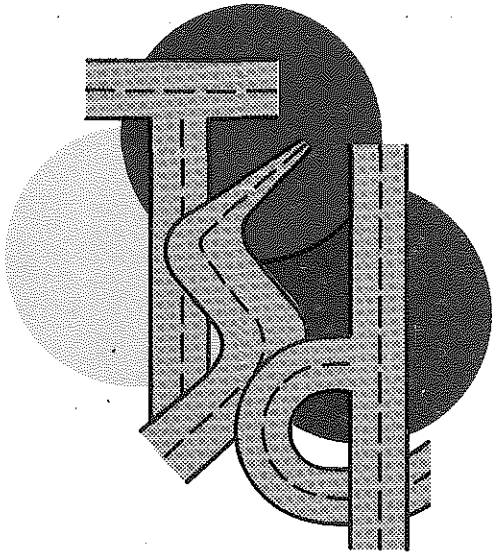


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Report TSD-253-74

A TRAFFIC ACCIDENT ANALYSIS  
AND TRAFFIC CONTROL DEVICES  
INVENTORY IN THE CITY OF MOUNT CLEMENS



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OF  
STATE HIGHWAYS AND TRANSPORTATION

Report TSD-253-74

A TRAFFIC ACCIDENT ANALYSIS  
AND TRAFFIC CONTROL DEVICES  
INVENTORY IN THE CITY OF MOUNT CLEMENS

Robert G. Lariviere

TRAFFIC ENGINEERING SERVICES

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September, 1976

PREPARED BY

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

in cooperation with  
The Michigan Office of Highway Safety Planning  
and  
The U. S. Department of Transportation  
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"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 accidents."

One of the goals of this standard is identifying specific locations which have a high accident experience as a basis for establishing priorities for eliminating or reducing accidents. Another objective is an orderly inventory of all traffic control devices which are used in the highway system to regulate, warn and guide vehicular and pedestrian traffic.

The State of Michigan is involved in the above activities on the state trunkline system. Many city and county agencies, however, lack the financial and technical prerequisites necessary to pursue similar programs on their road systems.

To improve the accident picture on the local road system, the Michigan Department of State Highways and Transportation requested and received a federally funded project entitled "Traffic Engineering Services for Cities and Counties." The Office of Highway Safety Planning in the Department of State Police is responsible for administering the federal grant. Under this program, Department of Transportation personnel will provide the expertise for each participating city and county. An engineering evaluation of the factors contributing to traffic accidents will be conducted and recommendations to correct these conditions will be made. Furthermore, all traffic control devices will be inventoried and upgraded where necessary to comply with the Michigan Manual of Uniform Traffic Control Devices (hereafter referred to as the Michigan Manual).

### Scope

The intent of this program is to improve traffic safety on all Michigan streets and highways by expanding the traffic engineering evaluation of factors causing accidents, and by providing uniform standards for traffic control to reduce the frequency 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 Department of State Police, also operating under a federal grant, is responsible for identifying and locating the high accident locations. After the basic data is collected at these locations, the Department of Transportation conducts an accident analysis and technical evaluation from which remedial recommendations are formulated. The traffic control devices inventory includes a field review of all city major routes noting the placement, condition and adequacy of the control devices. From this data the priorities for upgrading the traffic control devices are determined and a cost estimate for the proposed recommendations is prepared.

### Funding

The implementation of the proposed recommendations is the responsibility of the city of Mount Clemens. Financial assistance may be obtained through the Highway Safety Act of 1976 which was established to provide funding for the implementation of safety improvement projects aimed at the elimination or reduction of traffic accidents. Table I indicates the sections available under the 1976 Safety Act along with the type of projects and financing that pertain to each section. Financial Assistance is also available through the Urban Systems Program which is also federally sponsored. Further information on these two programs may be obtained by contacting the Local Government Division of the Michigan Department of State Highways and Transportation.

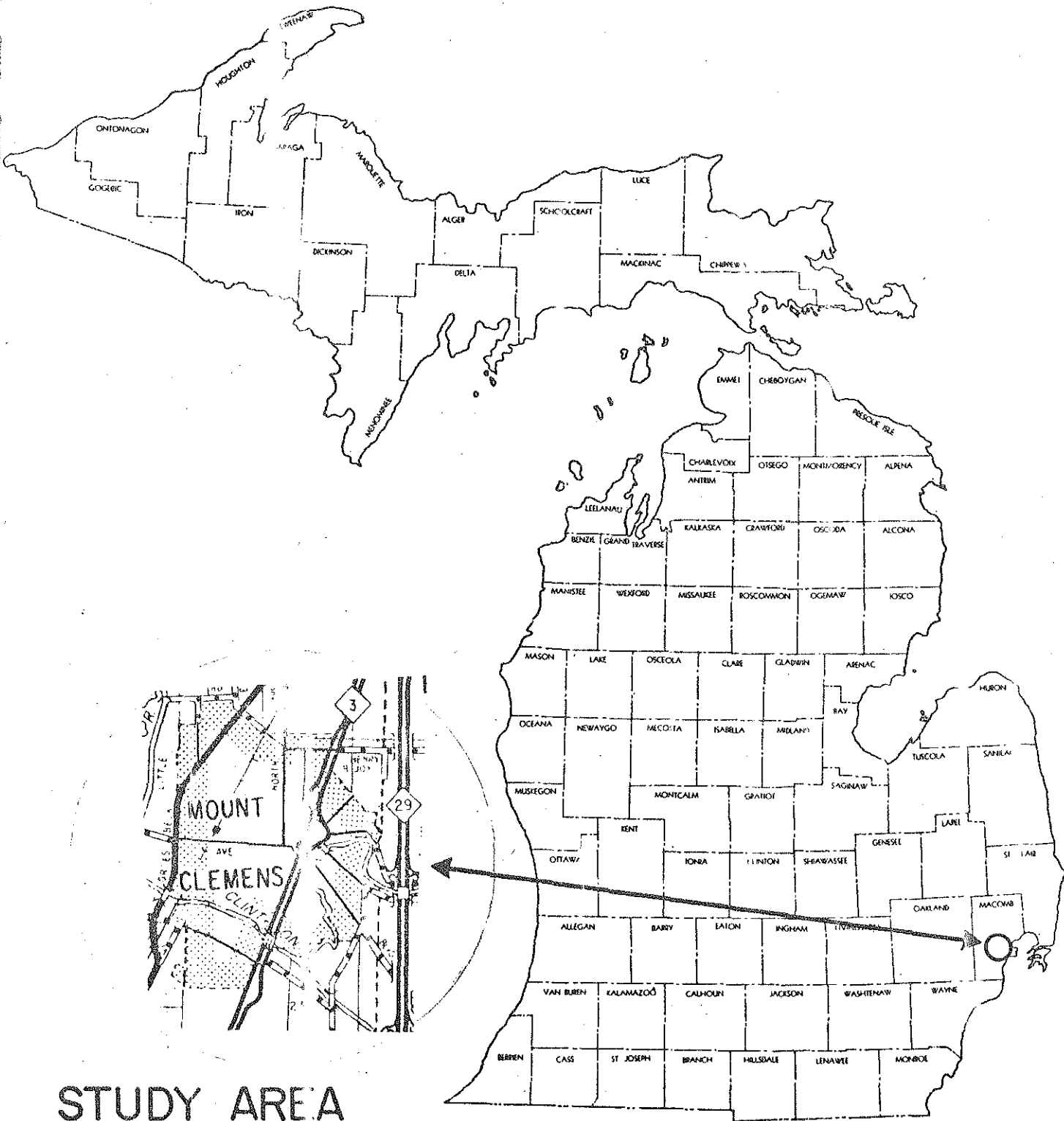
### Study Area

Mount Clemens, which is the county seat of Macomb County, is located 20 miles north of Detroit on the banks of the Clinton River (Figure 1). The city, which has an approximate area of 3.5 square miles has shown continuous growth and prosperity since the adoption of a new City Charter in 1954. This growth and prosperity has been greatly influenced by the excellent transportation facilities which surround the city. The street system of the city of Mount Clemens is composed of 3.25 miles of state trunkline, 1.12 miles of county roads, 14.51 miles of city major streets and 39.48 miles of city local streets for a total of 58.36 miles of roadway within the city limits. This information is found in the Twenty-Third Annual Progress Report, which is compiled by the Local Government Division of the Michigan Department of State Highways and Transportation. A map of this street system can be found on page 5 of this report.

TABLE I  
HIGHWAY SAFETY ACT OF 1976

Section	Highway System	Types of Projects	Finance
203 Rail-Highway Grade Crossings	Federal-aid and non-Federal Aid (except inter- state)	Protective Devices; Signs & Markings; Crossing Illumination & Surface Improvements	90-10
204 Bridge Construction and Replacement	Federal Aid (except inter- state)	Reconstruction and Replacement of Existing Bridges on the Federal Critical Bridge List	75-25
205 Pavement Marking Demonstration Program	All Highways (except inter- state)	Centerline & Edgeline Markings; Establishing & Painting "NO PASSING" Zones	100
209 & 210 Projects for High Hazard Locations and  Programs for Elimination of Roadside Obstacles	Federal-aid (except inter- state)	Intersection Widening, Channelization, & Signali- zation, Skid-prone Location Correction  Guardrail End Treatments; Breakaway Signs; Crash Cushions; Tree Removal; Culvert Headwall Corrections	90-10
SOS Safer Off-System Roads	Non Federal-aid	Construction, Reconstruction and Improvement of Any Off- System Road, Including, But Not Limited to, the Correction of Safety Hazards, the Replacement of Bridges, the Elimination of High- Hazard Locations and Roadside Obstacles	70-30

# FIGURE I


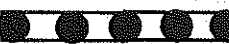




**STUDY AREA**

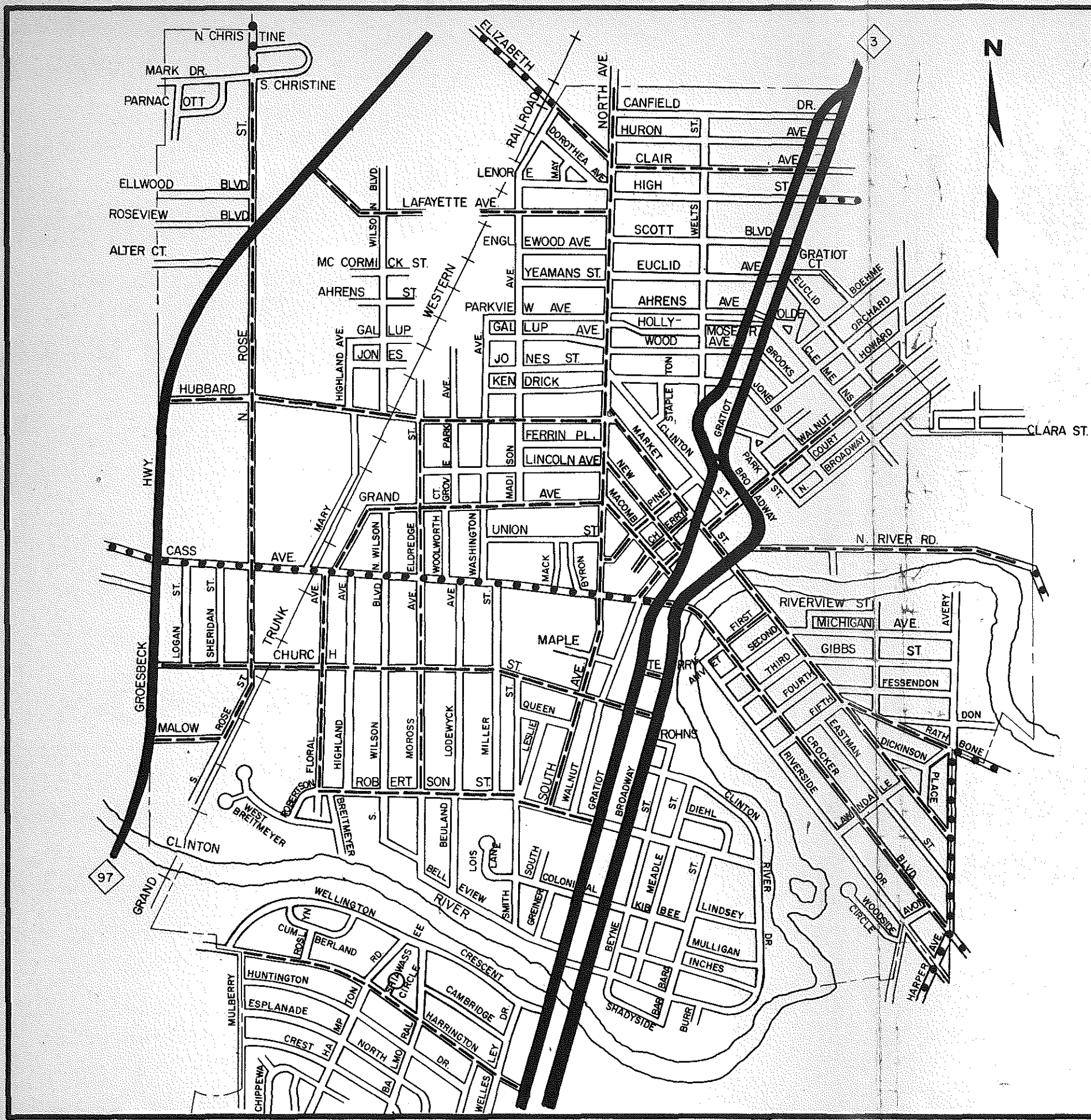
# CITY OF MT. CLEMENS MACOMB COUNTY

FIGURE 2

## STREET SYSTEMS

- STATE TRUNKLINE 
- COUNTY PRIMARY 
- MAJOR STREET 
- LOCAL STREET 

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Control Devices Inventory and Analysis

The inventory and analysis of all the traffic control devices on the City Major Street System in Mount Clemens was completed in April 1973. The results, including the inventory sheets and quantity sheets, are found in a separate book which accompanies this report.

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 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.

This study does not include a check of Traffic Control Orders for speed zones or parking prohibitions and restrictions. It is recommended that the City of Mount Clemens, as a part of their general sign upgrading, check all speed control zones and parking restrictions to ensure conformance with existing City Ordinances. Where City Ordinances do not exist, the City should enact ordinances to fulfill the necessary legal requirements or eliminate the zone in question. If there are any changes in location or type of those signs now in place, or if any new signs are placed, they should be checked for conformance to the "Michigan Manual of Uniform Traffic Control Devices."

Conversion of Field Data

Two simple forms, inventory sheets and quantity sheets were developed upon which to record the collected field data. These forms will enable the City's personnel to determine the necessary work which must be done city-wide and per route.

Inventory Sheets

Both the zerox and vellum base inventory sheets 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 removed (from the vellum 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.

#### Quantity Sheets

The quantity sheets which proceed 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 Mount Clemens to be apprised of a) the total amount of work necessary to implement the inventory, b) the amount of work necessary to complete individual routes, and c) the current status of the 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. This priority is assigned for the installation of a new sign, replacement of an existing sign and the removal or relocation of a sign.
- Priority 2 - Work which should be completed when and if the existing signing is replaced with symbol signing.
- Priority 3 - Any work specifically related to guide signs.

#### Sign Classifications

Signs are classified functionally into regulatory, warning and guide signs. In this inventory study the various classifications were reviewed separately. It is recommended that all signs erected at the side of the road in rural districts shall be mounted at a bottom 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, the clearance to the bottom of the sign shall be at least seven feet.

Regulatory Signs - A comprehensive study of the traffic control devices on the City of Mount Clemens Major Street System has established a need for installation or maintenance of approximately 10 percent of the required regulatory signs. The primary reasons for these deficiencies were the lack of reflectivity, poor condition and/or absence of "STOP" signs (R1-1), "4-WAY" panels (R1-3), "DO NOT ENTER" signs (R5-1), One Way Arrows (R6-1) and "NO PARKING AT ANY TIME" signs (R7-1).

Warning Signs - The inventory indicates a need for the installation or replacement of approximately 18 percent of the required warning signs. The most evident deficiencies were the lack of reflectivity, poor condition and/or absence of Bi-Directional Target Arrows (W1-7), Pavement Width Transition Symbols (W4-2), "LANE ENDS MERGE LEFT" signs (W9-2), Double Arrows (W12-1), "DEAD END" signs (W14-1), School Advance Symbols (S1-1) and End of Roadway Markers (ER-1).

Guide Signs - The inventory indicates a need for the installation or replacement of approximately 2 percent of the required guide signs. The most evident deficiencies were the lack of reflectivity, poor condition and/or absence of Street Name signs (D3-1) and "PARKING" signs (D4-1).

### Pavement Markings and Delineators

#### Turns

Although not specifically recommended in this report, we suggest the use of pavement markings and/or delineators on those sections of streets where the motorist must negotiate a turn. These markings and/or delineators, when used in conjunction with the warning signs, will enable the drivers to safely negotiate these turns and therefore reduce the accident potential.

#### No-Passing Zones

The existing no-passing zones designated by sign and/or markings on the city street system in Mount Clemens were checked. A no-passing zone is defined as a section of roadway having insufficient passing sight distance. It is recommended that, as time and resources permit, a field survey be completed on all sections of hard surfaced streets where sight distances are restricted. Such a field survey should result in any necessary corrections being made to the limits of existing no-passing zones and the establishment of new zones where necessary.



After the field survey is completed, no-passing zones should be indicated by solid yellow lines applied along the limits established by the survey. Then "DO NOT PASS" (R4-1) and "PASS WITH CARE" (R4-2) signs may (at the option of the City) be placed at the limits of the no-passing zones, however, when either of these signs is used, they shall both be erected. Where additional notice is deemed necessary for a no-passing zone, a pennant-shaped "NO PASSING ZONE" sign (W14-3) shall be located on the left side of the roadway opposite the beginning of the zone.

#### Railroad Crossings

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 provide suitable protection.

#### Cost Estimate

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

		R O U T E		
Sign Type	Priority	Nonfederal Aid	Federal Aid Secondary	Federal Aid Urban
Regulatory	Priority 1	\$1,520	\$510	\$160
	Priority 2	140	--	95
Warning	Priority 1	235	28	45
Guide	Priority 3	32	75	43
	Subtotal	1,927	613	343
	Total	\$2,883		

## Accident Analysis

The accident analysis portion of the study involves evaluating the summarized facts and field data and prescribing the proper remedial treatment at the high accident locations. One of the basic tools used in this type of analysis is a graphic representation of accidents, either on a collision diagram or strip map, which is used to determine accident patterns. An accident pattern is the prevalence of one or more types of accident occurrences. An accident pattern gives an indication of the type of corrective action needed at a specific location.

Accident causes, however, are numerous and often difficult to determine. An accident pattern does not always exist. In some cases the collisions may involve a combination of driving hazards such as slippery pavement, snow or fog, drinking drivers, defective equipment, excessive speed and inadequate traffic control. In many cases these hazards may be eliminated or at best alleviated. 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.

### 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 Mount Clemens (and providing an accident inventory at 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 Mount Clemens were determined by manually extracting and compiling those locations with the highest number of accidents from the 1969 city accident reports. From this list the 16 highest accident locations (numbered one to sixteen from the highest number of accidents to the lowest number of accidents) were selected (spot map p. 14). Once the problem locations were identified, accident information for the years 1971 to 1973 was compiled to provide a recent accident base. After compiling this information, the Department of State Police transmitted it to the Department of State Highways and Transportation.

The Department of State Highways and Transportation is then 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. 15).

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.

### Citywide Recommendations

#### Stop Signs

At many of the intersections in the city of Mount Clemens that are under stop control, 24-inch "Stop" signs are used. According to the Michigan manual a 30-inch "Stop" sign is the standard size. On low-volume local streets and secondary roads with low approach speeds a 24-inch "Stop" sign may be used. We recommend that 30-inch "Stop" signs be used in the City on all primary roads and at intersections which experience high traffic volumes.

