STERLING HEIGHTS MASTER ROAD PLAN

Final Report

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

STERLING HEIGHTS MASTER ROAD PLAN UPDATE

1.0 INTRODUCTION

The City of Sterling Heights is located in western Macomb County, in close proximity to the rapidly growing communities of Troy, Rochester Hills, Utica, Macomb Township, Shelby Township and Clinton Township. The population of the City increased to over 120,000 in 1990 and residential, commercial, and industrial development continue in the several regions of the City. Current projections indicate that the City population will reach approximately 140,000 at build-out. The continued growth, combined with rapid growth in adjacent municipalities, places a heavy demand on the City's roadway network.

The purpose of this report is to document existing roadway deficiencies, identify areas of growth and congestion in the community, and provide solutions to the identified problems. The purpose of the Master Road Plan is to provide a foundation from which the City may schedule construction of needed roadway improvements and/or new roadway segments. Previous Master Road Plans were reviewed for the City of Sterling Heights. Data was collected from the City of Sterling Heights, surrounding communities, the Macomb County Road Commission (MCRC), the Southeast Michigan Council of Governments (SEMCOG), and the Michigan Department of Transportation (MDOT). The data collected included traffic count information, signal information, crash information, future improvements, and cost estimates. Existing conditions were analyzed and summarized. SEMCOG's TRANPLAN (TRANsportation PLANning) model was utilized for the assessment of alternatives for the forecast year of 2020. SEMCOG has a seven county southeast Michigan TRANPLAN model, which was used for the Sterling Heights Master Road Plan. TRANPLAN is an integrated suite of programs for forecasting the impacts of alternative land use scenarios and/or transportation networks. It is used as a travel demand forecasting software which forecasts future year volumes. The final chapter of this report includes the proposed Master Road Plan to handle the forecast traffic volumes for the year 2020.

1.5 PROJECT DEVELOPMENT

The first step for Parsons Brinckerhoff Michigan, Inc. (PBM) in the Sterling Heights Master Road Plan Update was to review zoning maps, previous Master Road Plans, aerial photography, traffic studies, available GIS data, the Municipal Improvement Program, the Capital Improvement Plan, crash data, future land use plans, M-59 studies, public transit data, and right-of-way data.

A survey was sent to the City Manager, Planning Commission, and City Council in order to receive public input. The results of the survey were used to set the direction of the study, as well as ensuring that critical issues were identified.

PBM requested proposed roadway improvement plans from the surrounding communities. These improvements, as well as those listed in the Municipal Improvement Program and in SEMCOG's 2020 Regional Transportation Plan, were utilized in the calibration/validation of the southeast Michigan TRANPLAN model. The improvements added capacity by adding new laneage along select roadways.

The existing conditions data was compiled and presented to the Traffic Advisory Committee (TAC). The data included the surveys regarding the Master Road Plan Update, population growth within the City, land development, signal locations, number of lanes, traffic volumes, level of service, crash data, and transit data.

Monthly meetings were held with the TAC, and regularly with the City of Sterling Heights staff, as a review process. The meetings looked to identify problems. Through these meetings, a list of roadway deficiencies and possible solutions were developed.

The TAC held a Public Informational Meeting in order to solicit additional problems and possible solutions from the City of Sterling Heights residents. There was one alternative that came from the public: adding on- and off-ramps to M-53 at Clinton River Road.

The individual solutions and cost estimates were analyzed. The individual alternatives did not provide congestion relief on their own; therefore individual alternatives were then combined. The combination alternative results and cost estimates were also analyzed. The Planning Commission became involved with TAC in final product development.

A draft Master Road Plan report was reviewed by the City of Sterling Heights, TAC, and Planning Commission. The comments received were incorporated in the final report.

The Planning Commission will hold a Public Hearing on the final draft report.

OTHER ISSUES

There were some issues raised from the survey responses that are critical issues, but they are not appropriate to be addressed in a master road plan update. Some of these issues are marginal access roads, alleviating cut-through traffic, curb cuts, and signal timings. These each need to be addressed on a case-by-case basis. The master road plan update is to address the transportation needs for the entire arterial roadway network. Some the issues raised above need to be addressed and studied in a traffic engineering context, as they deal with local roadway issues. The traffic signal timings are not utilized in the travel demand forecasting model that was used for the master road plan update, so the quality of the signal timing is not key in this analysis. It is agreed that signal systems need to be checked and revised to meet the current demands of the roadway network on a reoccurring basis. Each of these issues need to be studied independently to identify and fix problem areas.

