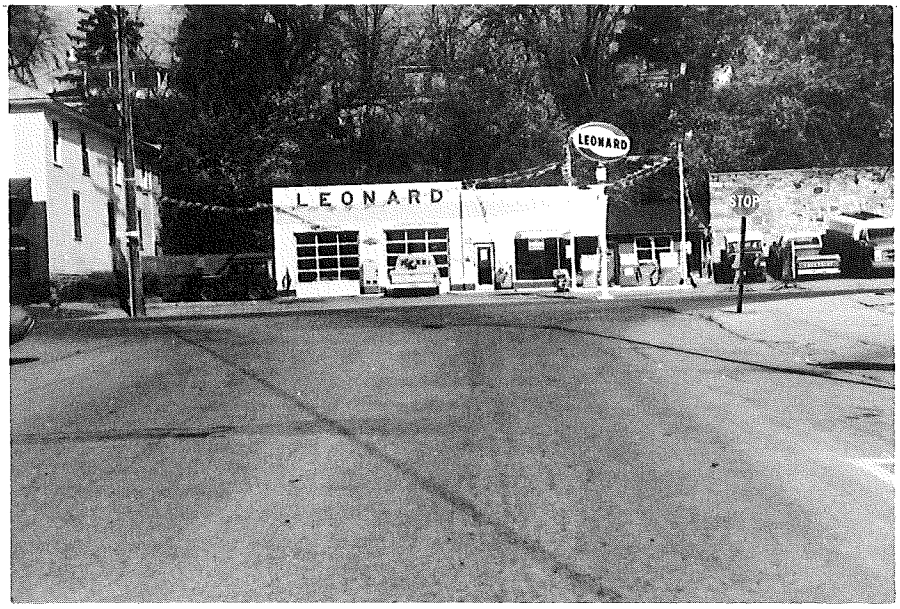
ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969

IONIA CO. Description CITY OF IONIA

WASHINGTON ST. at STEELE ST.

Accidents – Total 6 ( )
P.D. 6 Injury 0
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DVW Date 6-23-70 Rev.
Plan No. # 12



NORTHBOUND

STEELE STREET

EASTBOUND

WASHINGTON STREET

WESTBOUND

WASHINGTON STREET

FIGURE 14a

SUMMARY

There was a total of 838 reported traffic accidents in the City of Ionia during the study period 1966 through 1969 for an average of about 209 accidents per year. The 12 high accident locations on city streets accounted for 185 of the total reported accidents in the city during the four-year study period. This figure is 22% of the reported accidents. Table 1, found on the following page, contains some interesting data on the reported traffic accidents in the City of Ionia and on the vehicle registrations in Ionia County. Reported traffic accidents in the City of Ionia increased through 1968 with the greatest increase occurring between 1966 and 1967. The total accidents decreased 7.4% in 1969. This decrease was also reflected on Ionia County routes where accidents decreased 1.4% in 1969. These decreases are impressive when one considers that the vehicle registrations went up almost 7% in Ionia County in 1969.

To further document the various facts present at the 12 high accident locations, the following tables were prepared to tabulate and chart specific data.

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

Table 1

REPORTED TRAFFIC ACCIDENTS IN THE CITY OF IONIA

Year	Total	Property Damage	Injury	Fatal	Persons Injured	Persons Killed
1966	93	76	16	1	23	1
1967	315	259	54	2	76	2
1968	379	303	76	0	113	0
1969	351	286	64	1	96	1

COMPARISON OF ACCIDENT FREQUENCY

	Ionia City Streets	Ionia County Roads	Total Accidents State of Mich.
1966	93	658	302,880
1967	315	862	299,004
1968	379	553	305,495
1969	351	545	331,223

1966-67	238.7	31.0	-1.3
1967-68	20.3	-35.8	2.2
1968-69	-7.4	-1.4	8.4

VEHICLE REGISTRATIONS IN IONIA COUNTY

Year	Pass.	Comm.	Farm Vehicle	Trailer	Trailer Coach	Motor Cycles	Muni-cipal	Total Plates
1966	16,815	-	-	-	-	-	-	25,317
1967	16,990	3,434	597	2,979	512	639	1	25,152
1968	17,463	3,831	603	3,109	575	759	21	26,361
1969	18,384	4,753	-	4,123	-	865	10	28,135

Table 2 shows that the peak accident month was December with September, October and December together accounting for almost 40% of the accidents. The peak days were Wednesday, Friday and Saturday which together comprise 55% of the total accidents.