#### 4-Way Stops

At a multi-way stop intersection a supplementary plate indicating who has to stop should be mounted just below each "Stop" sign. If the number of approach legs to the intersection is three or more, the numeral on the supplementary plate shall correspond to the actual number of legs (4-Way), or the legend "All-Way" may be used. It is recommended that this procedure be followed at all multi-way stop intersections in Mount Clemens.

#### Clearance Intervals

The cycle lengths for some of the signalized intersections in the city of Mount Clemens included clearance intervals under four seconds. Yellow clearance intervals should have a duration of between 4 and 4.5 seconds to be effective. Thus, it is recommended that all signalized locations within the city of Mount Clemens have a minimum yellow clearance interval of four seconds and a maximum time of 4.5 seconds. An adequate yellow clearance interval will contribute to the prevention of right angle accidents at signalized locations.

### Parking Near 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 feet of a crosswalk, or if none, within 15 feet of the intersection of property lines at an intersection of highways." At some of the intersections in Mount Clemens the first parking stalls from the intersection abuted the crosswalk. We strongly recommend that the Vehicle Code Law concerning crosswalks be implemented as soon as possible.

### High Accident Locations

After the analysis of the 16 high accident locations was complete, it was apparent that no engineering recommendations, other than those formulated in the Traffic Control Devices Inventory, would be feasible for six of the locations. There were no correctable accident patterns at these six 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 10 locations. A cost estimate based on Michigan Department of State Highways and Transportation costs for materials and labor is included with each recommendation. The high accident locations and the average accident rates for each location during the study period 1971-73 are as follows:

	<u>Location</u>	<u>Accidents</u>	<u>Average Accident Rate</u>
1.	Cass Avenue at North and South Avenues	38	2.36 ACC/MV
2.	North Avenue at Elizabeth Street and Clair Avenue	34	3.86 ACC/MV
3.	Cass Avenue at Rose Street	33	4.14 ACC/MV
4.	North Avenue at Hubbard Avenue and Market Street	33	3.58 ACC/MV
5.	Cass Avenue at Walnut Street	31	2.53 ACC/MV
6.	Market Street at Walnut Street	27	5.45 ACC/MV
*7.	Cass Avenue at Grand Avenue and Floral Avenue	21	2.57 ACC/MV

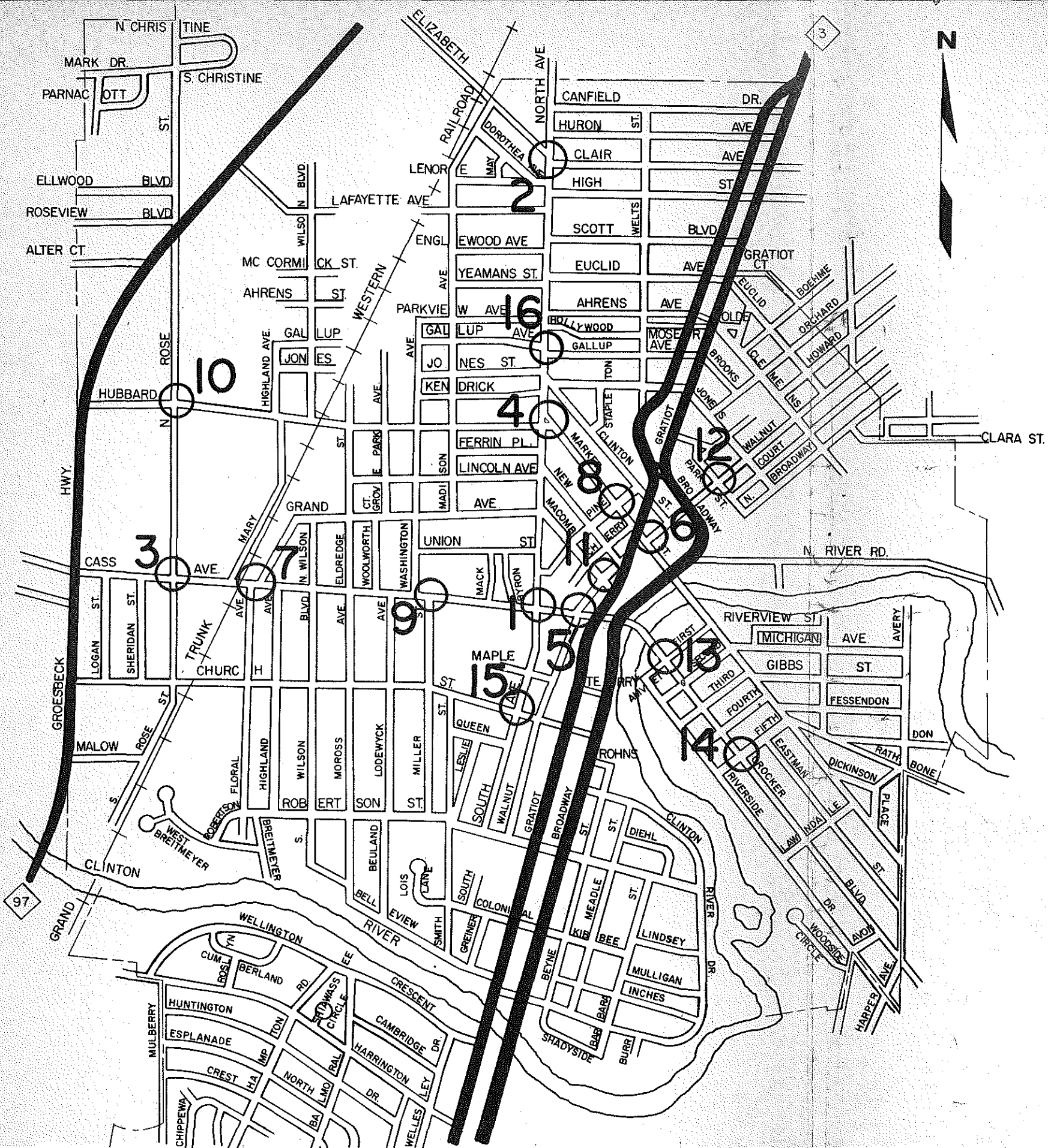
8.	Market Street at Pine Street	18	3.01 ACC/MV
9.	Cass Avenue at Miller Street	15	2.39 ACC/MV
*10.	Hubbard Avenue at North Rose Street	15	3.81 ACC/MV
11.	Walnut Street at Macomb Street	13	1.40 ACC/MV
*12.	N. Walnut Street at Park Street	13	10.71 ACC/MV
13.	Crocker Boulevard at First Street	13	1.89 ACC/MV
*14.	Crocker Boulevard at Fifth Street	11	1.77 ACC/MV
*15.	South Avenue at Church Street	10	3.69 ACC/MV
*16.	North Avenue at Gallup Street	7	1.19 ACC/MV

\*Locations not discussed.

# CITY OF MT. CLEMENS MACOMB COUNTY

FIGURE 3

**SPOT MAP  
FOR  
HIGH ACCIDENT  
LOCATIONS**







LOCATION 1 - CASS AVENUE AT NORTH AND SOUTH AVENUES

## Operational Analysis:

Cass, North and South Avenues form a right-angle intersection that is under signal control. The two overhead signals and two pedestal mounted signals operate on a 60-second cycle with a 64-36 split favoring Cass Avenue, a 6-percent clearance interval and a 3-percent all red interval for Cass Avenue. There are pedestrian signals on all four corners.

Each leg of this intersection has three lanes with the center lane for left turns only and the right approach lane for right turns and thru movements. Parking is prohibited on all four legs.

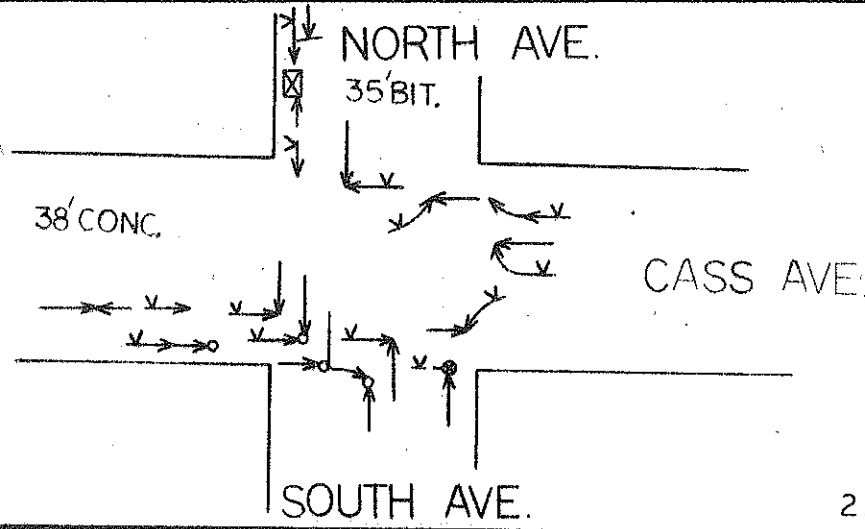
<u>Type</u>	<u>Accidents</u>			<u>Total</u>
	<u>1971</u>	<u>1972</u>	<u>1973</u>	
Right-Angle	5	6	3	14
Rear end	2	1	5	8
Head-On Left	2	1	1	4
Misc.	<u>5</u>	<u>3</u>	<u>4</u>	<u>12</u>
Total	14	11	13	38

The miscellaneous accident category includes three right angles at a parking lot exit, two improper backings, two improper turns, one sideswipe and one ran off roadway. There were also three accidents involving motor vehicles and pedestrians. The accident rate at this intersection during the study period was 2.36 ACC/MV.

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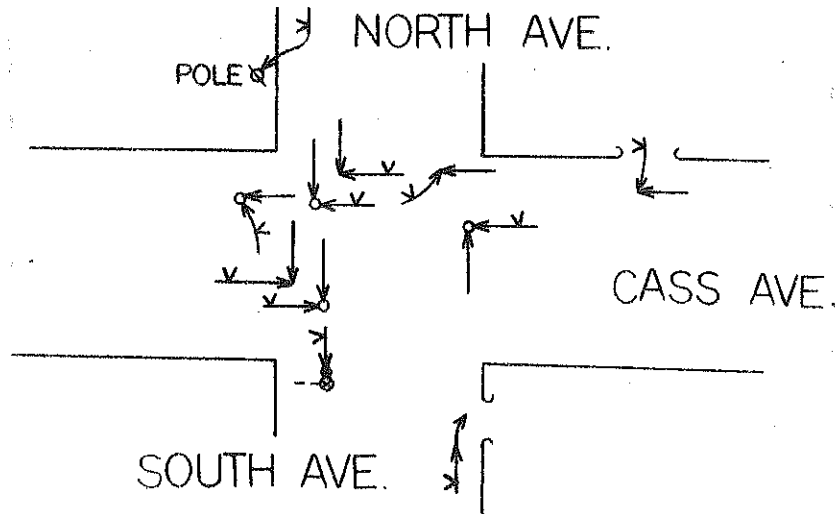


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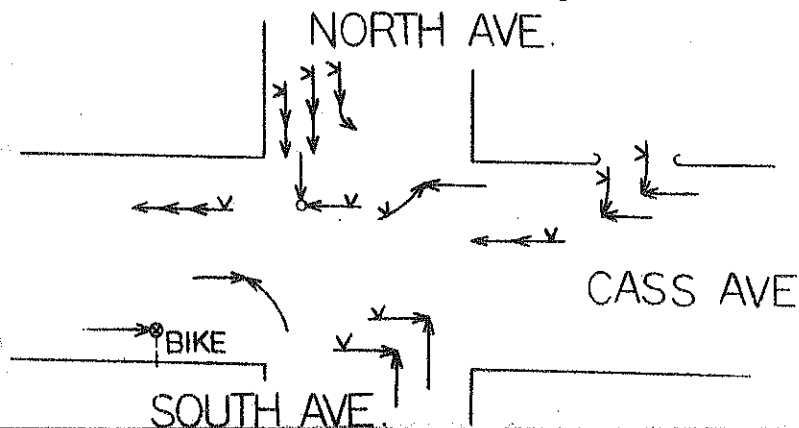
1971 (14)

2.61 ACC./M.V.



1972 (11)

2.05 ACC./M.V.



1973 (13)

2.42 ACC./M.V.

LEGEND

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

STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS  
AND TRANSPORTATION

Location CASS AVE. at NORTH, SOUTH AVE.  
CITY OF MT. CLEMENS  
MACOMB CO.

Period: 1971 THRU 1973 2.36 ACC./M.V.

Accidents - Total 38 P.D. 29

Injury 8 (11) Fatal 1 (1)

C.S. \_\_\_\_\_ Miles \_\_\_\_\_ Drawn DVW

Plan No. LOCATION 1 Date \_\_\_\_\_



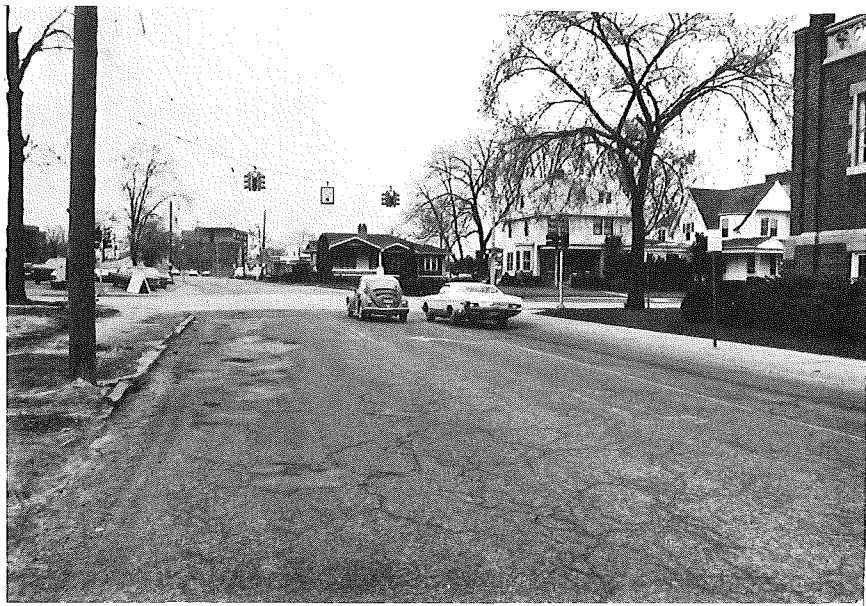
EASTBOUND CASS AVENUE



WESTBOUND CASS AVENUE



NORTHBOUND NORTH AVENUE



SOUTHBOUND SOUTH AVENUE

FIGURE 7

RECOMMENDATIONS

Estimated Costs

1. Yellow clearance intervals should have a duration of between 4 and 4.5 seconds to be effective. For this reason it is recommended that the clearance interval be increased to 7 percent which would be 4.2 seconds. \$ 50
  
  2. Word and symbol pavement markings should not be used for mandatory messages except in support of standard signs. For this reason symbol Lane-Use Control signs should be erected at the intersection and in advance of the intersection on both North and South Avenues. On Cass Avenue the message Lane-Use Control signs are nonstandard and should be removed. A second symbol Lane-Use Control sign should be erected in advance of the intersection for both legs of Cass Avenue. \$165
  
  3. Word and symbol pavement markings indicating lane assignments should be applied to Cass Avenue in support of the Lane-Use Control signs. The proposed left-turn arrows for Cass Avenue and the existing left-turn arrow for South Avenue refer to a mandatory movement and should be accompanied by the word "ONLY". Symbol pavement markings should also be applied to the right turn-thru movement lane for both North and South Avenues. \$600
  
  4. Thirty-four percent of the accidents at this location occurred on wet pavement. For this reason skidometer tests were conducted by the Testing and Research Division of the Michigan Department of State Highways and Transportation. The results of these tests, along with an analysis of the accident history indicates that at this time there is no significant slippery pavement problem. However, the potential does exist for wet pavement accidents on Cass Avenue where there were a couple coefficients of friction below normal. If a wet pavement rear-end accident pattern develops on Cass Avenue, we recommend resurfacing with a skid resistant overlay.
- Total \$815



NORTH AVE.

Pedestal Signal mounted on Pedestrian Signal

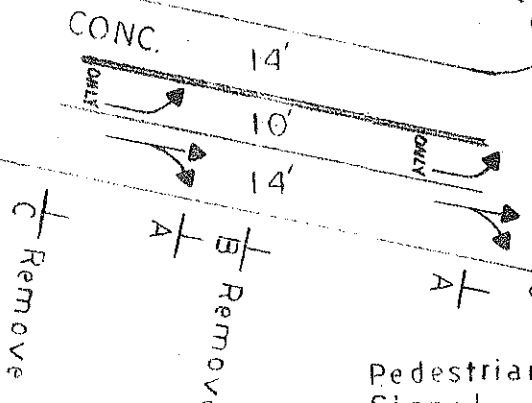
CASS AVE.

BIT.

Pedestrian Signal

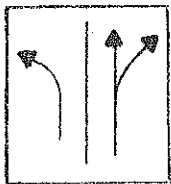
Remove

Remove



Pedestrian Signal

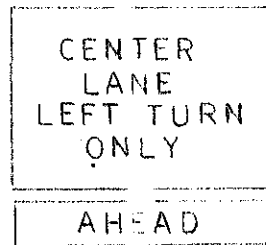
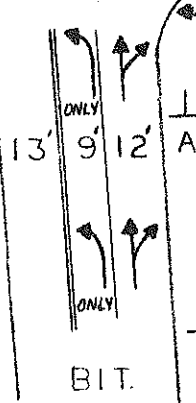
Pedestal Signal mounted on Pedestrian Signal



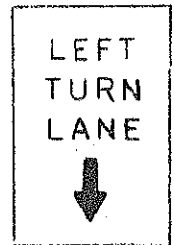
A  
(R3-8)



B  
(R3-9)



C  
(R3-9)



D  
(R3-10)

SOUTH AVE.