2.0 PREVIOUS STUDIES

1980 City of Sterling Heights Master Road Plan. Existing conditions were analyzed by looking at traffic volumes, the capacity of the existing roadway network, and crash data. Traffic projections, which took into account proposed developments, were converted into roadway requirements. Projections were based on the 1965 TALUS (Transportation and Land Use Study) report. Recommended roadway and right-of-way standards were reviewed. Macomb County Road Commission adopted 11 foot lanes as the standard lane width, while the Federal Highway Administration encouraged standard 12-foot lanes. The City of Sterling Heights also uses 11 foot lanes as the standard lane width. Recommendations for the arterial system, secondary thoroughfares, and collector streets were provided. The recommendations included obtaining the right-of-way needed to establish continuity along thoroughfares and reconstruct existing roadways toward ultimately required widths.

Report on City Road Needs. The report was generated by the City Development Department and outlines the major roadway needs, as well as the financing of the program. The report stated that the projected growth of the City would bring continued traffic problems, since a substantial portion of the arterial roadway system operates beyond capacity. Economic development is attracted by good roadways and unless the City recognizes that, the growth that would come to the City would go elsewhere. The report recommended that the City Council consider the following: discussing the recommended citywide roadway improvement program as a whole; recognize that the voters of the community should be given an opportunity to accept or reject the program as presented in the report; consider forming a Citizens Task Force that may study the issue and ultimately spearhead an effort to present the facts to the community as a whole.

1990 Traffic Circulation Plan Section 5 and 6. This study evaluated street patterns and prepared a unified traffic circulation plan providing appropriate access to major roads for Sections 5 and 6 in the northwest part of the City of Sterling Heights. Intersections of internal public streets with arterial streets at ½ mile points were established as important to provide the signal spacing which encourages progressive traffic movement at arterial speeds. The circulation plans for Sections 5 and 6 are a refinement of the 1980 Master Thoroughfare Plan.

1992 Traffic Study to update portions of the 1980 City of Sterling Heights Master Road Plan. Since the publication of the 1980 *City of Sterling Heights Master Road Plan* there have been land use changes, due to the addition of office and commercial areas, in Sections 5 and 6. The update concentrated on three roadway segments that were reconstructed due to the City of Sterling Heights Bond Program. The three segments examined were Ryan Road from 18 Mile Road to M-59; Dodge Park from 15 Mile Road to Metropolitan Parkway (16 Mile Road); and 17 Mile Road from Mound Road to Dequindre Road. The three segments had 24 hour machine traffic counts taken, as well as afternoon peak hour turning-movement counts at the signalized locations. The 1980 Master Road Plan suggested widening these three segments to five lanes. The Traffic Study agreed that the widening of these segments should occur in the near future for Dodge Park and 17 Mile Road. It was determined that the widening of Ryan Road north of 18 Mile Road was to wait until development occurred, but south of 18 Mile Road was to be widened in the near future. A Traffic Signal Warrant Study was conducted at the Ryan Road/18 ½ Mile Road intersection. The results found that signal installation was not warranted, at the time of the study.

3.0 EXISTING CONDITIONS

This chapter will cover the surveys regarding the Master Road Plan Update, the population growth, land development, signal locations, number of lanes, traffic volumes, level of service, crash data, and transit data.

SURVEYS

Survey forms were sent out to the City Manager, Planning Commission, and City Council in order to receive public input for the Sterling Heights Master Road Plan (MRP) Update. Input into the MRP Update is crucial in setting the direction of this study and ensuring that critical issues are identified. The survey focused on three areas: issues of concern regarding the MRP Update, critical areas of the City, and any general comments. The main issues focused around reducing cut through traffic and the 18 Mile Road completion. A summary of the survey results are as follows:

Issues of Concern Regarding the Master Road Plan Update:

- Decrease demand at intersections
- Look at increased traffic flow at Sterritt Road and Fox Hill Road
- Have select roads carry the majority of traffic so all the roads do not have to be five lanes
- Funding of improvements
- Completion of M-59: how it will effect the City
- Traffic flow with/without the 18 Mile Road completion between Hayes Road and Utica Road
- Use the best information and the latest technology so that the MRP conservatively reflects road and transportation needs
- The MRP should follow the Master Land Use Plan
- Special interest groups will interfere with good road planning

Critical Areas of the City:

- Northwest quadrant is experiencing tremendous growth without any road improvements
- Improve traffic flow for east-west traffic from Clinton Township to Troy
- Eliminate cut through traffic, especially in the northeast quadrant
- Adequacy of the north-south and east-west roads
- Extension of the M-53 freeway to Mound Road
- Add the 18 Mile Road connector; the safety of the residents come first
- Decrease the amount of curb cuts and add marginal access roads
- Metropolitan Parkway should be expanded to 6 or 8 lanes
- Extension of 17 Mile Road and 19 Mile Road would be to costly due to wetlands and land acquisition
- Combine driveways along Van Dyke Road
- Marginal access roads along Mound Road
- Completion of Ryan Road and Dequindre Road