The information summarized in Table 3 shows that of the 185 accidents at the 12 high accident locations during the study period, only 26 resulted in personal injury while 159 resulted in property damage. The low number of personal injury accidents is accounted for by the high number of parking accidents (84) which usually do not produce an injury. There were no fatal accidents during the four-year study period at the 12 high accident locations.

Table 4 shows the peak accident hour as 4:00 to 5:00 p.m. (13.6%) with the next closest hour being 10:00 a.m. to 11:00 a.m. (10.8%). Tables 5 and 6 contain the age and residence of the drivers involved in the accidents while Tables 7 and 8 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 2

MONTHLY AND DAILY ACCIDENT OCCURRENCE

TWELVE HIGH ACCIDENT LOCATIONS IN THE CITY OF IONIA

Period Studied: 1966 through 1969

Month	Day of the Week							Monthly Total	% Of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
January	2	2	1	2	2	3	1	13	7.0
February	1	1	2		2	2	1	9	4.9
March	7	1	1		3	3		15	8.1
April		1	2		4	2		9	4.9
May	1	1	1	3	2		2	10	5.4
June	1	1	3	1	8	4		18	9.7
July	1	2	1	1	2	4	2	13	7.0
August	2	1	1	2	2		1	9	4.9
September		2	5	3	2	7	3	22	11.9
October	4	3	6	3	3	2	1	22	11.9
November	3		8	1	2	2		16	8.6
December	9	6	3	1	2	5	3	29	15.7
Day Total	31	21	34	17	34	34	14	185	100.0
% of Total	16.7	11.3	18.4	9.2	18.4	18.4	7.6	100.2	100.0

Peak Accident Day: Wednesday, Friday and Saturday

Peak Accident Month: December

ACCIDENT ANALYSIS

Table 3

ANNUAL ACCIDENT SUMMARY

TWELVE HIGH ACCIDENT LOCATIONS IN THE CITY OF IONIA

Period Studied: 1966 through 1969

Accident Type	Day	Night	Total
Fatal Accident			
Personal Injury Acc.	16	10	26
Property Damage Acc.	129	30	159
Total	145	40	185

Month	Fatal		Injury		Prop. Damage		Sub. Total		Total
	Day	Night	Day	Night	Day	Night	Day	Night	
January					9	4	9	4	13
February					6	3	6	3	9
March				1	9	5	9	6	15
April				1	8		8	1	9
May			1		9		10		10
June				2	13	3	13	5	18
July			2	1	10		12	1	13
August				1	7	1	7	2	9
September			6	2	11	3	17	5	22
October			2		16	4	18	4	22
November			2	2	9	3	11	5	16
December			3		22	4	25	4	29
S. Total			16	10	129	30	145	40	185
Total			26		159		185		185

ACCIDENT ANALYSIS

Table 4

DAILY AND HOURLY ACCIDENT OCCURRENCE

TWELVE HIGH ACCIDENT LOCATIONS IN THE CITY OF IONIA

Period Studied: 1966 through 1969

Hour	Day of the Week							Hour Total	% of Total
	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.		
12 - 1AM	1					2		3	1.6
1 - 2AM									
2 - 3AM			1					1	0.5
3 - 4AM							1	1	0.5
4 - 5AM	1	1					1	3	1.6
5 - 6AM	1							1	0.5
6 - 7AM					1			1	0.5
7 - 8AM			1					1	0.5
8 - 9AM	1		2				1	4	2.3
9 - 10AM	5		1					6	3.2
10 - 11AM	4	2	6	1	3	2	2	20	10.8
11 - 12AM	1		1	3	4	4	1	14	7.6
12 - 1PM	5	2	2		2	5		16	8.6
1 - 2PM	3	2	2	3	1	1		12	6.5
2 - 3PM	5	1	2		2	1		11	5.9
3 - 4PM	3	1	3	1	4	4	1	17	9.2
4 - 5PM		5	6	5	4	3	2	25	13.6
5 - 6PM		1	1	2	3	2		9	4.9
6 - 7PM		1	1		1	1		4	2.3
7 - 8PM		1	1		1	2	1	6	3.2
8 - 9PM		2	1	1	4	1	2	11	5.9
9 - 10PM		1			2	2		5	2.7
10 - 11PM	1	1	1	1		1		5	2.7
11 - 12PM			2		2	3	2	9	4.9
Not Stated									
Day Total	31	21	34	17	34	34	14	185	100.0
% of Total	16.7	11.3	18.4	9.2	18.4	18.4	7.6	100.2	100.0

Peak Accident Hour: 4 - 5 p.m.