NOTE: Sign D facing each direction

FIGURE 8

STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS

TRAFFIC & SAFETY DIVISION

AUTH. NO.		DRAWN	
CONT. SEC.		DATE	
REF.		SCALE	
SHEET	OF	PLAN	

CASS AVE. AT NORTH, SOUTH AVE.  
CITY OF MT. CLEMENS  
MACOMB COUNTY

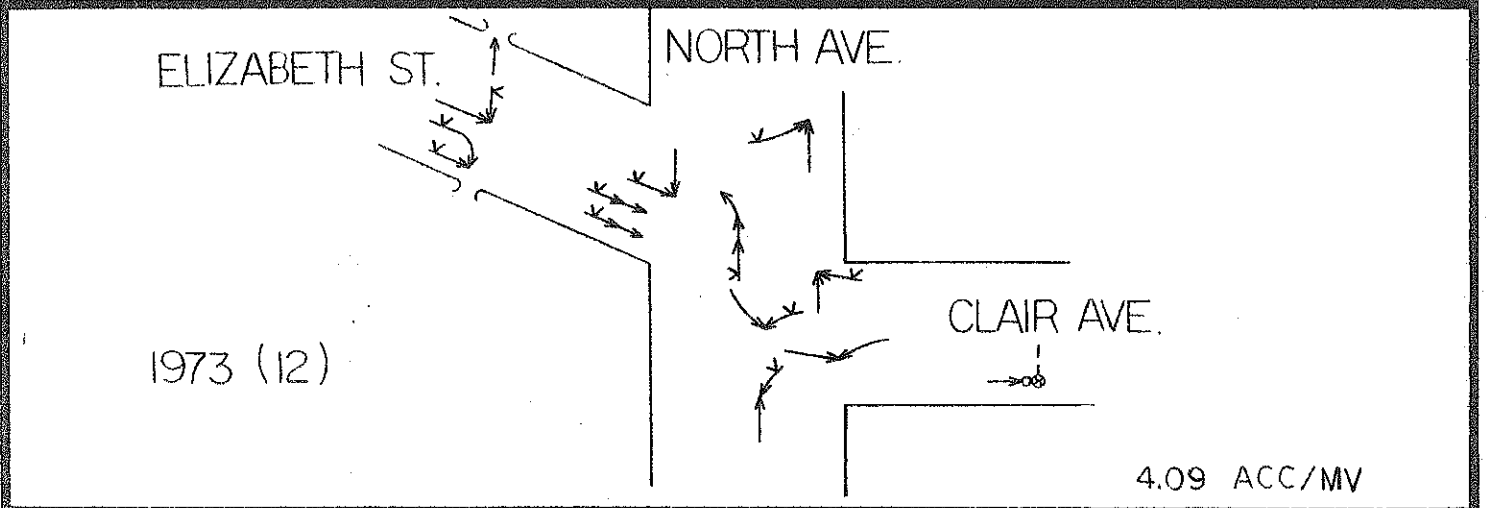
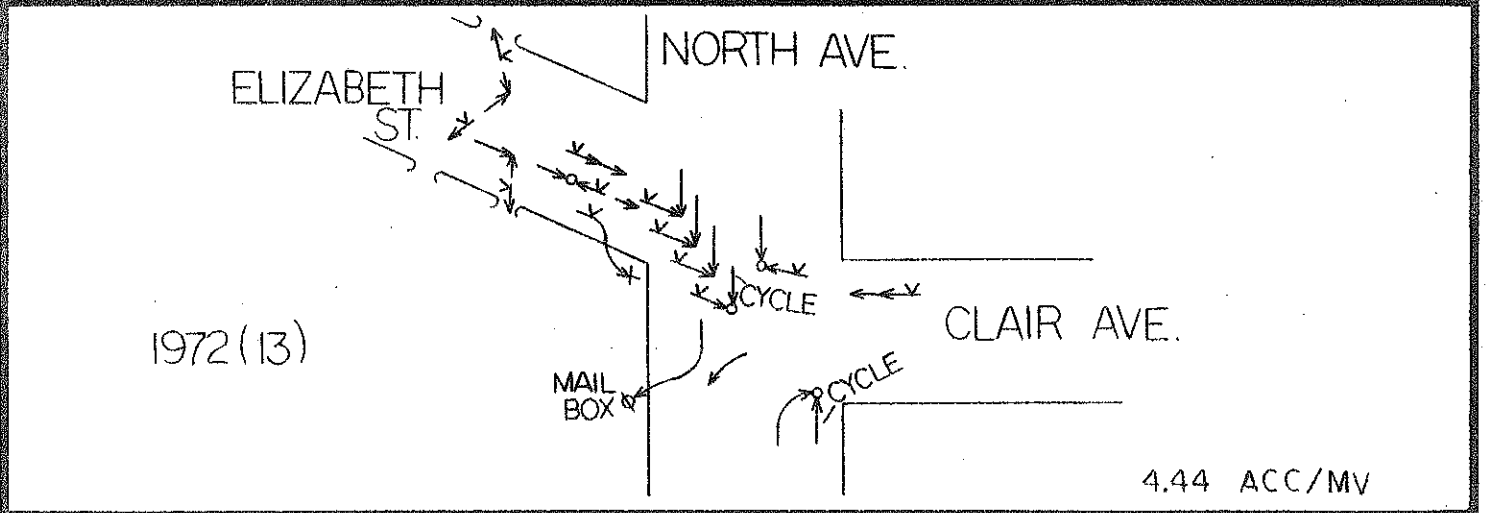
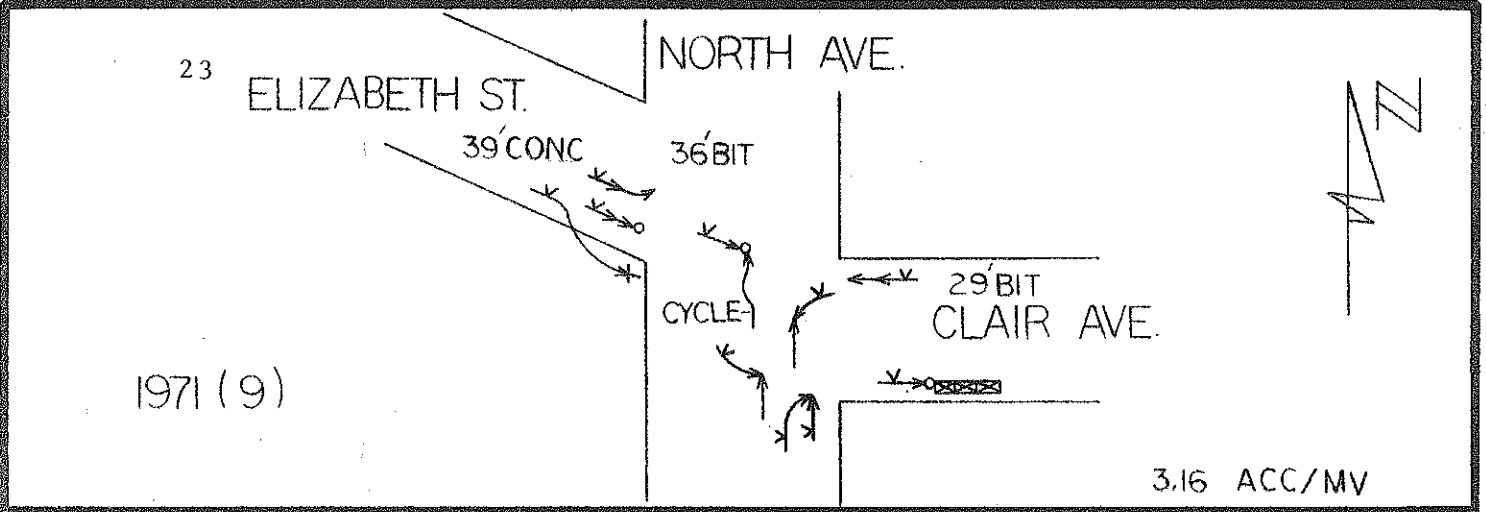
LOCATION 2 - NORTH AVENUE AT ELIZABETH STREET AND CLAIR AVENUE






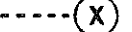


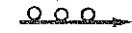







## Operational Analysis:

North Avenue, Elizabeth Street, and Clair Avenue form a four-legged intersection that is under stop control. Elizabeth Street joins North Avenue at a skew and is offset approximately 20 feet north of Clair Avenue. There is a 24-inch "STOP" sign controlling traffic on Clair Avenue while a 30-inch "STOP" sign controls traffic on Elizabeth Street. Parking is prohibited on Clair Avenue in the immediate intersectional area.

<u>Type</u>	<u>Accidents</u>			
	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>Total</u>
Right-Angle	2	5	5	12
Rear end	3	2	3	8
Improper Backing	0	3	0	3
Parking	1	0	2	3
Ran off Roadway	1	2	0	3
Misc.	<u>2</u>	<u>1</u>	<u>2</u>	<u>5</u>
Total	9	13	12	34

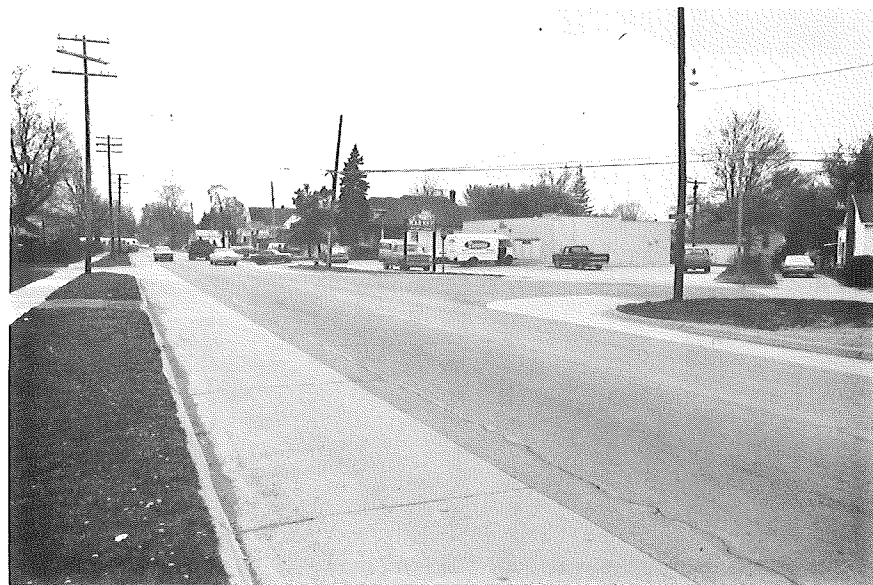
The miscellaneous accidents included two sideswipes, two head-on left turns, and one accident involving a pedestrian. The accident rate at this intersection during the study period was 3.86 ACC/MV.



<b>LEGEND</b>		STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION	
Stop & Go Signal 	Stop Sign 	Location NORTH AVE. at CLAIR AVE., ELIZABETH ST. CITY OF MT. CLEMENS MACOMB CO.	
Flashing Beacon 	Yield Sign 		
Fatal 	Pedestrian 	Period: 1971 THRU 1973	3.86 ACC/MV
Injury 	Tree 	Accidents - Total	34
Skidding 	Out of Control 	Injury	8 (9) Fatal 0 ( )
Jackknife 	Driver Intent 	C.S.	Miles _____ Drawn DVW
Overtuned 	Deer 	Plan No.	LOCATION 2
Backing 	Violator 	Date	_____



NORTHBOUND NORTH AVENUE



SOUTHBOUND NORTH AVENUE





SOUTHEASTBOUND ELIZABETH STREET



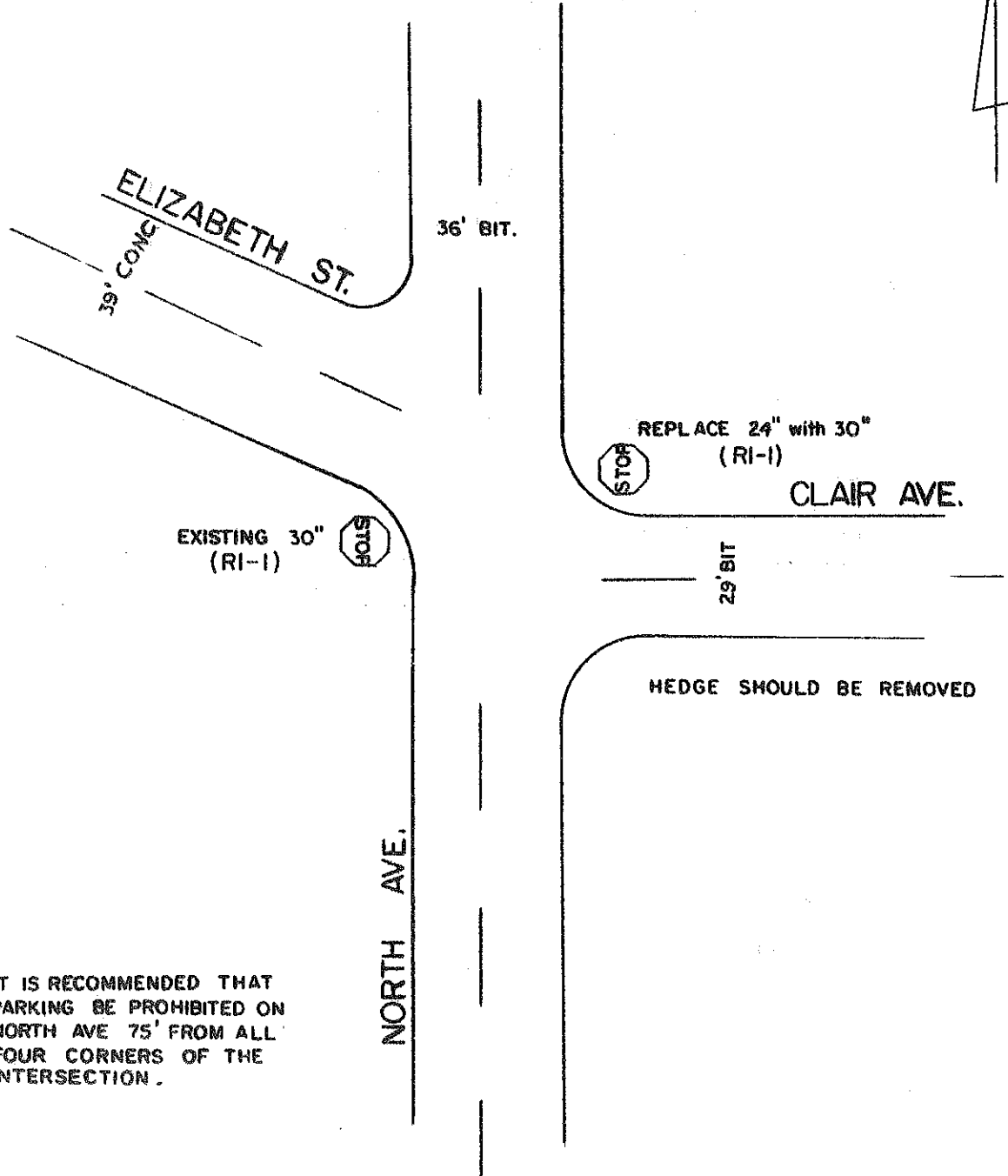
WESTBOUND CLAIR AVENUE

RECOMMENDATIONSEstimated Cost

- |    |  |       |
|----|--|-------|
| 1. | The standard size "STOP" sign shall be 30 inches by 30 inches except at the intersection of low-volume local streets and secondary roads with low approach speeds where a 24-inch sign may be used. Due to the traffic volumes experienced at this location we recommend that the 24-inch "STOP" sign on Clair Avenue be replaced by a 30-inch sign.                           | \$ 30 |
| 2. | Eight of the vehicle operators involved in the right-angle accidents indicated that they did not see the vehicle they struck. The parked cars on North Avenue are causing a visibility problem. We recommend that the parking on North Avenue be prohibited 75 feet from all four corners of the intersection.   | \$ 75 |
| 3. | A further visibility problem exists for motorists on westbound Clair Avenue due to a hedge located in the southeast quadrant. It is recommended that this hedge be removed so that northbound North Avenue traffic can be seen from the east leg of Clair Avenue. The removal of the hedge along with the parking removal on North Avenue will reduce the right angle problem. | \$ 50 |

Total

\$155



NOTE: IT IS RECOMMENDED THAT PARKING BE PROHIBITED ON NORTH AVE 75' FROM ALL FOUR CORNERS OF THE INTERSECTION.

FIGURE 12

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.		DRAWN <b>KLS</b>
	CONT. SEC.		DATE
	REF.		SCALE
	SHEET OF	PLAN	

NORTH AT CLAIR, ELIZABETH ST.  
 CITY OF MT. CLEMENS  
 MACOMB COUNTY

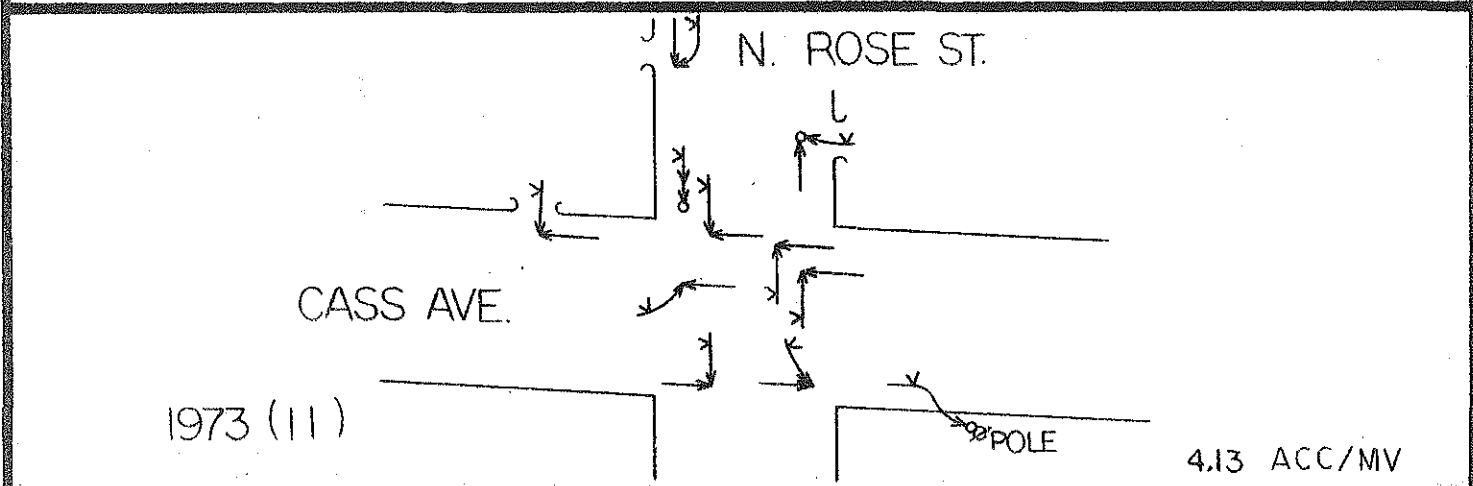
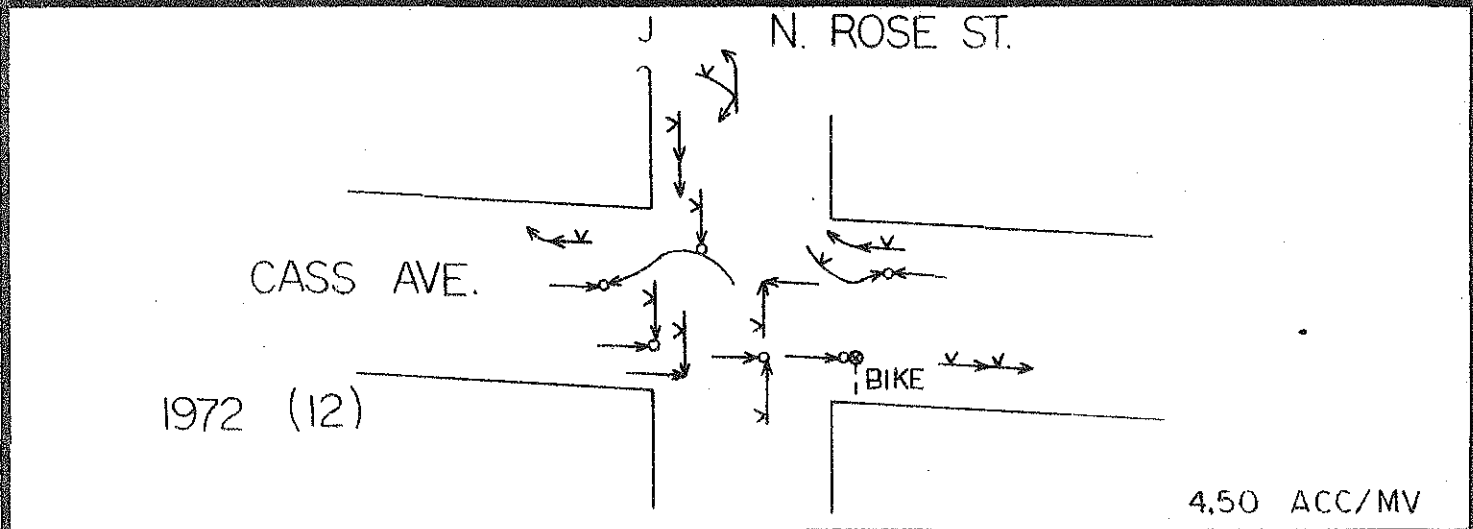
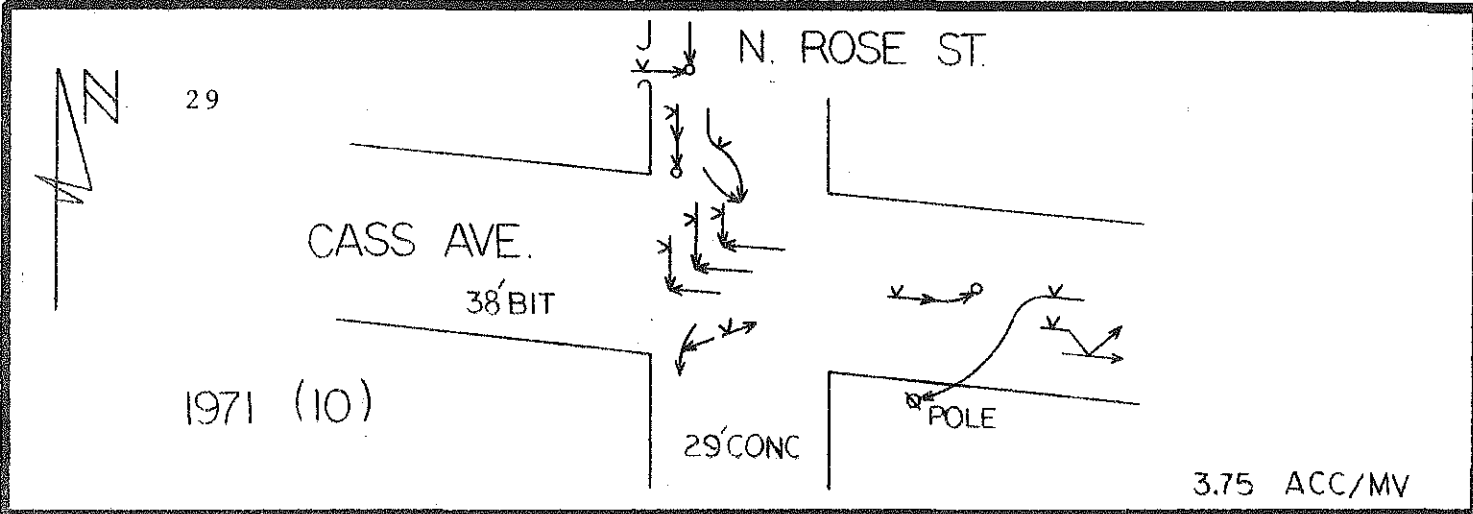
LOCATION 3 - CASS AVENUE AT ROSE STREET

## Operational Analysis:

Cass Avenue and Rose Street form a four-legged intersection that is under stop control. Cass Avenue is three lanes wide at the intersection with the center lane for left turns only. Symbol and message Lane-Use Control signs are used on Cass Avenue both in advance of and at the intersection. Each leg of Rose Street has a 24-inch "STOP" sign.

