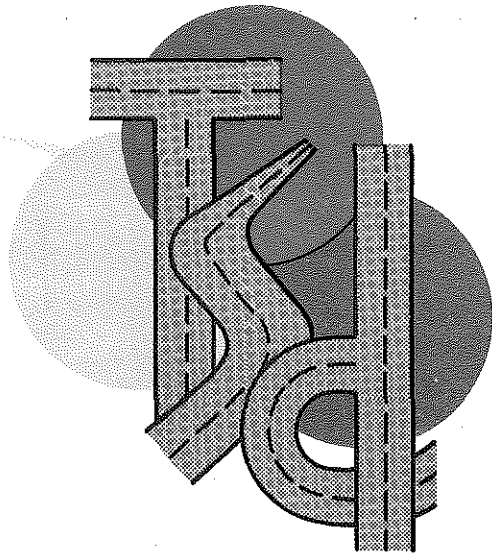


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A TRAFFIC ACCIDENT ANALYSIS
AND TRAFFIC CONTROL DEVICES INVENTORY
IN THE CITY OF ST. JOSEPH

Report TSD-215-73



**TRAFFIC and
SAFETY
DIVISION**

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A TRAFFIC ACCIDENT ANALYSIS
 AND TRAFFIC CONTROL DEVICES INVENTORY
 IN THE CITY OF ST. JOSEPH

Report TSD-215-73

by

Robert G. Lariviere

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Traffic Engineering Services
Traffic and Safety Division
Michigan Department of State Highways and Transportation

in cooperation with

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and
The U. S. Department of Transportation
Federal Highway Administration

"The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the State or U. S. Department of Transportation, Federal Highway Administration."

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INTRODUCTION

The Highway Safety Act of 1966 was enacted by the Congress of the United States in order to promote highway safety. Highway safety standards were then developed to assure the orderly implementation of the Act.

Purpose

Highway Safety Standard 4.4.13, Traffic Engineering Services, is one of those standards. The purpose of Standard 4.4.13 is

"to assure the full and proper application of modern traffic engineering principles and uniform standards for traffic control to reduce the likelihood and severity of traffic accidents".

This standard includes the identifying of specific locations or sections of streets and highways which have a high accident experience or potential as a basis for establishing priorities for improvement, selective enforcement or other practices that will eliminate or reduce the hazards. It provides an orderly inventory of all traffic control devices, which include those signs, signals, markings and devices placed on, over or adjacent to a street or highway to regulate, warn and guide vehicular and pedestrian traffic.

The State of Michigan carries out a program of this type on the state trunkline system; however, many of the state's city and county agencies lack the financial and technical prerequisites necessary to pursue similar programs with similarly defined objectives. To insure that this additional highway safety standard is met and to improve the overall evaluation of the accident picture in Michigan, the Michigan Department of State Highways and Transportation requested and received through the Office of Highway Safety Planning in the Department of State Police, a federally funded project entitled "Traffic Engineering Services for Cities and Counties".

In cooperation with participating cities and counties, the proposed service, under the direction of Department personnel, will make a traffic engineering evaluation of the factors causing traffic accidents and will recommend corrections to those conditions which may be contributing to accidents; and additionally will recommend the upgrading of traffic control devices where necessary.

Scope

The intent of this program is to improve traffic safety on all Michigan streets and roads by expanding the traffic engineering evaluation of factors causing accidents, and by providing uniform

standards for traffic control to reduce the likelihood and severity of traffic accidents.

Study Procedures

The study procedures for this project involve a review of high accident locations, and an inventory of traffic control devices.

The review of high accident locations includes: basic data collection, identifying and locating high accident locations, field investigations, an accident analysis of the high accident locations, technical evaluation of previously compiled facts and consequent remedial recommendations.

The traffic control devices inventory includes: a field review of all major non-trunkline routes noting the placement, condition and adequacy of traffic control devices, tabulating the field data, determining priorities for upgrading of traffic control devices and determining costs for this program.

Study Area

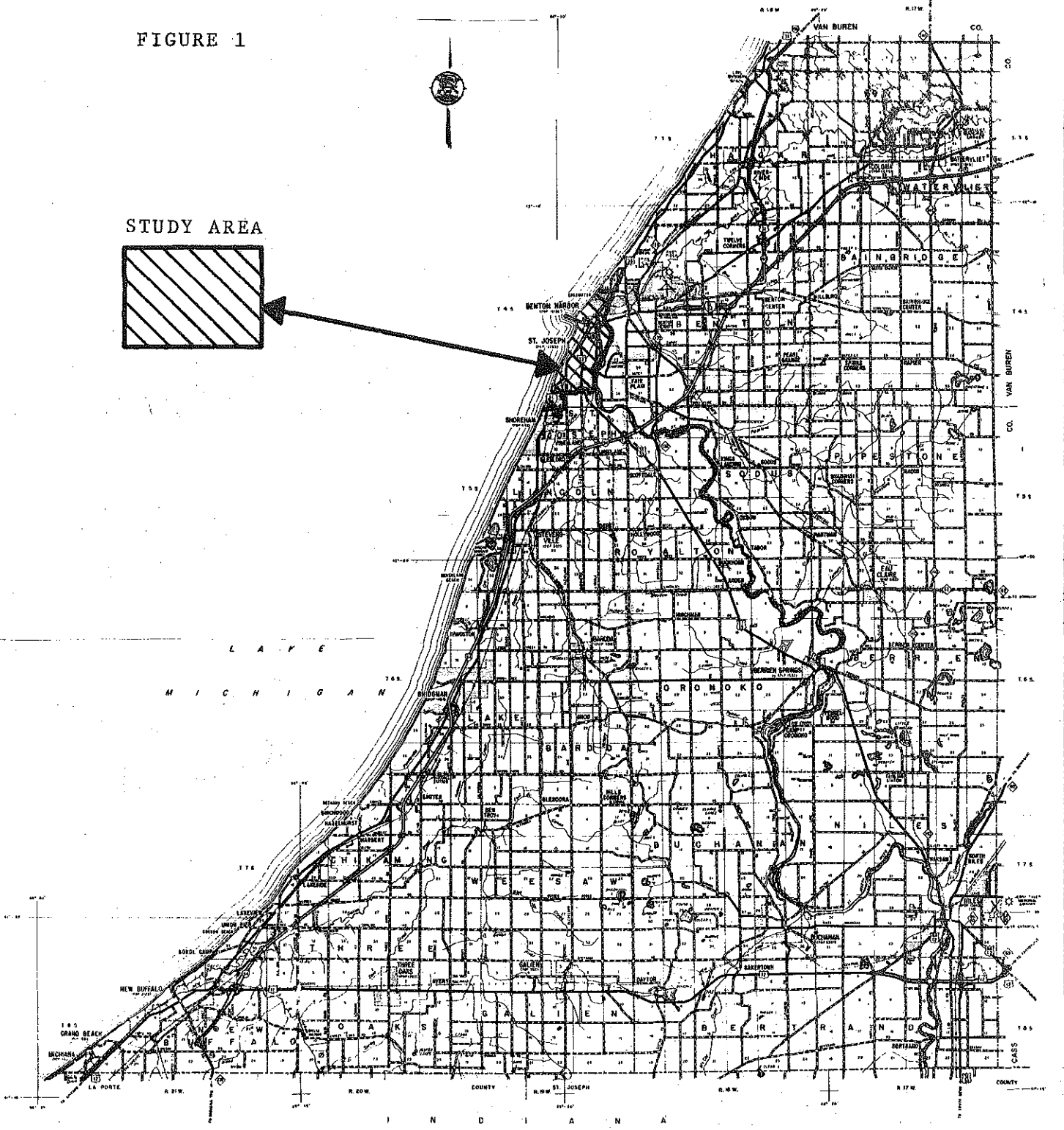
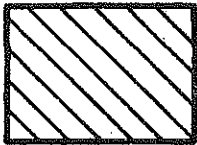
The City of St. Joseph, which is the county seat of Berrien County, is located on Lake Michigan in the southwestern portion of the state (Figure 1). St. Joseph is positioned at the mouth of the St. Joseph River across from the City of Benton Harbor. Located near I-94 and I-196, St. Joseph is a short distance from the larger metropolitan areas of Chicago and Kalamazoo. Due to the fact that Chicago is only 92 miles to the west, St. Joseph continues to be affected by Chicago's expanding metropolitan area.

Until 1970, St. Joseph has had a steady increase in population as can be seen by the population trend (Figure 2). The largest increase was experienced between 1950 and 1960 when the population increased 15 percent. However, two-thirds of this increase was due to annexation. The 1970 census showed a 6.1 percent decrease in the population. Population projections, however, do indicate that the population will again increase in the next decade.

According to the Twentieth Annual Progress Report, as compiled by the Local Government Division of the Michigan Department of State Highways, the City of St. Joseph has 47.31 miles of streets. This figure includes 6.35 miles of state trunkline, 12.51 miles of city major streets and 28.45 miles of city local streets (a map showing these road types can be found on p. 5).

FIGURE 1

STUDY AREA



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KEY TO COUNTIES

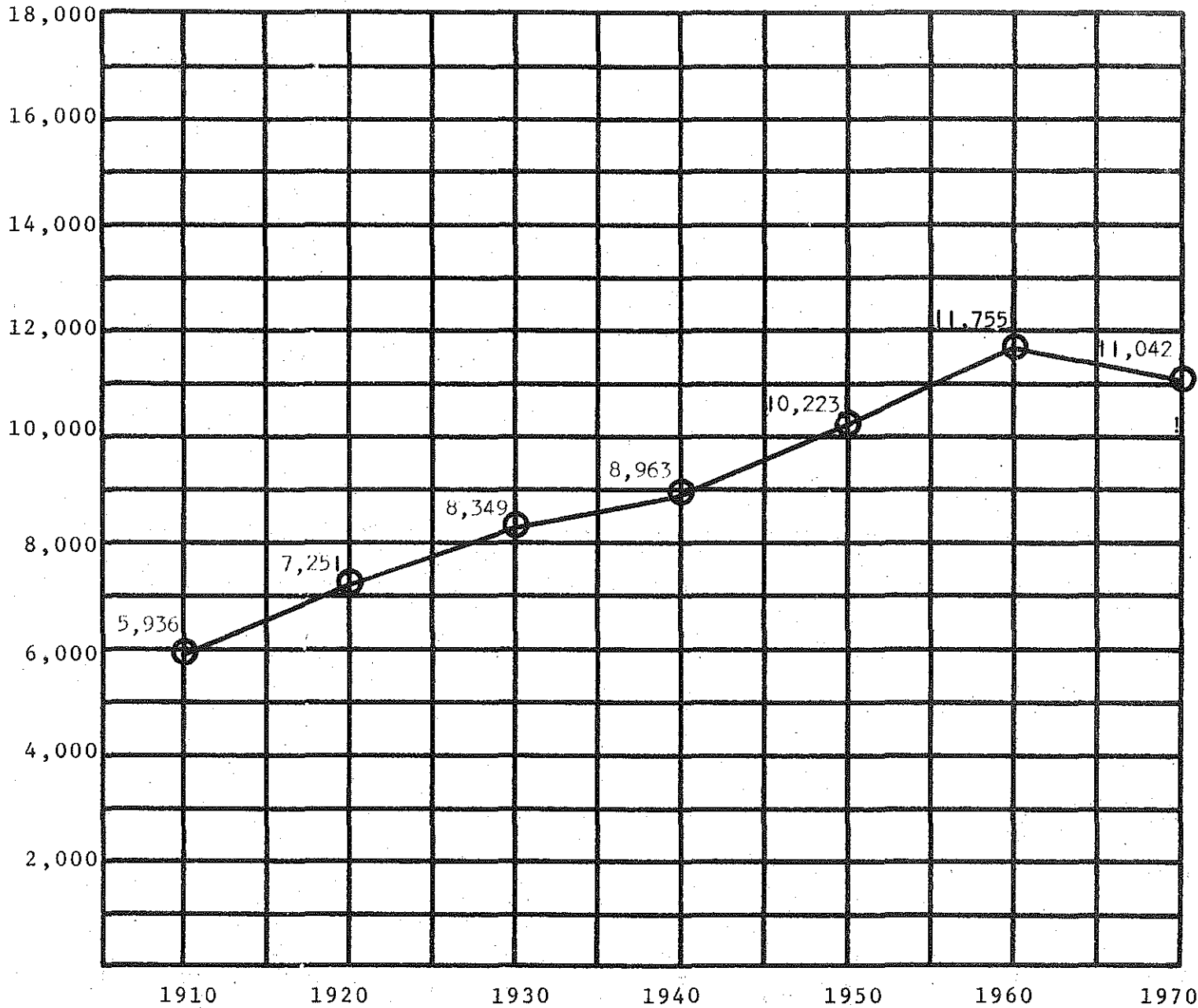
GENERAL HIGHWAY MAP
BERRIEN COUNTY

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

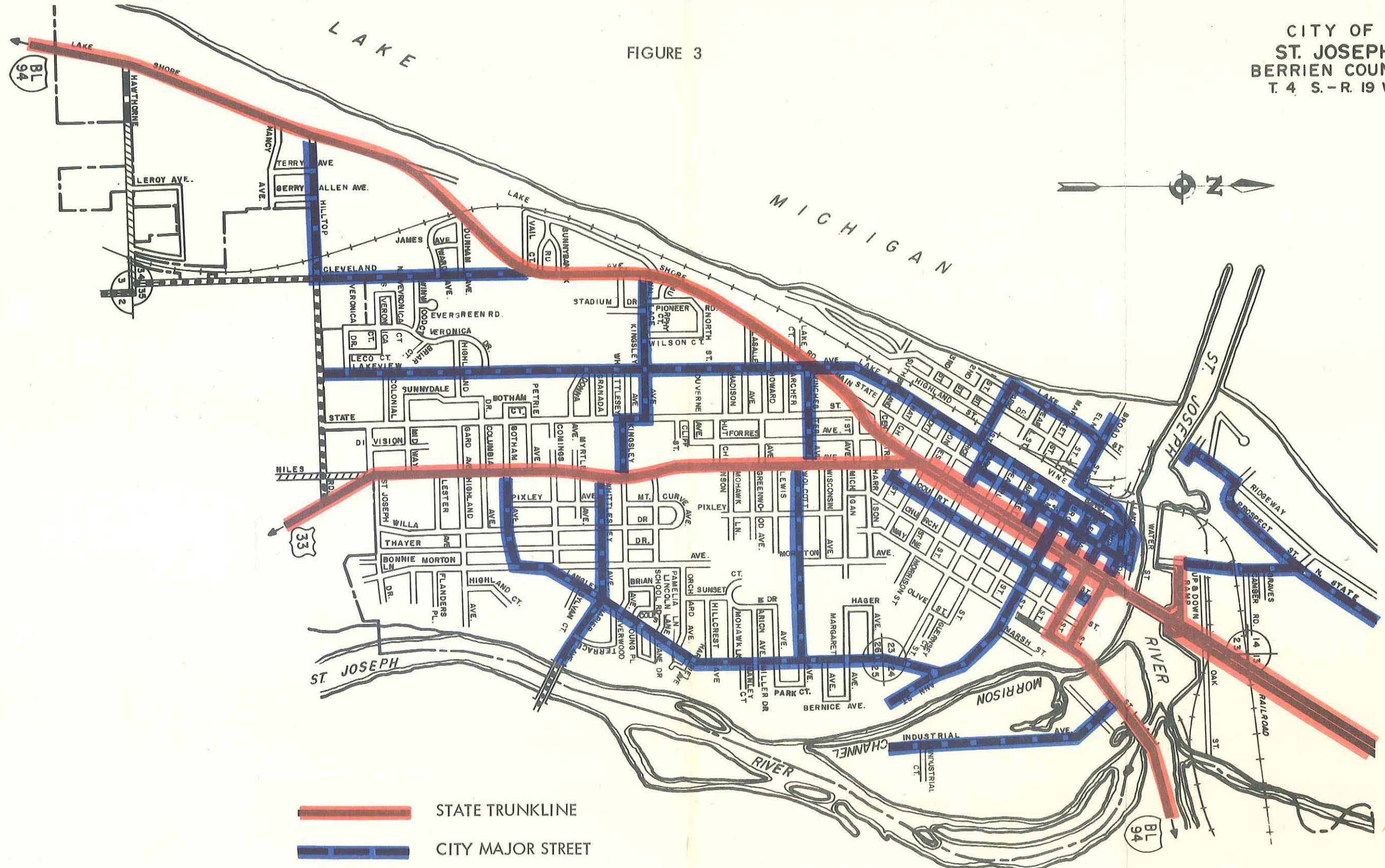
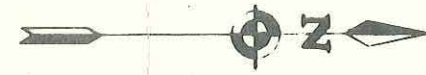
1944
1" = 2.75 MILES
TRAFFIC REGULATIONS



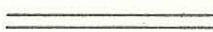
FIGURE 2
POPULATION TREND
CITY OF ST. JOSEPH: 1910 - 1970

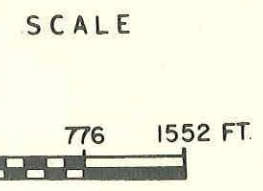


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FIGURE 3



-  STATE TRUNKLINE
-  CITY MAJOR STREET
-  CITY LOCAL STREET



TRAFFIC ENGINEERING ANALYSIS

Control Devices Inventory

The inventory of all the traffic control devices on the City Major Street System in St. Joseph was completed in March 1973. The results, including the inventory sheets and quantity sheets, are found in a separate book which accompanies this report. It is expected that the revised edition of the Michigan Manual of Uniform Traffic Control Devices will be published in late 1973 and will be in accordance with the 1973 National Manual on Uniform Traffic Control Devices. Therefore, it is recommended that placement of control devices not be undertaken until receipt of the revised Michigan Manual.

Collection of Field Data

The traffic control devices were surveyed by driving all of the city major streets. These traffic control devices were recorded on inventory sheets and referenced at their locations by establishing a mileage stationing from a cross street or city limit. Any signs, located on city minor cross streets, relating to intersections with city major streets were also noted. The inventory sequence was established by driving the streets from west to east, or south to north, depending upon the basic direction of the route. In the case of two inventoried routes intersecting, the intersectional controls were recorded on each of the respective route inventories.

Inventory Data

The collected data is recorded on inventory sheets and quantity sheets. The inventory sheets (both the ozalid and cronaflex base) show those control devices which should be erected, those which must be removed and those which are adequate. It is recommended that all unnecessary notes and priority numbers be erased (from the cronaflex base copies) as each portion of work is completed. The remaining control devices will be those which are in place on the street system. It is also recommended that the inventory be updated as future control devices are installed, removed or altered.

The quantity sheets which precede the inventory sheets for each of the routes show the existing controls, their condition and the additional controls needed to meet

current standards. The total number of control devices needed throughout the city is shown on the city wide quantity sheets. This arrangement allows the local government to be apprised of a) the total amount of work necessary to complete the program, b) the amount of work necessary to complete individual routes, and c) the current status of traffic controls as the inventory sheets are updated to reflect changes made.

Priorities

The work to be done is divided into three priority levels. Priorities are established as follows:

- Priority 1 - Work which should be completed as soon as possible.
- Priority 2 - Work which should be completed when existing control devices are in need of maintenance.
- Priority 3 - Work that would be beneficial to the guidance of traffic, although if not completed, would not specifically affect traffic safety.

The first priority generally refers to those signs and/or supports, traffic signals and pavement markings which are essential to the safe and efficient operation of traffic flow. The second priority refers to those traffic controls which are not standard but are performing their intended function to a limited extent. The third priority only refers to guide signs and their usage.

Signals

There were five signalized locations and one flasher installation in the City of St. Joseph. Four of the five signalized locations had only one signal face visible per approach. The 1973 edition of the Michigan Manual of Uniform Traffic Control Devices makes it mandatory that two vehicular signal faces be visible per approach for the following reasons:

1. Two (or more) properly located overhead signal 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 signal 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.

It is recommended that two signal faces per approach be provided for each signalized location in the City of St. Joseph.

Also, the four signals located in the Central Business District showed a green indication simultaneously with the yellow clearance interval. The clearance interval should function after the green interval to eliminate driver confusion. It is recommended that these four signals be changed in this regard as soon as possible.

Furthermore, one of the signalized locations (State Street at Ship Street) had pedestal type signals only. The Michigan Vehicle Code (Revision of 1968) indicates under Law 257.612, Section 612, that "whenever traffic is controlled by traffic control signals, at least one signal shall be located over the traveled portion of the roadway so as to give drivers a clear indication of the right-of-way assignment from their normal positions approaching the intersection." Pedestal type signal heads can be used as a supplement to overhead signals but they cannot be used alone. It is recommended that this intersection and all future signalized intersections conform to the Michigan Vehicle Code in this regard.

Sign Classifications

Signs are classified functionally into regulatory, warning and guide signs. In this inventory study, the various classifications were reviewed separately. In each classification a high percentage of the signs were installed with an insufficient bottom height. According to the 1973 edition of the Michigan Manual, signs erected at the side of the road in rural districts shall be mounted at a height of at least five feet, measured from the bottom of the sign to the near edge of the pavement. In business, commercial and residential districts where parking and/or pedestrian movement is likely to occur or where there are other obstructions to view, the clearance to the bottom of the sign shall be at least seven feet.

Regulatory Signs - A comprehensive study of traffic control devices on the City of St. Joseph Major Street System has established a need for installation

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or maintenance of approximately 52 percent of the required regulatory signs. The primary reason for this deficiency was the lack of or maintenance of "STOP" (R1-1), "YIELD" (R1-2), "4-WAY" and "3-WAY" (R1-3), Speed Limit (R2-1), "ONE WAY" (R6-1) and Parking Control signs.

Warning Signs - The inventory indicates a need for the installation of approximately 79 percent of the required warning signs. The most evident deficiency is the need for additional directional Target Arrow (W1-6), Bi-Directional Target Arrow (W1-7), Advance Railroad Warning (W10-1), School Advance (S1-1) and School Crossing (S2-1) signs.

Guide Signs - The guide signing in the City of St. Joseph consists mainly of reflectorized Street Name (D3-1) signs. Thus the cost estimate for Priority 3 work provides for the placement of additional Street Name signs.