Peak Accident Day: Wednesday, Friday and Saturday

Table 5

AGE OF DRIVERS INVOLVED IN ACCIDENTS

TWELVE HIGH ACCIDENT LOCATIONS IN THE CITY OF IONIA

Period Studied: 1966 through 1969

Age Group	Number of Drivers Involved in				Percent
	Fatal	Injury	Prop. Damage	Total	
Under 16					
16-19		18	64	82	22.8
20-24		10	44	54	15.0
25-34		4	54	58	16.1
35-44		6	37	43	11.9
45-54		5	39	44	12.2
55-64		2	35	37	10.3
65-74		1	22	23	6.4
75 & Over		1	17	18	5.0
Not Stated			1	1	0.3
Total		47	313	360	100.0

Table 6

RESIDENCE OF DRIVERS INVOLVED IN ACCIDENTS

Residence	Number of Drivers Involved in				Percent
	Fatal	Injury	Prop. Damage	Total	
City		24	166	190	52.9
County		17	107	124	34.4
Michigan		6	37	43	11.9
Out of State			3	3	0.8
Not Stated					
Total		47	313	360	100.0

Table 7

WEATHER CONDITIONS AT SCENE OF ACCIDENTS

TWELVE HIGH ACCIDENT LOCATIONS IN THE CITY OF IONIA

Period Studied: 1966 through 1969

Weather	Severity of Accident				Percent
	Fatal	Injury	Prop. Damage	Total	
Clear or Cloudy		18	132	150	81.1
Rain		6	13	19	10.3
Fog		1		1	0.5
Snow or Sleet			14	14	7.6
Not Stated		1		1	0.5
Total		26	159	185	100.0

Table 8

PAVEMENT CONDITIONS AT SCENE OF ACCIDENTS

Pavement	Severity of Accident				Percent
	Fatal	Injury	Prop. Damage	Total	
Dry		17	109	126	68.2
Wet		6	29	35	18.9
Snowy/Icy		1	19	20	10.8
Icy		1	2	3	1.6
Not Stated		1		1	0.5
Total		26	159	185	100.0