<u>Types</u>	<u>Accidents</u>			
	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>Total</u>
Right-Angle	4	6	7	17
Rear end	2	4	1	7
Sideswipe	2	0	0	2
Ran Off Roadway	1	0	1	2
Misc.	<u>1</u>	<u>2</u>	<u>2</u>	<u>5</u>
Total	10	12	11	33

The miscellaneous accidents include one improper turn, one improper backing, one head-on and one head-on left turn. There was also one accident involving an automobile and a bicycle. The accident rate at this intersection during the study period was 4.14 ACC/MV.



<b>LEGEND</b>		STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION	
Stop & Go Signal		Stop Sign	
Flashing Beacon		Yield Sign	
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overtaken		Deer	
Backing		Violator	
		Location CASS AVE. at ROSE ST. CITY OF MT. CLEMENS MACOMB CO. 4.14 ACC/MV	
		Period: 1971 THRU 1973	
		Accidents - Total 33 P.D. 22	
		Injury 11 (16) Fatal 0 ( )	
		C.S. _____ Miles _____ Drawn DVW	
		Plan No. LOCATION 3 Date _____	



EASTBOUND CASS AVENUE



WESTBOUND CASS AVENUE



NORTHBOUND ROSE STREET



SOUTHBOUND ROSE STREET

FIGURE 15

RECOMMENDATIONSEstimated Costs

- |    |  |       |
|----|--|-------|
| 1. | It is recommended that the 24-inch "STOP" signs on Rose Street be replaced by 30-inch signs because of the traffic volumes experienced at this intersection.   | \$ 60 |
| 2. | On Cass Avenue the message Lane-Use Control signs are non-standard and should be removed. A symbol Lane-Use Control sign should be erected in advance of the intersection for both legs of Cass Avenue.  | \$ 55 |
| 3. | The Lane-Use Control signs on Cass Avenue should be supplemented by pavement word and symbol markings. The left-turn lane should be marked with two sets of left-turn arrows each including the word "ONLY". Two sets of thru or right-turn arrows should be placed on the outside approach lanes. | \$420 |
|    | Total  | \$535 |



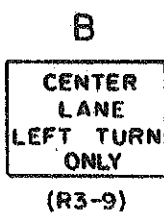
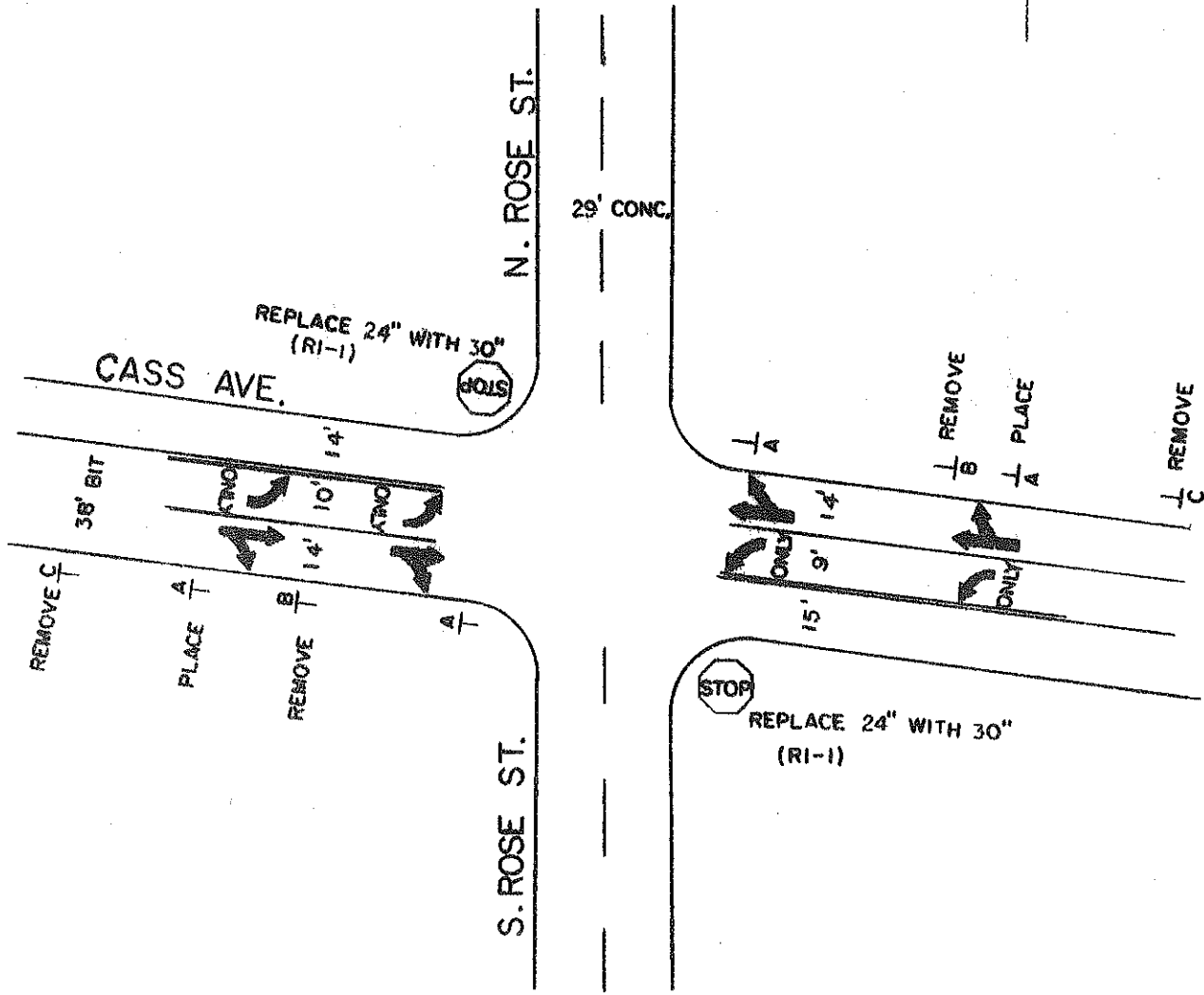


FIGURE 16

STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS  
TRAFFIC & SAFETY DIVISION

AUTH. NO.		DRAWN <b>KLS</b>	
CONT. SEC.		DATE	
REF.		SCALE	
SHEET	OF	PLAN	

CASS AVE. AT ROSE ST.  
CITY OF MT. CLEMENS  
MACOMB COUNTY

LOCATION 4 - NORTH AVENUE, HUBBARD AVENUE AND MARKET STREET

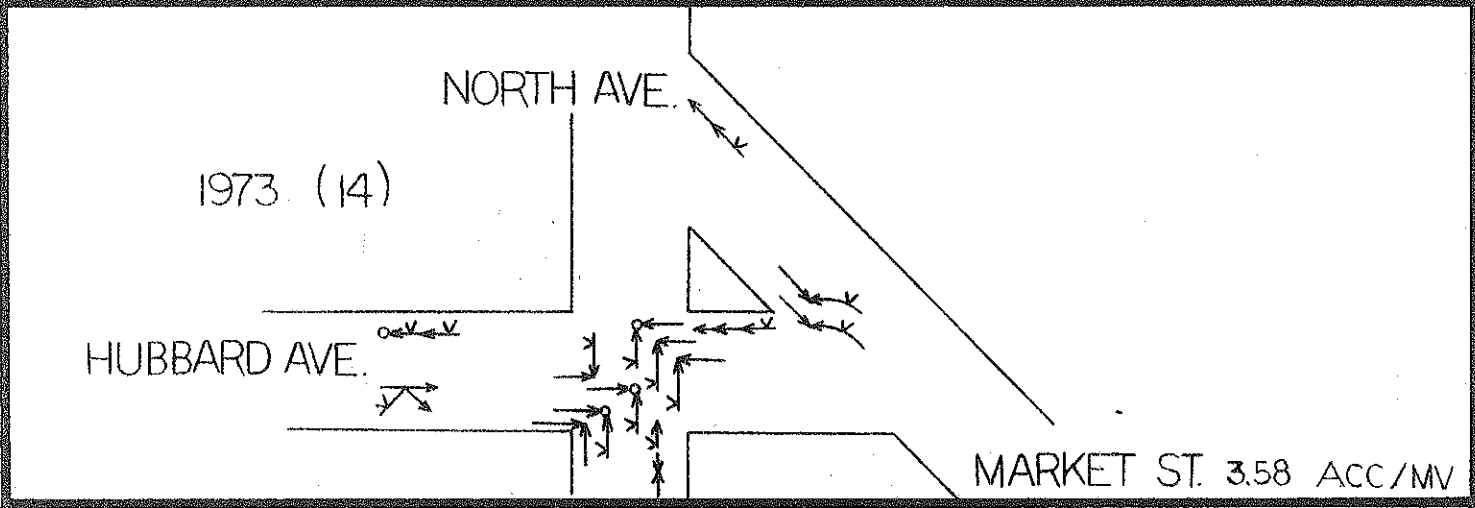
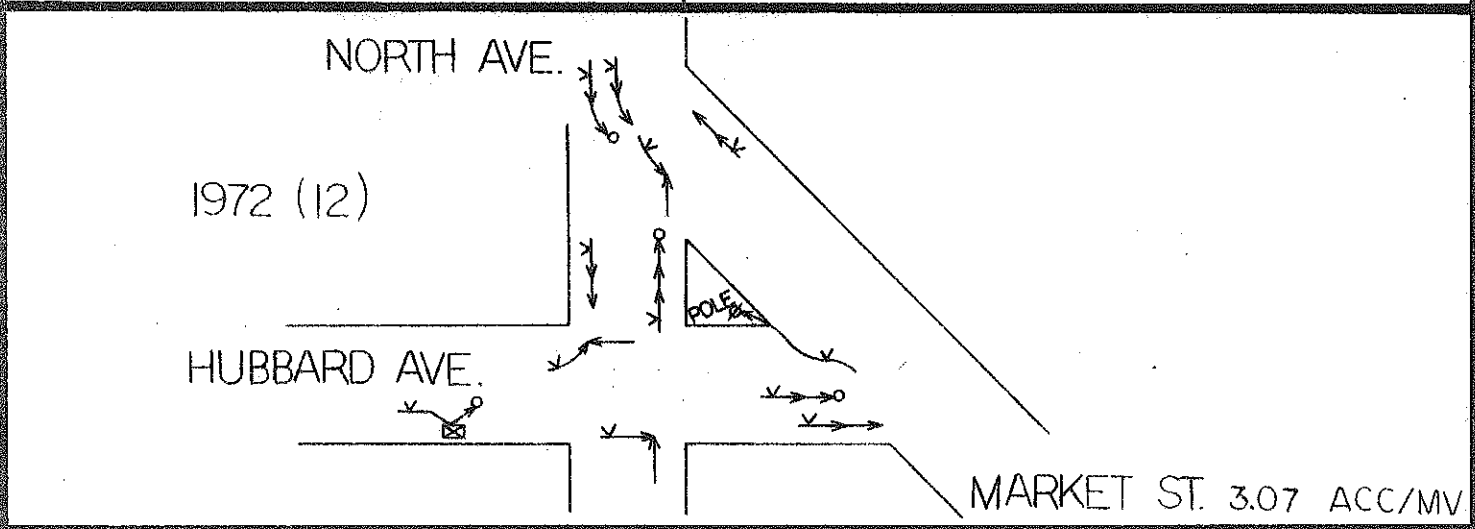
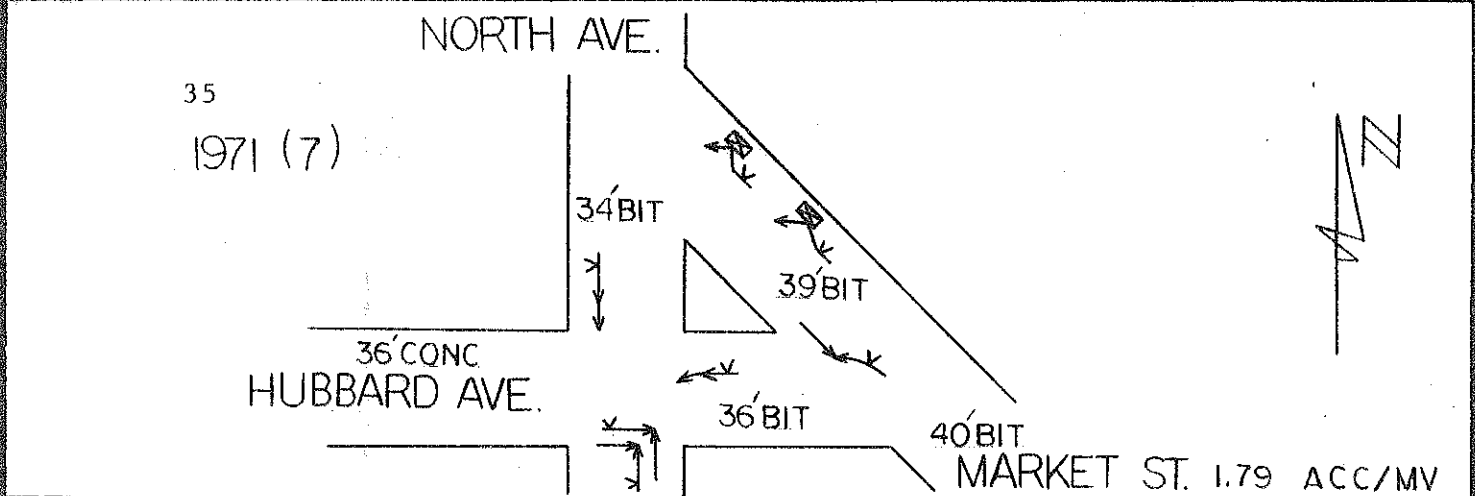
## Operational Analysis:

North Avenue and Hubbard Avenue form a four-legged intersection that is under signal control. The two overhead signals and two pedestal mounted signals operate on a 60-second cycle with a 65-35 split favoring North Avenue and a 7 percent clearance interval.

Market Street intersects North Avenue approximately 100 feet north of Hubbard Avenue and intersects Hubbard Avenue approximately 100 feet east of North Avenue. There is a 24-inch "STOP" sign on Market Street at its intersection with North Avenue and one on Hubbard Avenue at its intersection with Market Street.

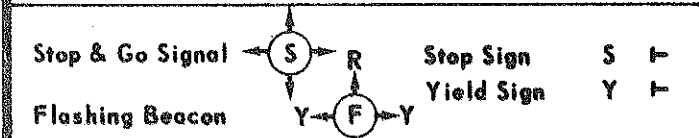
<u>Type</u>	<u>Accidents</u>			<u>Total</u>
	<u>1971</u>	<u>1972</u>	<u>1973</u>	
Rear end	2	7	3	12
Right-angle	2	1	7	10
Head-on Left	1	2	2	5
Parking	2	1	1	4
Misc.	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total	7	12	14	33

The miscellaneous category includes one improper backing and one ran off roadway accident. The accident rate at this intersection during the study period was 2.81 ACC/MV.

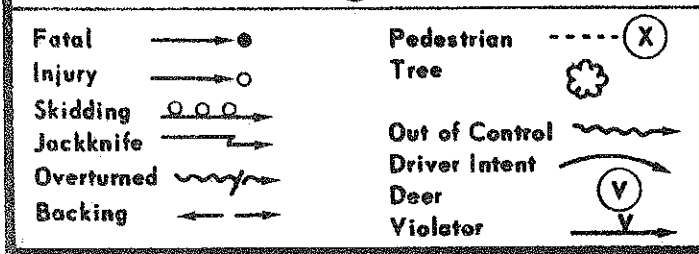


**LEGEND**

STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS  
AND TRANSPORTATION



Location NORTH AVE at MARKET ST., NORTH AVE. at HUBBARD AVE., HUBBARD AVE. at MARKET ST.  
CITY OF MT. CLEMENS  
MACOMB CO.