Pavement Markings at Railroad Crossings

The approach lanes at several of the railroad crossings were not properly marked. Beginning with the 1973 pavement marking season, the pavement marking in advance of a railroad crossing shall consist of an X, the letters RR, centerline markings to indicate no passing, and certain transverse lines. Such markings shall be white except for the no-passing markings which are yellow. These markings should be placed on all paved approaches to railroad crossings. If this is not practical, they shall at least be placed, if physically feasible, at all grade crossings where railroad crossing signals or automatic gates are operating, and at all other crossings when the prevailing speed of highway traffic is 40 mph or greater. These markings shall also be placed at crossings where engineering studies indicate there is a significant potential conflict between vehicles and trains. At minor crossings or in urban areas, they may be omitted if engineering studies indicate other devices installed provide suitable protection.

Cost Estimate

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

Priority 1	\$ 12,730.00
Priority 2	3,299.00
Priority 3	275.00

Accident Analysis

Collection and Analysis of Data

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 the City of St. Joseph (and providing an inventory of those locations) was designated as State Police responsibility. Due to the fact that an automated system of locating accidents has not yet been established on a statewide basis, the high accident locations for the City of St. Joseph 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 17 highest accident locations (numbered one to seventeen from the highest number of accidents to the lowest number of accidents) were selected (Spot Map p. 14). Once the problem locations were identified, additional accident information for the years 1966, 1967, 1969 and 1970 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 and Transportation a list, along with the accident reports, of the high accident locations for the City of St. Joseph.

The Department of State Highways and Transportation is responsible for further data collection utilizing the following basic steps: 1) Conducting field investigations; 2) Preparing collision diagrams and, if necessary, physical condition diagrams for each selected location; and 3) Obtaining traffic counts and preparing an Average Daily Traffic Map (p. 13).

This data is analyzed 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. At each high accident location, individual accident reports were reviewed in detail and the accident factors were tabulated and grouped in various tables. The collision diagrams which were prepared for each location are used to identify accident patterns and to locate the accident in relation to the intersection. A technical evaluation and engineering analysis of the compiled data is used to recommend corrections to those conditions which may be contributing to accidents.

City-Wide Recommendations

Wet Pavement Accidents

After the pertinent data was assembled an accident analysis of the 17 high accident locations was conducted. This analysis indicated that wet pavement accidents occurred frequently at many of the locations. At any location where wet pavement accidents are greater than 27 percent of the total accidents and greater than 40 percent of the total accidents minus the snow and ice accidents, skidometer tests are usually warranted. This criteria is used by the Michigan Department of State Highways and Transportation in their safety program. Skidometer testing is available through the Testing and Research Division of the Michigan Department of State Highways and Transportation. Prior arrangement should be made with Testing and Research because these tests are scheduled on a priority basis. If a skidometer test is warranted at a particular location, it will be mentioned under the recommendation portion of the discussion.

Furthermore, it is recommended that the City of St. Joseph initiate a city-wide project to skid test all brick surfaces. It is our hypothesis that brick surfaces have a lower skid coefficient (wsf - wet sliding friction) than other pavement surfaces. It is not uncommon for a brick surface to become polished with age. This deterioration causes the road surface to become slippery not only during inclement weather but while the pavement is dry.

All skidometer test values are expressed as 40 mph coefficients of wet sliding friction. A wsf value of 0.40 is generally considered the dividing point between "satisfactory" and "unsatisfactory" pavement surfaces and it has been arbitrarily defined as the "Departmental Safety Standard". Surfaces with coefficient values of 0.35 to 0.40 are in a "transitional" or questionable range. Surfaces below 0.35 could be dangerous under wet conditions depending on prevailing speeds, road alignment, and geometrics. Surfaces with wsf's below 0.20 are considered as slippery as packed snow. Pavements that fall within the unsatisfactory range should be resurfaced in the very near future.

Pavement Markings

The field study of the high accident locations revealed a deficiency in center line markings throughout the city. On all major rural highways having an even number of lanes,

and on many urban streets and less important rural roads, center lines are necessary and should be applied throughout the entire length of the pavement. In urban locations where a continuous center line is not provided, short sections of center line are useful on approaches to busy intersections, marked crosswalks, railroad crossings, around curves or at hillcrests. In this case the center line serves both to warn of any unusual conditions and to organize and control traffic through a hazardous or congested zone. It is recommended that all city major streets have marked center lines, especially those streets comprising the Central Business District. Any other city street where unusual conditions exist or there is a need to control traffic through a congested area should also have center line markings.

Signalized Locations in the Central Business District

Locations 3, 4, 5 and 15 are all signalized intersections located in the Central Business District of St. Joseph. Average Daily Traffic counts were available for all four locations and 24-hour volume counts were available for all but Location 15. These volumes indicated that all four locations do not satisfy the minimum volume requirements of Warrant I for pretimed signals found in the Michigan Manual of Uniform Traffic Control Devices. Warrant Graphs depicting this situation are included with the analysis of each of these locations. Further investigation should be conducted to ascertain whether the original warrants, which necessitated the installation of these signals, still apply. If the above signalized locations do not satisfy the minimum requirements of the Manual, the stop and go operation should be discontinued. These signals can be placed on flasher operation or be removed. Those intersections where the signals meet the minimum requirements should be provided with two signal faces per approach as recommended in the 1973 edition of the Michigan Manual.

High Accident Locations

After the analysis of the 17 high accident locations in the City of St. Joseph was complete, it was apparent that no engineering recommendations would be feasible for five of the locations. There were no accident patterns at these five 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 12 locations. The collision diagrams and pictures for each of these will be found on the pages following the discussion. The collision diagrams for the remaining five locations are found in Appendix I.

AVERAGE DAILY TRAFFIC MAP

OF CITY MAJOR STREETS IN THE CITY OF ST. JOSEPH

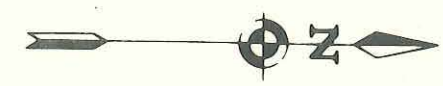
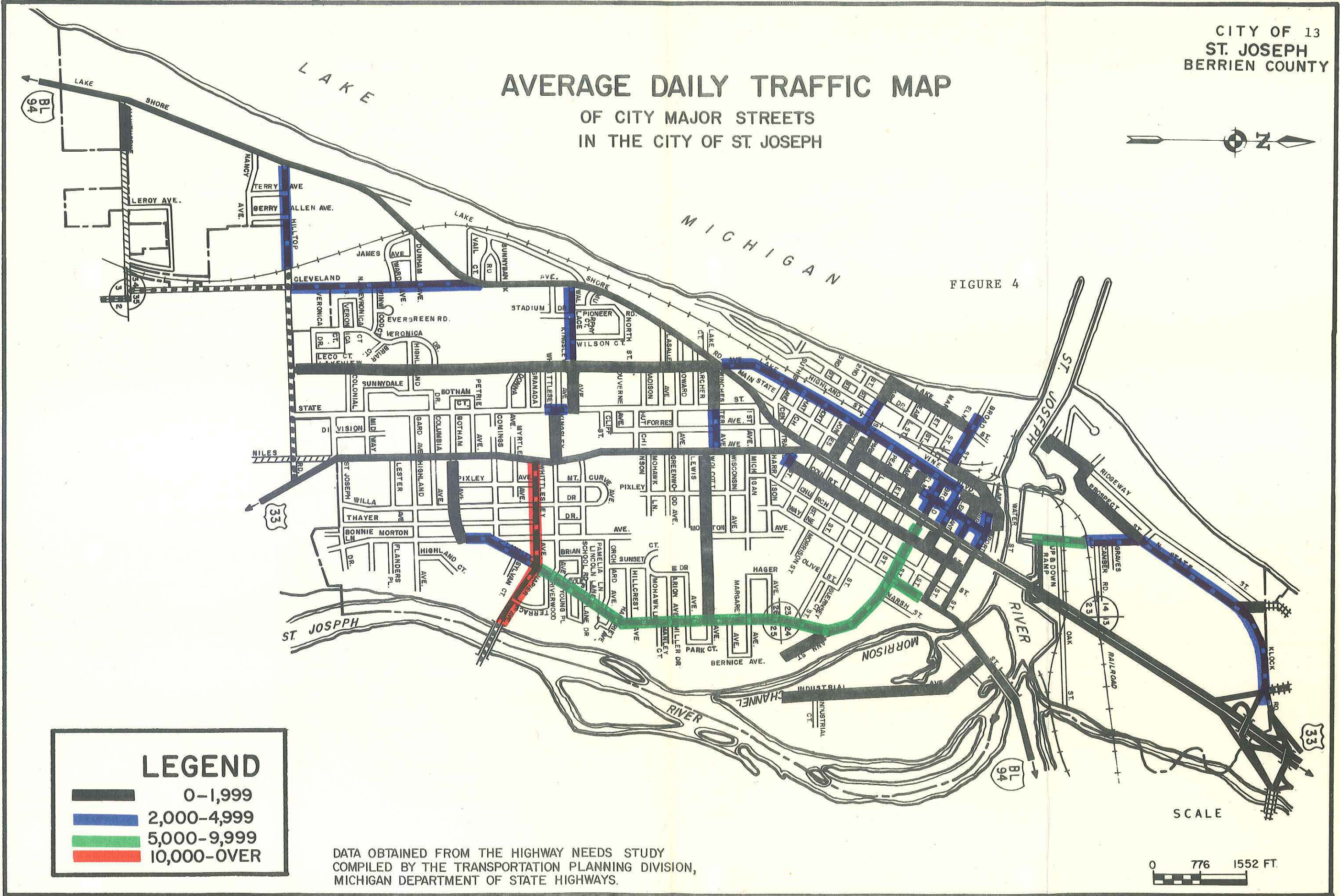
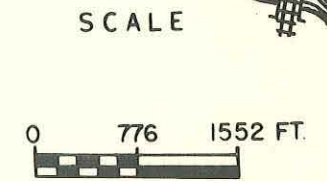


FIGURE 4

LEGEND	
	0-1,999
	2,000-4,999
	5,000-9,999
	10,000-OVER

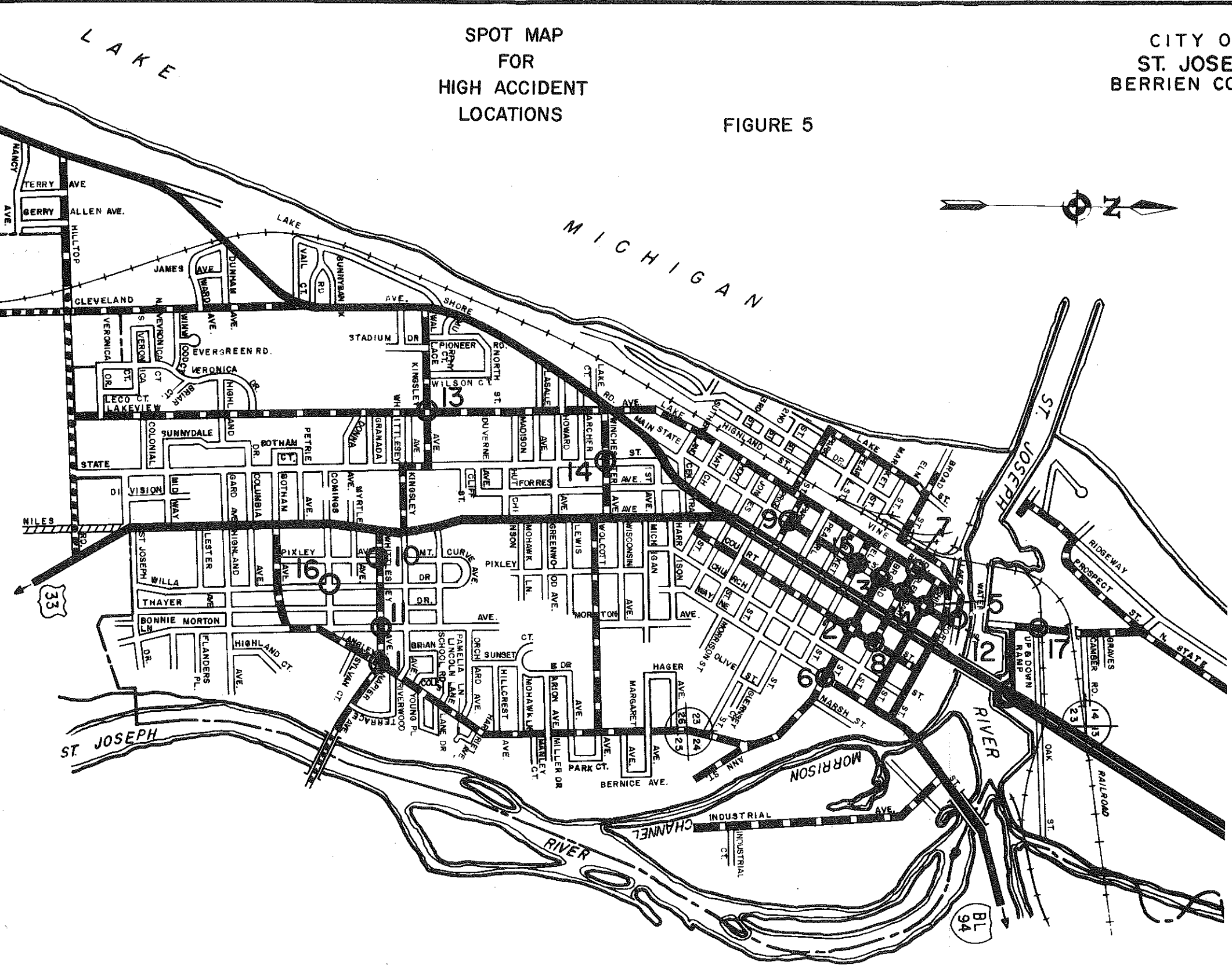
DATA OBTAINED FROM THE HIGHWAY NEEDS STUDY
COMPILED BY THE TRANSPORTATION PLANNING DIVISION,
MICHIGAN DEPARTMENT OF STATE HIGHWAYS.



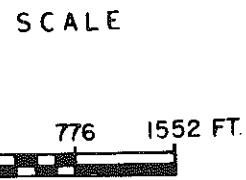
SPOT MAP FOR HIGH ACCIDENT LOCATIONS

FIGURE 5

CITY OF ST. JOSEPH BERRIEN COUNTY



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LOCATION 1

NAPIER AVENUE AT LANGLEY AVENUE

Napier and Langley Avenues form a four-legged intersection that is under signal control. The west leg of Napier Avenue has a 32 ft. wide bituminous cap that was placed on a concrete pavement. The bituminous surface has worn away in spots exposing the old pavement. The southeast leg of Napier Avenue has a three lane, 40 ft. wide concrete pavement. The horizontal alignment of Napier Avenue from east to west consists of a left hand curve. Langley Avenue northeast of the intersection has a three lane, 40 ft. wide pavement that is both concrete and bituminous. Langley Avenue southwest of the intersection has a two lane, 30 ft. wide concrete pavement. Parking at this intersection is allowed only on the west side of the southwest leg of Langley Avenue.

There are three signal heads suspended over the center of the intersection. Each approach has access to two signal faces. The southeast leg of Napier Avenue has a lane for left turns and a lane for right turns and thru traffic. The lane assignments are indicated by painted arrows, lane lines, overhead signs and a Lane-Use Control sign located in advance of the intersection. The west leg of Napier Avenue also has a lane for left turns and a lane for right turns and thru movements; however, there are no painted arrows, lane line markings or overhead signs. The center line is marked and a 24 in. sign on each side of Napier Avenue reads, "Left Lane Traffic Must Turn Left". Southwestbound Langley Avenue has three lanes, including a left turn lane and a lane for right turns and thru movements. The lane assignments are indicated by painted arrows and a 24 in. Lane-Use Control sign. North-eastbound Langley Avenue has no traffic controls other than the overhead signals.

There was a total of 45 accidents at this location during the five-year study period. Twenty six of these accidents occurred on dry pavement, thirteen occurred on wet pavement and six occurred on snowy pavement. Rear end collisions accounted for twenty of the total accidents. Nine of the rear end accidents occurred on wet pavement and three others occurred on snowy pavement. Careless driving was reportedly the cause of eight of the rear end accidents. The next highest accident category involved sideswipe collisions. Six of the ten sideswipe accidents involved improper lane usage. The remaining accidents at this location consisted of five head-on left turns, four involving improper backing, two ran-off roadways, one involving improper passing and one involving a pedestrian.

Recommendations

Fourteen of the 19 accidents that occurred on wet or snowy pavement happened on Napier Avenue. Ten of these accidents were rear end collisions. It appears from the above figures that this street becomes slippery when wet. Thus, it is recommended that skidometer tests be conducted on Napier Avenue through the intersection. If

these tests indicate that resurfacing is necessary, it is recommended that the project be included in the City's construction program and completed at the earliest feasible date.

There were 10 sideswipe accidents at this intersection during the study period. Six of these accidents occurred on the southeast leg of Napier Avenue with five of them involving improper lane usage. The overhead lane assignments for this leg are difficult to see due to the absence of a dark background behind the white arrow indications (Figure 8, p. 20). It is recommended that standard overhead Lane-Use Control signs employing the proper background be erected in place of the existing signs.

Furthermore, it is recommended that the lane assignments be changed to prohibit left turns from the southeast leg of Napier Avenue. A capacity analysis was performed at this intersection during the p.m. peak. The following results were obtained.

BEFORE LEFT TURN PROHIBITION			AFTER LEFT TURN PROHIBITION	
MOVEMENT	V/C RATIO	LEVEL OF SERVICE	V/C RATIO	LEVEL OF SERVICE
Right/Thru	0.87	E		
Left Only	0.12	C		
Right Only			0.33	D
Thru Only			0.57	D

Level of Service	Traffic Flow Description	V/C Ratio
A	Free Flow	0.0
B	Stable Flow	≤ 0.1
C	Stable Flow	≤ 0.3
D	Approaching Unstable Flow	≤ 0.7
E	Unstable Flow	≤ 1.00 (capacity)
F	Forced Flow	Not Applicable

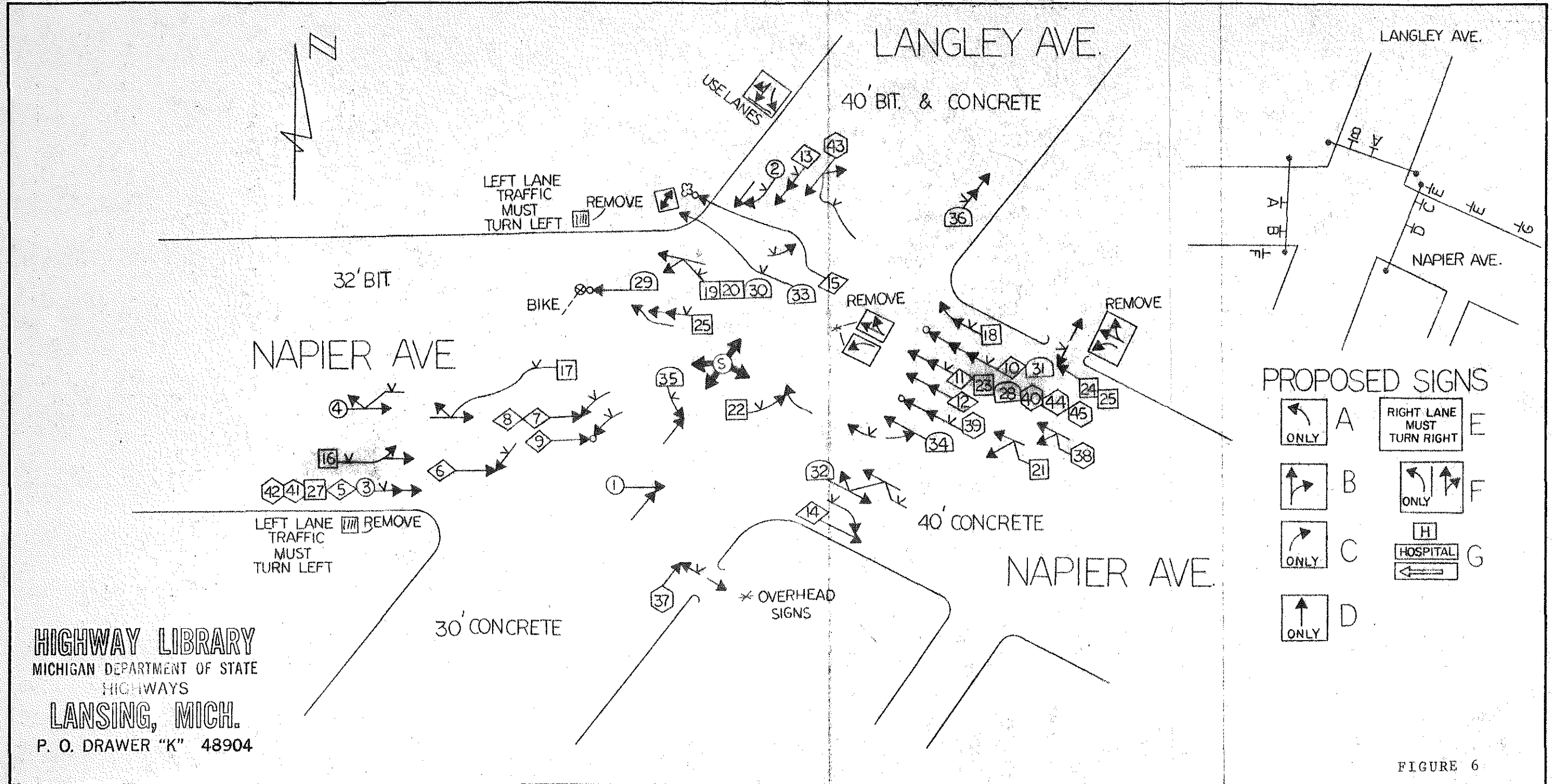
Presently the thru and right turn lane is operating under a condition of unstable flow. Prohibiting the left turn will create separate thru and right turn lanes. These lanes will both operate

at Level of Service D which is a condition approaching unstable flow. To improve the level of service further would require major construction. At this time prohibiting the left turn is the most feasible approach to improve the traffic flow. A before and after flow diagram of the left turn prohibition can be found on p. 21.

The recommended signing for the southeast leg of Napier Avenue should consist of a thru only arrow (R3-5a) erected over the center lane and a right turn only arrow (R3-5) erected over the curb lane. This overhead signing should be located 75 ft in advance of the intersection. The roadside signing should consist of two "Right Lane Must Turn Right" signs (R3-7), one located at the intersection and the other located in advance of the intersection. The painted arrows should be changed to correspond with these lane assignments. Access to the hospital located in the southeast quadrant is available via a private road which intersects Napier Avenue east of this location. A "Hospital" sign (D9-2) should be erected east of the private road to minimize the need for a left turn at the Napier Avenue-Langley Avenue intersection.