APPENDIX I

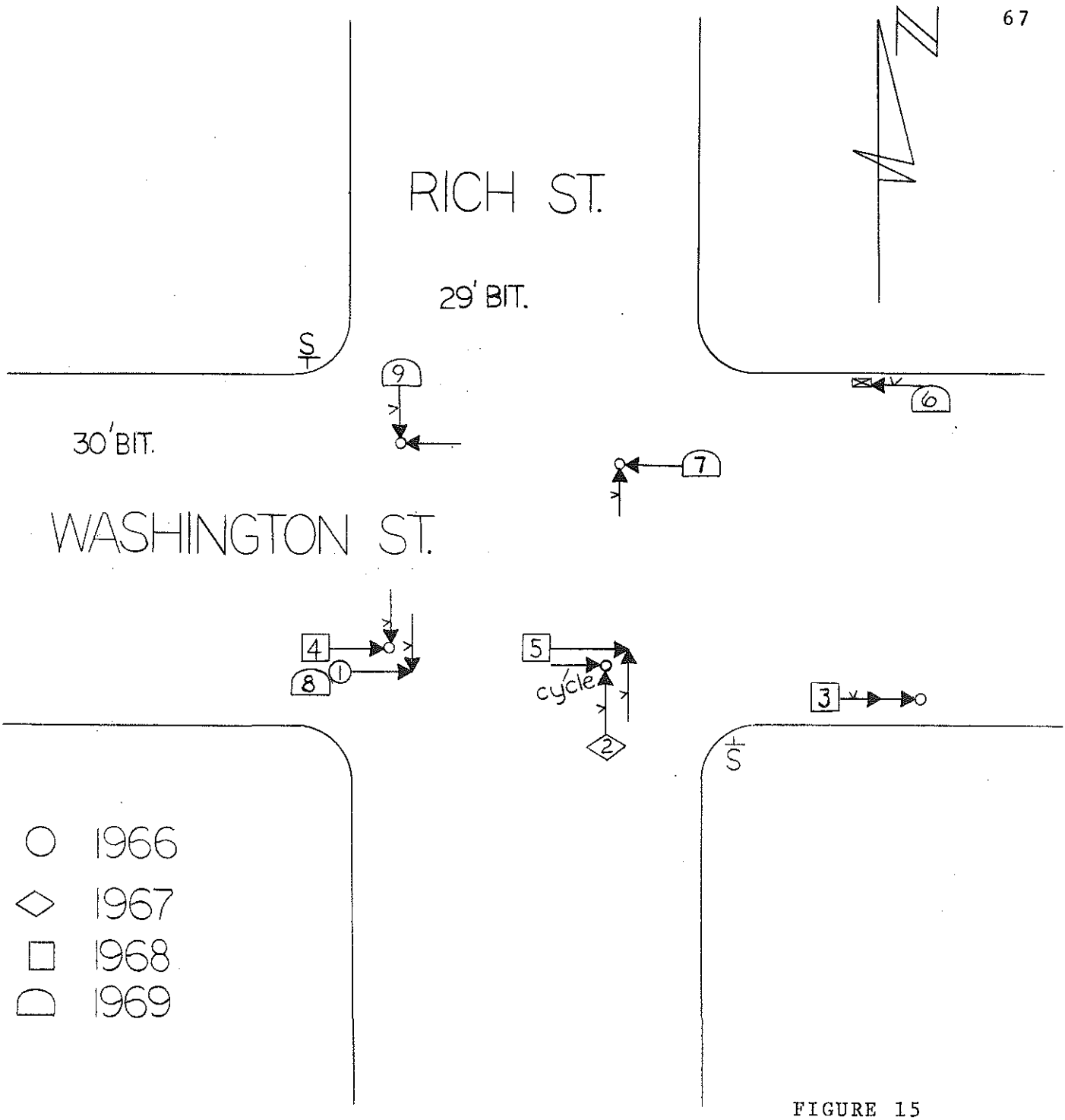


FIGURE 15

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 1969

IONIA CO. Description CITY OF IONIA

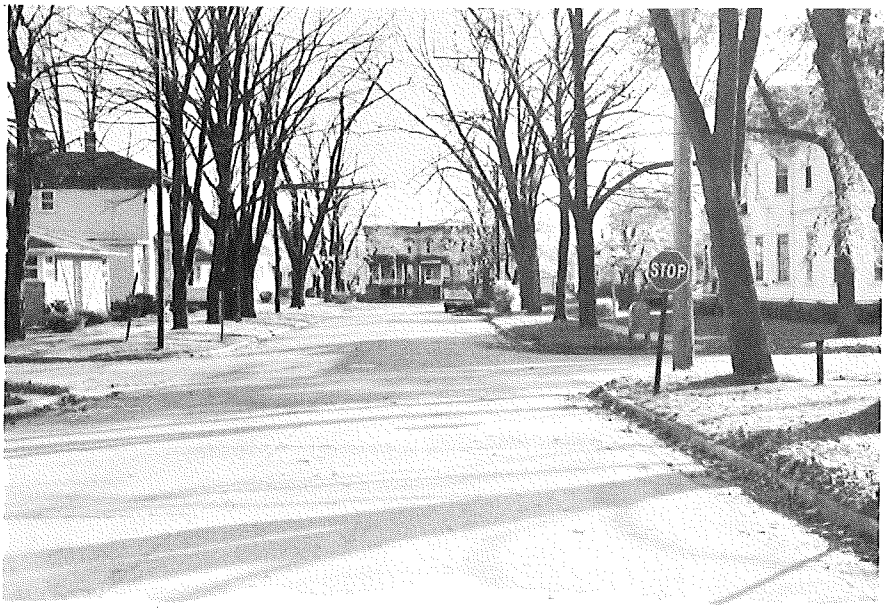
WASHINGTON ST. at RICH ST.

Accidents – Total 9 (7)
P.D. 4 Injury 5
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm

C.S. Miles

Drawn DVW Date 6-22-70 Rev.