Period: 1971 THRU 1973 2.81 ACC/MV  
 Accidents - Total 33 P.D. 25  
 Injury 8 (16) Fatal 0 ( )  
 C.S. \_\_\_\_\_ Miles \_\_\_\_\_ Drawn DVW  
 Plan No. LOCATION 4 Date \_\_\_\_\_



NORTHBOUND NORTH AVENUE  
AT HUBBARD AVENUE



SOUTHBOUND NORTH AVENUE  
AT HUBBARD AVENUE



EASTBOUND HUBBARD AVENUE  
AT NORTH AVENUE



WESTBOUND HUBBARD AVENUE  
AT NORTH AVENUE

FIGURE 19



EASTBOUND HUBBARD AVENUE  
AT MARKET STREET



NORTHWESTBOUND MARKET STREET  
AT HUBBARD AVENUE

FIGURE 20





NORTHWESTBOUND MARKET STREET  
AT NORTH AVENUE



SOUTHBOUND NORTH AVENUE  
AT MARKET STREET

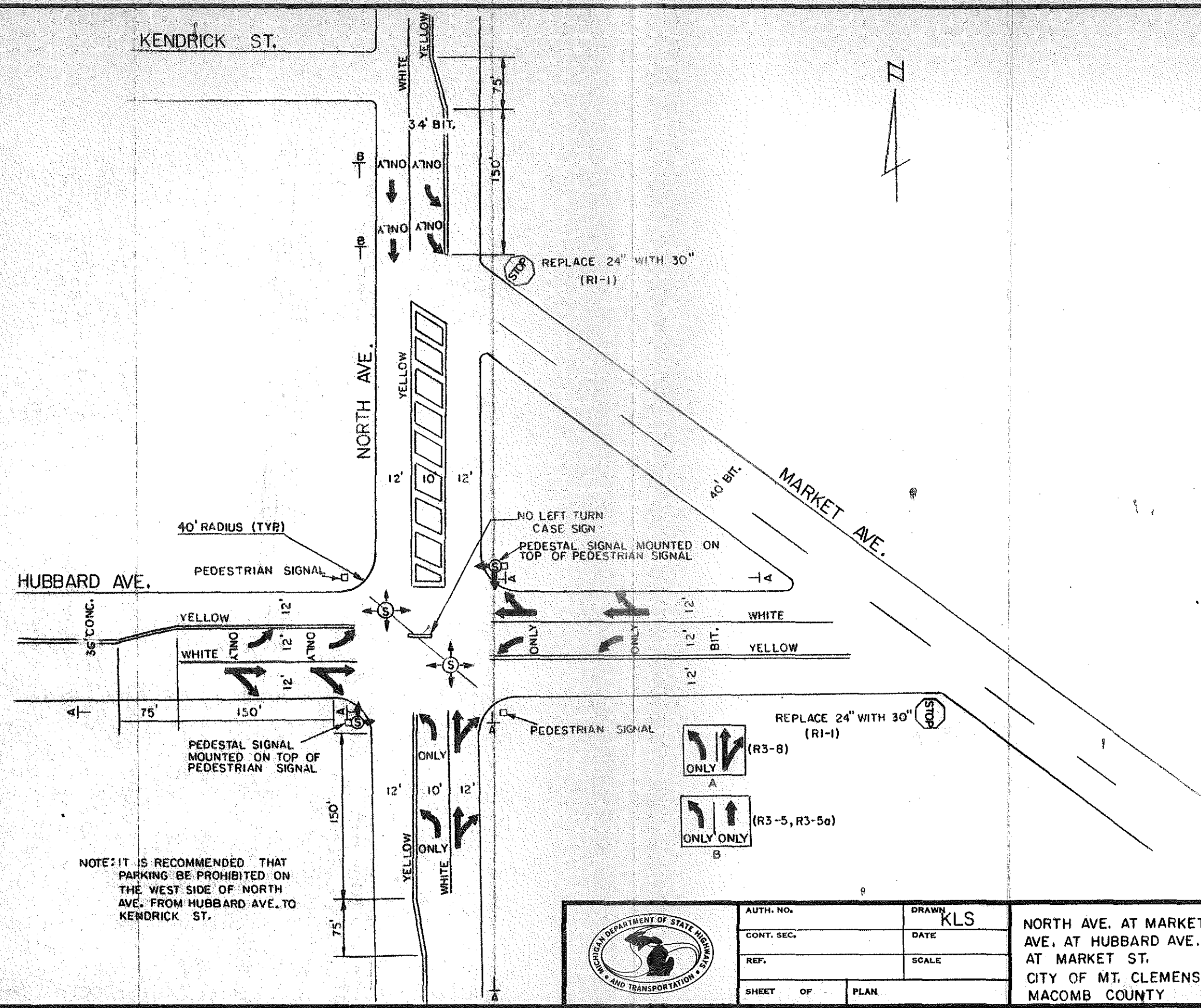
FIGURE 21

RECOMMENDATIONSEstimated Cost

- |    |   |        |
|----|---|--------|
| 1. | It is recommended that the 24-inch "STOP" signs on Market Street and Hubbard Avenue be replaced by 30-inch signs because of the traffic volumes experienced at this location.   | \$ 60  |
| 2. | In all 10 of the right-angle accidents at the North Avenue-Hubbard Avenue intersection, the motorist at fault disregarded the red signal indication. Seven of these operators were traveling on north or south-bound North Avenue. We recommend that a 3 percent (1.8 seconds) all-red clearance interval be incorporated in the cycle length to follow the North Avenue yellow clearance interval.   | \$ 50  |
| 3. | It is recommended that two-lane approaches be established at the intersection of North Avenue and Hubbard Avenue. Both legs of Hubbard Avenue and the south leg of North Avenue should be painted for three lanes with the center lane for left turns only and the outside approach lanes for right turns and through movements. The north leg of North Avenue should be painted for three lanes with the middle lane cross hatched with yellow paint from Market Avenue to Hubbard Street so that moving traffic will not use it as a left-turn lane. An overhead case sign indicating "NO LEFT TURN" for south-bound North Avenue should be suspended over the intersection. This left-turn movement can be provided for at the North Avenue - Market Street intersection. Three lanes should be painted at this intersection with the center lane for left turns only and the outside lane for through movements only. Pavement word and symbol markings and symbol Lane-Use Control signs should be provided as indicated on the proposed intersection diagram for this location. | \$1000 |
| 4. | Parking should be prohibited on the west side of North Avenue from Hubbard Avenue north to Kendrick Street. Through traffic will then be able to go around vehicles turning left from North Avenue to Market Street.  | \$ 75  |

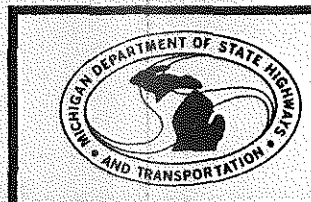
Total	\$1185
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NOTE: IT IS RECOMMENDED THAT PARKING BE PROHIBITED ON THE WEST SIDE OF NORTH AVE. FROM HUBBARD AVE. TO KENDRICK ST.

FIGURE 22



AUTH. NO.	DRAWN KLS
CONT. SEC.	DATE
REF.	SCALE
SHEET OF	PLAN

NORTH AVE. AT MARKET ST., NORTH AVE. AT HUBBARD AVE., HUBBARD AVE. AT MARKET ST.  
CITY OF MT. CLEMENS  
MACOMB COUNTY

Operational Analysis:

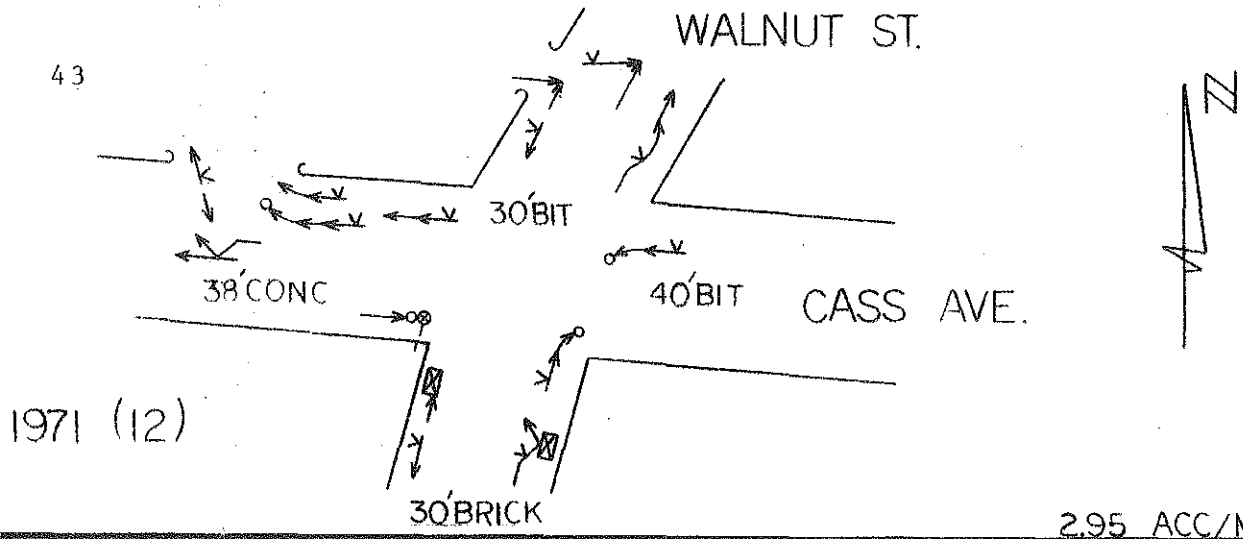
Cass Avenue and Walnut Street form a four-legged intersection that is under signal control. The three overhead signals and two pedestal mounted signals operate on a 60-second cycle with a 60-40 split favoring Cass Avenue and a 6 percent clearance interval. Parking is permitted on the west side of Walnut Street only.

	<u>Accidents</u>			
<u>Type</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>Total</u>
Rear end	6	2	3	11
Parking	1	1	4	6
Improper Backing	2	1	1	4
Improper Lane Usage	1	0	3	4
Improper Turn	0	2	1	3
Misc.	<u>2</u>	<u>0</u>	<u>1</u>	<u>3</u>
Total	12	6	13	31

The miscellaneous category includes one right-angle, one sideswipe and one car-pedestrian accident. The accident rate at this intersection during the study period was 2.53 ACC/MV.

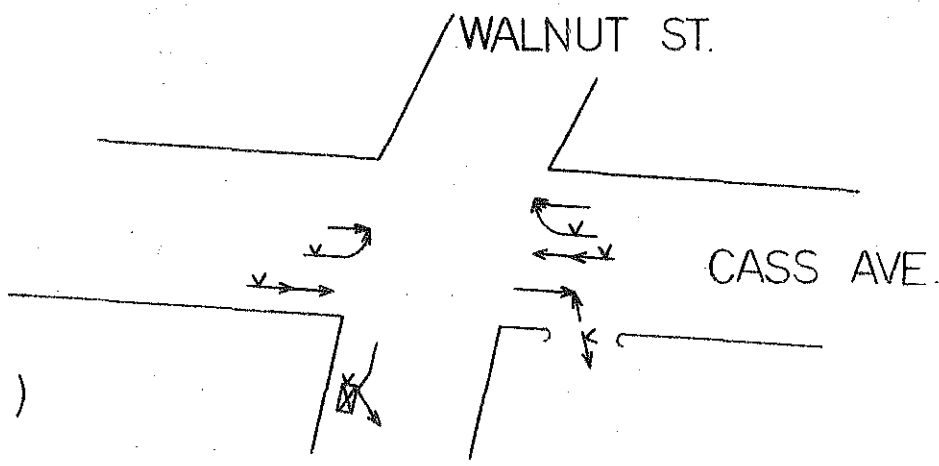
**TRANSPORTATION LIBRARY  
MICHIGAN DEPT. STATE HIGHWAYS &  
TRANSPORTATION LANSING, MICH.**

43



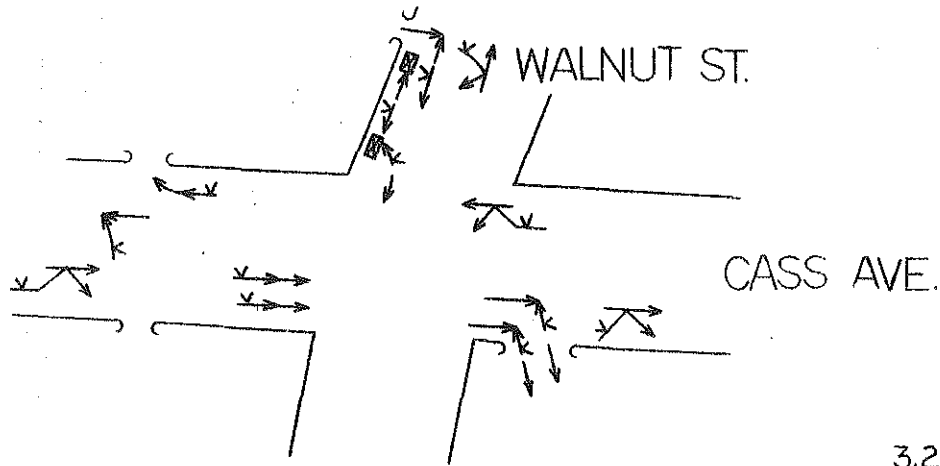
1971 (12)

2.95 ACC/MV



1972 (6)

1.47 ACC/MV



1973 (13)

3.20 ACC/MV

LEGEND

- Stop & Go Signal Stop Sign S Y
- Flashing Beacon Yield Sign Y F
- Fatal Pedestrian --- (X)
- Injury Tree
- Skidding Out of Control ~~~~~
- Jackknife Driver Intent (V)
- Overtaken Deer (D)
- Backing Violator (V)

STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS  
AND TRANSPORTATION

Location: CASS AVE. at WALNUT ST.  
CITY OF MT. CLEMENS  
MACOMB CO. 2.53 ACC/MV

Period: 1971 THRU 1973  
Accidents - Total 31 P.D. 27  
Injury 4 (4) Fatal 0 ( )  
C.S. \_\_\_\_\_ Miles \_\_\_\_\_ Drawn DVW  
Plan No. LOCATION 5 Date \_\_\_\_\_



EASTBOUND CASS AVENUE



WESTBOUND CASS AVENUE



NORTHBOUND WALNUT STREET



SOUTHBOUND WALNUT STREET

FIGURE 25

RECOMMENDATIONS

	<u>Estimated Cost</u>
1. Yellow clearance intervals should have a duration of between 4 and 4.5 seconds to be effective. For this reason it is recommended that the clearance interval be increased to 7 percent which is 4.2 seconds.	\$50
2. The center line should be applied along the entire length of Walnut Street in the Central Business District.	\$20
Total	\$70



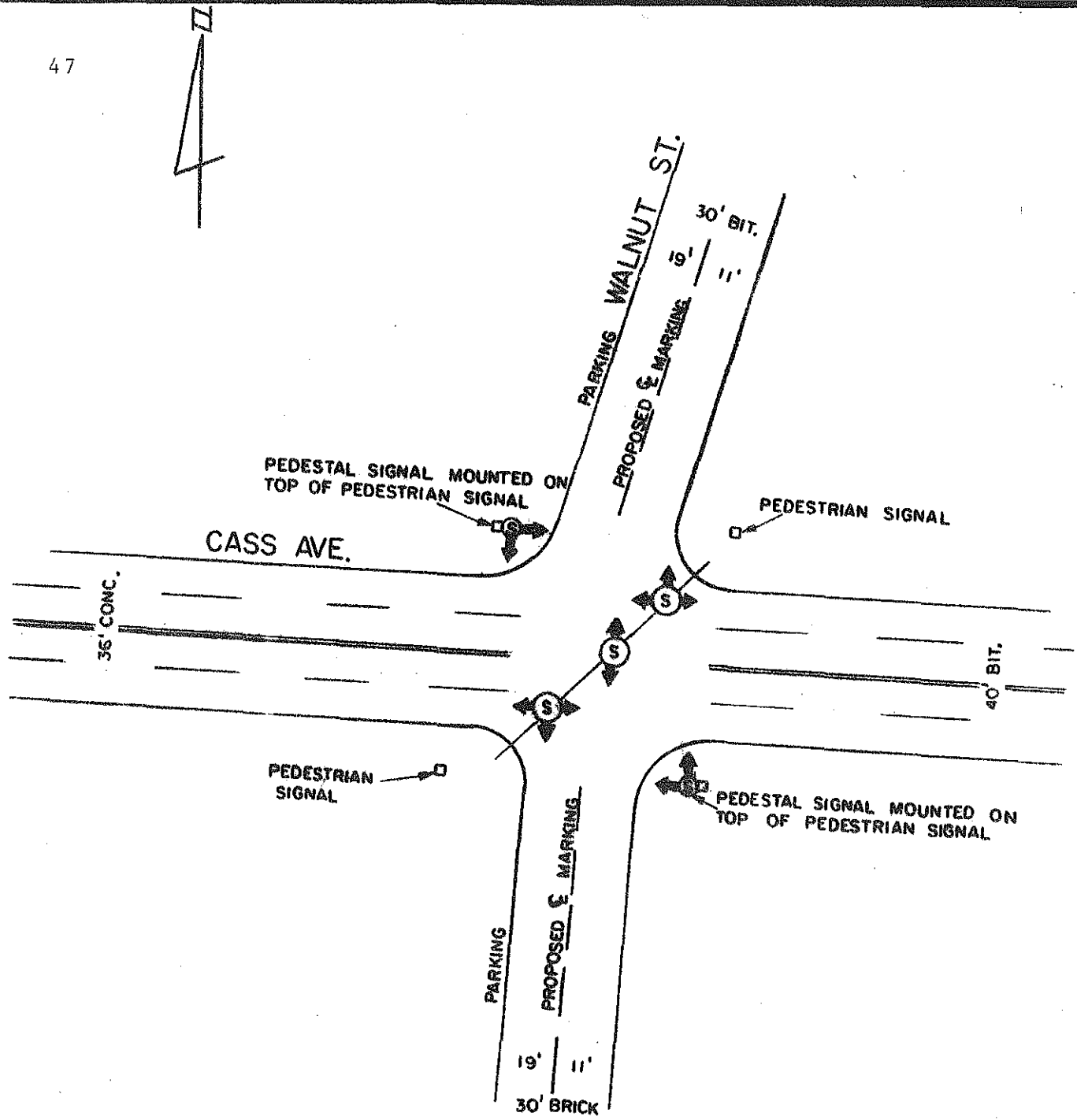


FIGURE 26

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.	DRAWN KLS	CASS AVE. AT WALNUT ST. CITY OF MT. CLEMENS MACOMB COUNTY
	CONT. SEC.	DATE	
	REF.	SCALE	
	SHEET OF	PLAN	