Comments:

- Major road contracts should not be given to the lowest developer but to the lowest cost to build and maintain over a 10 year period
- MRP should be user friendly and used for guidance when making decisions on future development of the City; residents concerns are that new development brings congestion and cut through traffic through residential areas
- Mass transit or other transportation modes are not an alternative
- MRP should not be influenced by vocal minorities, but should reflect a truly professional determination of need

- The avoidance of 18 Mile Road or 19 Mile Road extensions across the Clinton River should only be accommodated if they do not unreasonably impact other roadways
- Use sound road planning principles
- Bigger is not better; expansion brings more traffic; improve signal timings, limit right-turn-on-red, restrict curb cuts, add marginal access roads
- Decrease cut through traffic
- Look at intersections along Utica Road, Canal Road, Clinton River Road due to them not being perpendicular and often offset

POPULATION GROWTH

The City of Sterling Heights has experienced a continued increase in population over time. The most dramatic growth occurred between 1960 and 1980. In 1960 the population for the City was only 14,622 and in 1996 the population had grown to 121,900. The population for the year 2000 has been estimated by the Sterling Heights Office of Planning and Zoning to be 124,600. The projection is based on a factor determined by using the number of households and the 1990 population. The City's population was obtained from SEMCOG, the Southeast Michigan Council of Governments and from the Sterling Heights Office of Planning and Zoning and is shown in Table 1.

Table 1--Change in Population over Time

Year	Population	% Change
1960	14,622	
1970	61,365	319.68%
1980	108,990	77.61%
1990	117,810	8.09%
1996	121,900	3.47%
2000*	124,600	5.76%

* = Indicates the projected population for the year 2000 by the Sterling Heights Office of Planning and Zoning

LAND DEVELOPMENT

The city street directory and the zoning district map were provided by the City of Sterling Heights. From those two sources, along with aerial photography, the existing undeveloped land within the City was identified. This information was confirmed by the Office of Planning and Zoning. The City of Sterling Heights has approximately 23,514 acres of land, of which 2,088.9 acres are undeveloped. Undeveloped land is land that has the potential to be developed. It does not include parks. Table 2 summarizes the undeveloped land in Sterling Heights by category, to date. There is approximately 8.9-percent of undeveloped land within the city.

Table 2--Total Amount of Undeveloped Land in Sterling Heights by Category

Description of Type	Acres
Commercial	245.61
Office Research	13.54
Technical Research Office	5.46
Planned Center District	16.98
Industrial	336.76
Office	164.75
Residential	1,305.84