Plan No. #8

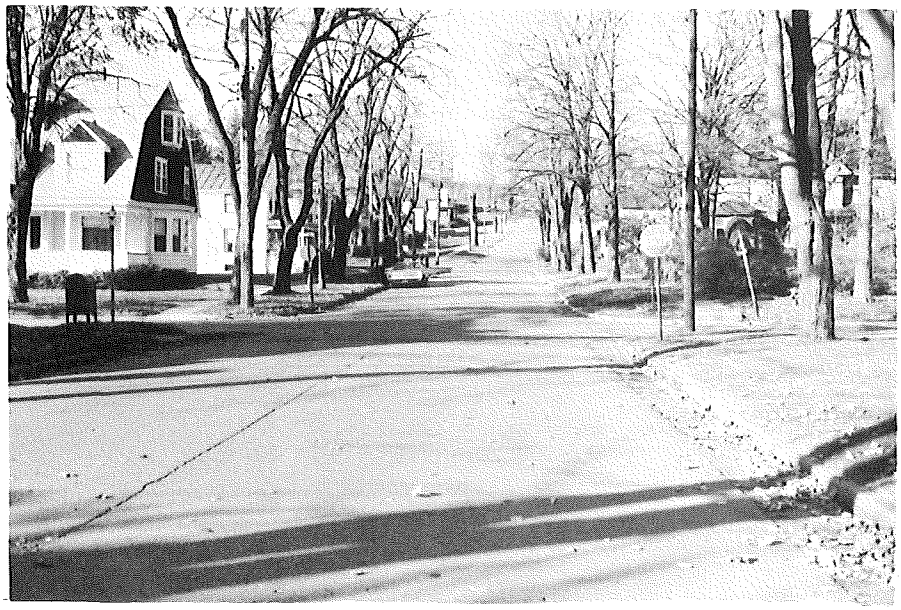


SOUTHBOUND

RICH STREET

WESTBOUND

WASHINGTON STREET



NORTHBOUND

RICH STREET

FIGURE 15a

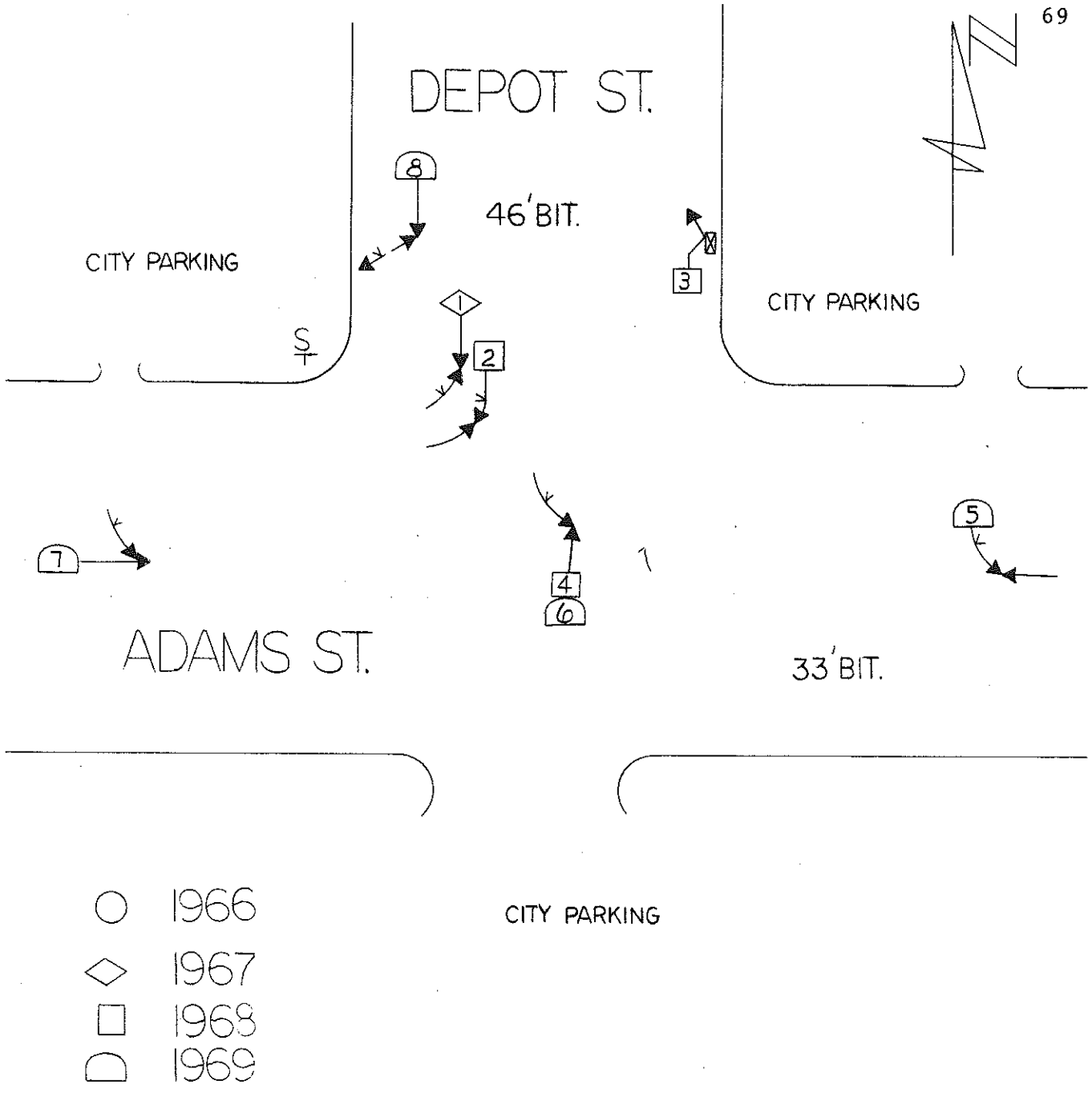


FIGURE 16

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 — Deer — Violator — Out of Control — Driver Intent