The west leg of Napier Avenue had only two sideswipe accidents during the study period. However, the proper lane assignments for eastbound traffic are not apparent. It is recommended that overhead Lane-Use Control signs, including a left turn only arrow (R3-5) over the center lane and a thru and right turn arrow (R3-6) over the curb lane be erected 75 ft in advance of the intersection. Additionally, the overhead signing should be supplemented by painted arrows and a 30 in. roadside sign (R3-8) to give advance warning of the lane assignments. Furthermore, a lane line should be applied to divide the two approach lanes for eastbound traffic.

Lastly, southwestbound Langley Avenue is offset to the west in relation to northeastbound Langley Avenue. Due to this alignment, it is recommended that a left turn only arrow (R3-5) be erected over the left turn lane and a thru and right turn arrow (R3-6) be erected over the curb lane. This overhead signing should be located 75 ft in advance of the intersection. These signs should eliminate confusion at this intersection by giving all motorists an unobstructed view of the required lane assignments.



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PROPOSED SIGNS





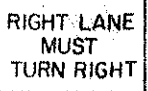





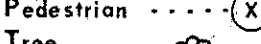
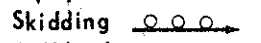

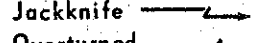

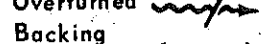
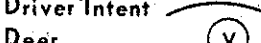




-  A
-  B
-  C
-  D
-  E
-  F
-  G

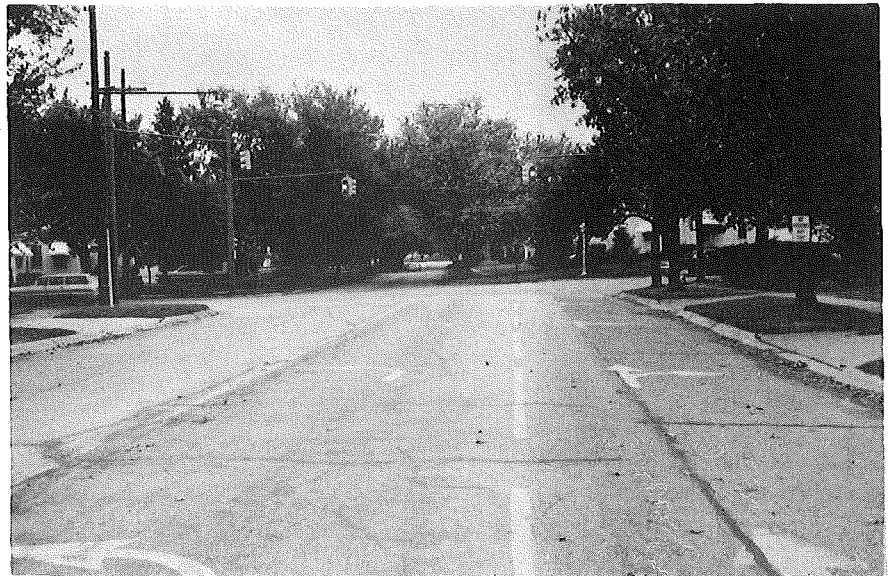
FIGURE 6

<p>REMARKS</p> <ul style="list-style-type: none"> ○ 1966 ◇ 1967 □ 1968 ◐ 1969 ◑ 1970 	<p style="text-align: center;">LEGEND</p> <p>Stop & Go Signal  Stop Sign S</p> <p>Flashing Beacon  Yield Sign Y</p> <p>Fatal  Pedestrian </p> <p>Injury  Tree </p> <p>Skidding  Out of Control </p> <p>Jackknife  Driver Intent </p> <p>Overturned  Deer </p> <p>Backing  Violator </p>	<p style="text-align: center;">ACCIDENT STUDY COLLISION DIAGRAM</p> <p>Period: <u>1966 THRU 1970</u></p> <p>Accidents - Total <u>45</u></p> <p>P.D. <u>39</u> ADT _____</p> <p>Injury <u>6 (7)</u> Rate _____ /100 mvm</p> <p>Fatal <u>0 ()</u> Rate _____ / mvy</p>	<p style="text-align: center;">MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p> <p>Location <u>NAPIER AVE. at LANGLEY AVE.</u></p> <p><u>CITY OF ST. JOSEPH</u></p> <p><u>BERRIEN CO.</u></p> <p>C.S. _____ Miles _____</p> <p>Drawn <u>DVW</u> Date <u>5-7-70</u></p> <p>Plan No. <u>LOCATION 1</u></p>
--	--	--	--



SOUTHWESTBOUND
LANGLEY AVENUE

SOUTHWESTBOUND
LANGLEY AVENUE



NORTHEASTBOUND
LANGLEY AVENUE

FIGURE 7



EASTBOUND NAPIER AVENUE



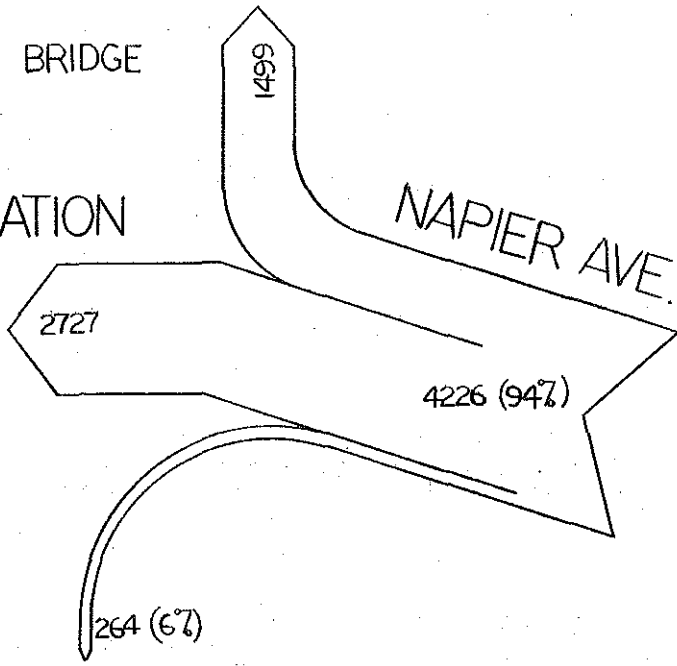
NORTHWESTBOUND NAPIER AVENUE

LOCATION I

TRAFFIC FLOW MAP OFF FROM BRIDGE

PRESENT OPERATION

50% OF LANEAGE CARRIES
94% OF TRAFFIC



SURVEY TAKEN:
9-9/10-70, WED.-THUR.
11A-1P, 2P-6P, 7A-9A

PROPOSED OPERATION

50% OF LANEAGE CARRIES 64%
OF TRAFFIC. CAPACITY INCREASED
BY ABOUT 50%. REAR END ACCIDENT
POTENTIAL REDUCED BY 50%.

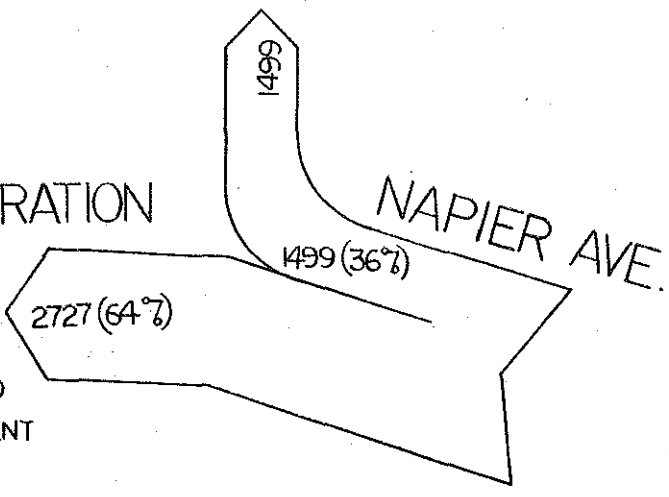


FIGURE 9

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC & SAFETY DIVISION	AUTH. NO.		DRAWN DVW	NAPIER AVE. at LANGLEY AVE. CITY of ST. JOSEPH BERRIEN CO.
	CONT. SEC.		DATE 8/6/73	
	REF.		SCALE 1"=4000 veh.	
	SHEET	OF	PLAN	

LOCATION 2

BROAD STREET AT COURT STREET

Broad Street and Court Street form a four-legged intersection located in a residential area. The existing traffic controls consist of 24 in. "Stop" signs for north and southbound Court Street. Broad Street has a 40 ft wide bituminous pavement and Court Street has a 36 ft wide brick pavement. Visibility from north and southbound Court is adequate west of the intersection, but impaired east of the intersection due to a positive gradient on eastbound Broad Street.

There were 41 accidents at this intersection during the five-year study period. Almost 60 percent of these accidents occurred on either wet, snowy or icy pavement. Fifty-four percent of the accidents involved right-angle collisions. Thirteen of these operators reported that they did not see the vehicles they struck while only three reported that they did not see the "Stop" signs. Fourteen of the right-angle accidents involved eastbound Broad Street traffic, while the remaining eight involved westbound traffic. The next largest accident category involved parked cars. Four of these seven accidents involved parked cars that were struck by thru traffic. The remaining accident types at this location did not form any distinct patterns.

Recommendations

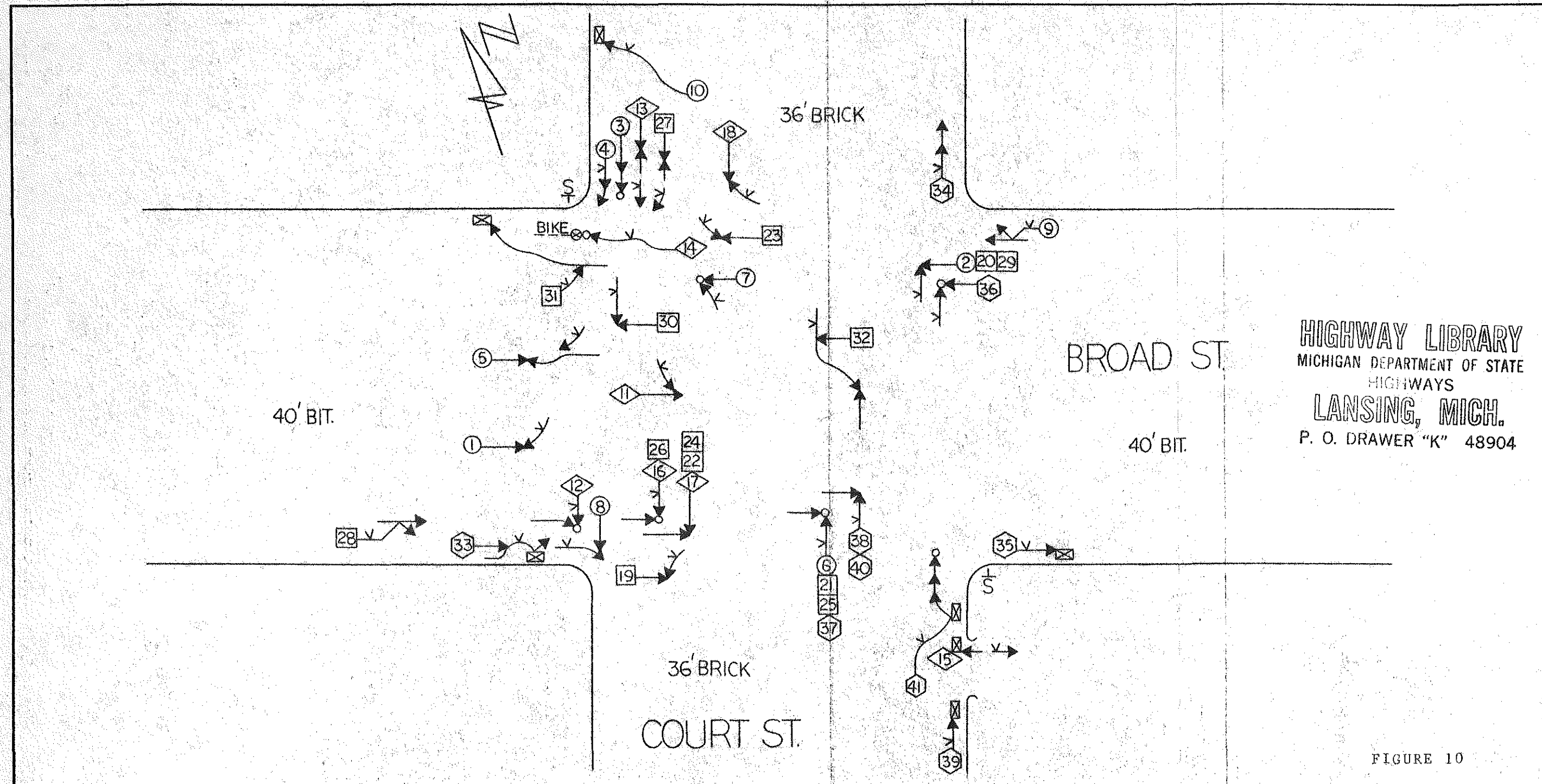
Twenty-nine percent of the accidents at this location occurred on wet pavement. Taken as a percentage of the dry and wet pavement accidents only (this excludes the accidents that occurred on snow and ice), 41 percent of the accidents occurred on wet pavement. These figures indicate that the pavement may become slippery when wet. Furthermore, brick pavement becomes polished with age and will contribute to wet pavement accidents. Thus, it is recommended that skidometer tests be conducted at this location.

Right-angle collisions accounted for the greatest number of accidents. In almost 60 percent of these accidents the operators reported that they did not see the vehicle they struck. In all these cases the operators did stop at the "Stop" signs. Parking has already been removed for a short distance from each corner. However, it is apparent that this parking removal was not adequate. Thus, it is recommended that parking be removed at least 75 ft from each corner on Broad Street.

Furthermore, the number of right-angle accidents meets the minimum requirements of the 1973 edition of the Michigan Manual of Uniform Traffic Control Devices for the installation of a flashing beacon.

The MANUAL states that a flashing beacon can be installed where there is a serious concentration of accidents (six or more over a two year period) which are susceptible of correction by the cautioning or stopping of traffic. There were 21 right-angle accidents at this location which is an average of four a year. The smallest number of right-angle accidents in any two-year period was six. It is recommended that the flashing beacon be installed if the parking removal does not decrease the number of right-angle accidents in the future.

Lastly, the signs on Broad Street that state "No Parking Here To Corner" are positioned perpendicular to Broad Street. It is recommended that these signs be turned to face east and westbound Broad Street traffic. The parking signs with arrows should be set at an angle of not less than 30 nor more than 45 degrees with the line of traffic flow to be visible to approaching traffic. Parking signs without an arrow can be erected an an angle of 90 degrees to the curb line.



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FIGURE 10

REMARKS ○ 1966 ◇ 1967 □ 1968 ◡ 1969 ⬡ 1970	LEGEND Stop & Go Signal Stop Sign S Flashing Beacon Yield Sign Y		ACCIDENT STUDY COLLISION DIAGRAM Period: 1966 THRU 1970 Accidents - Total 41		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
	Fatal Pedestrian X Injury Tree Skidding Out of Control Jackknife Driver Intent Overturned Deer Backing Violator		P.D. 29 Injury 12 (16) Fatal 0 ()		ADT _____ Rate _____ /100 mvm Rate _____ / mvm	
				C.S. _____ Miles _____ Drawn DVW Date 5-7-70 Plan No. LOCATION 2 REVISED 3-14-72		



SOUTHWESTBOUND
COURT STREET

SOUTHEASTBOUND
BROAD STREET



NORTHWESTBOUND
BROAD STREET

FIGURE 11

LOCATION 3

STATE STREET AT BROAD STREET

State Street at Broad Street is a signalized intersection located in the Central Business District. A single signal head is suspended over the center of the intersection.

State Street has a 46 ft wide brick surface. Broad Street has a 68 ft wide pavement that is bituminous west of the intersection and brick east of the intersection. Fifteen-minute parallel parking exists on both sides of State Street from 9:00 a.m. to 10:00 p.m., while unrestricted angle parking is allowed on both sides of Broad Street.

The collision diagram for the five-year study period indicates a total of 32 accidents. Ten of these accidents occurred on wet pavement, while only one occurred on icy pavement. Nineteen of the 32 accidents were parking accidents involving the angle parking along Broad Street. Fourteen of the 19 parking accidents involved thru traffic, while the four remaining accidents involved careless parking maneuvers. There were six rear-end accidents, including two at the signal and four involving parking maneuvers. Parking and rear-end accidents together accounted for approximately 81 percent of the total accidents at this location.

Recommendations

Almost 60 percent of the accidents at this location involved the angle parking on Broad Street. Approximately 74 percent of these parking accidents involved thru traffic. To reduce this high percentage of parking accidents, it would be necessary to reduce the conflict that exists between parked vehicles and thru traffic. Thus, we recommend that the angle parking be removed and replaced with parallel parking so that vehicles will not be backing into traffic.

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 15.

Another problem at this intersection involves the single signal head which provides only one visible signal face per approach. If this intersection remains signalized then a second signal head should be erected to provide two visible signal faces per approach.

Lastly, 31 percent of the accidents occurred on wet pavement. Furthermore, three of the four legs of this intersection have brick surfaces which produce a low coefficient of friction as they age. Therefore, it is recommended that skidometer tests be conducted.

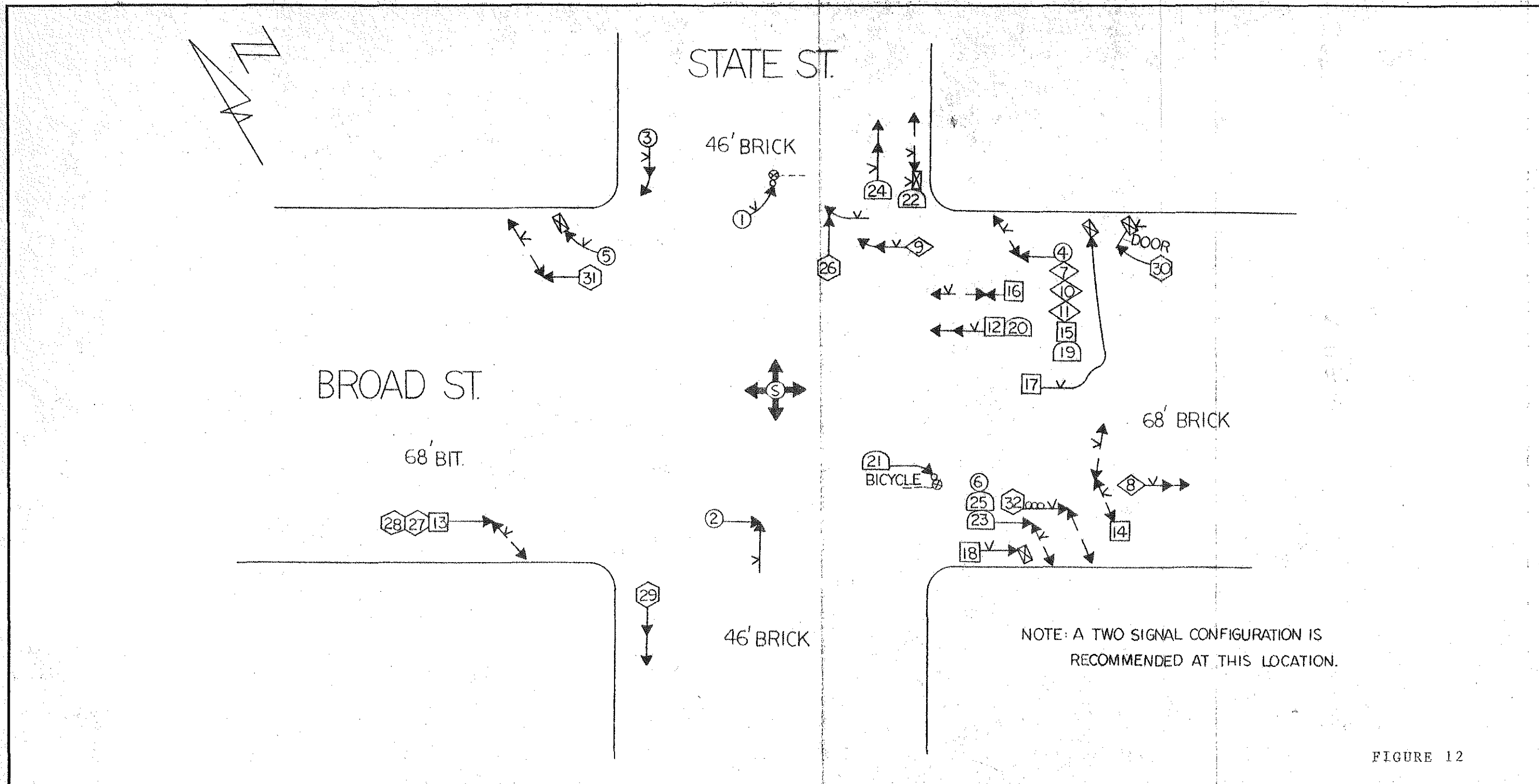


FIGURE 12

REMARKS ○ 1966 ◇ 1967 □ 1968 ◡ 1969 ⬡ 1970	LEGEND Stop & Go Signal Stop Sign S Flashing Beacon Yield Sign Y	ACCIDENT STUDY COLLISION DIAGRAM Period: 1966 THRU 1970 Accidents - Total 32 P.D. 30 Injury 2 (2) Fatal 0 ()		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION Location BROAD ST. at STATE ST. CITY OF ST. JOSEPH BERRIEN CO. C.S. _____ Miles _____ Drawn DVW Date 5-11-70 Plan No. LOCATION 3 REVISED 3-14-72
	Fatal Pedestrian Injury Tree Skidding Out of Control Jackknife Driver Intent Overturned Deer Backing Violator	ADT _____ Rate _____ /100 mvm Rate _____ / mv		