Source: City of Sterling Heights Office of Planning & Zoning

SIGNAL LOCATIONS/NUMBER OF LANES

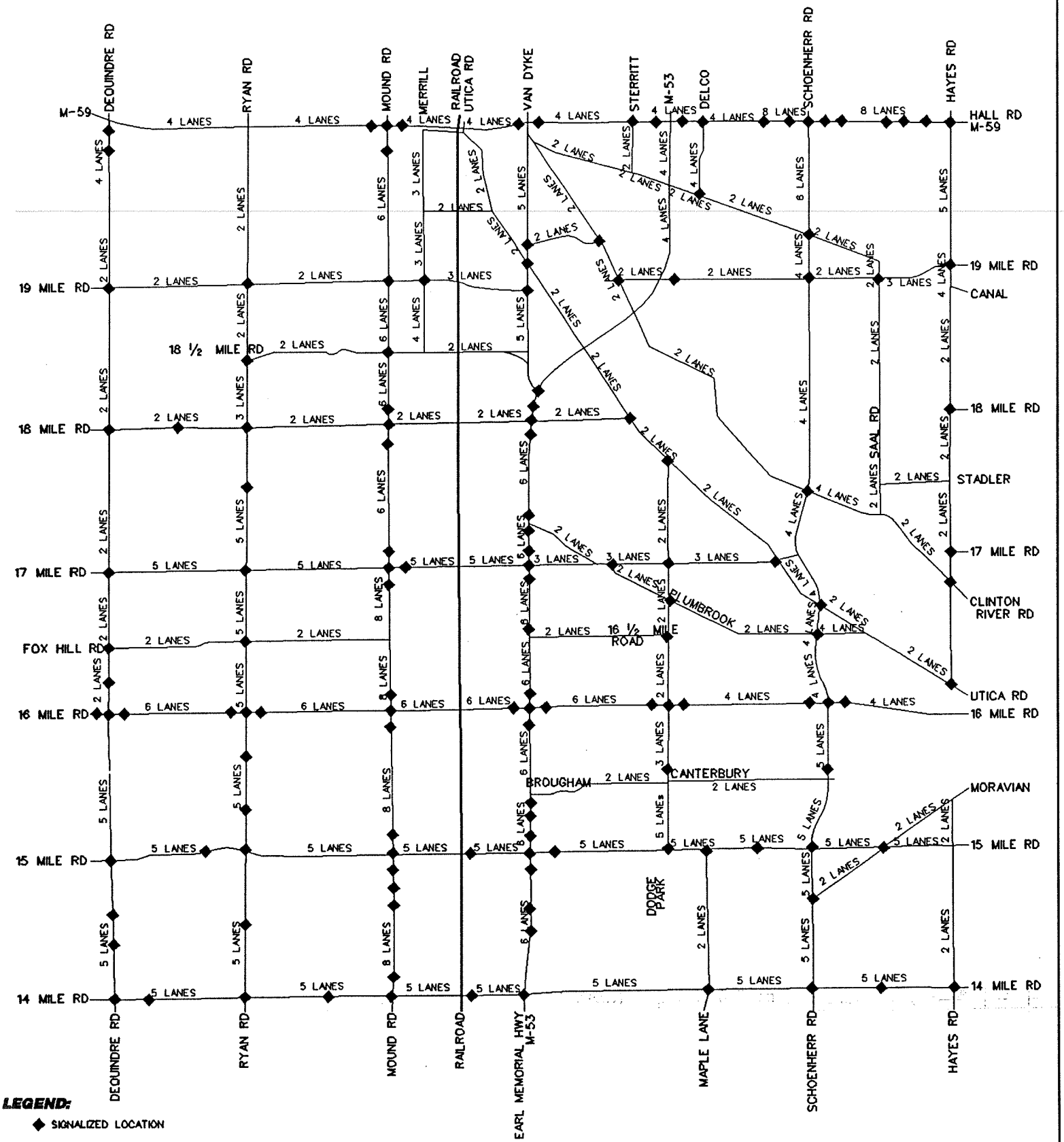
The signal timing plans provided lane configurations at each signalized intersection, as well as the signal timings. There are 140 signalized intersections within the City. The roadway segments with the majority of the traffic signals are the boulevards: Metropolitan Parkway (16 Mile Road) {16 signals}, Mound Road {20 signals}, Van Dyke Road {24 signals}, and M-59/Hall Road {18 signals}. The boulevards have signalized Michigan left-turns (turn-around), as well as signalized intersections. The number of lanes on the roadway segments to date, have also been recorded. There are a number of roads built within the maximum right-of-way, for example: 14 Mile Road (five lanes), 15 Mile Road (five lanes), Mound Road (eight lanes south of 17 Mile Road), and Van Dyke Road (six lanes south of 18 Mile Road). The laneage for M-59/Hall Road only reflects the roadway currently under construction. The signal locations, as well as the existing number of lanes, are shown in Figure 1. The signal location summary and the intersection geometry are shown in Table 3. An example of how to read Table 3 is as follows. The first signalized intersection is 14 Mile, the primary street. The secondary street is what intersects the primary street. The number of lanes is then given by which leg is approaching the intersection. The legend is as follows: LT-left turn, RT-right turn, T-through, L - left turn phase, * - no movement on this leg.

TRAFFIC VOLUMES

Average daily traffic (ADT) volumes, as well as signal timing plans, for the City of Sterling Heights were obtained from the Macomb County Road Commission. The ADT volumes were counted between 1991 and 1996. The count locations covered the major roadway segments within the City. There were approximately 50± locations that were recounted either due to the age of the counts or because they were never originally counted. Many roadways within the City have experienced widening over the years, so it was important to recount some of the locations if the counts were taken prior to the roadway expansion.

The ADT volumes, along with the year the counts were taken, are shown in Figure 2. The two roadways that handle the heaviest traffic volumes are M-59/Hall Road and Van Dyke Road (south of 18 Mile Road), which average between 30,000 to 46,000 vehicles per day. Mound Road, Schoenherr Road, and Metropolitan Parkway (16 Mile Road) carry around 20,000 to 25,000 vehicles per day. 14 Mile Road and 15 Mile Road carry the majority of east-west traffic, behind Metropolitan Parkway (16 Mile Road), with between 12,000 and 18,000 vehicles per day. Hayes Road, north of Utica Road, carries between 10,000 and 13,000 vehicles per day.