LOCATION 6 - MARKET STREET AT WALNUT STREET

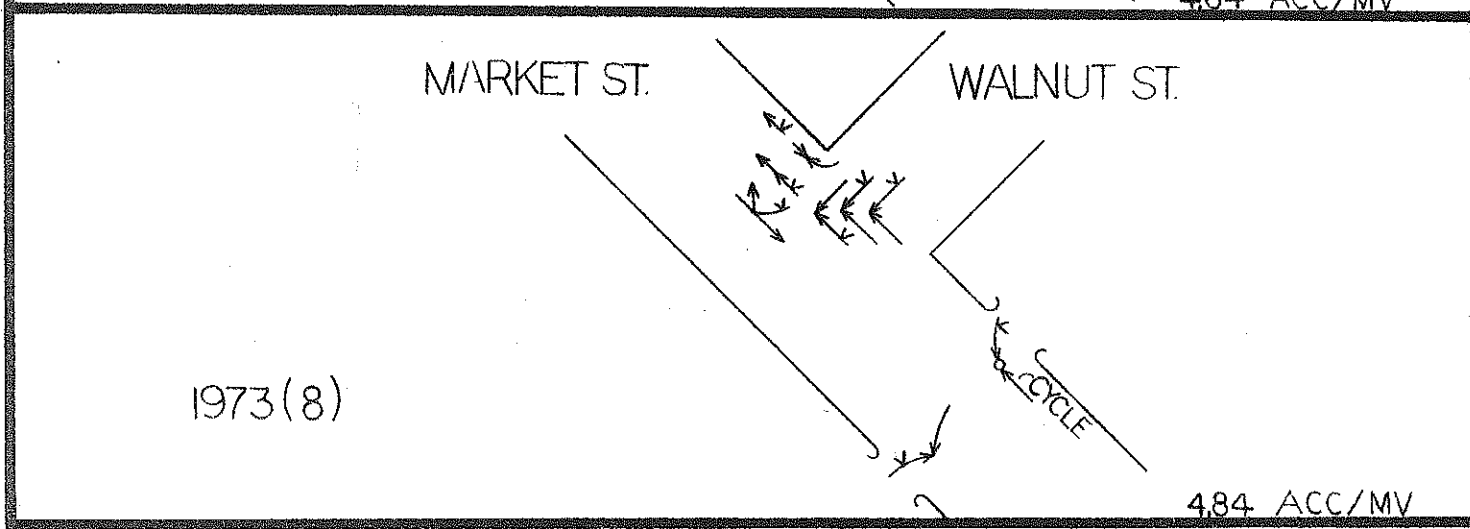
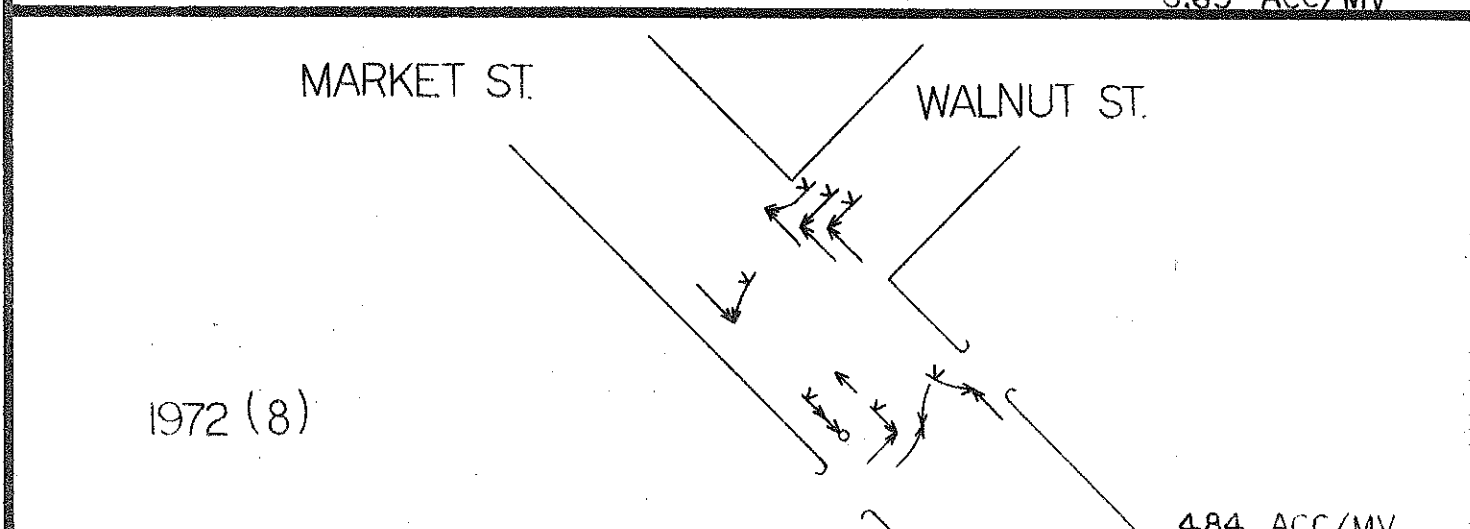
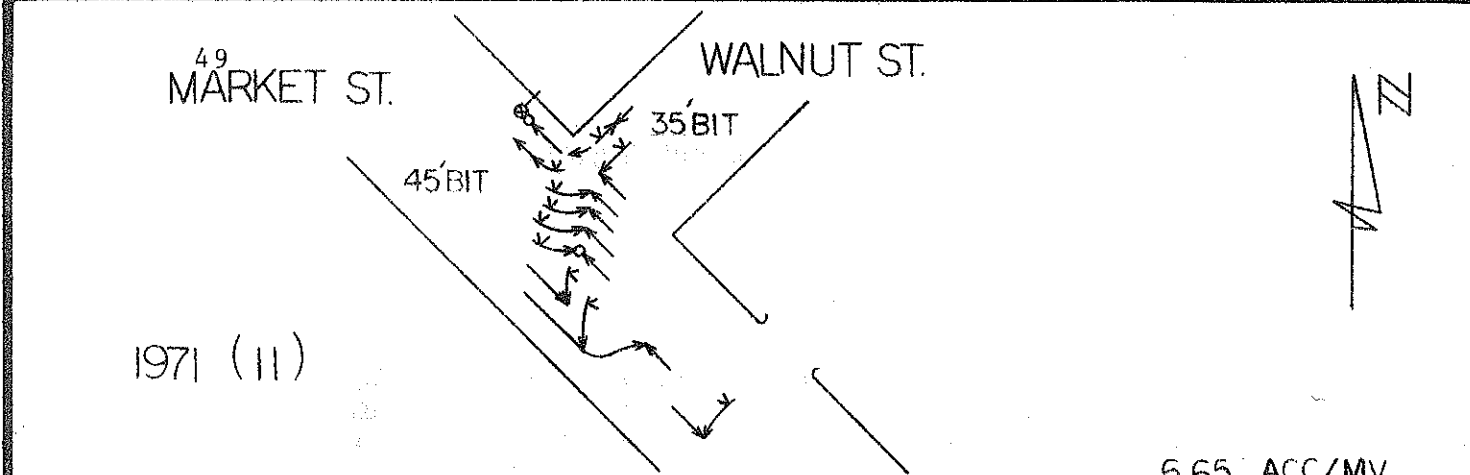
## Operational Analysis:

Market Street and Walnut Street form a "T" intersection in the Central Business District that is under stop control. This intersection is located only 75 feet southeast of the Gratiot Avenue - Market Street intersection. Walnut Street traffic is controlled by a 24-inch "STOP" sign. Left turns are prohibited from Walnut Street to Market Street and vice versa.

<u>Type</u>	<u>Accidents</u>			
	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>Total</u>
Right Angle	3	4	3	10
Driveway	1	2	2	5
Head-On Left	4	0	0	4
Rear End	1	1	1	3
Improper Backing	1	1	1	3
Misc.	<u>1</u>	<u>0</u>	<u>1</u>	<u>2</u>
Total	11	8	8	27

The miscellaneous category included one accident involving a pedestrian and one involving improper lane usage. The accident rate at this intersection during the study period was 5.45 ACC/MV.





<b>LEGEND</b>		STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION	
Stop & Go Signal	Stop Sign	Location MARKET ST. at WALNUT ST.	
Flashing Beacon	Yield Sign	CITY OF MT. CLEMENS	
Fatal	Pedestrian	MACOMB CO.	5.45 ACC/MV
Injury	Tree	Period: 1971 THRU 1973	
Skidding	Out of Control	Accidents - Total 27 P.D. 23	
Jackknife	Driver Intent	Injury 4 (6) Fatal 0 ( )	
Overturned	Deer	C.S. _____ Miles _____ Drawn DVW	
Backing	Violator	Plan No. LOCATION 6 Date _____	



NORTHWESTBOUND MARKET STREET



SOUTHEASTBOUND MARKET STREET



NORTHBOUND WALNUT STREET  
AT CLINTON STREET



SOUTHBOUND WALNUT STREET  
AT THE RESTAURANT DRIVEWAY



NORTHBOUND WALNUT STREET



NORTHBOUND WALNUT STREET  
AT THE RESTAURANT AND  
SHOPPING CENTER DRIVEWAYS



NORTHBOUND WALNUT AT CLINTON  
AND SHOPPING DRIVE

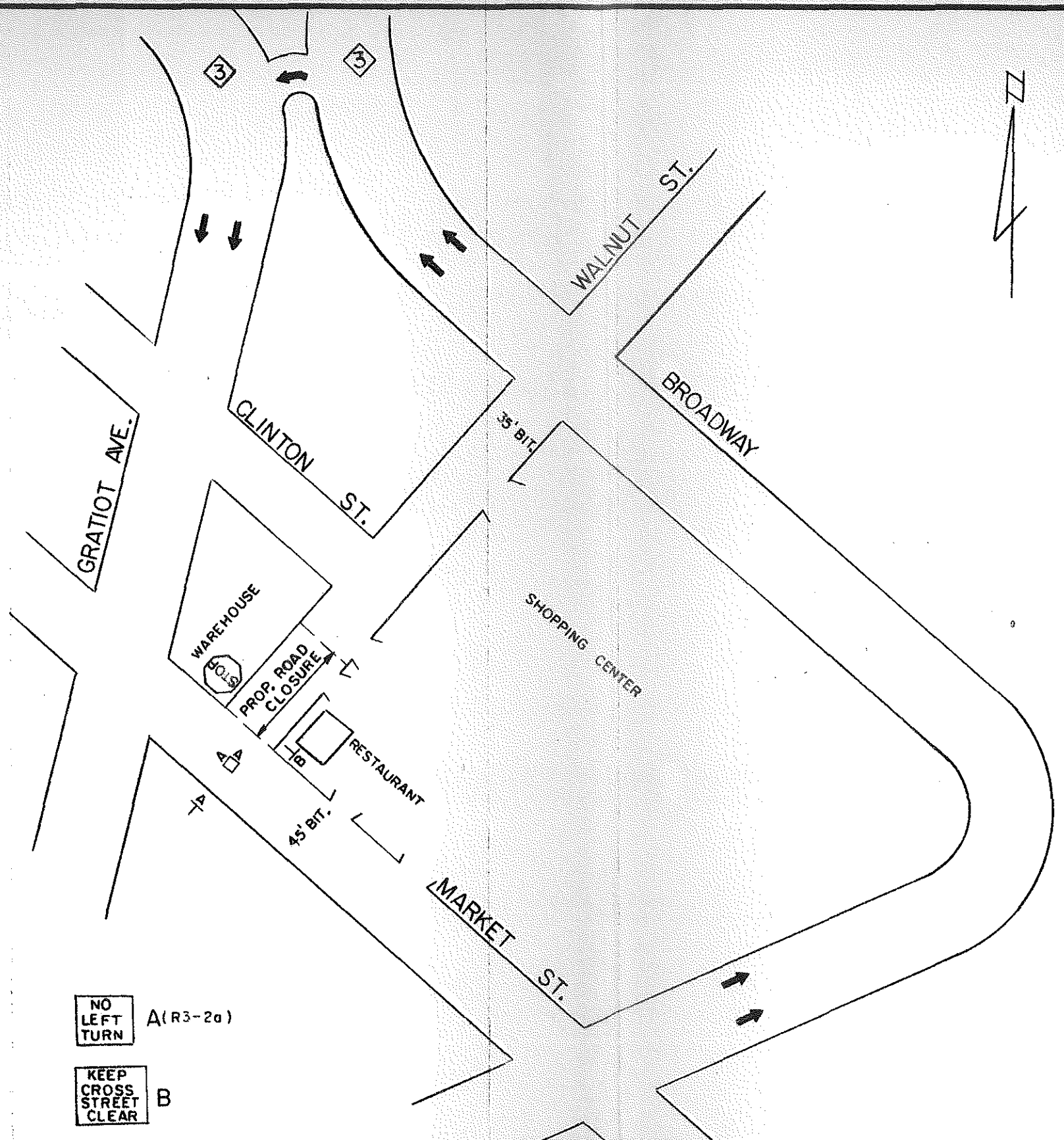


SOUTHBOUND WALNUT AT CLINTON  
AND SHOPPING DRIVE

RECOMMENDATION

The intersections of Gratiot Avenue and Walnut Street with Market Street are too close to each other for efficient operation. Some of the conflicts at these two intersections have been eliminated by prohibiting left turns involving Walnut Street. However, the right-turn movement from Walnut Street resulted in 11 accidents during the study period. Walnut Street has little importance to the traffic patterns of the Central Business District. Access to the shopping center located in the northeast quadrant is provided by driveways abutting Market Street and the north half of Walnut Street. Access to the restaurant on the northeast corner of the intersection is provided by a driveway abutting Market Street. Both Market Street and Clinton Street (located 250 feet northeast of Market Street) provide access to southbound Gratiot Avenue. We recommend that Walnut Street be closed from the shopping center driveway located southwest of Clinton Street to Market Street (a distance of 161 feet). This closure should be temporary while traffic operation on the surrounding streets is evaluated. If traffic congestion and accidents do not increase on the surrounding streets, then the closure of this portion of Walnut Street can be made permanent.





NO LEFT TURN A(R3-2a)  
 KEEP CROSS STREET CLEAR B

	AUTH. NO.	DRAWN <b>KLS</b>
	CONT. SEC.	DATE
	REF.	SCALE
	SHEET OF	PLAN

MARKET ST. AT WALNUT ST.  
 CITY OF MT. CLEMENS  
 MACOMB COUNTY

FIGURE 32

LOCATION 8 - MARKET STREET AT PINE STREET

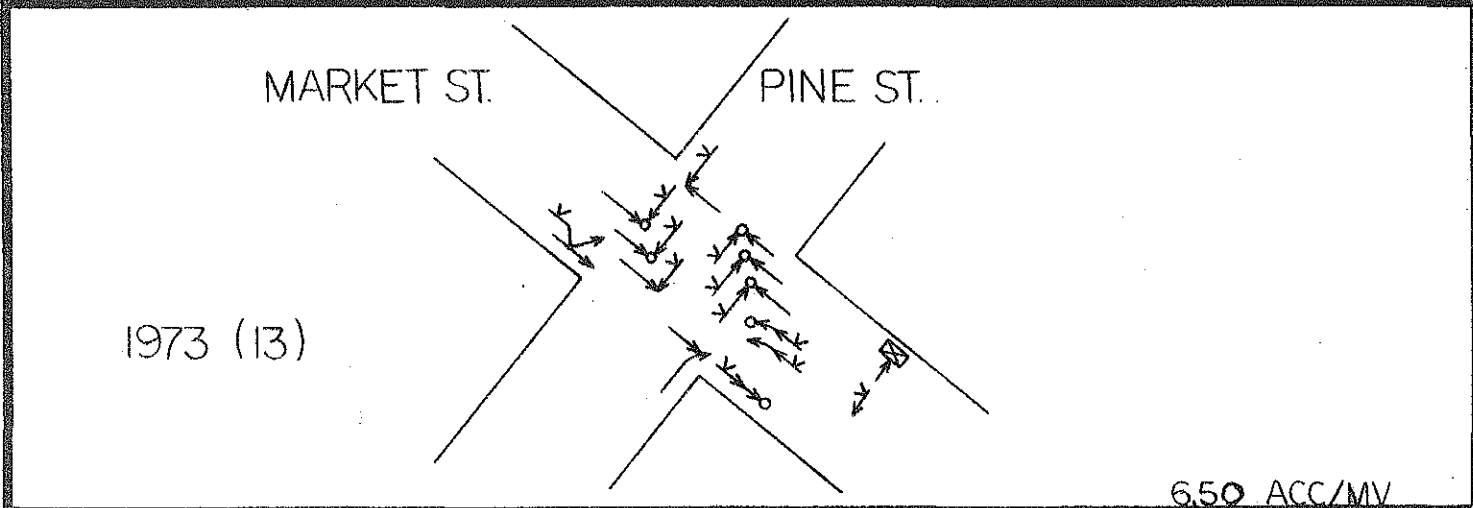
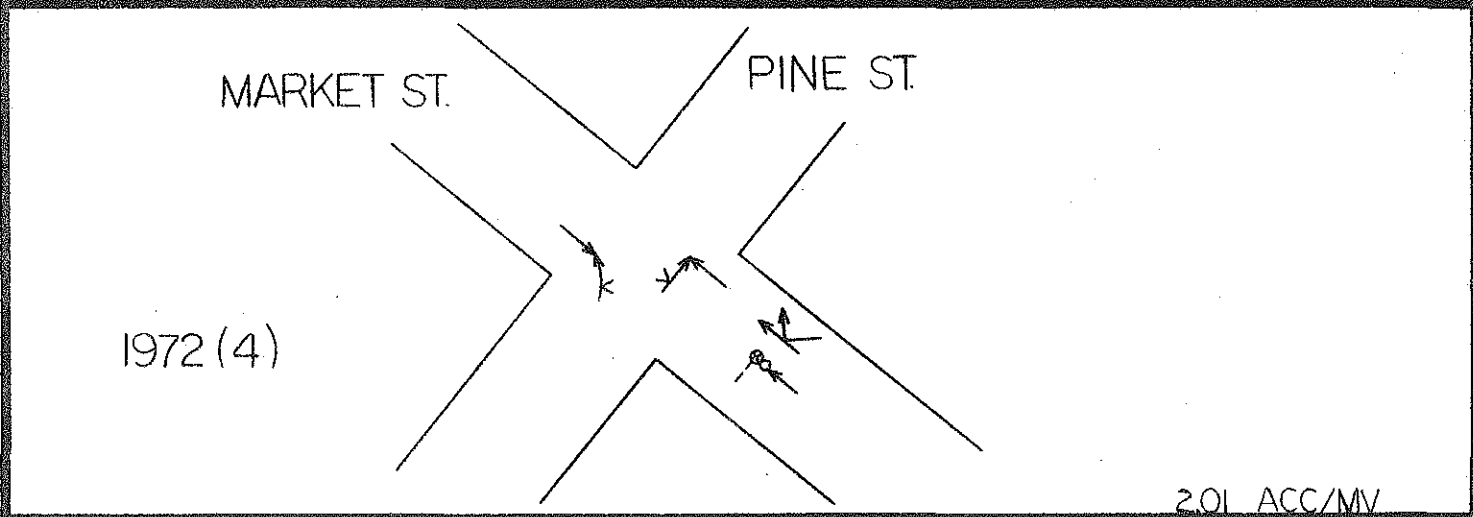
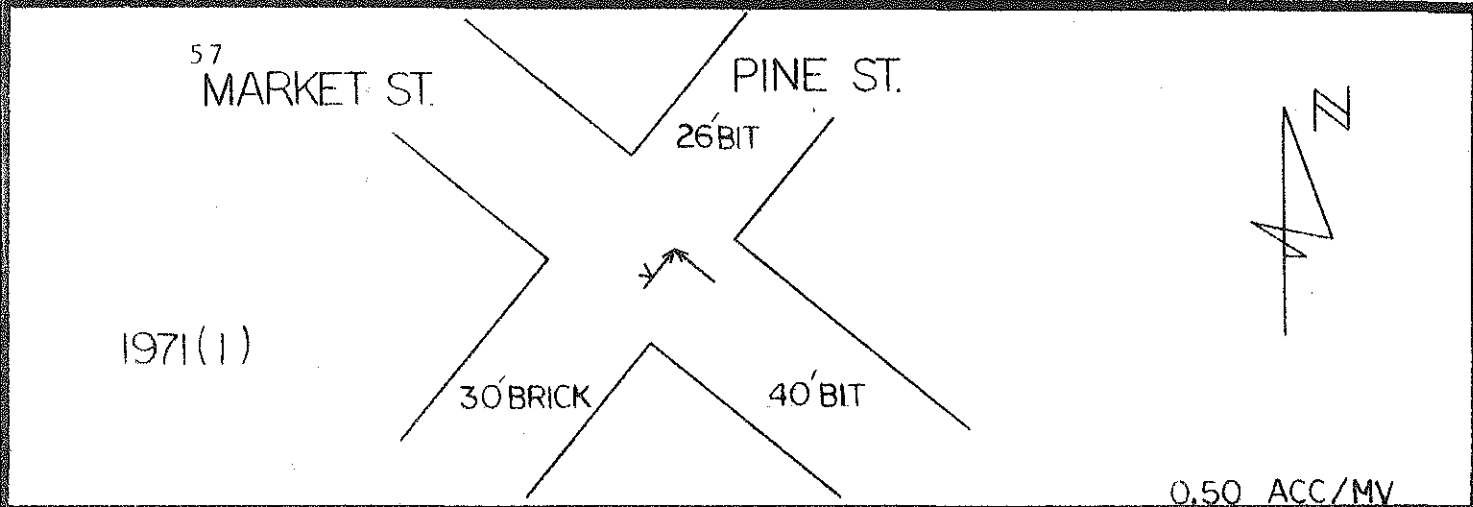
## Operational Analysis:

Market Street and Pine Street form a right angle intersection that is under stop control. There is a 24-inch "STOP" sign on each corner of Pine Street. The northeast leg of Pine Street has an uneven bituminous pavement, while the southwest leg has a brick pavement.