SOUTHWESTBOUND STATE STREET



NORTHEASTBOUND STATE STREET



SOUTHEASTBOUND BROAD STREET



NORTHWESTBOUND BROAD STREET

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FIGURE 14

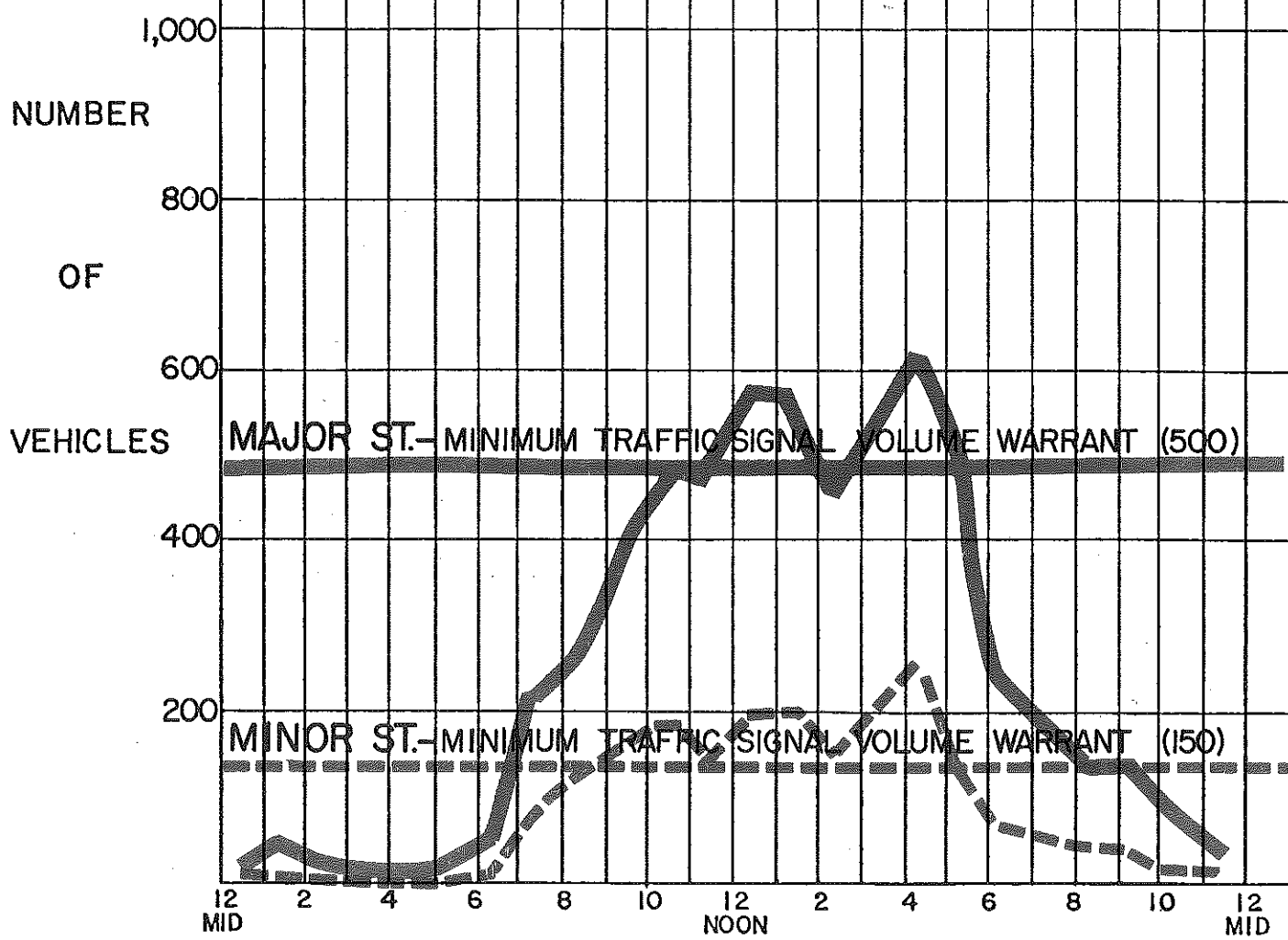
CITY OF LANSING
TRAFFIC DEPARTMENT

ACCIDENT COMPARISON - ANGLE PARKING AND PARALLEL PARKING

WASHINGTON AVENUE - NINE BLOCKS - GENESEE TO LENAWE

ALL MID-BLOCK ACCIDENTS					
WASHINGTON AVENUE	ANGLE PARKING				PARALLEL PARKING
	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					
EAST MICHIGAN AVE	ANGLE PARKING				PARALLEL PARKING
	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



SURVEY TAKEN 11-3/4-70

TIME OF DAY

LEGEND

ANALYSIS

BROAD ST.
 STATE ST.

APPLICABLE WARRANT: URBAN VEHICULAR

HOURLY VOLUMES:

MAJOR STREET MEETS WARRANT 5 HOURS OF REQUIRED 8 HOURS

MINOR STREET MEETS WARRANT 9 HOURS OF REQUIRED 8 HOURS

ACCIDENT EXPERIENCE

___ ACCIDENTS REPORTED IN ___, ACCIDENT RATE ___/M.V.

FIGURE 16

MICHIGAN STATE HIGHWAY DEPARTMENT TRAFFIC DIVISION	AUTH. NO.	DRAWN DVW	VEHICLE WARRANT GRAPH BROAD ST. at STATE ST. CITY OF ST. JOSEPH BERRIEN CO.
	CONT. SEC.	DATE 8-6-73	
	REP.	SCALE	
	SHEET OF	PLAN	

LOCATION 4 STATE STREET AT PLEASANT STREET

State Street at Pleasant Street is a signalized intersection located in the Central Business District. The existing traffic control consists of a single signal head suspended over the center of the intersection.

State Street has a 46 ft wide brick surface up to and including the intersection. Pleasant Street has a 44 ft wide bituminous pavement. Parking is allowed on all four legs of the intersection between 9:00 a.m. and 6:00 p.m. except for the first parking stalls which have a 15-minute restriction. The curb from each intersection corner to the first parking stall is painted yellow indicating a no parking zone.

There was a total of 24 accidents at this location during the five-year study period. Six of these accidents occurred on wet pavement, while one each occurred on snowy and icy pavement. Accidents involving parked vehicles accounted for about 54 percent of the total. Careless driving was reportedly the cause of 11 of the 13 parking accidents. Rear end collisions accounted for seven accidents, three of which occurred on wet pavement. The remaining accidents at this location consisted of two involving improper backing, one sideswipe and one improper turn.

Recommendations

Eight of the accidents at this location occurred on wet, snowy or icy pavement. Seven of these accidents happened on State Street which has a brick pavement. For this reason a skidometer test is recommended for State Street including the intersection area.

There were five sideswipe accidents during the study period, four of which were caused by a vehicle leaving a parking place. Neither State Street nor Pleasant Street have center line markings. Thus, it is recommended that center lines be applied to both streets. Center line markings will help reduce the conflict between vehicles entering or exiting a parking place and moving traffic by giving moving traffic an indication of the available pavement width.

Lastly, this intersection has only one overhead vehicular signal face visible to traffic on each approach. If this intersection remains signalized then a second signal head should be erected to provide two visible signal faces per approach.

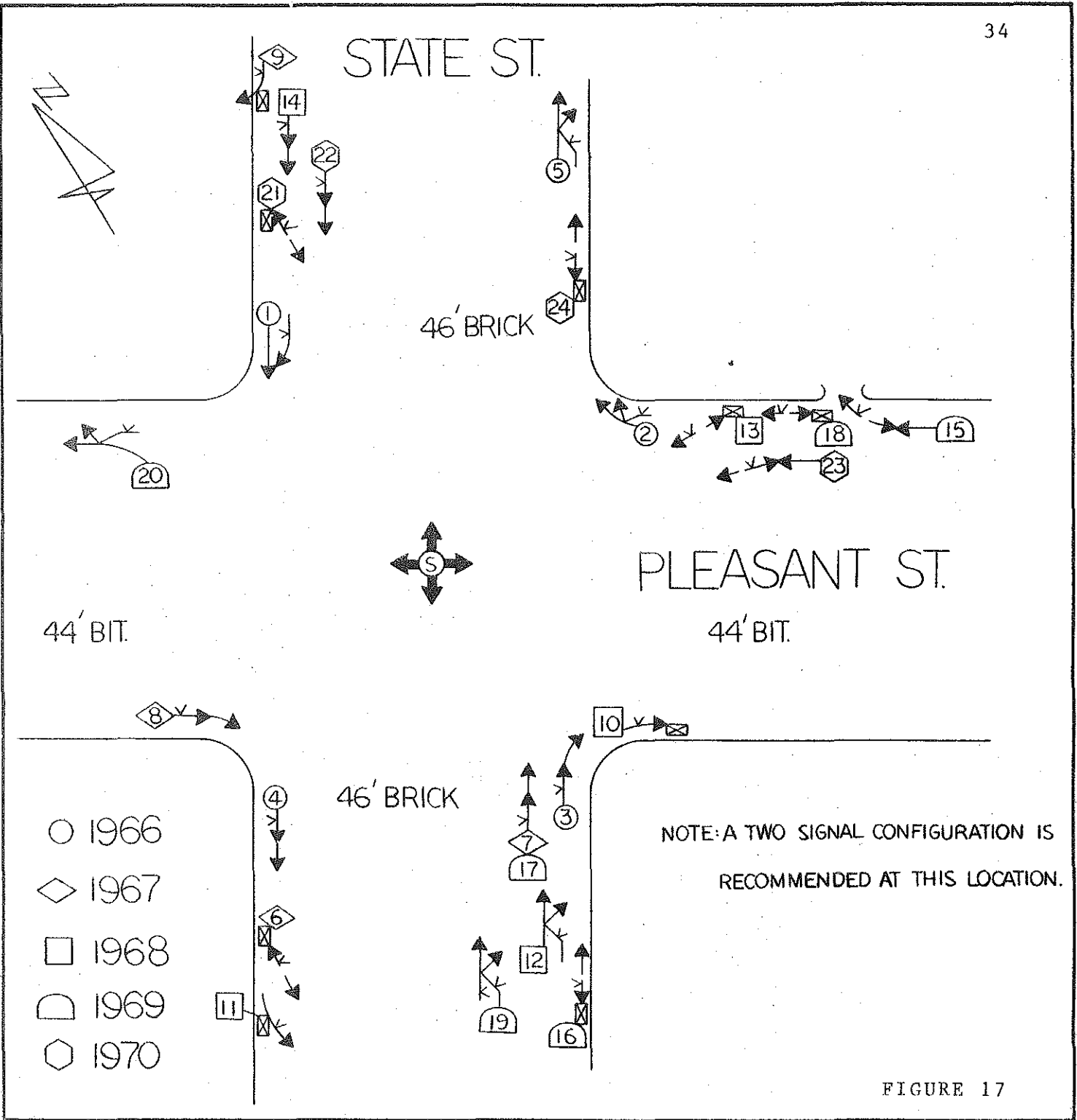
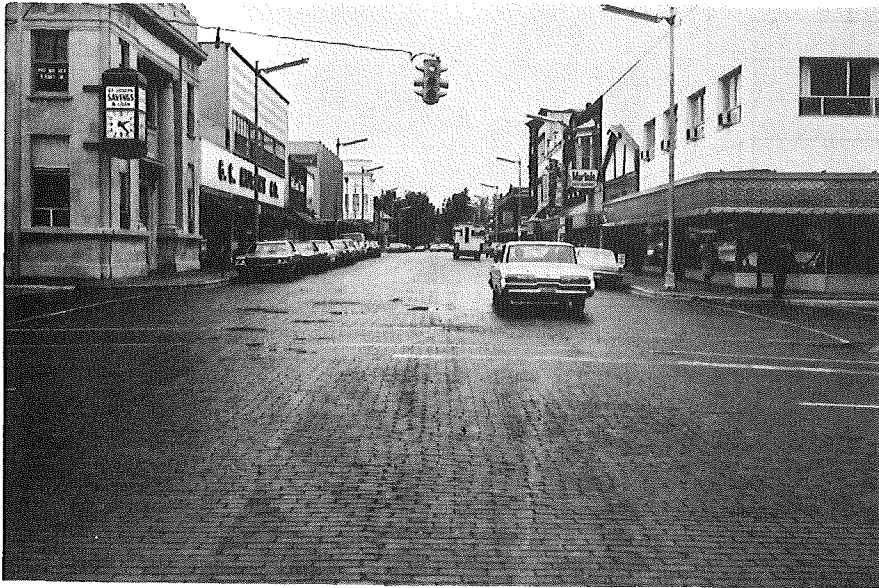


FIGURE 17

<p>LEGEND</p>	<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p>
<p>Stop & Go Signal </p> <p>Flashing Beacon </p> <p>Fatal </p> <p>Injury </p> <p>Skidding </p> <p>Jackknife </p> <p>Overturned </p> <p>Backing </p> <p>Pedestrian </p> <p>Tree </p> <p>Out of Control </p> <p>Driver Intent </p> <p>Deer </p> <p>Violator </p>	<p>Location STATE ST. at PLEASANT ST. CITY OF ST. JOSEPH BERRIEN CO.</p> <p>Period: 1966 THRU 1970</p> <p>Accidents - Total 24 P.D. 24</p> <p>Injury 0 () Fatal 0 ()</p> <p>C.S. _____ Miles _____ Drawn DVW</p> <p>Plan No. LOCATION 4 Date 5-13-70 REV. 3-15-72</p>

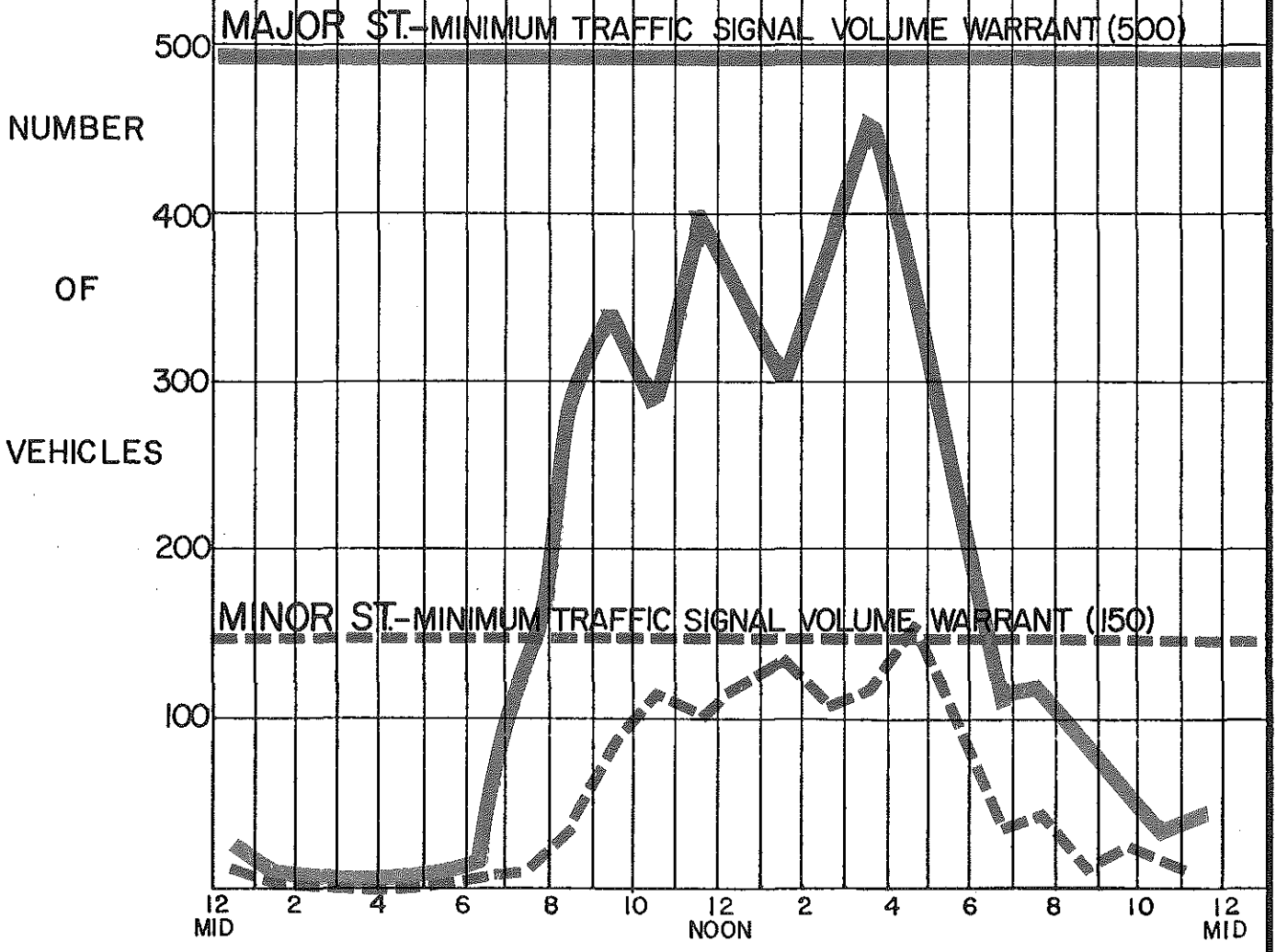


SOUTHWESTBOUND
STATE STREET

NORTHWESTBOUND
PLEASANT STREET



NORTHEASTBOUND
STATE STREET



SURVEY TAKEN 11-3/4-70

TIME OF DAY

LEGEND

ANALYSIS

STATE ST.

APPLICABLE WARRANT: URBAN VEHICULAR

PLEASANT ST.

HOURLY VOLUMES:

MAJOR STREET MEETS WARRANT 0 HOURS OF REQUIRED 8 HOURS

MINOR STREET MEETS WARRANT 1 HOURS OF REQUIRED 8 HOURS

ACCIDENT EXPERIENCE

___ ACCIDENTS REPORTED IN ___, ACCIDENT RATE ___/MV.

FIGURE 19

MICHIGAN STATE HIGHWAY DEPARTMENT TRAFFIC DIVISION	AUTH. NO.	DRAWN DVW	VEHICLE WARRANT GRAPH STATE ST. at PLEASANT ST. CITY OF ST. JOSEPH BERRIEN CO.
	CONT. SEC.	DATE 8-6-73	
	REF.	SCALE	
	SHEET OF	PLAN	

LOCATION 5

STATE STREET AT SHIP STREET

State Street at Ship Street is a right-angle intersection located at the north edge of the Central Business District. The traffic controls consist of two signals mounted on pedestals and located on the north and south corners.

State Street has a 46 ft wide brick surface up to and including the intersection while Ship Street has a 44 ft wide brick surface on the northwest leg and a 44 ft wide bituminous surface on the southeast leg. Two-hour parallel parking is allowed on both streets except for the first stalls which in some cases have a 15-minute restriction. Both streets also have pedestrian crosswalks and stop bars which indicate where a vehicle should stop for the red signal interval.

There was a total of 22 reported accidents at this location during the five-year study period. Ten of the 22 accidents, or slightly over 45 percent were parking accidents. Six of the remaining accidents, or 27 percent were right-angle collisions. Five of these accidents involved vehicles whose operators reportedly did not see the pedestal mounted traffic signals. The remaining accidents at this location consisted of three head-on left turns, two involving pedestrians, and one ran-off roadway.

Recommendations

A signalized intersection would be expected to cause a reduction in right-angle accidents and an increase in rear end accidents. However, at this signalized location during the five-year study period there were six right-angle accidents and no rear-end accidents. The fact that rear-end accidents did not occur over the past five years is very good. However, the fact that there were six right-angle accidents, with five of the operators involved reporting that they did not see the pedestal mounted traffic signals, indicates that a potential hazard does exist. According to the Michigan Vehicle Code (Revision of 1968, p. 103) at least one signal shall be located over the traveled portion of the roadway. Thus, it is recommended that this intersection conform to the law as set down in the Michigan Vehicle Code. In regard to the pedestal mounted traffic signals, it is felt that they do not have to be removed. Pedestal mounted traffic signals can be used as a supplement to overhead signals, but should not be used by themselves. Furthermore, it is recommended that this intersection eventually have two signal faces visible for each approach. If the pedestal signals are not removed one overhead signal will provide two visible signal faces per approach. If the pedestal signals are removed two overhead signals will have to be installed to provide two visible signal faces per approach. These recommendations will apply only if it is determined that this signal is warranted. If a signal is not warranted at this location, the pedestal mounted signals should be removed.

Also, it is recommended that State Street and the northwest leg of Ship Street be skid tested as part of the city-wide check of all brick surfaces. If these surfaces are found to have an unsatisfactory coefficient of friction, consideration should be given to resurfacing.