ACCIDENT STUDY
COLLISION DIAGRAM

Period: 1966 THRU 1969
IONIA CO. Description CITY OF IONIA
ADAMS ST. at DEPOT ST.
Accidents – Total 8 ( )
P.D. 8 Injury 0
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DVW Date 6-23-70 Rev.
Plan No. #10

WESTBOUND

ADAMS STREET

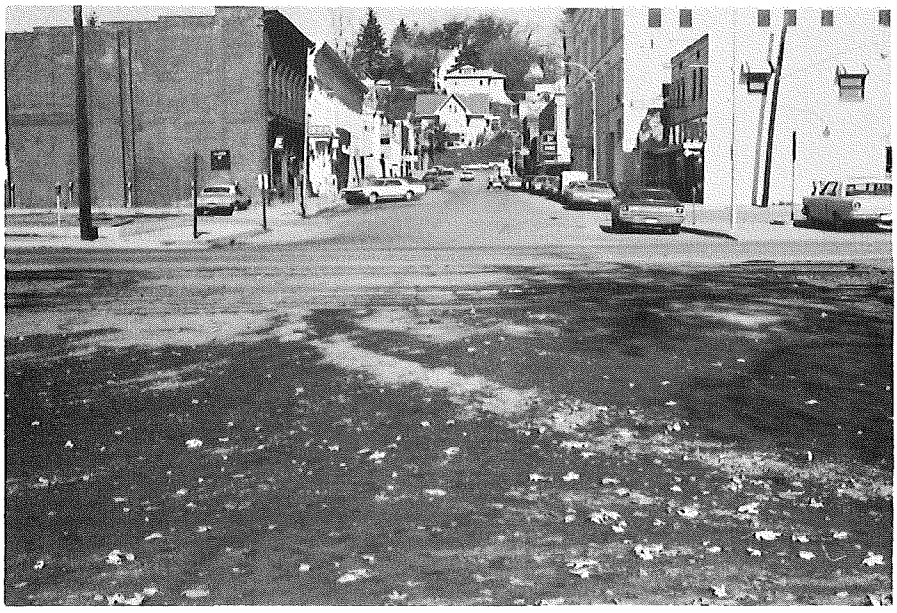
EASTBOUND

ADAMS STREET

FIGURE 16a

SOUTHBOUND

DEPOT STREET



NORTHBOUND

FROM PARKING LOT

FIGURE 16b

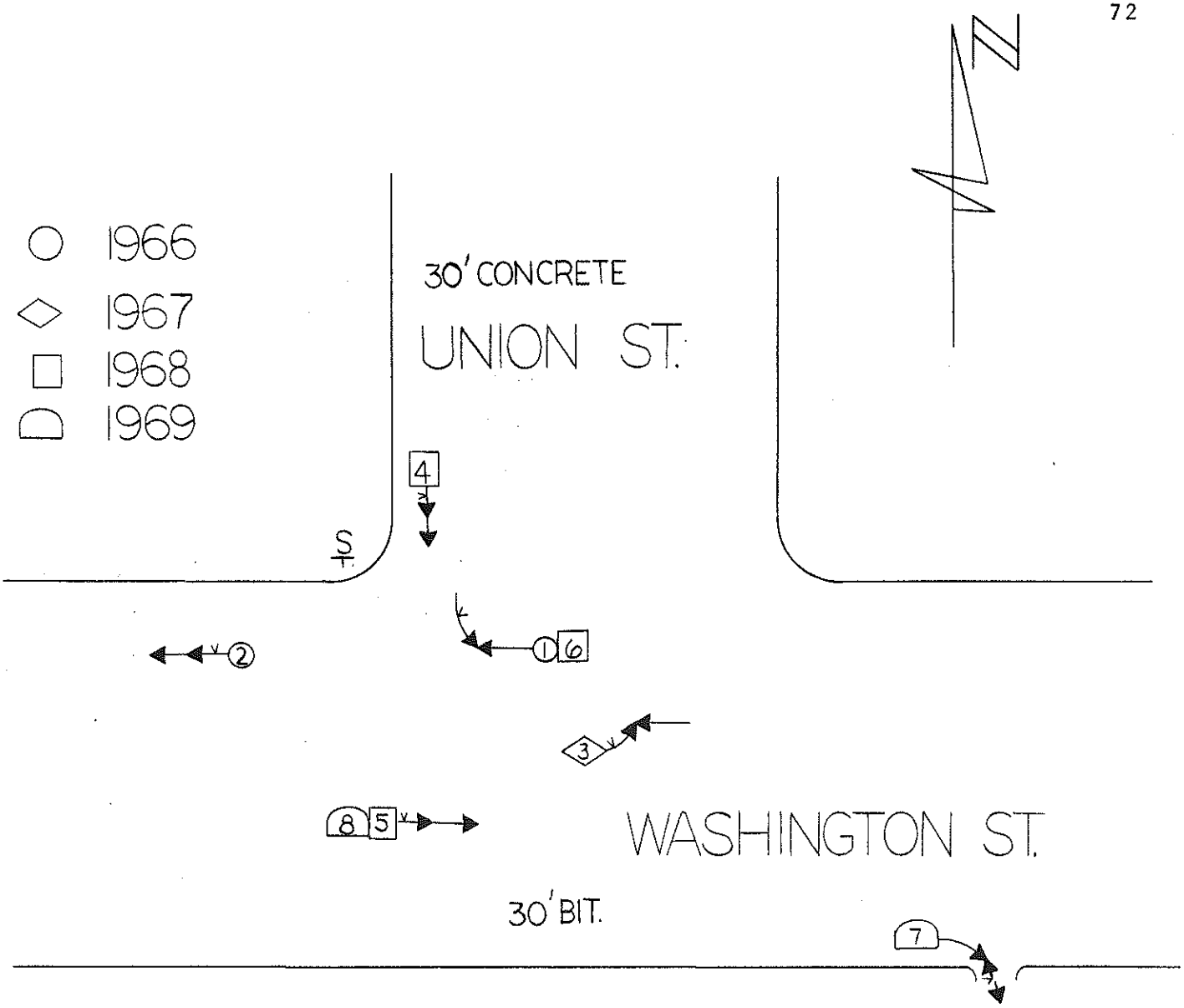


FIGURE 17

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 1969
IONIA CO. Description CITY OF IONIA
WASHINGTON ST. at UNION ST.

Accidents – Total 8 ( )
P.D. 8 Injury 0
Fatal 0 ( )
Acc. Rate/mv
Acc. Rate/mvm
C.S. Miles
Drawn DVW Date 6-22-70 Rev.
Plan No. #11

WESTBOUND

WASHINGTON STREET

EASTBOUND

WASHINGTON STREET

FIGURE 17a

SOUTHBOUND

UNION STREET

NORTHBOUND

LOOKING UP HILL

FIGURE 17b