The traffic counts provided by the County and State were broken down into hourly increments. This breakdown provided a means to calculate the PM peak hour. A sample of all the counts, scattered throughout the City, were taken in order to determine a PM peak hour of traffic. There are travel peaks due to the Chrysler and Ford factories, in addition to the typical businesses closing at 5:00 PM. The traffic volumes indicate a peak period between 4:00 to 6:00 PM, but the predominant PM peak hour was 5:00 to 6:00 PM. The roadways that experience the heaviest daily traffic in the PM peak hour are M-59/Hall Road and Van Dyke (south of 18 Mile Road) which average 1,700 to 4,000 vehicles per hour. Mound Road, Schoenherr Road, and Metropolitan Parkway (16 Mile Road) carry around 1,200 to 2,200 vehicles per hour. 14 Mile Road and 15 Mile Road carry the majority of east-west traffic, behind Metropolitan Parkway (16 Mile Road), with between 800 and 1,700 vehicles per hour. Hayes Road, north of Utica Road, carries between 700 and 1,300 vehicles per hour. The PM peak hour volumes are shown in Figure 3.



LEGEND:

◆ SIGNALIZED LOCATION

FIGURE 1

STERLING HEIGHTS MASTER ROAD PLAN UPDATE	PB 100 YEARS	**EXISTING TRAFFIC SIGNALS AND TOTAL NUMBER OF LANES**	SCALE: NTS DATE: 3-26-98 PAGE: 7

Table 3--Signal Location Summary

Intersection		Existing Laneage											
		West Leg			East Leg			North Leg			South Leg		
Primary Street	Secondary Street	LT	T	RT	LT	T	RT	LT	T	RT	LT	T	RT
14 Mile													
14 Mile	Dequindre	1	2	1	1	2	*	1	2	1	1	2	1
14 Mile	Viceroy	1	2	*	1	2	*	*	1	*	*	*	*
14 Mile	Ryan	1L	2	*	1L	2	*	1L	2	1	1L	2	*
14 Mile	Streefkerk	*	2	*	1	2	*	*	1	*	*	1	*
14 Mile	Mound (W)	*	2	1	*	2	*	*	4	*	*	*	*
14 Mile	Mound (E)	*	2	*	*	2	*	*	*	*	*	4	*
14 Mile	Sterling Pond	1L	2	*	*	2	1	1	*	1	*	*	*
14 Mile	Van Dyke	1L	2	*	1L	2	*	*	3	1	*	3	*
14 Mile	Maple Lane	1L	2	1	1L	2	*	1	2	*	1	2	*
14 Mile	Schoenherr	1L	2	*	1L	2	*	1L	2	1	1L	2	*
14 Mile	Bunert	*	2	*	1	2	*	*	*	*	*	1	*
14 Mile	Hayes	1	2	*	1	2	*	1	1	*	1	1	*
15 Mile													
15 Mile	Dequindre	1	2	1	1	2	1	1	2	1	1	2	1
15 Mile	Viceroy	*	2	*	1	2	*	*	*	*	*	1	*
15 Mile	Ryan	1L	2	*	1L	2	*	1L	2	*	1L	2	*
15 Mile	Mound (W)	*	2	1	*	2	*	*	4	1	*	*	*
15 Mile	Mound (E)	*	2	*	*	2	1	*	*	*	*	4	1
15 Mile	Chrysler Dr.	1	2	*	*	2	1	*	2	*	*	*	*
15 Mile	Van Dyke (W)	*	2	1	*	2	*	*	4	*	*	*	*
15 Mile	Van Dyke (E)	*	2	*	*	2	1	*	*	*	*	4	*
15 Mile	Terry Brook	1	2	*	1	2	*	*	1	*	*	1	*
15 Mile	Dodge Park	1L	2	*	1L	2	*	1	1	1	*	*	*
15 Mile	Maple Lane	*	2	*	1	2	*	*	*	*	1	*	1
15 Mile	Sterling Hts H.S.	1	2	*	1	2	*	1	1	*	*	1	*
15 Mile	Schoenherr	1L	2	*	1L	2	*	1L	2	*	1L	2	*
15 Mile	Moravian	1L	2	*	1L	2	*	1	2	*	1	2	*
16 Mile													
16 Mile	Dequindre (W)	*	3	*	*	3	*	*	2	1	*	*	*
16 Mile (WB)	Dequindre (E)	*	3	*	*	3	1	*	*	*	*	2	1
16 Mile (EB)	x-over W/Ryan	*	3	*	*	*	*	1	*	*	*	*	*
16 Mile	Ryan (W)	*	3	1	*	*	*	*	2	*	*	2	1
16 Mile	Ryan (E)	*	*	*	*	3	1	*	2	1	*	2	*
16 Mile	x-over E/Ryan	*	*	*	*	3	*	*	*	*	1	*	*
16 Mile	Mound (W)	*	3	1	*	*	*	*	4	*	*	4	1
16 Mile	Mound (E)	*	*	*	*	3	1	*	4	1	*	4	*
16 Mile (EB)	x-over W/M-53	*	3	*	*	*	*	1	*	*	*	*	*