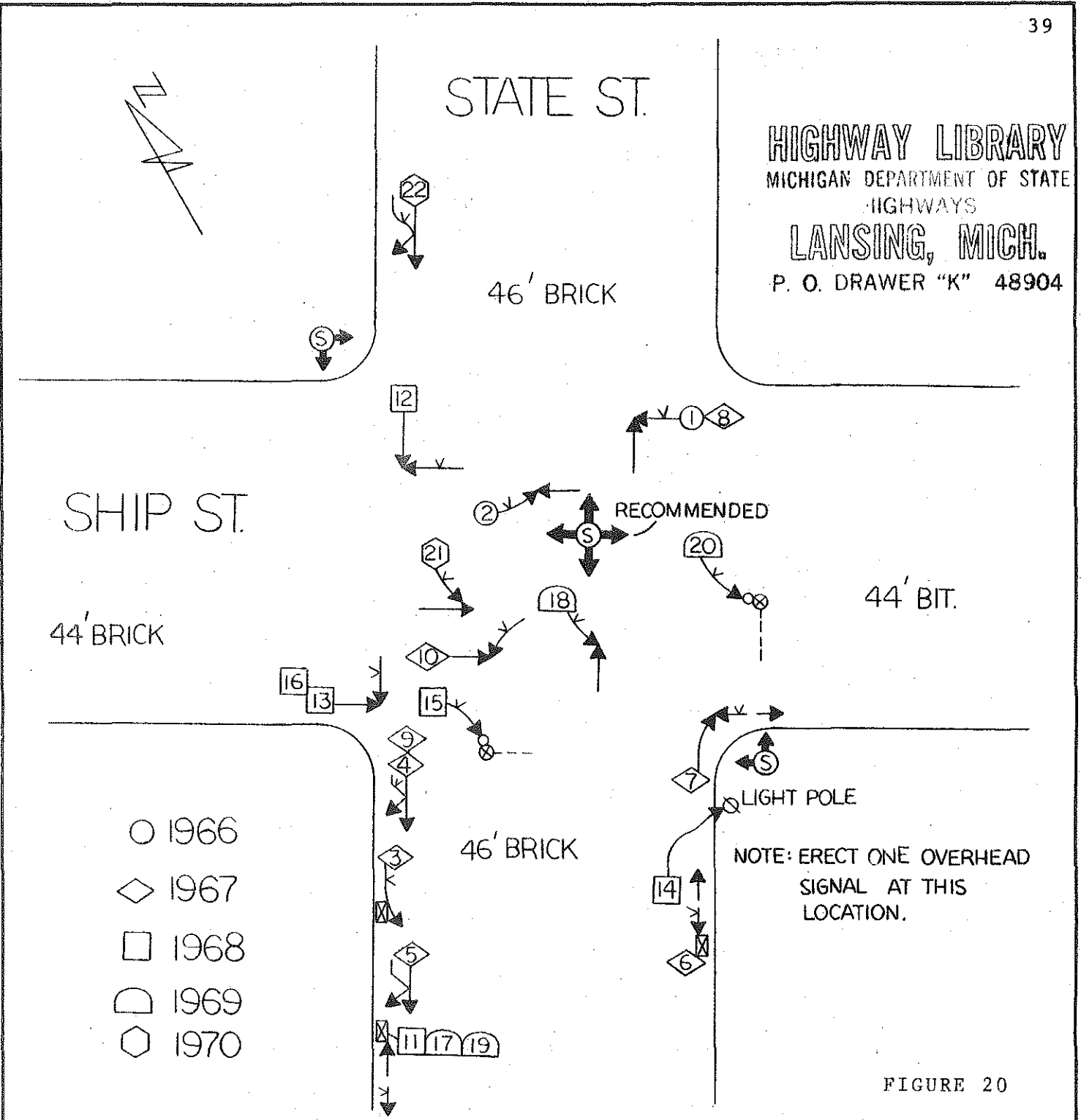
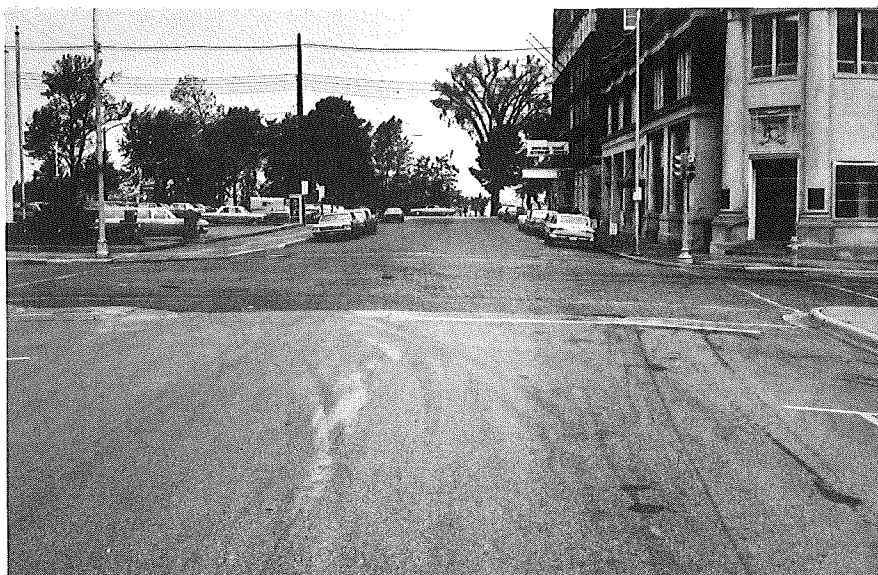


FIGURE 20

<p>LEGEND</p>	<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p>
<p>Stop & Go Signal Stop Sign S T Flashing Beacon Yield Sign Y T</p>	<p>Location STATE ST. at SHIP ST. CITY OF ST. JOSEPH BERRIEN CO.</p>
<p>Fatal Pedestrian (X) Injury Tree Skidding Out of Control Jackknife Driver Intent Overturned Deer Backing Violator (V)</p>	<p>Period: 1966 THRU 1970 Accidents - Total 22 P.D. 20 Injury 2 (2) Fatal 0 () C.S. _____ Miles _____ Drawn DVW Plan No. LOCATION 5 Date REV. 5-13-70 3-15-72</p>



SOUTHWESTBOUND
STATE STREET

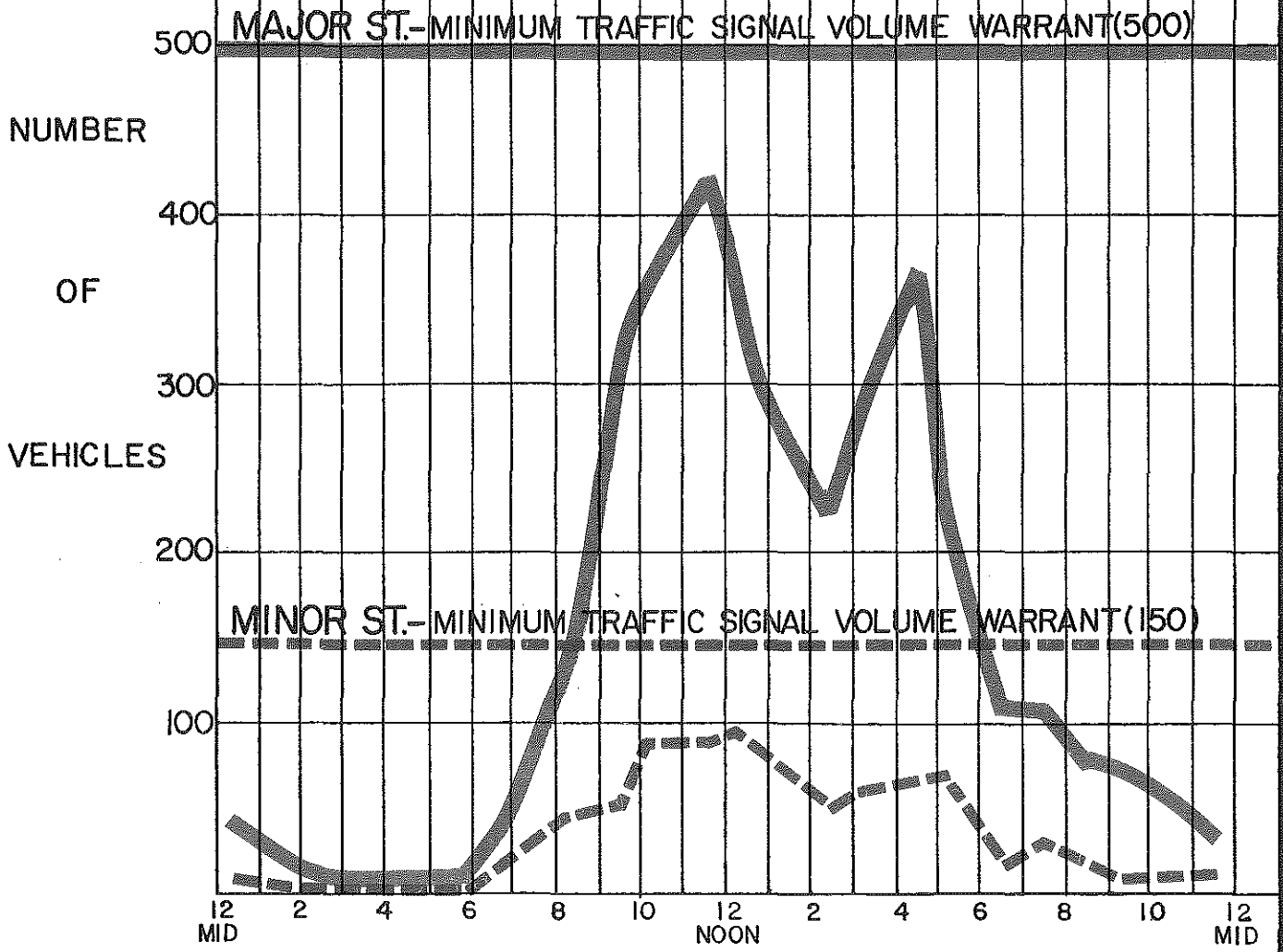


NORTHWESTBOUND
SHIP STREET



SOUTHEASTBOUND
SHIP STREET

FIGURE 21



SURVEY TAKEN 11-3/4-70

TIME OF DAY

LEGEND

ANALYSIS

STATE ST.

APPLICABLE WARRANT: URBAN VEHICULAR

SHIP ST.

HOURLY VOLUMES:

MAJOR STREET MEETS WARRANT 0 HOURS OF REQUIRED 8 HOURS

MINOR STREET MEETS WARRANT 0 HOURS OF REQUIRED 8 HOURS

ACCIDENT EXPERIENCE

___ ACCIDENTS REPORTED IN ___, ACCIDENT RATE ___/M.V.

FIGURE 22

MICHIGAN STATE HIGHWAY DEPARTMENT TRAFFIC DIVISION	AUTH. NO.	DRAWN DVW	VEHICLE WARRANT GRAPH STATE ST. at SHIP ST. CITY OF ST. JOSEPH BERRIEN CO.
	CONT. SEC.	DATE 8-6-73	
	REF.	SCALE	
	SHEET OF	PLAN	

LOCATION 6

BROAD STREET AT WAYNE STREET

The Broad Street and Wayne Street intersection is located in a residential area. Broad Street has the right-of-way, while Wayne Street traffic is controlled by two 24 in. "Stop" signs.

Broad Street has a two lane concrete pavement that is 30 ft wide east of the intersection and 41 ft wide west of the intersection. The vertical alignment of Broad Street consists of a negative gradient from northwest to southeast. Parallel parking is permitted on the northwest leg of Broad Street and prohibited on the southeast leg of Broad Street.

Wayne Street, which is 28 ft wide, has a two lane concrete pavement on the northeast leg and a two lane brick surface on the southwest leg. Parallel parking is prohibited on Wayne Street except for the east side of the northeast leg. Wayne Street southwest of the intersection has a three ft retaining wall on each side of the roadway. The retaining wall on the south side has hedges along its length that extend to a height of seven ft above the wall. The retaining wall begins to slope at a 45 degree angle 12 ft from the corner. The hedge stops at the point where the wall begins to slope. The sight distance from the southwest leg of Wayne is somewhat obstructed due to the retaining wall and any parked vehicles on the northwest leg of Broad Street. The sight distance from the northeast leg of Wayne Street to the northwest leg of Broad Street is also poor if there are any parked vehicles on the north side of Broad Street.

This intersection was the scene of 19 accidents during the five-year study period. Eleven of these accidents occurred on either wet, snowy or icy pavement. The largest single accident category involved right-angle collisions which accounted for 12 accidents, or 63 percent of the total. A southwestbound Wayne Street vehicle was at fault in eight of the right-angle accidents, while a northeastbound Wayne Street vehicle was at fault in the remaining four accidents. Five of the operators reported that they did not see the vehicle they struck. Only three of the operators involved in a right-angle accident failed to stop at the intersection. The remaining accidents at this location consisted of two rear ends, two parking accidents, one sideswipe and one ran-off roadway.

Recommendations

Altogether 58 percent of the accidents at this location occurred on wet, snowy or icy pavement, with 36 percent of the accidents occurring on wet pavement alone. It appears from these figures that the pavement becomes slippery when wet. For this reason, it is recommended that skidometer tests be conducted at this intersection to determine if resurfacing is necessary.

Furthermore, the parked cars on the northwest leg of Broad Street cause a sight obstruction for northeastbound and southwestbound Wayne Street traffic. It is recommended that parking be removed on Broad Street from the north and west corners northwesterly to the hill crest. Eliminating this parking will alleviate the sight distance problem and reduce the right-angle collisions.

There were three operators who reportedly did not stop for the "Stop" signs on Wayne Street. The "Stop" sign for northbound Wayne Street is connected to an arm brace that protrudes from the bushes that are located above the retaining wall (See the middle picture on p. 45). Since this sign is obscured by the bushes, it is recommended that the bushes be maintained so that the "Stop" sign is completely visible to northeastbound Wayne Street traffic. There is also a tree located approximately 100 ft from the intersection that hangs over the roadway and also blocks an operator's view of the "Stop" sign. This tree should be trimmed and then maintained so that it doesn't hang over the roadway.

The "Stop" sign for southbound Wayne Street is located about 20 ft from the intersection. It is recommended that this sign be located at the point of obedience.

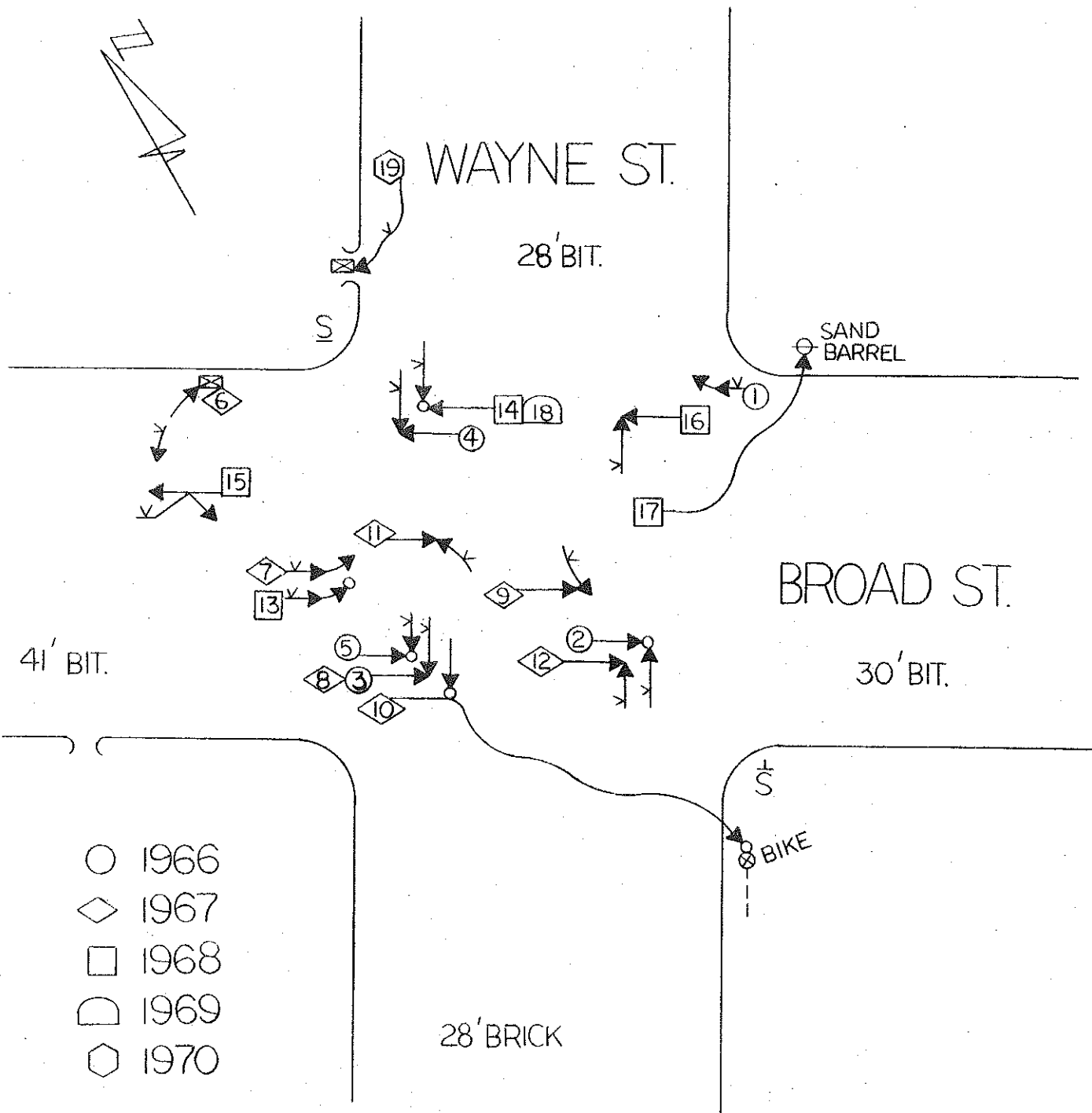


FIGURE 23

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal	Stop Sign	Location BROAD ST. at WAYNE ST. CITY OF ST. JOSEPH BERRIEN CO.	
Flashing Beacon	Yield Sign		
Fatal	Pedestrian	Period: 1966 THRU 1970	
Injury	Tree	Accidents - Total 19 P.D. 13	
Skidding	Out of Control	Injury 6 () Fatal 0 ()	
Jackknife	Driver Intent	C.S. _____ Miles _____ Drawn _____	
Overtaken	Deer	Plan No. LOCATION 6 Date REV 3-16-72	
Backing	Violator		



NORTHWESTBOUND
BROAD STREET



NORTHEASTBOUND
WAYNE STREET



SOUTHEASTBOUND
BROAD STREET

FIGURE 24

LOCATION 7

LAKE BOULEVARD AT PLEASANT STREET
(See Appendix I, p. 74)

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
18	16	2	0

LOCATION 8

PLEASANT STREET AT COURT STREET

Pleasant Street and Court Street form a right-angle intersection. Pleasant Street has a 40 ft wide concrete pavement approaching the intersection. Court Street has a 36 ft wide brick pavement up to and including the intersection. Court Street has the right-of-way with Pleasant Street traffic controlled by 24 in. "Stop" signs. The sight distances from Pleasant Street are adequate.

There was a total of 17 accidents at this location during the five-year study period. Nine of these accidents occurred on wet pavement and four others occurred on snow covered pavement. All but one of these 13 accidents occurred on the brick surface. There were seven right-angle accidents at this intersection, five of which occurred on wet pavement. Four of the operators involved in the right-angle accidents reported that they did not see the vehicle they struck. Only two operators reportedly did not stop for the "Stop" signs. The remaining accidents at this location consisted of three involving driveways, two rear ends, two improper turns, one sideswipe, one head-on left turn and one involving a parked vehicle.

Recommendations

Fifty-three percent of the accidents at this intersection occurred on wet pavement while altogether almost 70 percent of the accidents occurred on either wet, snowy or icy pavement. All but one of the accidents that occurred during inclement weather happened on the brick surface. Thus, it is recommended that skidometer tests be conducted on Court Street.

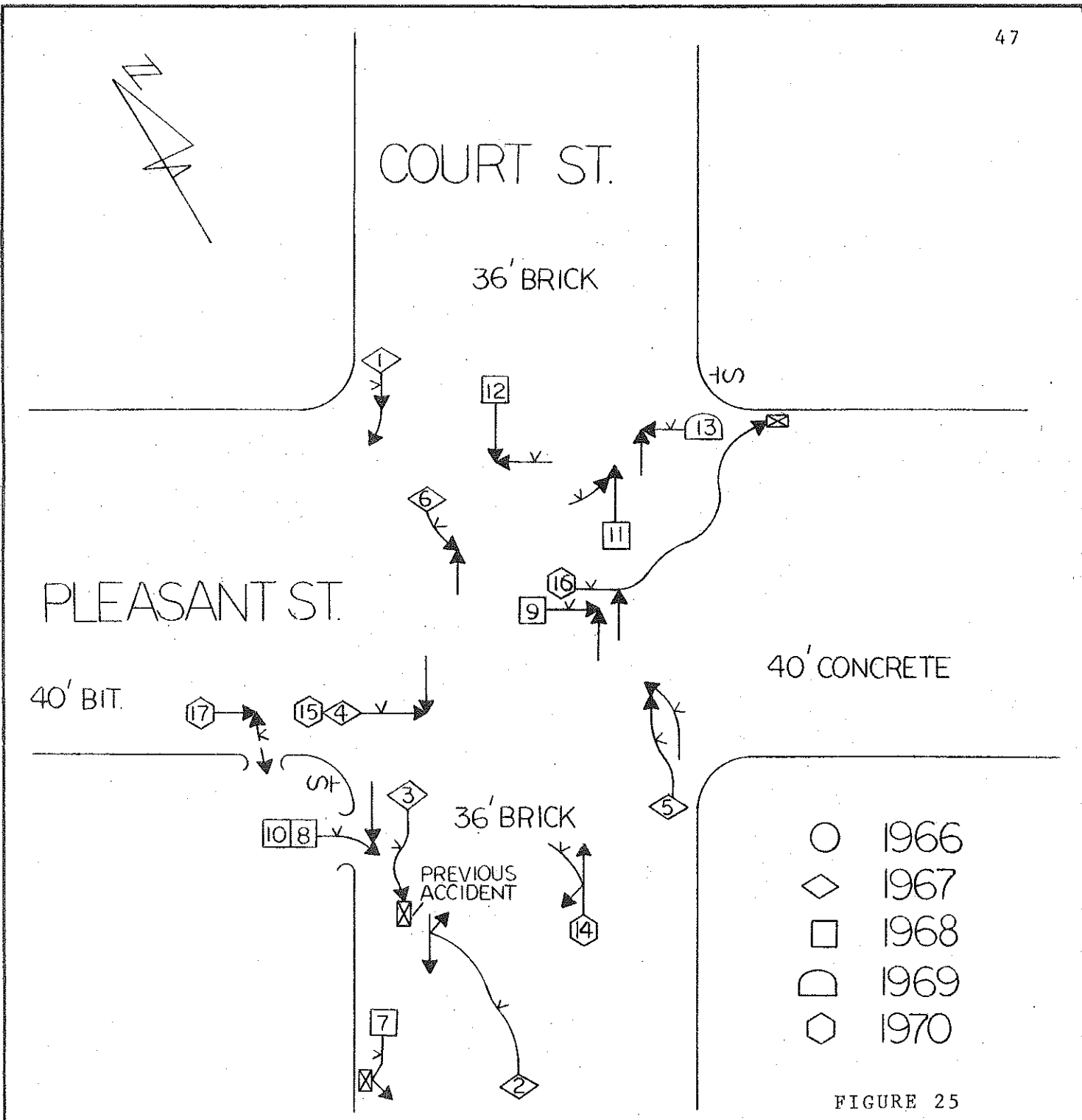


FIGURE 25

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal		Stop Sign	S
Flashing Beacon		Yield Sign	Y
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overturned		Deer	
Backing		Violator	
		Location	COURT ST. at PLEASANT ST. CITY OF ST. JOSEPH BERRIEN CO.
		Period:	1966 THRU 1970
		Accidents - Total	17 P.D. 17
		Injury	0 () Fatal 0 ()
		C.S.	Miles _____ Drawn DVW
		Plan No.	LOCATION 8 Date 5-14-72 REV. 3-17-72



SOUTHEASTBOUND
PLEASANT STREET

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NORTHEASTBOUND
COURT STREET



NORTHWESTBOUND
PLEASANT STREET

FIGURE 26

LOCATION 9

STATE STREET AT PARK STREET

State Street and Park Street form a right-angle intersection located in a residential area. Park Street has the right-of-way while State Street traffic is controlled by two 24 in. "Stop" signs. State Street provides access to and from the Central Business District.