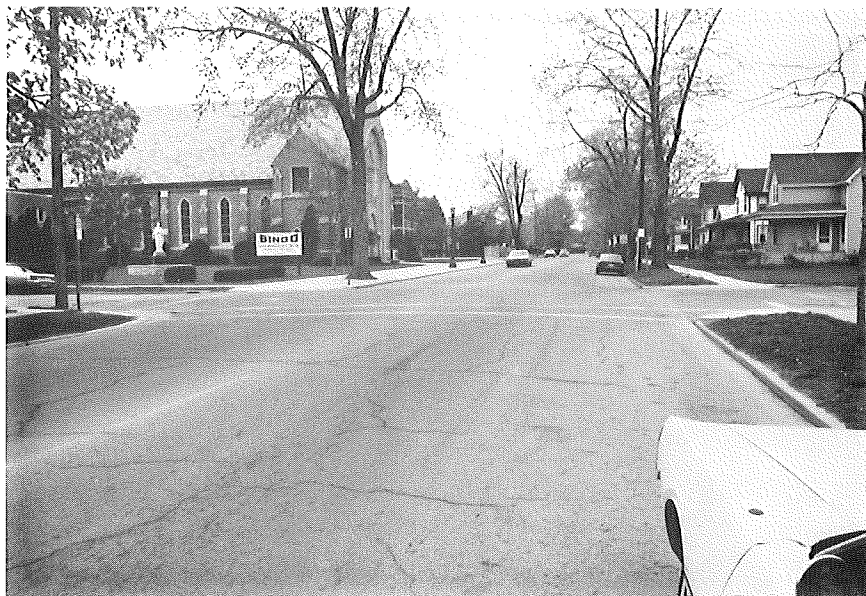
<u>Type</u>	<u>Accidents</u>			<u>Total</u>
	<u>1971</u>	<u>1972</u>	<u>1973</u>	
Right Angle	1	2	8	11
Rear end	0	0	3	3
Parking	0	1	1	2
Misc.	<u>0</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total	1	4	13	18

The miscellaneous accident types included one car-pedestrian and one sideswipe. The accident rate at this intersection during the study period was 3.01 Acc/MV.





<b>LEGEND</b>		STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION	
Stop & Go Signal		Stop Sign	
Flashing Beacon		Yield Sign	
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overtaken		Deer	
Backing		Violator	
		Location MARKET ST. at PINE ST. CITY OF MT. CLEMENS MACOMB CO. 3.01 ACC/MV	
		Period: 1971 THRU 1973	
		Accidents - Total 18 P.D. 10	
		Injury 8 (8) Fatal 0 ( )	
		C.S. Miles Drawn DVW	
		Plan No. LOCATION 8 Date	



NORTHWESTBOUND MARKET STREET



SOUTHEASTBOUND MARKET STREET



NORTHEASTBOUND PINE STREET



SOUTHWESTBOUND PINE STREET

FIGURE 35

RECOMMENDATIONSEstimated Costs

- |    |   |       |
|----|---|-------|
| 1. | It is recommended that the 24-inch "STOP" sign on the southwest leg of Pine Street be replaced by a 30-inch sign because of the higher than normal traffic volumes created by Pine Streets proximity to the Central Business District.  | \$ 60 |
| 2. | Ten of the 11 motorists responsible for the right angle accidents stopped at the intersection and then failed to yield the right-of-way to Market Street traffic. The sight distance from the northeast leg of Pine Street is poor in both directions due to parked vehicles on Market Street. This problem will be eliminated because the northeast leg of Pine Street is scheduled to be closed to through traffic. The sight distance from the southwest leg of Pine Street in the southeasterly direction is also poor due to parked vehicles on Market Street (Parking is prohibited on Market Street in the southwest quadrant). To alleviate this sight distance problem the first two parking stalls in the southeast quadrant should be removed. | \$ 50 |
|    | Total   | \$110 |

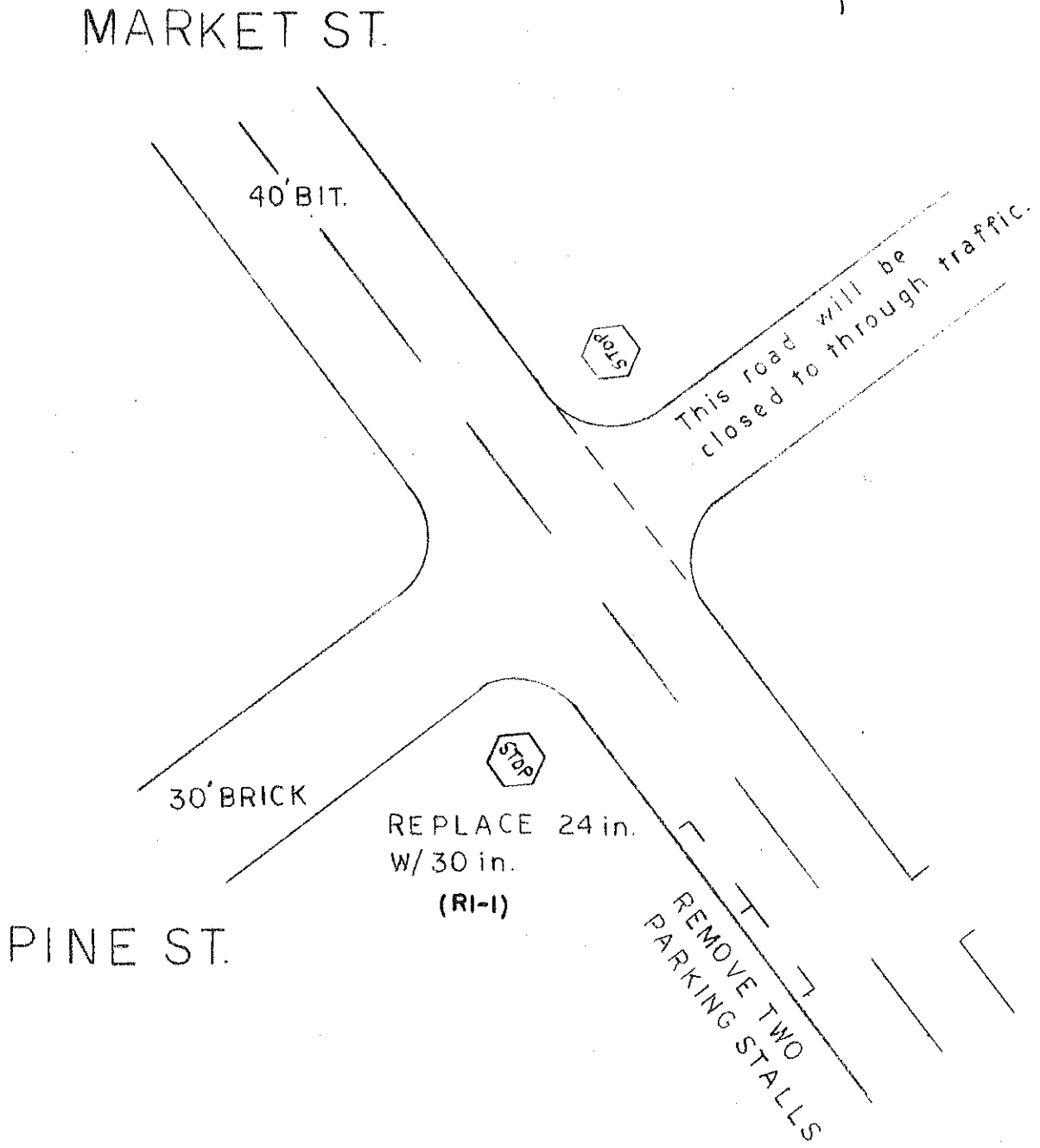


FIGURE 36

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS ● TRAFFIC & SAFETY DIVISION	AUTH. NO.		DRAWN		MARKET ST. AT PINE ST. CITY OF MT. CLEMENS MACOMB COUNTY
	CONT. SEC.		DATE		
	REF.		SCALE		
	SHEET	OF	PLAN		

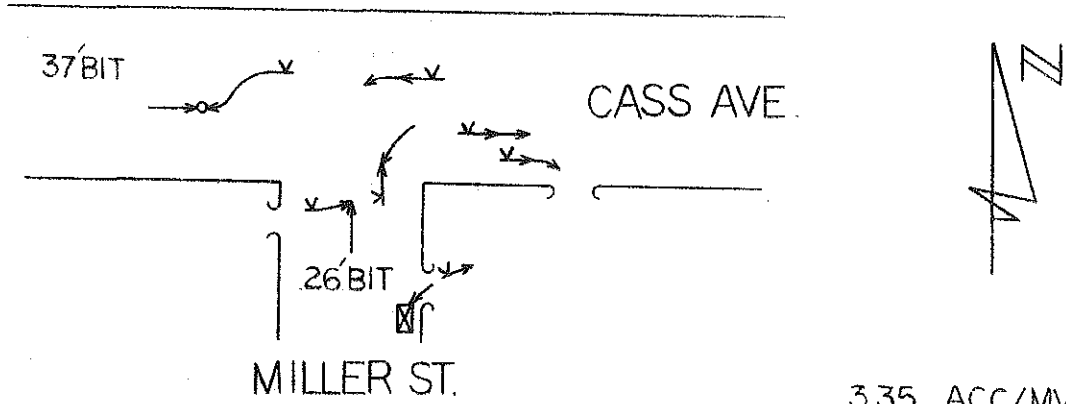
LOCATION 9 - CASS AVENUE AT MILLER STREET

Cass Avenue and Miller Street form a "T" intersection that is under stop control. A 24-inch "STOP" sign controls traffic on Miller Street. A dairy store is located in the southwest quadrant.

	<u>Accidents</u>			
<u>Type</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>Total</u>
Rear end	3	2	1	6
Right Angle	1	1	1	3
Driveway	2	1	0	3
Misc.	<u>1</u>	<u>2</u>	<u>0</u>	<u>3</u>
Total	7	6	2	15

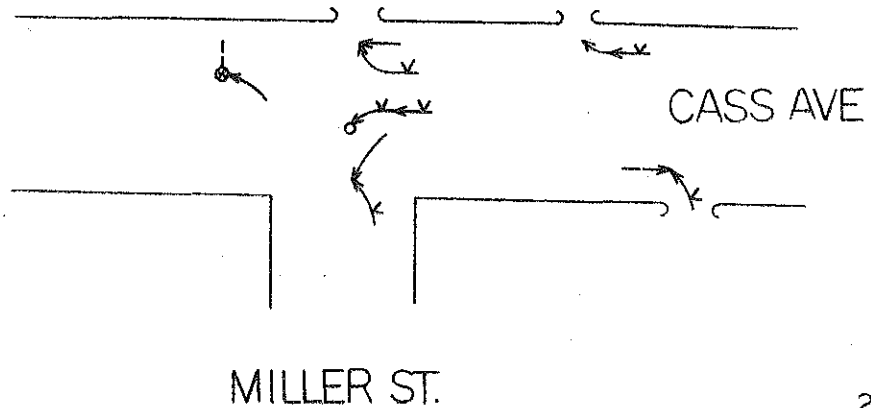
The miscellaneous accident types included one head-on, one car-pedestrian, and one improper turn. The accident rate at this intersection during the study period was 2.39 Acc/MV.

1971(7)



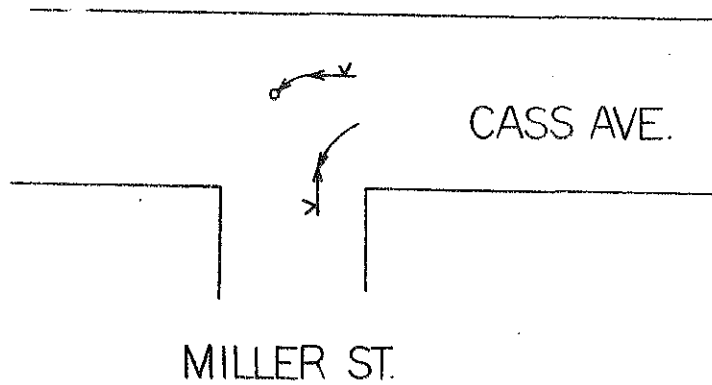
3.35 ACC/MV

1972(6)



2.87 ACC/MV

1973(2)



0.95 ACC/MV

LEGEND

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

STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS  
AND TRANSPORTATION

Location CASS AVE. at MILLER ST.  
CITY OF MT. CLEMENS  
MACOMB CO. 2.39 ACC/MV

Period: 1971 THRU 1973  
Accidents - Total 15 P.D. 12  
Injury 3 (3) Fatal 0 ( )  
C.S. \_\_\_\_\_ Miles \_\_\_\_\_ Drawn DVW  
Plan No. LOCATION 9 Date \_\_\_\_\_



EASTBOUND CASS AVENUE



WESTBOUND CASS AVENUE





NORTHBOUND MILLER STREET



SOUTHBOUND MILLER STREET

FIGURE 39

RECOMMENDATIONS

	<u>Estimated Costs</u>
1. It is recommended that the 24-inch "STOP" sign on Miller Street be replaced by a 30-inch sign because of the higher traffic volumes experienced on Cass Avenue.	\$ 30
2. The Dairy store located in the southwest quadrant has neither curbing nor a driveway to prevent indiscriminate ingress and egress from their parking area. It is recommended that this control be established by constructing a driveway and curbing on the west side of Miller Street.	\$2500
Total	\$2530

67



CASS AVE.

37' BIT.

STORE

MILLER ST.

26' BIT.

56'

34'



REPLACE 24" WITH 30"  
(R1-1)

FIGURE 40

STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS

TRAFFIC & SAFETY DIVISION

AUTH. NO.

CONT. SEC.

REF.

SHEET OF

PLAN

DRAWN

KLS

DATE

SCALE

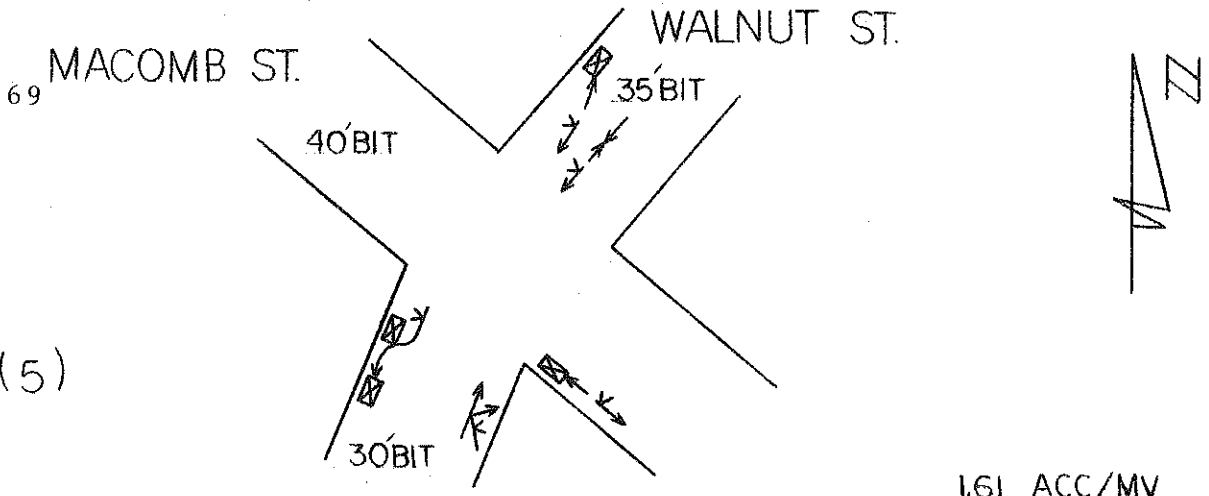
CASS AVE. AT MILLER ST.  
CITY OF MT. CLEMENS  
MACOMB COUNTY

LOCATION 11 - WALNUT STREET AT MACOMB STREET

Walnut Street and Macomb Street form a four-legged intersection located in the Central Business District and operating under signal control. The south leg of Walnut Street joins the intersection at a skew. The dual signal heads operate on a 60-second cycle with a 50-50 split and 5 percent clearance intervals. Left turns are prohibited from all four approaches and parking is prohibited only on the east side of the south leg of Walnut Street.

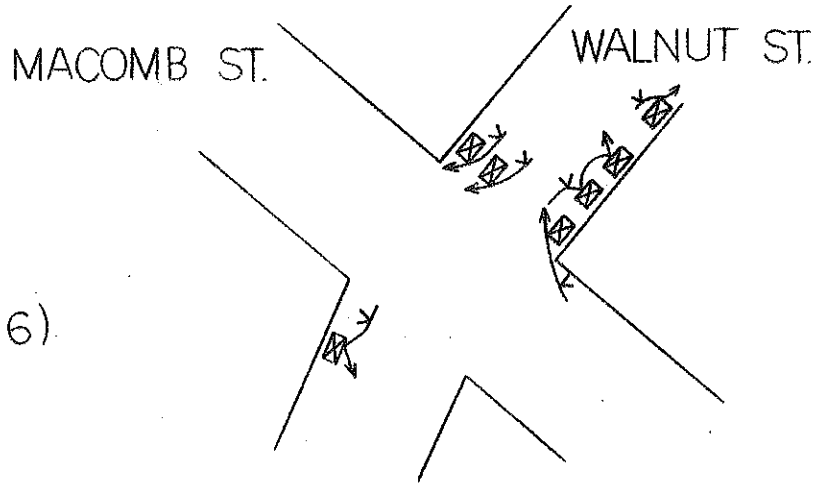
<u>Types</u>	<u>Accidents</u>			<u>Total</u>
	<u>1971</u>	<u>1972</u>	<u>1973</u>	
Parking	4	6	2	12
Improper Backing	<u>1</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total	5	6	2	13

Ten out of the twelve parking related accidents occurred on Walnut Street six of which occurred on the north leg. The accident rate at this intersection during the study period was 1.40 Acc/MV.