Table 3 Continued--Signal Location Summary

Intersection		Existing Laneage											
		West Leg			East Leg			North Leg			South Leg		
Primary Street	**Secondary Street**	**LT**	**T**	**RT**	**LT**	**T**	**RT**	**LT**	**T**	**RT**	**LT**	**T**	**RT**
16 Mile	M-53 (W)	*	4	1	*	*	*	*	3	*	*	3	1
16 Mile	M-53(E)	*	*	*	*	4	*	*	3	1	*	3	*
16 Mile (WB)	x-over E/M-53	*	*	*	*	3	*	*	*	*	1	*	*
16 Mile (EB)	x-over W/Dodge Park	*	3	*	*	*	*	1	*	*	*	*	*
16 Mile	Dodge Park (W)	*	3	1	*	*	*	*	*	1	*	1	1
16 Mile	Dodge Park (E)	*	*	*	*	3	1	*	1	1	*	1	*
16 Mile (WB)	x-over E/Dodge Park	*	*	*	*	3	*	*	*	*	1	*	*
16 Mile (EB)	x-over E/Schoenherr	*	2	*	*	*	*	1	*	*	*	*	*
16 Mile	Schoenherr (W)	*	3	*	*	*	*	*	2	*	*	2	1
16 Mile	Schoenherr (E)	*	*	*	*	3	*	*	2	1	*	2	*
16 Mile (WB)	x-over E/Schoenherr	*	*	*	*	2	*	*	*	*	1	*	*
17 Mile													
17 Mile	Dequindre	1	1	*	1	1	1	1	1	*	1	1	1
17 Mile	Ryan	1	1	*	1	1	1	1	1	1	1	1	1
17 Mile	Mound (W)	*	2	1	*	2	*	*	4	1	*	*	*
17 Mile	Mound (E)	*	2	*	*	2	1	*	*	*	*	4	1
17 Mile	Ford Service Dr.	1	2	1	1	2	1	*	1	*	*	1	*
17 Mile	Van Dyke (W)	*	2	1	*	2	*	*	4	*	*	*	*
17 Mile	Van Dyke (E)	*	2	*	*	2	1	*	*	*	*	4	*
17 Mile	Plumbrook (E Leg)	1	1	*	1	1	*	*	1	*	*	1	*
17 Mile	Dodge Park	1	1	*	1	1	*	1	1	1	1	1	1
17 Mile	Utica	1L	1	*	1L	1	*	1	1	1	1	1	1
17 Mile	Hayes	*	*	*	*	1	*	1	1	*	*	1	1
18 Mile													
18 Mile	Dequindre	1	1	1	1	1	1	1	1	1	1	1	1
18 Mile	Gulliver	*	1	1	1	1	*	*	*	*	*	1	*
18 Mile	Ryan	*	2	1	*	2	1	1	2	*	1	2	*
18 Mile	Mound (W)	*	2	1	*	2	*	*	3	1	*	*	*
18 Mile	Mound (E)	*	2	*	*	2	1	*	*	*	*	3	1
18 Mile	Van Dyke (W)	*	2	*	*	2	*	*	4	*	*	*	*
18 Mile	Van Dyke (E)	*	2	*	*	2	*	*	*	*	*	4	*
18 Mile	Utica	1	*	1	*	*	*	*	1	*	1	1	*
18 Mile	Hayes	*	*	*	1	*	1	1	1	*	1	1	1
18 1/2 Mile													
18 1/2 Mile	Ryan	*	*	*	*	1	*	*	1	1	*	1	*