State Street has a 36 ft wide bituminous pavement. The only existing pavement markings outline the crosswalk area. Park Street has a 30 ft wide concrete pavement with no pavement markings. Parallel parking is not prohibited or restricted on either roadway.

There were 15 accidents at this location during the five-year study period. Two of these accidents occurred on wet pavement while one accident occurred on snow covered pavement. Eighty percent of the accidents involved right-angle collisions. Nine of the right-angle accidents involved southbound State Street traffic. Seven of the vehicle operators involved in the right-angle accidents indicated that they did not see the vehicle they struck. Four other operators failed to stop for the "Stop" signs. The remaining accidents at this location consisted of two involving a parked car and one rear-end.

Recommendations

The critical aspect of this location is the occurrence of right-angle accidents. There were 12 right-angle accidents in a five-year period. Nine of the violators were traveling on the north-east leg of State Street. This is the first intersection involving State Street where the cross street has the right-of-way. It appears that State Street traffic needs to be made more aware of the impending stop at Park Street. Thus it is recommended that 36 in. "Stop" signs be erected in place of the present 24 in. signs. If right-angle accidents continue in the future consideration should be given to erecting "Stop Ahead" signs for north and southbound State Street.

STATE ST.

36' BIT.

PARK ST.

30' CONCRETE

30' CONCRETE

36' BIT.

REPLACE WITH 36" SIGN.





REPLACE WITH 36" SIGN

- 1966
- ◇ 1967
- 1968
- ◐ 1969
- ⬡ 1970













FIGURE 27

LEGEND

MICHIGAN DEPARTMENT OF STATE HIGHWAYS
TRAFFIC AND SAFETY DIVISION

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

Location PARK ST. at STATE ST.
CITY OF ST. JOSEPH
BERRIEN CO.

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

Period: 1966 THRU 1970
Accidents - Total 15 P.D. 12
Injury 3 (3) Fatal 0 ()
C.S. _____ Miles _____ Drawn DVW
Plan No. LOCATION 9 Date REV. 3-16-72



NORTHEASTBOUND
STATE STREET



SOUTHEASTBOUND
PARK STREET



NORTHWESTBOUND
PARK STREET

FIGURE 28

LOCATION 10

NAPIER AVENUE AT PIXLEY AVENUE(See Appendix I, p. 75)

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
12	10	2	0

LOCATION 11

NAPIER AVENUE AT MORTON AVENUE(See Appendix I, p. 76)

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
11	11	0	0

LOCATION 12

STATE STREET AT WATER STREET

State Street and Water Street form a "T" intersection one block north of the Central Business District. The existing traffic control consists of a "Yield" sign for the east leg of Water Street.

State Street has a two lane, 60 ft wide bituminous pavement with curb and gutter. Water Street has a two lane, 37 ft wide bituminous pavement west of State Street and a 20 ft wide bituminous pavement east of State Street. The east leg of Water Street provides access to an apartment building parking lot. State Street and the west leg of Water Street have center line markings while the east leg of Water Street has no pavement markings. The main flow of traffic is from State Street to the west leg of Water Street and vice versa. The vertical alignment at this location consists of a positive gradient from the west leg of Water Street to State Street.

There were eleven accidents at this intersection during the five-year study period. Two of these accidents occurred on wet pavement and only one occurred on snow covered pavement. Sixty-four percent of the accidents involved sideswipes. Careless driving was involved in five of the seven sideswipes while excessive speed played a contributory role in two accidents. Six of the seven drivers at fault were traveling on eastbound Water Street. The remaining accidents at this location consisted of two rear ends and two run-off roadways.

Recommendations

Seven of the eleven accidents at this location were sideswipes with six involving eastbound Water Street traffic. Each accident involved a motorist crossing the center line on the curve that

extends from the west leg of Water Street to the south leg of State Street. Devil Level readings indicate that 15 mph Speed Panels are necessary at this curve. The Devil Level readings taken at this location were as follows:

East - Southbound		North - Westbound	
<u>Speed</u>	<u>Reading</u>	<u>Speed</u>	<u>Reading</u>
15 mph	11°	15 mph	12°
20 mph	16°	20 mph	17°
25 mph	20°	25 mph	21°

Due to these figures it is recommended that 15 mph Advisory Speed Panels accompany 30 in. Turn signs for both eastbound Water Street and northbound State Street traffic. It is also recommended that double yellow centerline markings be used in conjunction with this signing to help keep opposing traffic from crossing the centerline.

Lastly, it is recommended that a 48 in. Directional Target Arrow be placed at the end of State Street.

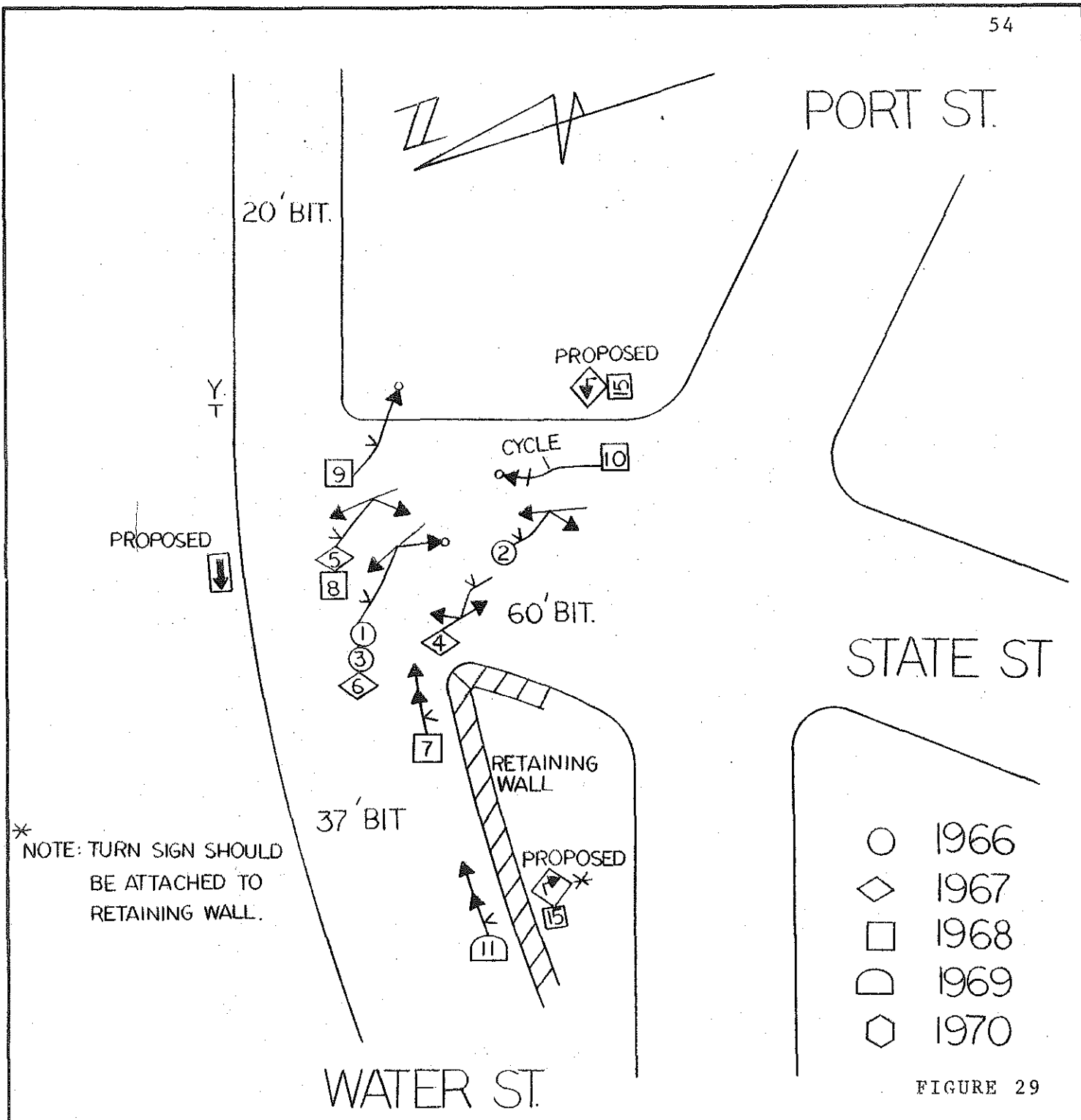


FIGURE 29

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal		Stop Sign	S T
Flashing Beacon		Yield Sign	Y T
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overturned		Deer	
Backing		Violator	
		Location	STATE ST. at WATER ST. CITY OF ST. JOSEPH BERRIEN CO.
		Period:	1966 THRU 1970
		Accidents - Total	11 P.D. 6
		Injury	5 (10) Fatal 0 ()
		C.S.	Miles Drawn DVW
		Plan No.	LOCATION 12 Date 5-19-70 REV. 3-30-72



NORTHBOUND
STATE STREET



NORTHBOUND
STATE STREET

FIGURE 30



SOUTHWESTBOUND
WATER STREET



NORTHEASTBOUND
WATER STREET

FIGURE 31

LOCATION 13

WALLACE AVENUE AT LAKEVIEW AVENUE
 (See Appendix I, p. 77)

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
10	9	1	0

LOCATION 14

WINCHESTER AVENUE AT STATE STREET

Winchester Avenue and State Street form a right-angle intersection in a residential area. Winchester Avenue has a 32 ft wide brick surface west of the intersection and a 40 ft wide brick surface east of the intersection. The brick pavement extends through the intersection. State Street has a 30 ft wide concrete pavement north of the intersection and a 40 ft wide concrete pavement south of the intersection. Parking is permitted on State Street except for the immediate intersection area and that portion abutting the southwest quadrant. Parking is permitted on Winchester Avenue except for the immediate intersection area.

Winchester Avenue has the right-of-way at this intersection with State Street traffic controlled by two 24 in. "Stop" signs. The west leg of Winchester Avenue is a one-way street in the easterly direction while the east leg has two-way traffic. There are five signs facing westbound Winchester Avenue traffic. Three of these signs are suspended over the west leg of Winchester Avenue while the other two are on the supports for the overhead signs. The two signs on the supports and the center one of the three overhead signs read "Do Not Enter". The remaining two signs both read "One-Way Do Not Enter". The backs of the signs located on the overhead sign supports face eastbound Winchester traffic and indicate that "One-Way Traffic Ends". Below the "Stop" sign for southbound State Street traffic there is a "No Right Turn" sign. Also, northbound State Street has a 24 in. "Stop Ahead" sign and the east leg of Winchester Avenue has a "Slow School" sign.

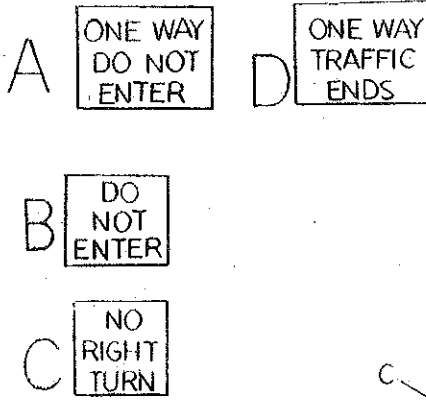
There were ten accidents at this location during the five-year study period. Two of these accidents occurred on wet pavement and four others occurred on snowy or icy pavement. There were three rear end accidents, all occurring on the south leg of State Street. Two of these accidents involved wet pavement. There were also three right-angle accidents, all involving carelessness on the part of the operators. The remaining accidents consisted of two involving a parked car, one head-on left turn, and one ran-off roadway.

Recommendations

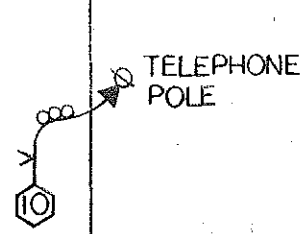
Brick pavements are more susceptible to becoming slippery when wet than other roadway surfaces. Therefore, it is recommended that skidometer tests be conducted on Winchester Avenue to determine if a slippery condition exists. If such a condition does exist resurfacing will be necessary and should be scheduled as soon as it is feasible.

The remaining recommendations at this location involve signing changes and can be found under the Traffic Control Devices Inventory and on the proposed signing diagram (Figure 35).

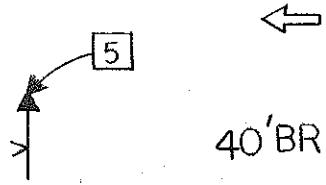
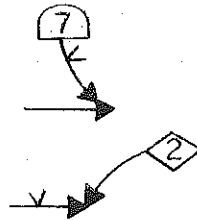
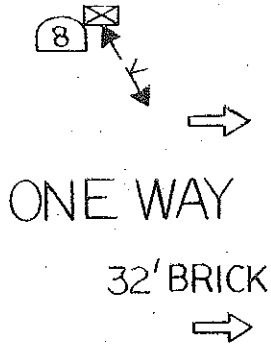
EXISTING SIGNS



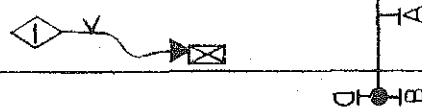
STATE ST.



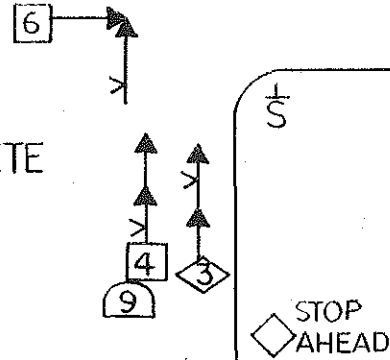
30' CONCRETE



WINCHESTER AVE



40' CONCRETE



- 1966
- ◇ 1967
- 1968
- ◐ 1969
- ⬡ 1970

FIGURE 32

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal	Stop Sign	Location WINCHESTER AVE. at STATE ST. CITY OF ST. JOSEPH BERRIEN CO.	
Flashing Beacon	Yield Sign		
Fatal	Pedestrian	Period: 1969 THRU 1970	
Injury	Tree	Accidents - Total 10	P.D. 10
Skidding	Out of Control	Injury 0 ()	Fatal 0 ()
Jackknife	Driver Intent	C.S. _____ Miles _____	Drawn DVW
Overtaken	Deer	Plan No. LOCATION 14	Date REV. 5-19-70
Backing	Violator		Date REV. 3-28-72



NORTHBOUND
STATE STREET



NORTHBOUND
STATE STREET



SOUTHBOUND
STATE STREET

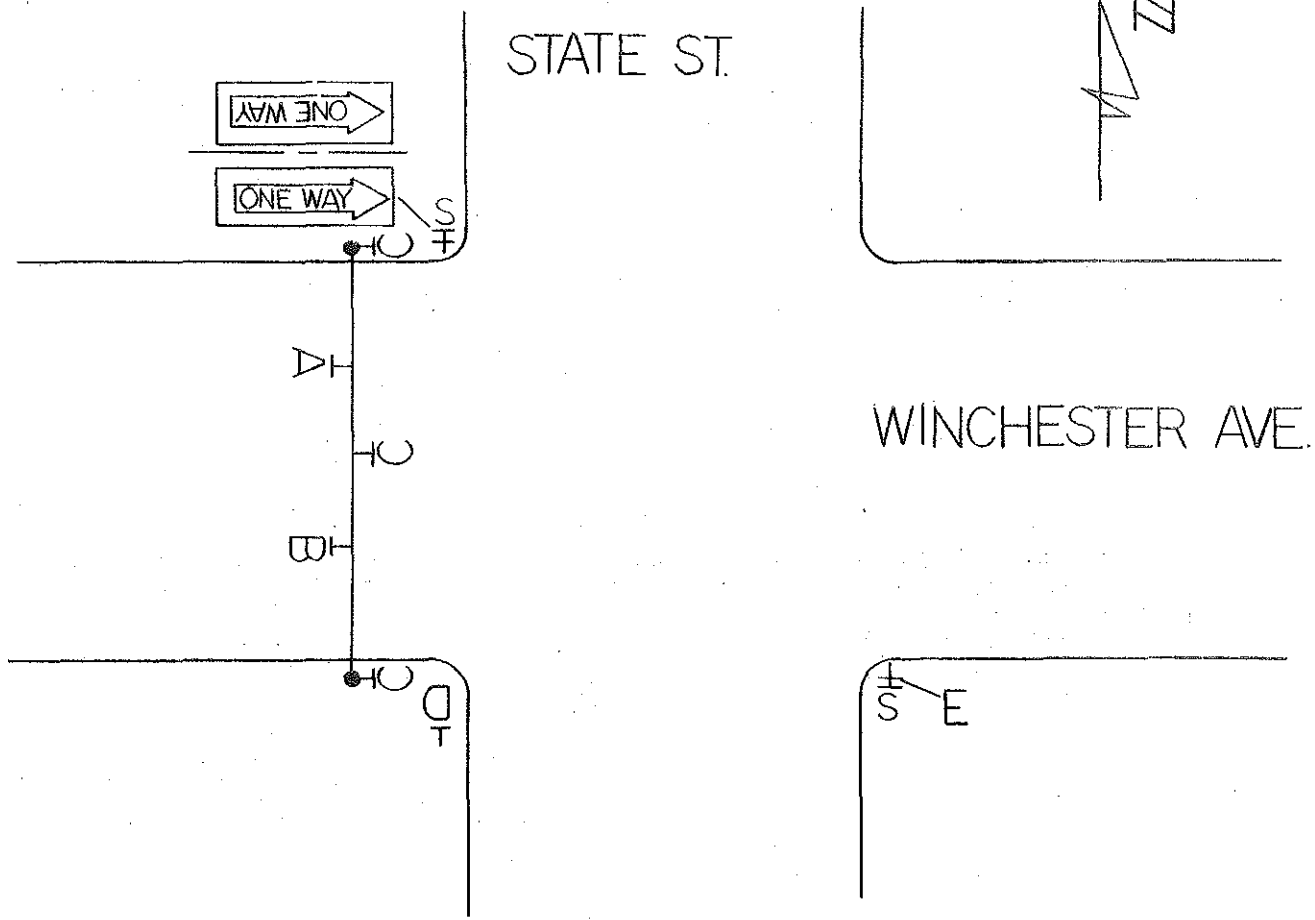


WESTBOUND WINCHESTER AVENUE



EASTBOUND WINCHESTER AVENUE

FIGURE 34



PROPOSED SIGNS

- A
- B
- C
- D
- E

FIGURE 35

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN DVW	PROPOSED SIGNING OF WINCHESTER AVE. at STATE ST. CITY OF ST. JOSEPH BERRIEN CO.
	CONT. SEC.	DATE	
	REF.	SCALE	
	SHEET OF	PLAN	

LOCATION 15 STATE STREET AT ELM STREET

State Street at Elm Street is a signalized intersection at the fringe of the Central Business District. There is one signal head suspended over the center of the intersection.

State Street has a 46 ft wide brick surface north of and including the intersection area and a 36 ft wide brick surface south of the intersection. Parking on the south leg of State Street is not restricted, while parking on the north leg has a two-hour limit except for the first stall on the east side which has a 15-minute restriction.

Elm Street has a 44 ft wide concrete pavement on the east leg of the intersection and a 40 ft wide concrete pavement on the west leg of the intersection. Two-hour parking is permitted on both sides of Elm Street except for the first stall on the north half of the east leg which has a 15-minute restriction. Behind this parking stall there are two stalls which are used as a loading area for laundry trucks.

There were ten accidents at this location during the five-year study period. Four of these accidents occurred on wet pavement while three others occurred on snowy or icy pavement. During the study period there were four parking accidents, two sideswipes, two involving a driveway, one improper backing and one involving a bicyclist.

Recommendations

Seven of the ten accidents at this location occurred during adverse weather conditions. Furthermore, all but one of the accidents occurred on State Street which has a brick surface. Thus, it is recommended that State Street be skid tested as part of the city-wide check of all brick surfaces. If a slippery condition exists consideration should be given to resurfacing.

Lastly, this intersection has only one overhead vehicular signal face visible to traffic on each approach. If this intersection remains signalized then a second signal head should be erected to provide two visible signal faces per approach.