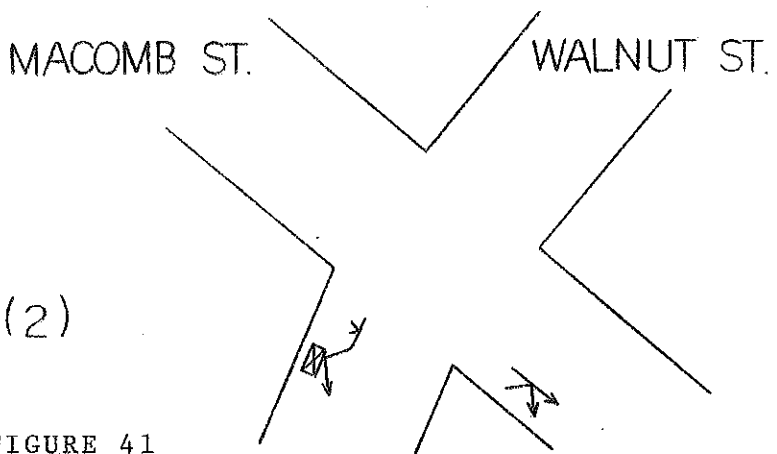
1971 (5)

1.61 ACC/MV



1972 (6)

1.93 ACC/MV



1973 (2)

0.64 ACC/MV

FIGURE 41

<b>LEGEND</b>		STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION	
Stop & Go Signal		Stop Sign	
Flashing Beacon		Yield Sign	
Fatal		Pedestrian	
Injury		Tree	
Skidding		Out of Control	
Jackknife		Driver Intent	
Overtuned		Deer	
Backing		Violator	
		Location WALNUT ST. at MACOMB ST.	
		CITY OF MT. CLEMENS	
		MACOMB CO. 1.40 ACC/MV	
		Period: 1971 THRU 1973	
		Accidents - Total 13 P.D. 13	
		Injury 0 ( ) Fatal 0 ( )	
		C.S. _____ Miles _____ Drawn DVW	
		Plan No. LOCATION II Date _____	



NORTHWESTBOUND MACOMB STREET



SOUTHEASTBOUND MACOMB STREET

FIGURE 42



NORTHEASTBOUND WALNUT STREET



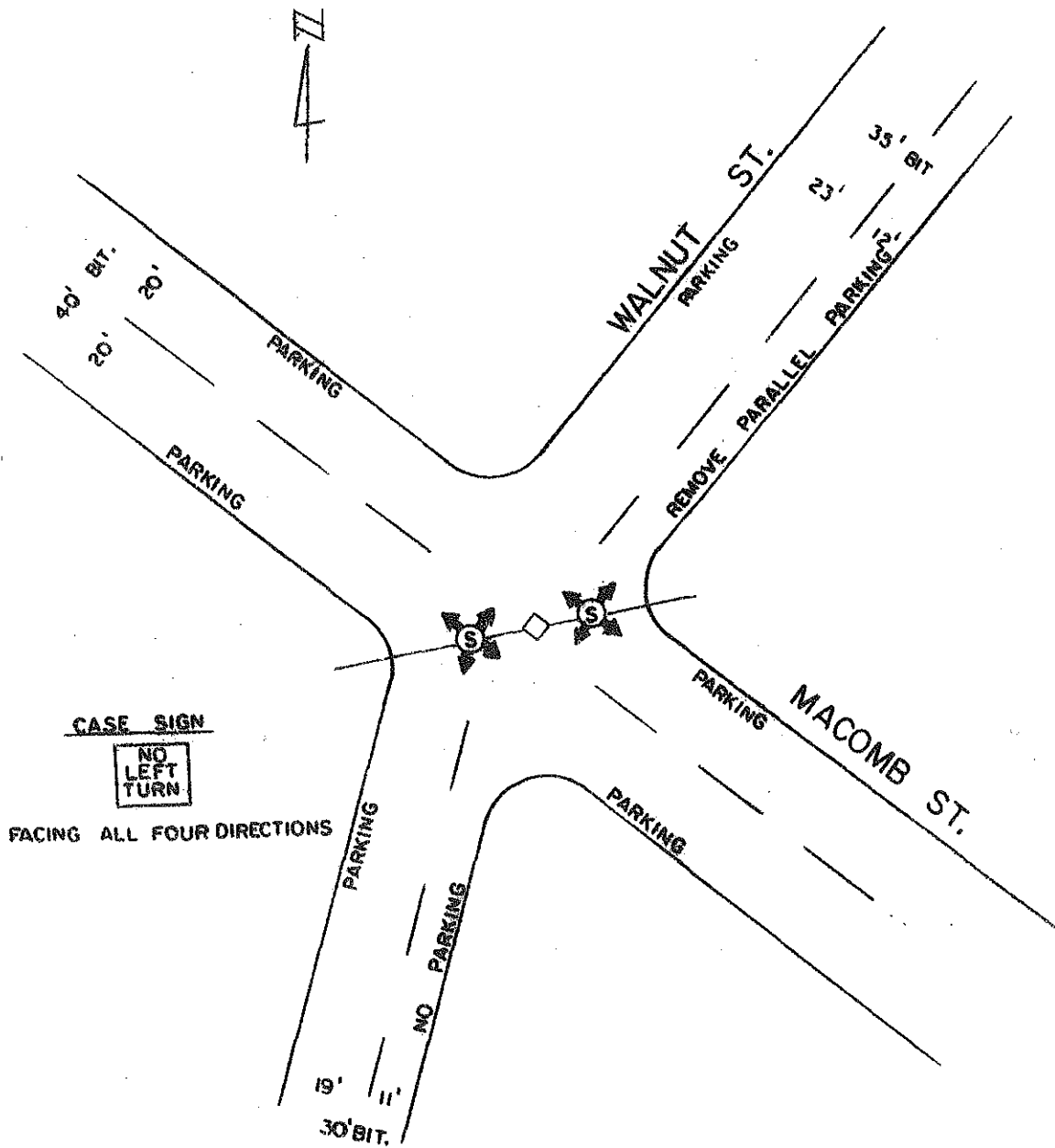
SOUTHWESTBOUND WALNUT STREET

FIGURE 43

RECOMMENDATIONSEstimated Cost

- |    |   |       |
|----|---|-------|
| 1. | Yellow clearance intervals should have a duration of between 4 and 4.5 seconds to be effective. For this reason it is recommended that the existing clearance interval be increased to 7 percent or 4.2 seconds.  | \$ 50 |
| 2. | An additional pavement width of at least eight and preferable 10 feet should be provided per parking lane. A minimum of eight feet per parking lane on the north leg of Walnut Street leaves only 19 feet for moving traffic. To improve this situation it is recommended that parking be removed on the east side of the north leg of Walnut Street. | \$ 50 |
| 3. | Centerline markings should be applied to both Macomb and Walnut Streets.  | \$ 50 |
|    | Total   | \$150 |





CASE SIGN



FACING ALL FOUR DIRECTIONS

FIGURE 44

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS — ● — TRAFFIC & SAFETY DIVISION	AUTH. NO.		DRAWN	WALNUT ST. AT MACOMB ST. CITY OF MT. CLEMENS MACOMB COUNTY
	CONT. SEC.		DATE	
	REF.		SCALE	
	SHEET	OF	PLAN	

KLS

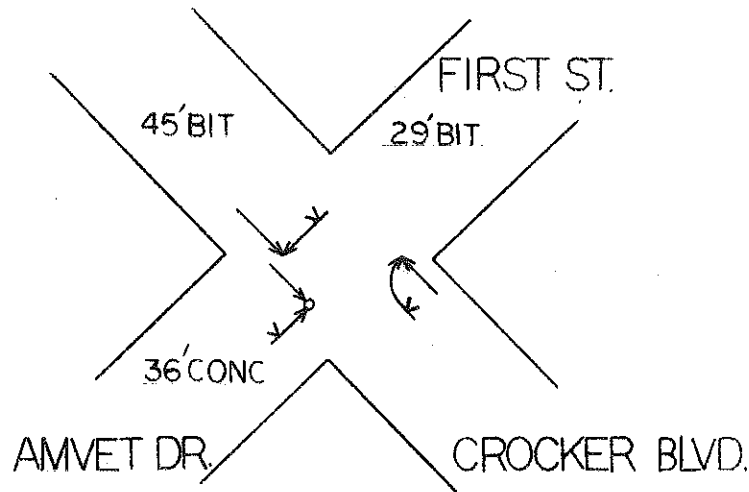
LOCATION 13 - CROCKER BOULEVARD AT FIRST STREET AND AMVET DRIVE

Crocker Boulevard intersects First Street and Amvet Drive to form a right angle intersection under stop control. Both First Street and Amvet Drive have 24-inch "STOP" signs to control traffic. Crocker Boulevard has four lanes for moving traffic west of the intersection and due to parallel parking only two lanes for moving traffic east of the intersection.

<u>Type</u>	<u>Accidents</u>			
	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>Total</u>
Parking	0	1	3	4
Right Angle	2	0	1	3
Ran-off Roadway	0	1	1	2
Misc.	<u>1</u>	<u>3</u>	<u>0</u>	<u>4</u>
Total	3	5	5	13

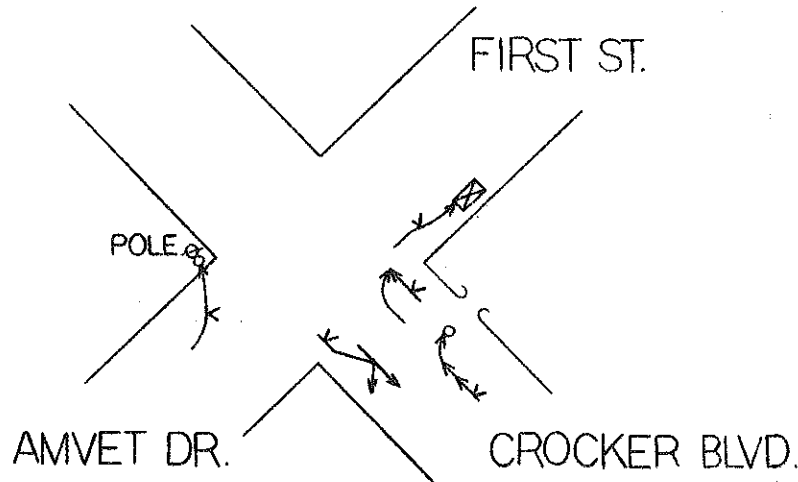
The miscellaneous accident types included one rear end, one improper turn, one sideswipe and one involving improper lane usage. The accident rate at this intersection during the study period was 1.89 ACC/MV.

1971(3)



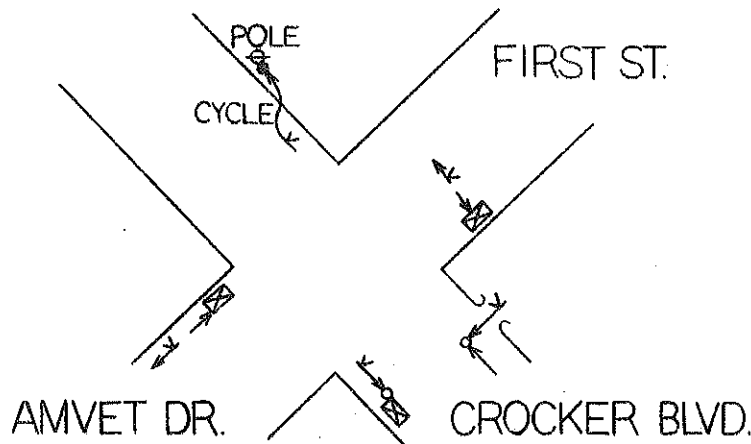
1.31 ACC/MV

1972(5)



2.18 ACC/MV

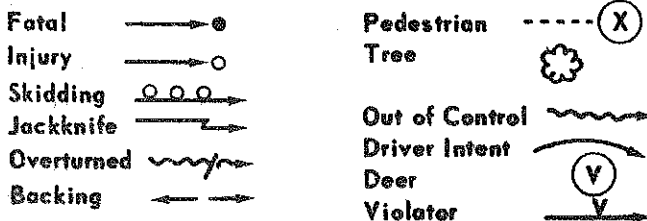
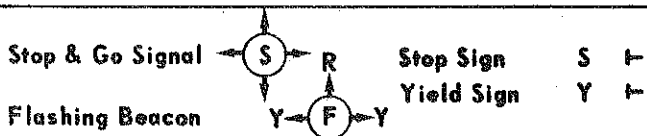
1973(5)



2.18 ACC/MV

FIGURE 45

**LEGEND**



STATE OF MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS  
AND TRANSPORTATION

Location CROCKER BLVD. at FIRST ST, AMVET DR.  
CITY OF MT. CLEMENS  
MACOMB CO. 1.89 ACC/MV

Period: 1971 THRU 1973  
Accidents - Total 13 P.D. 7  
Injury 5 (7) Fatal 1 (1)  
C.S. \_\_\_\_\_ Miles \_\_\_\_\_ Drawn DVW  
Plan No. LOCATION 13 Date \_\_\_\_\_



NORTHWESTBOUND CROCKER BOULEVARD



SOUTHEASTBOUND CROCKER BOULEVARD



NORTHEASTBOUND FIRST STREET



SOUTHWESTBOUND AMVET DRIVE

FIGURE 47

RECOMMENDATIONSEstimated Cost

- |    |  |      |
|----|--|------|
| 1. | Eastbound Crocker Boulevard traffic has two driveable lanes west of Amvet Drive and due to parking only one driveable lane east of Amvet Drive. It is recommended that a Pavement Width Transition sign be placed 250 feet in advance of the intersection to warn drivers of the approaching lane reduction.   | \$35 |
| 2. | It is recommended that the existing 24-inch "STOP" sign on First Street be replaced by a 30-inch sign. First Street carries a little more than twice the Average Daily Traffic of Amvet Drive and approximately one-fourth the Average Daily Traffic of Crocker Boulevard. Furthermore First Street provides access to the city of Mount Clemens Municipal offices. A 24-inch "STOP" sign can be used only at the intersection of low-volume local streets and secondary roads with low approach speeds. | \$30 |
|    | Total  | \$65 |

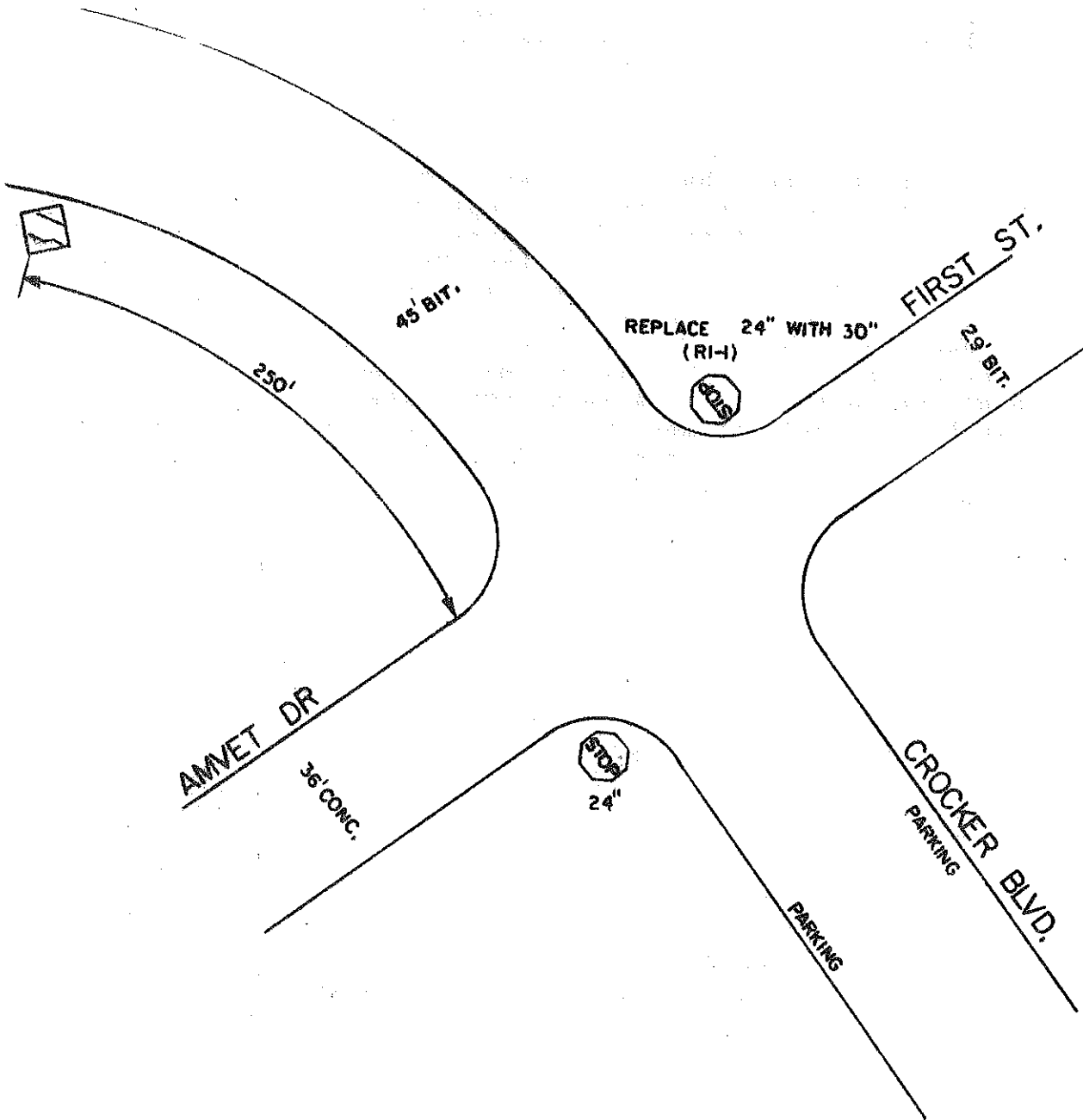


FIGURE 48

STATE OF MICHIGAN DEPARTMENT OF STATE HIGHWAYS  TRAFFIC & SAFETY DIVISION	AUTH. NO.		DRAWN	KLS
	CONT. SEC.		DATE	
	REF.		SCALE	
	SHEET	OF	PLAN	

AMVET DR. AT CROCKER BLVD.  
 CITY OF MT. CLEMENS  
 MACOMB COUNTY

SUMMARY OF RECOMMENDATIONSTraffic Control Devices Inventory

The traffic control devices inventory of the City Major Street System in Mount Clemens was completed in April, 1973. The results of the inventory including a cost estimate for implementation are as follows:

Regulatory Signs - The inventory indicated a need for the installation or maintenance of approximately 10 percent of the required regulatory signs at a cost of about \$2,425.

Warning Signs - The inventory indicated a need for the installation or maintenance of approximately 18 percent of the required Warning signs at a cost of about \$308.

Guide Signs - The inventory indicated a need for the installation or replacement of approximately 2 percent of the required guide signs at a cost of about \$150.

High Accident Locations

The Department of State Police submitted 16 high accident locations in the city of Mount Clemens to the Michigan Department of State Highways and Transportation. After an indepth study of these locations recommendations were formulated for 10 of them. The locations and their recommendations are as follows:

Location Description  
and Estimated CostRecommendations

- |  |   |
|--|---|
| 1. Cass Avenue at North and South Avenues<br>\$815             | The yellow clearance interval should be increased to 7 percent. Symbol Lane-Use Control signs should be erected at the intersection and in advance of the intersection on North and South Avenues and in advance of the intersection for Cass Avenue. Word and symbol pavement markings should be applied to Cass Avenue and North and South Avenues. |
| 2. North Avenue at Elizabeth Street and Clair Avenue.<br>\$155 | The hedge located in the southeast quadrant should be removed. The 24-inch "STOP" sign on Clair Avenue should be  |



replaced by a 30-inch sign. The parking on North Avenue should be prohibited 75 feet from each corner of the intersection.

3. Cass Avenue at Rose Street  
\$535

The 24-inch "STOP" signs on Rose Street should be replaced by 30-inch signs. Symbol Lane-Use Control signs should be erected in advance of the intersection for both legs of Cass Avenue. Pavement word and symbol markings indicating lane use should be applied on Cass Avenue.

4. North Avenue, Hubbard Avenue and Market Street  
\$1,185

The 24-inch "STOP" signs on Market Street and Hubbard Avenue should be replaced by 30-inch signs. Parking should be prohibited on the west side of North Avenue from Hubbard Avenue north to Kendrick Street. A 3 percent, all-red clearance interval should follow the North Avenue yellow clearance interval. Two lane approaches should be established at the intersection of North Avenue and Hubbard Avenue by painting each leg for three lanes with the center lane for left turns only. The center lane for the north leg of North Avenue should be cross hatched to prevent its use. An overhead case sign indicating "NO LEFT TURN" for southbound North Avenue should be suspended over the intersection. The north leg of North Avenue at its intersection with Market Street should be painted for three lanes with the center lane for left turns only. Pavement word and symbol markings and symbol Lane-Use Control signs should be used to indicate lane usage.

5. Cass Avenue at Walnut Street  
\$70  
The yellow clearance interval should be increased to 7 percent. The center line should be applied along Walnut Street in the Central Business District.
6. Market Street at Walnut Street  
Walnut Street should be closed from the shopping center driveway located southwest of Clinton Street to Market Street.
8. Market Street at Pine Street  
\$110  
The 24-inch "STOP" sign for the southwest leg of Pine Street should be changed to a 30-inch sign. On Market Street the first two parking stalls in the southeast quadrant should be removed.
9. Cass Avenue at Miller Street  
\$2530  
The 24-inch "STOP" sign on Miller Street should be replaced by a 30-inch sign. Driveway control should be established along the west side of Miller Street by constructing a driveway and curbing.
11. Walnut Street at Macomb Street  
\$150  
The yellow clearance interval should be increased to 7 percent or 4.2 seconds. Parking should be removed on the east side of the north leg of Walnut Street. Center-line markings should be applied to both Macomb and Walnut Streets.
13. Crocker Boulevard at First Street and Amvet Drive  
\$65  
A Pavement Width Transition sign should be placed on east-bound Crocker Boulevard 250 feet in advance of the intersection. The 24-inch "STOP" sign on First Street should be replaced by a 30-inch sign.

Citywide Recommendations

Some general recommendations were formulated that should be implemented throughout the city of Mount Clemens. These recommendations are as follows:

1. We recommend that 30-inch "STOP" signs be used in the city on all primary roads and at intersections which experience high traffic volumes.
2. At a multi-way stop intersection a supplementary plate indicating who has to stop should be mounted just below each "STOP" sign.
3. All signal installations should have a minimum clearance interval of four seconds and a maximum time of 4.5 seconds.
4. At all intersections in Mount Clements the first parking stall shall be located at least 20 feet from the crosswalk.

TOTAL ESTIMATED COST = \$8,498