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 a. "STOP" Sign b. "YIELD" Sign	(R1 Series)
(2)	Speed	(R2 Series)
(3)	Movement a. Turning b. Alignment c. One Way d. Exclusion	(R3 Series)
(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

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*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.

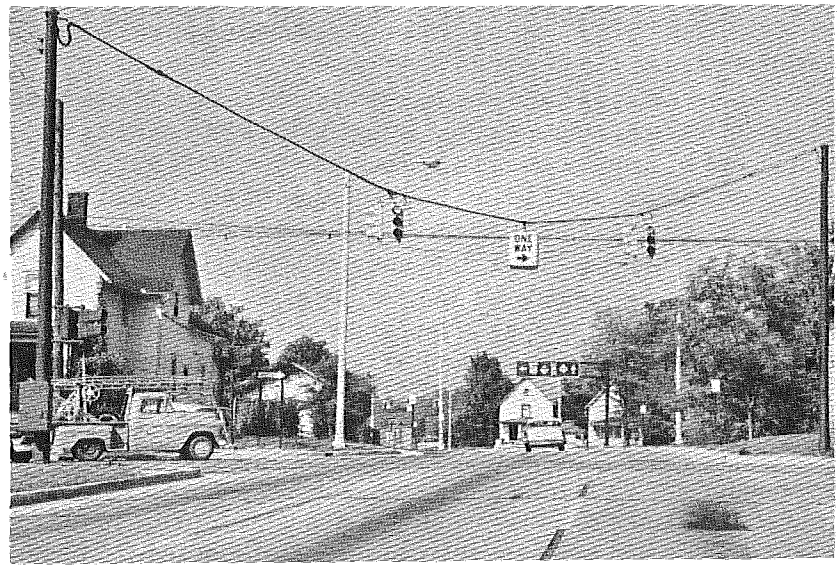

Figure 4-2. Traffic control signal installation with illuminated case sign.

Types of Mountings for Signal Heads

Signal heads shall be mounted over the traveled portion of the roadway using either cable or mast arm suspension. Supplementary signal heads may be placed along the side of the roadway on poles or pedestals.

Signals shall be so located that the meaning of the indications is always clear and unmistakeable. It is essential that signal indications be readily visible to drivers in all lanes approaching the signal location.