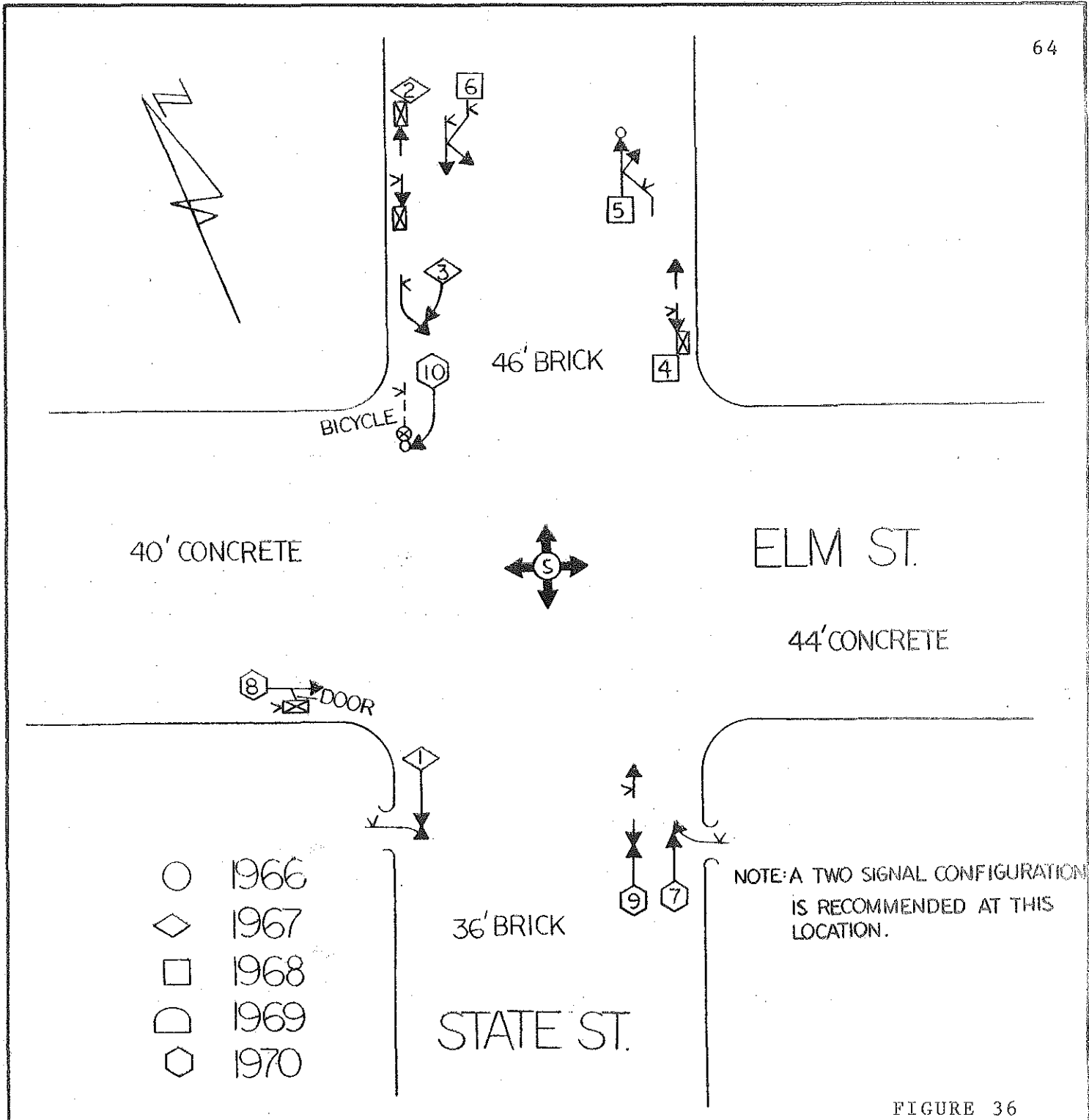


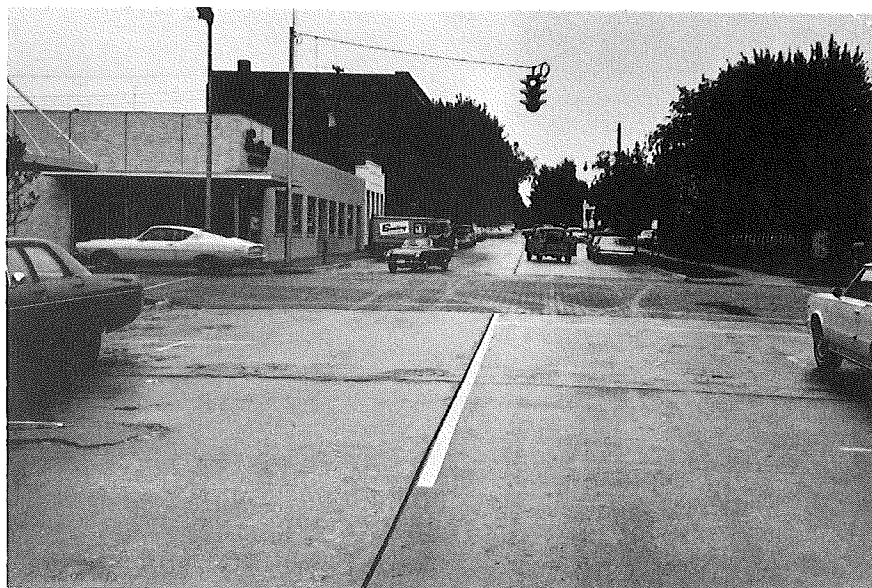
FIGURE 36

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal		Stop Sign	S T
Flashing Beacon		Yield Sign	Y T
Fatal ———● Injury ———○ Skidding ———○○○ Jackknife ———/ Overturned ———/ Backing ———←		Location STATE ST. at ELM ST. CITY OF ST. JOSEPH BERRIEN CO.	
Pedestrian ·····(X) Tree ☼ Out of Control ———/ Driver Intent ———/ Deer (V) Violator ———Y		Period: 1966 THRU 1970 Accidents - Total 10 P.D. 8 Injury 2 (2) Fatal 0 () C.S. _____ Miles _____ Drawn DVW Plan No. LOCATION 15 Date REV. 3-29-72	



SOUTHWESTBOUND
STATE STREET

SOUTHEASTBOUND
ELM STREET

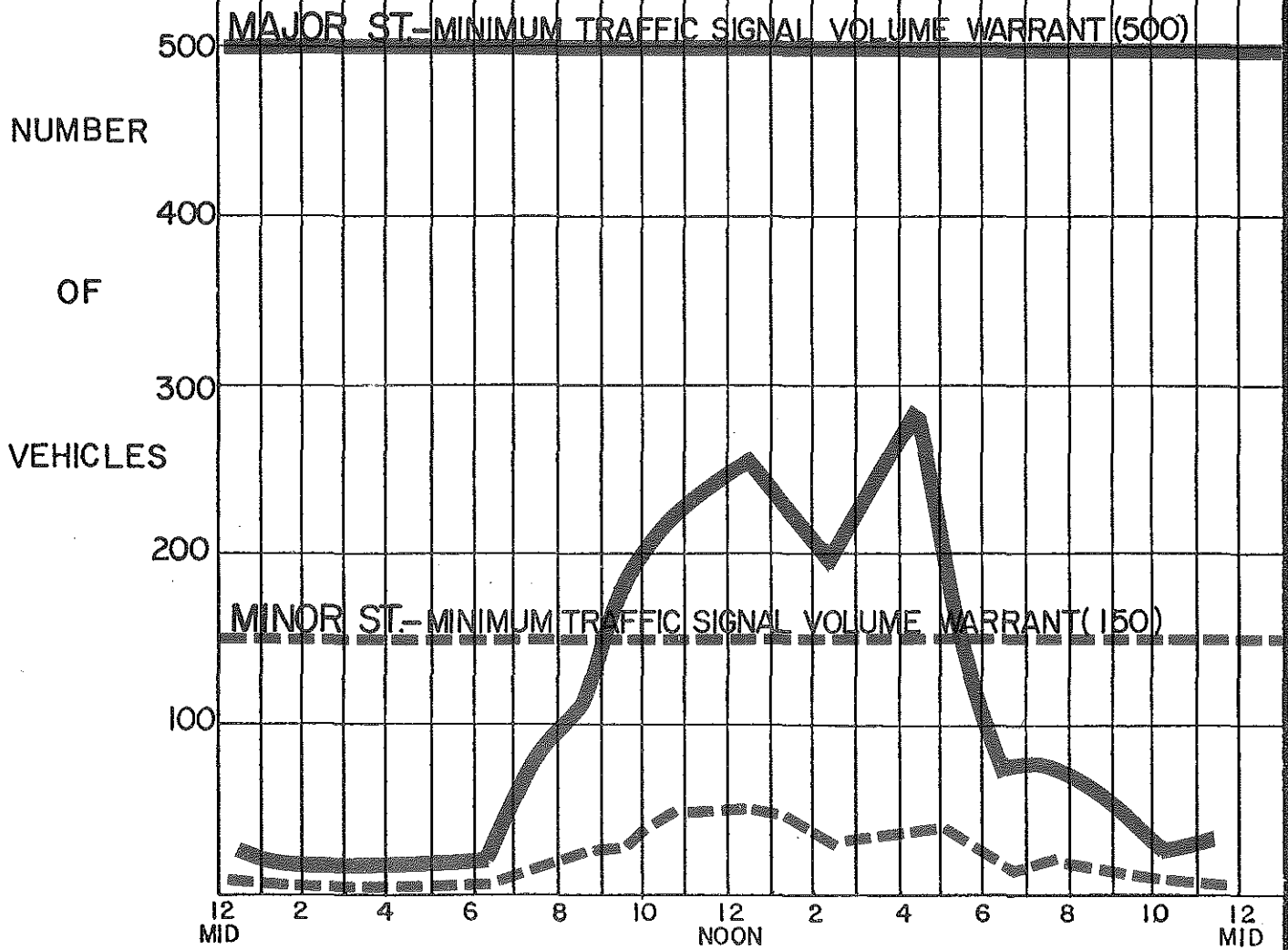


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NORTHWESTBOUND
ELM STREET

FIGURE 37



SURVEY TAKEN 11-3/4-70

TIME OF DAY

LEGEND

ANALYSIS

STATE ST.

APPLICABLE WARRANT: URBAN VEHICULAR

ELM ST.

HOURLY VOLUMES:

MAJOR STREET MEETS WARRANT 0 HOURS OF REQUIRED 8 HOURS

MINOR STREET MEETS WARRANT 0 HOURS OF REQUIRED 8 HOURS

ACCIDENT EXPERIENCE

___ ACCIDENTS REPORTED IN ___, ACCIDENT RATE ___/M.V.

FIGURE 38

MICHIGAN STATE HIGHWAY DEPARTMENT TRAFFIC DIVISION	AUTH. NO.	DRAWN DVW	VEHICLE WARRANT GRAPH STATE ST. at ELM ST. CITY OF ST. JOSEPH BERRIEN CO.
	CONT. SEC.	DATE 8-6-73	
	REF.	SCALE	
	SHEET OF	PLAN	

LOCATION 16 WILLA DRIVE AT VAN BRUNT AVENUE
 (See Appendix I, p. 78)

<u>Total</u>	<u>Property Damage</u>	<u>Injury</u>	<u>Fatal</u>
9	6	3	0

LOCATION 17 UPTON DRIVE AT OAK STREET

Upton Drive and Oak Street form a "T" intersection with Upton Drive having the right-of-way. Oak Street, which is an entrance to a factory has a 24 in. "Stop" sign on the northeast corner.

Upton Drive has a 45 ft wide bituminous pavement with curb and gutter and no pavement markings. A single track railroad crossing is located on Upton Drive just north of Oak Street. Parking is prohibited on both sides of Upton Drive.

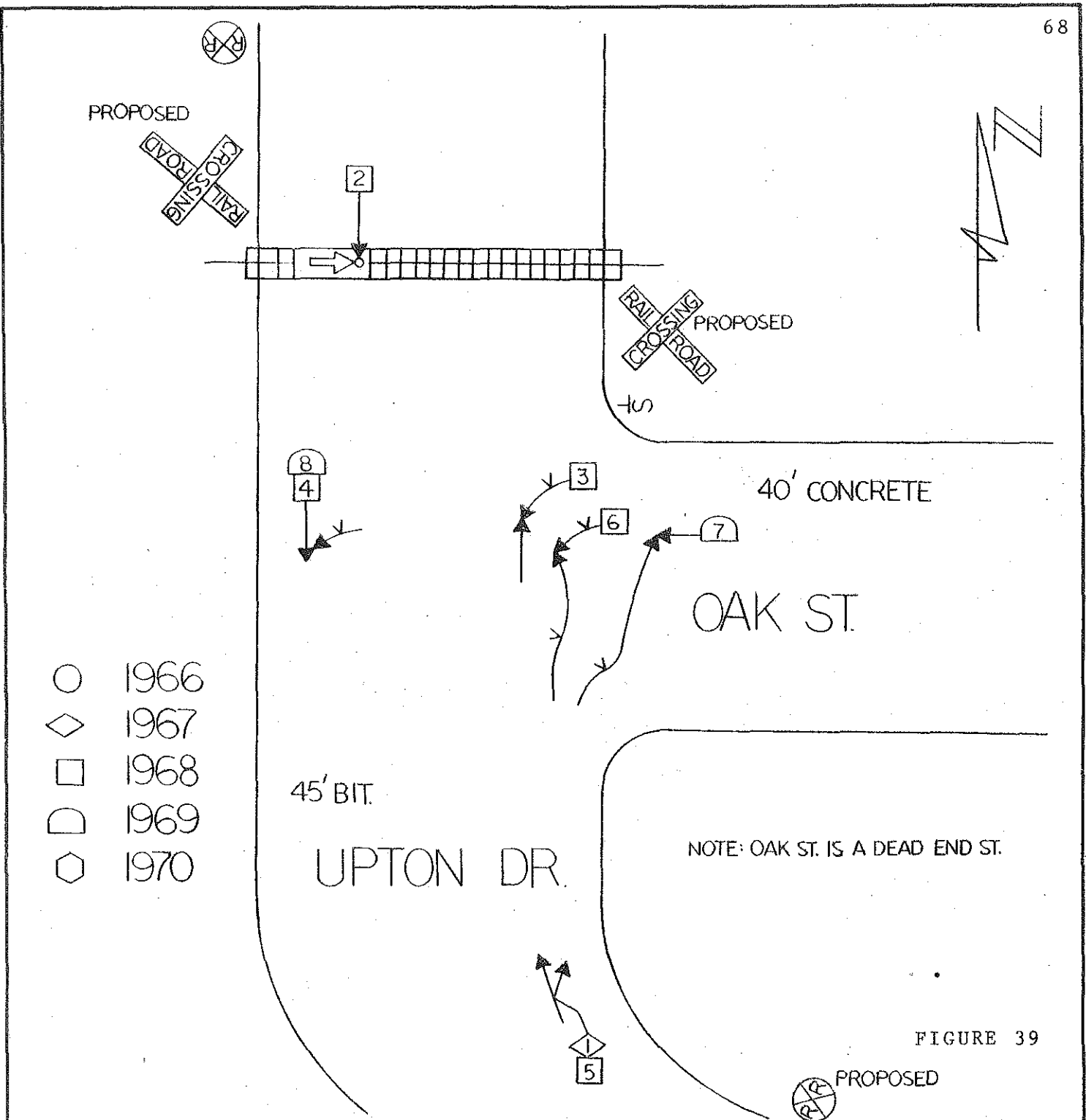
Oak Street, which is not a thru street, has a 40 ft wide concrete pavement. There are no pavement markings on Oak Street and parking is prohibited on both sides.

There were eight accidents at this intersection during the five-year study period. Four of these accidents happened on wet pavement and one happened on snowy pavement. The accidents at this location consisted of four right-angles, two sideswipes, one improper turn and one involving a train.

Recommendations

The railroad tracks that cross Upton Drive are not identified so that motorists can detect their presence. It is recommended that Railroad Crossing signs and Railroad Advance Warning signs be erected for both north and southbound Upton Drive.

Furthermore, the Manual suggests that all four lane undivided pavements have center line markings. Thus, it is recommended that a painted center line be applied to Upton Drive.



- 1966
- ◇ 1967
- 1968
- ◐ 1969
- ◑ 1970

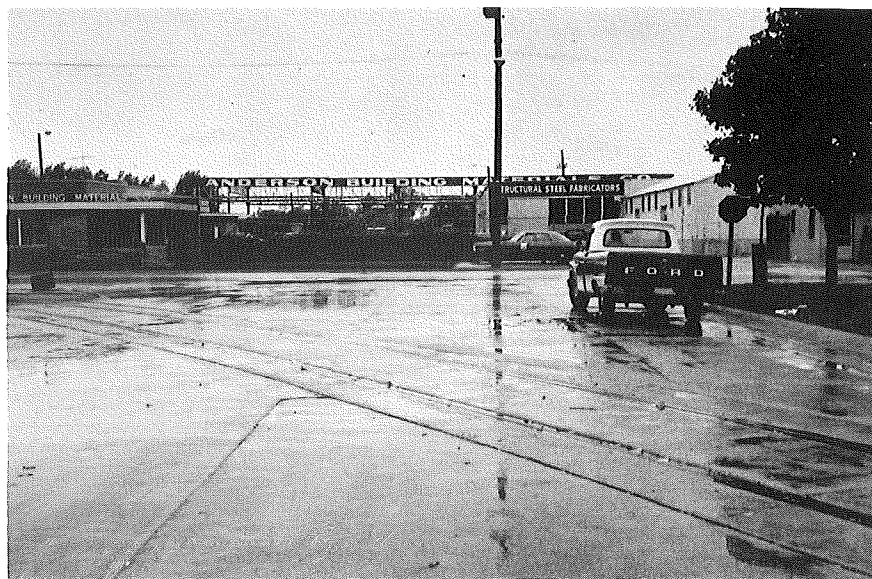
FIGURE 39

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal	Flashing Beacon	Stop Sign	Yield Sign
Fatal	Injury	Skidding	Jackknife
Overturned	Backing	Pedestrian	Tree
		Out of Control	Driver Intent
		Deer	Violator
Location: UPTON DR. at OAK ST. CITY OF ST. JOSEPH BERRIEN CO.		Period: 1966 THRU 1970 Accidents - Total 8 P.D. 7 Injury 1 (1) Fatal 0 () C.S. _____ Miles _____ Drawn DVW Plan No. LOCATION 17 Date REV. 4-12-72	



SOUTHBOUND
UPTON DRIVE

WESTBOUND
OAK STREET



NORTHBOUND
UPTON DRIVE

FIGURE 40

SUMMARY OF RECOMMENDATIONS

The Department of State Police submitted 17 high accident locations for the City of St. Joseph to the Michigan Department of State Highways and Transportation. After an indepth study of these locations, recommendations were formulated for 12 of them. The locations and their recommendations are as follows:

<u>Location Number</u>	<u>Location Description</u>	<u>Quantity</u>	<u>Recommendations</u>
1	Napier Avenue at Langley Avenue	3 2 2 1 1 1	R3-5 R3-6 R3-7 R3-8 R3-5a D9-2 Standard signing with the proper background should be used. Skidometer tests should be conducted. Change painted arrows to correspond to recommended lane assignments for the southeast leg of Napier Avenue. Lane lines and painted arrows should be applied on the west leg of Napier Avenue.
2	Broad Street at Court Street		Skidometer tests should be conducted. Parking should be removed 75 ft from each corner on Broad Street. "No Parking Here To Corner" signs should be turned to face east and westbound Broad Street traffic.
3	State Street at Broad Street	1	Overhead Signal Replace angle parking with parallel parking. Skidometer tests should be conducted.
4	State Street at Pleasant Street	1	Overhead Signal Skidometer tests should be conducted on State Street. Center line markings should be added to both roadways.

<u>Location Number</u>	<u>Location Description</u>	<u>Quantity</u>	<u>Recommendations</u>
5	State Street at Ship Street	1	Overhead Signal Skidometer tests of the brick surfaces
6	Broad Street at Wayne Street		Skidometer tests should be conducted. Remove parking on the west leg of Broad Street from the intersection westerly to the hill crest. Maintain bushes that surround the "Stop" sign located on the south corner. Trim the tree that hangs over northeastbound Wayne Street. Move the "Stop" sign for southwestbound Wayne Street to the point of obedience.
8	Pleasant Street at Court Street		Skidometer tests should be conducted on Court Street.
9	State Street at Park Street	2	RI-1 (36 in.)
12	State Street at Water Street	2 2 1	W1-1 (30 in.) W13-1 (15 MPH) W1-6 (48 in.) Apply double yellow center-line markings.
14	Winchester Avenue at State Street		Skidometer tests should be conducted on Winchester Avenue.
15	State Street at Elm Street	1	Overhead Signal Skidometer tests should be conducted on State Street.
17	Upton Drive at Oak Street	2 2	RI5-1 W10-1 The center line for Upton Drive should be marked.

City-Wide Recommendations

1. It is recommended that the City of St. Joseph initiate a city-wide project to skid test all brick surfaces.
2. Further investigation should be conducted to ascertain whether the original signal warrants, which necessitated the installation of the four signals in the Central Business District, still apply.
3. Those signalized intersections which satisfy the minimum requirements of the Manual should be provided with two signal faces per approach.
4. The four signals in the Central Business District should not show a green indication simultaneously with the yellow clearance interval.
5. All city major streets should have marked center lines. Any other streets where unusual conditions exist or where there is a need to control traffic through a congested area should also have marked center lines.