Table 3 Continued--Signal Location Summary

Intersection		Existing Laneage											
		West Leg			East Leg			North Leg			South Leg		
Primary Street	Secondary Street	LT	T	RT	LT	T	RT	LT	T	RT	LT	T	RT
19 Mile													
19 Mile	Dequindre	1	1	*	1	1	*	1	1	*	1	1	*
19 Mile	Ryan	1	1	*	1	1	*	1	1	*	1	1	*
19 Mile	Mound	*	1	1	*	1	1	*	3	1	*	3	1
19 Mile	Merrill	1	1	*	1	1	*	1	1	*	1	1	1
19 Mile	Van Dyke	1	2	*	*	1	*	1	2	*	1	2	*
19 Mile	Clinton River Rd.	*	*	*	1	1	*	1	1	*	*	1	1
19 Mile	Gainsley	1	1	*	1	1	*	*	1	*	*	1	*
19 Mile	Schoenherr (W)	*	2	1	*	2	*	*	2	1	*	*	*
19 Mile	Schoenherr (E)	*	2	*	*	2	1	*	*	*	*	2	1
19 Mile	Saal	1	1	*	1	1	*	1	1	*	1	1	*
19 Mile	Hayes	1	2	*	*	3	*	1L	2	1	1L	2	1
M-59 (Hall Rd)													
(see Note 1)													
M-59	x-over W/Mound	1	4	*	*	*	*	2	*	*	*	*	*
M-59	Mound (W)	*	2	1	*	2	*	*	3	1	*	*	*
M-59	Mound (E)	*	2	*	*	2	1	*	*	*	*	3	1
M-59	x-over E/Mound	*	*	*	*	3	*	*	*	*	2	*	*
M-59	x-over W/Van Dyke	*	4	1	*	*	*	1	*	*	*	*	*
M-59	Van Dyke	1	2	*	1	2	*	1	1	*	1	1	*
M-59	Sterrit	1	2	*	1	2	*	1	*	*	*	1	1
M-59 (EB)	SB M-53 off-ramp	*	4	*	*	*	*	2	*	*	*	*	*
M-59 (WB)	NB M-53 off-ramp	*	*	*	*	4	*	2	2	*	*	*	*
M-59 (WB)	NB M-53 ramps	*	2	*	*	2	1	*	2	*	*	*	*
M-59 (EB)	Delco	*	4	1	*	*	*	*	2	*	*	2	*
M-59 (EB)	Northpoint	*	*	*	*	4	1	*	*	2	2	*	*
M-59 (EB)	x-over W/Schoenherr	*	4	1	*	*	*	2	*	*	*	*	*
M-59	Schoenherr (W)	*	4	2	*	*	*	*	3	*	*	3	1
M-59	Schoenherr (E)	*	*	*	*	4	2	*	3	*	*	3	*
M-59 (WB)	x-over E/Schoenherr	*	*	*	*	4	1	*	*	1	2	*	*
M-59 (EB)	Westbrook	*	4	1	*	*	*	2	*	*	*	*	2
M-59 (WB)	x-over W/Eastbrook	*	*	*	*	4	1	*	*	*	2	*	*
M-59 (EB)	Eastbrook	*	4	1	*	*	*	2	*	*	*	*	2
M-59 (EB)	x-over W/Hayes	*	4	1	*	*	*	2	*	*	*	*	2
M-59	Hayes (W)	*	5	1	*	*	*	*	2	*	*	2	1
M-59	Hayes (E)	*	*	*	*	4	1	*	2	1	*	2	*

Table 3 Continued--Signal Location Summary

Intersection		Existing Laneage											
		West Leg			East Leg			North Leg			South Leg		
Primary Street	**Secondary Street**	**LT**	**T**	**RT**	**LT**	**T**	**RT**	**LT**	**T**	**RT**	**LT**	**T**	**RT**
Dequindre													
Dequindre	Elliott (N of 14 Mile)	1	1	*	*	1	*	1	2	1	1	2	*
Dequindre	Tarry (N of Elliott)	*	1	*	*	1	*	1	2	*	1	2	*
Dequindre	Hospital (N of 19 Mile)	1	1	*	*	2	*	1	1	1	1	1	1
Mound													
Mound	x-over N/14 Mile	*	*	*	1	*	*	*	4	*	*	*	*
Mound	x-over/Sterling Dr S	1	*	*	*	*	*	*	*	*	*	2	*
Mound	x-over N/Sterling Dr N	*	*	*	1	*	*	*	4	*	*	*	*
Mound	x-over S/15 Mile	1	*	*	*	*	*	*	4	*	*	*	*
Mound	x-over N/15 Mile	*	*	*	1	*	*	*	*	*	*	4	*
Mound	x-over S/16 Mile	1	*	*	*	*	*	*	*	*	*	4	*
Mound	x-over N/16 Mile	*	*	*	1	*	*	*	4	*	*	*	*
Mound	x-over S/17 Mile	1	*	*	*	*	*	*	*	*	*	4	*
Mound	x-over N/17 Mile	*	*	*	1	*	*	*	3	*	*	*	*
Mound	x-over S/18 Mile	1	*	*	*	*	1	*	*	*	*	3	*
Mound	x-over N/18 Mile	*	*	*	1	*	*	*	3	*	*	*	*
Mound	18 1/2 Mile (W)	*	1	1	*	1	*	*	3	1	*	*	*
Mound	18 1/2 Mile (E)	*	1	*	*	1	1	*	*	*	*	3	1
M-53													
M-53	Denwood/Sterling Pond	1	1	*	*	1	*	1L	3	1	1L	3	*
M-53	TRW/14 1/2 Mile	2L	*	*	*	1L	*	1L	3	1	1L	3	*
M-53	x-over S/15 Mile	2	*	*	*	1	*	*	*	*	*	3	*
M-53	x-over N/15 Mile	*	*	*	2	*	*	*	3	*	*	*	*
M-53	x-over S/Brougham	*	*	*	1	*	*	*	4	*	*	*	*
M-53	x-over S/Brougham	1	*	*	*	*	*	*	*	*	*	3	*
M-53	x-over S/16 Mile	2	*	*	*	*	*	*	*	*	*	3	*
M-53	x-over N/16 Mile	*	*	*	2	*	*	*	3	*	*	*	*
M-53	x-over N/16 1/2 Mile	*	*	*	1	*	*	*	3	*	*	*	*
M-53	x-over S/17 Mile	2	*	*	*	*	*	*	*	*	*	3	*
M-53	x-over N/17 Mile	*	*	1	1	*	*	*	3	*	*	*	*
M-53	x-over S/Plumbrook	1	*	*	*	*	*	*	*	*	*	3	*
M-53	x-over N/Plumbrook	*	*	*	1	*	*	*	3	*	*	*	*
M-53	x-over S/18 Mile	1	*	*	*	*	*	*	*	*	*	3	*
M-53	x-over N/18 Mile	*	*	*	2	*	*	*	3	*	*	*	*
M-53	NB ramp B @ SB M-53	*	*	*	*	2	*	*	2	*	*	*	*