Number of Signal Faces

At signalized intersections, where one or more approach is a State trunkline highway, there shall be a minimum of two overhead vehicular signal faces, located over the traveled portion of the roadway, visible to traffic on each approach. Where a separate turning signal(s) is provided, only one indication is required for each signalized turning movement. See figure 4-13.

At all other signalized intersections, a minimum of one overhead vehicular signal face per approach is required. It is strongly recommended, however, that at least two vehicular signal faces be provided per approach for the following reasons:

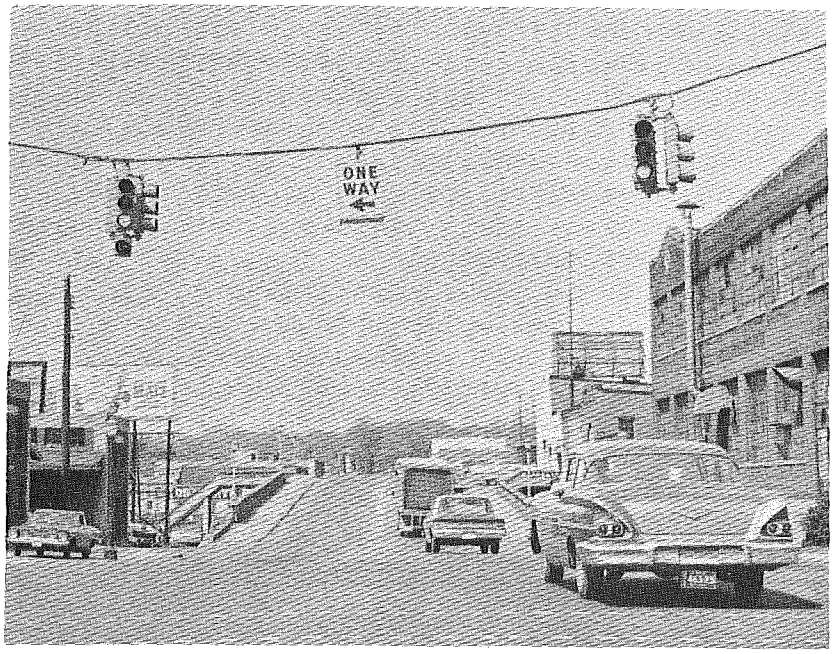

Figure 4-3. Traffic control signal installation with delayed left turn arrow.

1. Two (or more) properly located overhead faces will in almost all cases provide drivers with a signal indication even though trucks or buses may momentarily obscure one signal face.
2. Multiple faces provide a safety factor where the signals must compete with a brilliant background such as advertising signs or the sun.
3. The occasional inevitable lamp failure in one face will not leave an approach without any signal indication.

Where only one vehicular signal face is provided per approach, it shall be positioned as near to the intersection of the centerlines of the intersecting roadways as possible.

The number of signal faces in excess of two per approach will be dictated by local conditions such as the number of vehicular lanes, the need for special turn indications, and the configuration of the intersection and channelizing islands.

Vehicular signals may be supplemented by pedestrian signals, where warranted, located at each end of each controlled crosswalk.

Signal faces shall be located at the intersection so as to give drivers and pedestrians a clear, unmistakeable indication of the right-of-way assignment from their normal positions on the approaches and as they pass through the intersection area. At intersections where signals are installed on the basis of the pedestrian volume warrant, or at other signalized locations where the pedestrian volume equals or exceeds the warrant, pedestrian signals shall be installed.

Pedestals in the roadway to carry signals are driving hazards, and are prohibited despite any advantages as a conspicuous signal location. This is not intended however, to preclude the use of signals on pedestals or posts within the area of properly designed channelized islands or in the median strip of divided roadways.

Where physical conditions prevent the driver from having a continuous view of at least one signal indication for approximately ten seconds before reaching the stop line, consideration may be given to the use of a supplementary signal to improve this visibility.

Advance warning of a signal may be provided by the use of a W3-3 (Signal Ahead) sign. For greater emphasis flashing yellow beacons may be used in conjunction with this sign as provided in Part V, Miscellaneous Electrical Devices.

Height of Vehicular Signal Faces

The vertical clearance of overhead signals shall not be less than 15 feet or normally more than 17 feet. Where used, supplementary pedestal or pole mounted signals shall have a bottom height of not less than 8 feet nor more than 15 feet.

Maximum visibility and adequate clearance should be the guiding consideration in deciding signal height. Grades on approaching streets may be important factors, however, in determining the most appropriate height.

Transverse Location of Signal Faces

Where dual overhead signal faces are provided over the approach to a signal they should normally be centered on the approach with a minimum of 14 foot separation from each other. Transverse spacing, however, should be carefully checked by the Engineer to provide prominent and conspicuous location.