APPENDIX I

HIGHWAY LIBRARY
 MICHIGAN DEPARTMENT OF STATE HIGHWAYS
 LANSING, MICH.
 P. O. DRAWER "K" 48904

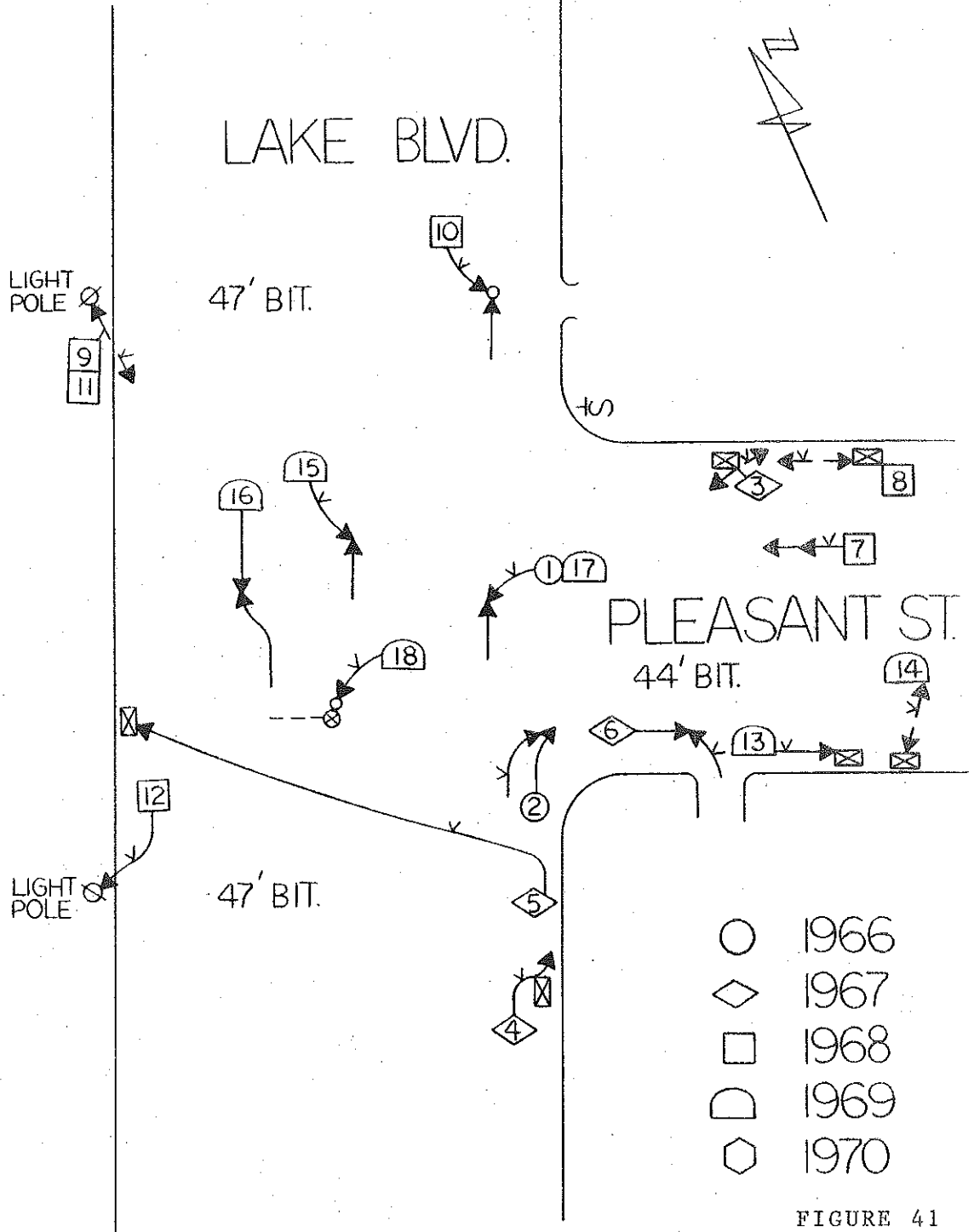


FIGURE 41

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal		Stop Sign	S T
Flashing Beacon		Yield Sign	Y T
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overtaken		Deer	
Backing		Violator	
		Location	LAKE BLVD. at PLEASANT ST. CITY OF ST. JOSEPH BERRIEN CO.
		Period:	1966 THRU 1970
		Accidents - Total	18 P.D. 16
		Injury	2 (3) Fatal 0 ()
		C.S.	Miles _____ Drawn DVW
		Plan No.	LOCATION 7 Date REV 4-7-72

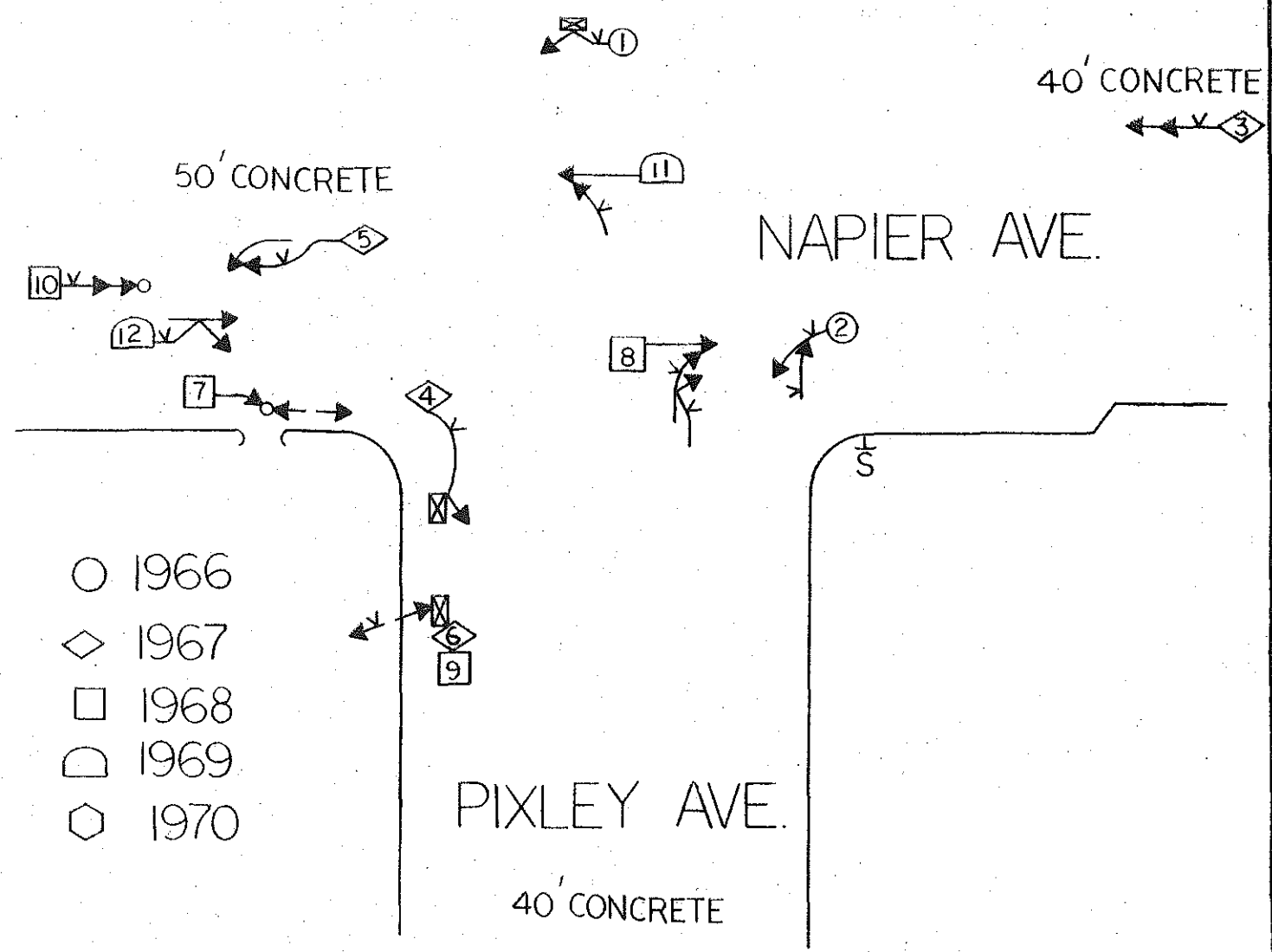


FIGURE 42

<p>LEGEND</p>	<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p>
<p>Stop & Go Signal Stop Sign S T</p> <p>Flashing Beacon Yield Sign Y T</p>	<p>Location NAPIER AVE. at PIXLEY AVE. CITY OF ST. JOSEPH BERRIEN CO.</p>
<p>Fatal Pedestrian (X)</p> <p>Injury Tree *</p> <p>Skidding Out of Control ~~~~~</p> <p>Jackknife Driver Intent ~~~~~</p> <p>Overturned Deer (V)</p> <p>Backing Violator (V) Y</p>	<p>Period: 1966 THRU 1970</p> <p>Accidents - Total 12 P.D. 10</p> <p>Injury 2 (2) Fatal 0 ()</p> <p>C.S. _____ Miles _____ Drawn DVW</p> <p>Plan No. LOCATION 10 Date REV. 3-30-72</p>

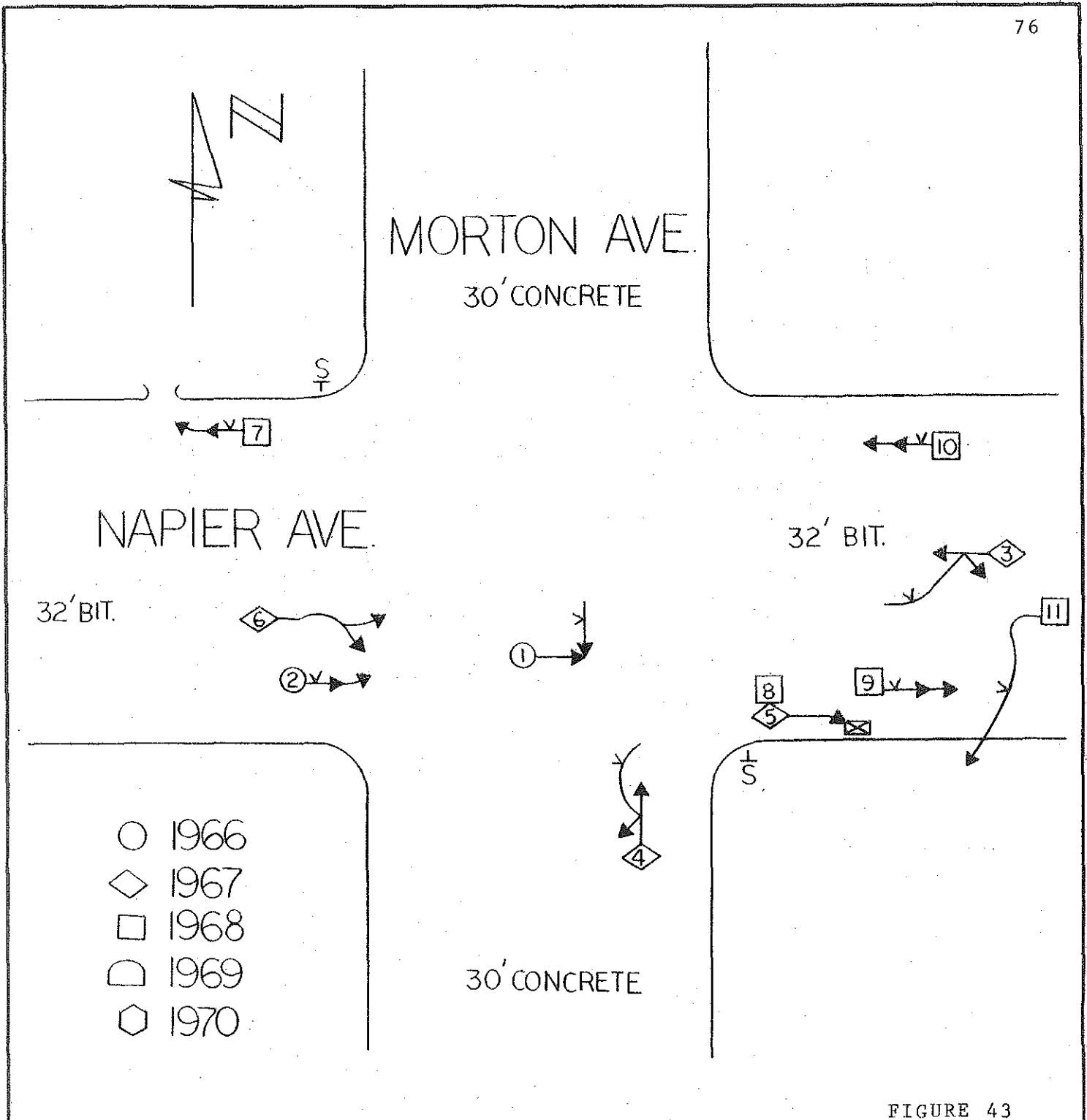

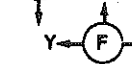


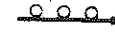









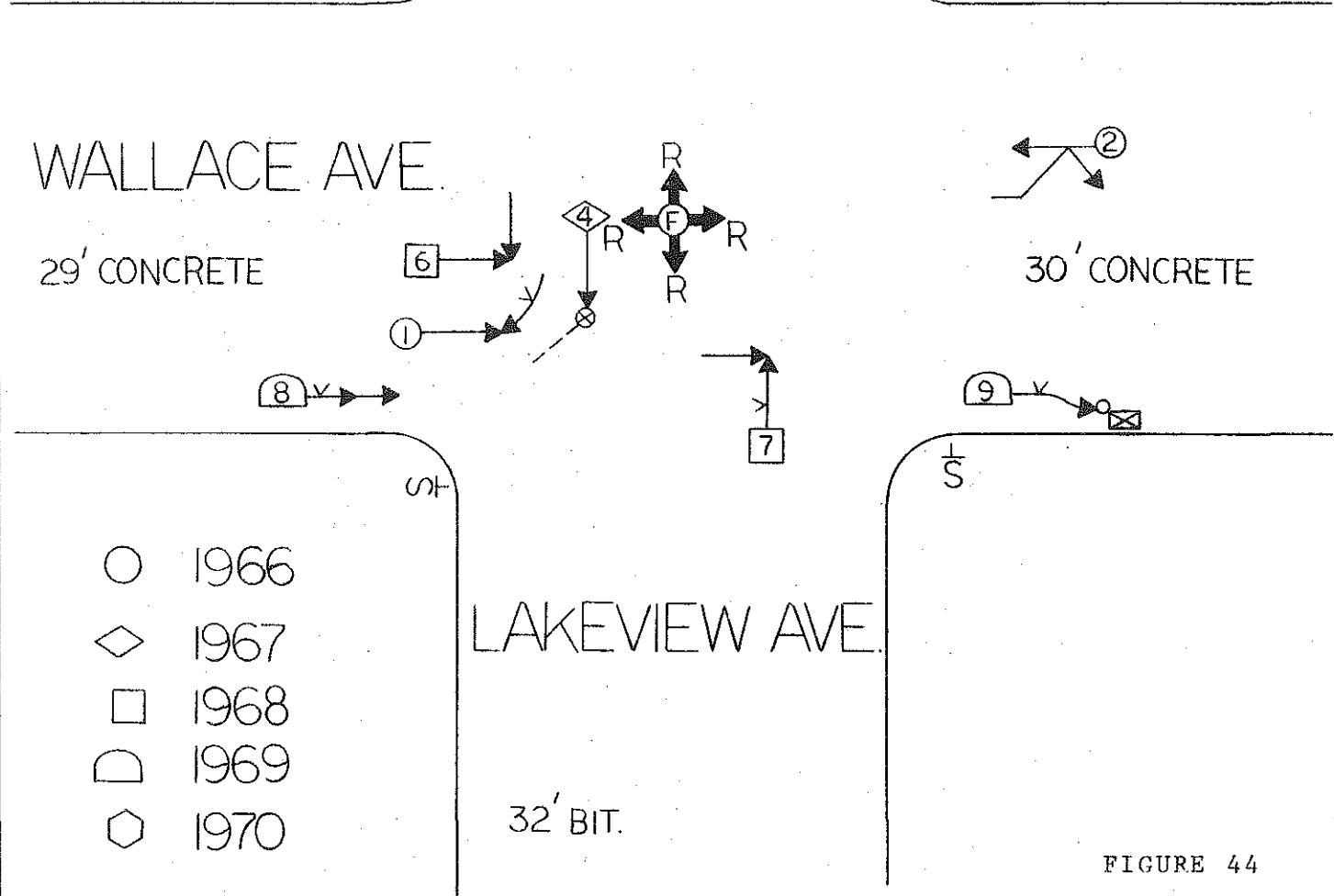
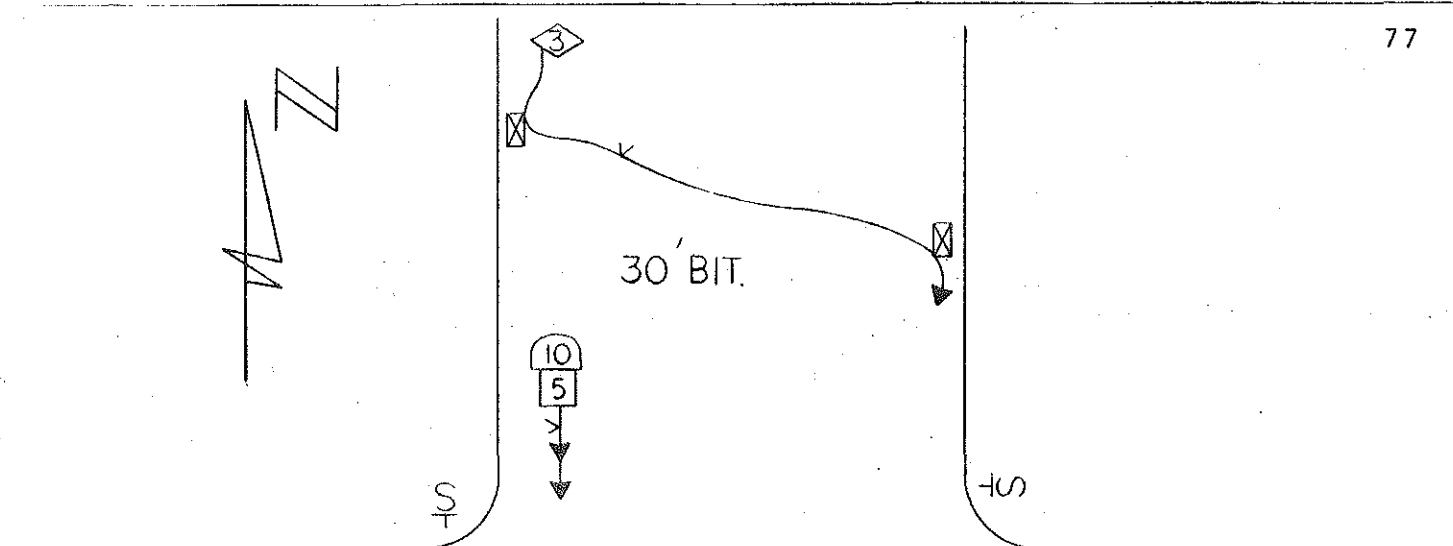


FIGURE 43

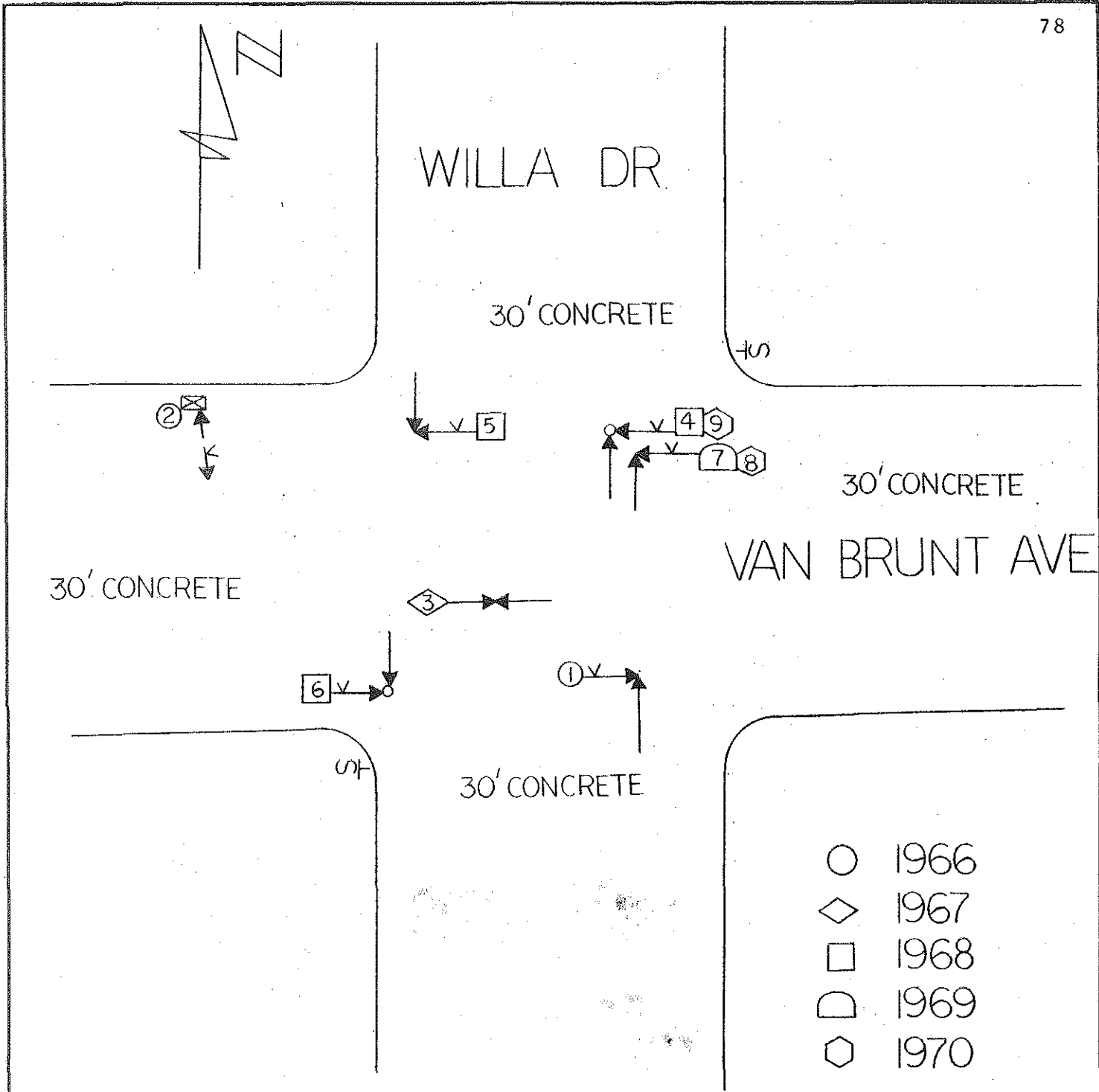
<p>LEGEND</p>	<p>MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p>
<p>Stop & Go Signal  Stop Sign S T Flashing Beacon  Yield Sign Y T</p>	<p>Location NAPIER AVE. at MORTON AVE. CITY OF ST. JOSEPH BERRIEN CO.</p>
<p>Fatal  Injury  Skidding  Jackknife  Overturned  Backing  Pedestrian  Tree  Out of Control  Driver Intent  Deer  Violator </p>	<p>Period: 1966 THRU 1970 Accidents - Total 11 P.D. 11 Injury 0 () Fatal 0 () C.S. _____ Miles _____ Drawn DVW Plan No. LOCATION 11 Date REV. 4-10-72</p>



- 1966
- ◇ 1967
- 1968
- ◐ 1969
- ◑ 1970

FIGURE 44

LEGEND		MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION	
Stop & Go Signal		Stop Sign	S
Flashing Beacon		Yield Sign	Y
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overturned		Deer	
Backing		Violator	
		Location	WALLACE AVE. at LAKEVIEW AVE. CITY OF ST. JOSEPH BERRIEN CO.
		Period:	1966 THRU 1970
		Accidents - Total	10 P.D. 9
		Injury	1 (2) Fatal 0 ()
		C.S.	Miles _____ Drawn DVW
		Plan No.	LOCATION 13 Date 5-18-70 REV. 4-7-72



- 1966
- ◇ 1967
- 1968
- ◡ 1969
- ⬡ 1970

FIGURE 45

<p style="text-align: center;">LEGEND</p>	<p style="text-align: center;">MICHIGAN DEPARTMENT OF STATE HIGHWAYS TRAFFIC AND SAFETY DIVISION</p>
<p>Stop & Go Signal Stop Sign S Y</p> <p>Flashing Beacon Yield Sign Y</p>	<p>Location WILLA DR. at VAN BRUNT AVE. CITY OF ST. JOSEPH BERRIEN CO.</p>
<p>Fatal Pedestrian Pedestrian</p> <p>Injury Tree Tree</p> <p>Skidding Out of Control Out of Control</p> <p>Jackknife Driver Intent Driver Intent</p> <p>Overturned Deer Deer</p> <p>Backing Violator Violator</p>	<p>Period: 1966 THRU 1970</p> <p>Accidents - Total 9 P.D. 6</p> <p>Injury 3 (4) Fatal 0 ()</p> <p>C.S. _____ Miles _____ Drawn DVW</p> <p>Plan No. LOCATION 16 Date 5-20-70 REV. 3-29-72</p>