Table 3 Continued--Signal Location Summary

Intersection		Existing Laneage											
		West Leg			East Leg			North Leg			South Leg		
Primary Street	**Secondary Street**	**LT**	**T**	**RT**	**LT**	**T**	**RT**	**LT**	**T**	**RT**	**LT**	**T**	**RT**
Dodge Park													
Dodge Park	Canterbury	*	1	*	*	1	*	1	1	*	1	1	*
Dodge Park	16 1/2 Mile	*	1	*	*	*	*	*	1	1	1	1	*
Dodge Park	Plumbrook	1	1	*	1	1	*	1	1	*	1	1	*
Dodge Park	Utica	1	1	*	1	1	1	1	1	*	1	1	*
Schoenherr													
Schoenherr	Moravian	*	1	*	1	1	*	1	2	*	1	2	1
Schoenherr	Canterbury	*	1	*	*	*	*	*	2	*	1	2	*
Schoenherr	Plumbrook (W)	*	1	*	*	2	*	*	2	1	*	*	*
Schoenherr	Plumbrook (E)	*	2	*	*	2	*	*	*	*	*	2	1
Schoenherr	Utica (W)	*	1	1	*	1	*	*	2	1	*	*	*
Schoenherr	Utica (E)	*	1	*	*	1	1	*	*	*	*	2	1
Schoenherr	Clinton River (W)	*	2	*	*	2	*	*	2	1	*	*	*
Schoenherr	Clinton River (E)	*	2	*	*	2	*	*	*	*	*	2	1
Schoenherr	S of Hall (M-59)	1	*	*	*	*	*	*	*	*	*	3	*
Hayes													
Hayes	Utica	1	2	*	*	2	1	2	*	1	*	*	*
Hayes	Clinton River	1	1	*	1	1	*	1	1	*	1	1	*
Hayes	Shoreline Dr	*	2	*	*	1	*	1L	2	*	1L	2	*
Van Dyke													
Van Dyke	Utica	1	2	*	1	2	*	1L	2	*	1L	2	*
Van Dyke	Riverland	*	1	*	*	1	*	1	2	*	1	2	*
Clinton River													
Clinton River	Riverland	1	*	1	*	*	*	*	1	1	1	1	*
Ryan													
Ryan	Bieber (N of 14 Mile)	*	*	*	*	1	*	1	2	*	*	2	*
Ryan	Grissom Jr High (N of 15 Mile)	*	*	*	*	*	*	*	2	*	*	2	*
Ryan	Veronica (N of 15 Mile)	*	1	*	*	1	*	1	2	*	1	2	*
Ryan	Foxhill (N of 16 Mile)	1	1	*	1	1	*	1	2	*	1	2	*
Ryan	Franklin Park (N of 17 Mile)	1	1	*	1	1	*	1	2	*	1	2	*

Table 3 Continued--Signal Location Summary

Intersection		Existing Laneage											
		West Leg			East Leg			North Leg			South Leg		
Primary Street	**Secondary Street**	**LT**	**T**	**RT**	**LT**	**T**	**RT**	**LT**	**T**	**RT**	**LT**	**T**	**RT**
Canal													
Canal	Schoenherr (W)	*	1	1	*	1	*	*	2	1	*	*	*
Canal	Schoenherr (E)	*	1	*	*	1	1	*	*	*	*	2	1
Canal	Delco	1	1	*	1	1	*	1	1	*	*	1	*
Dobry Drive													
Dobry Drive	Dequindre	1	2	*	1	2	*	1	2	*	1	2	*

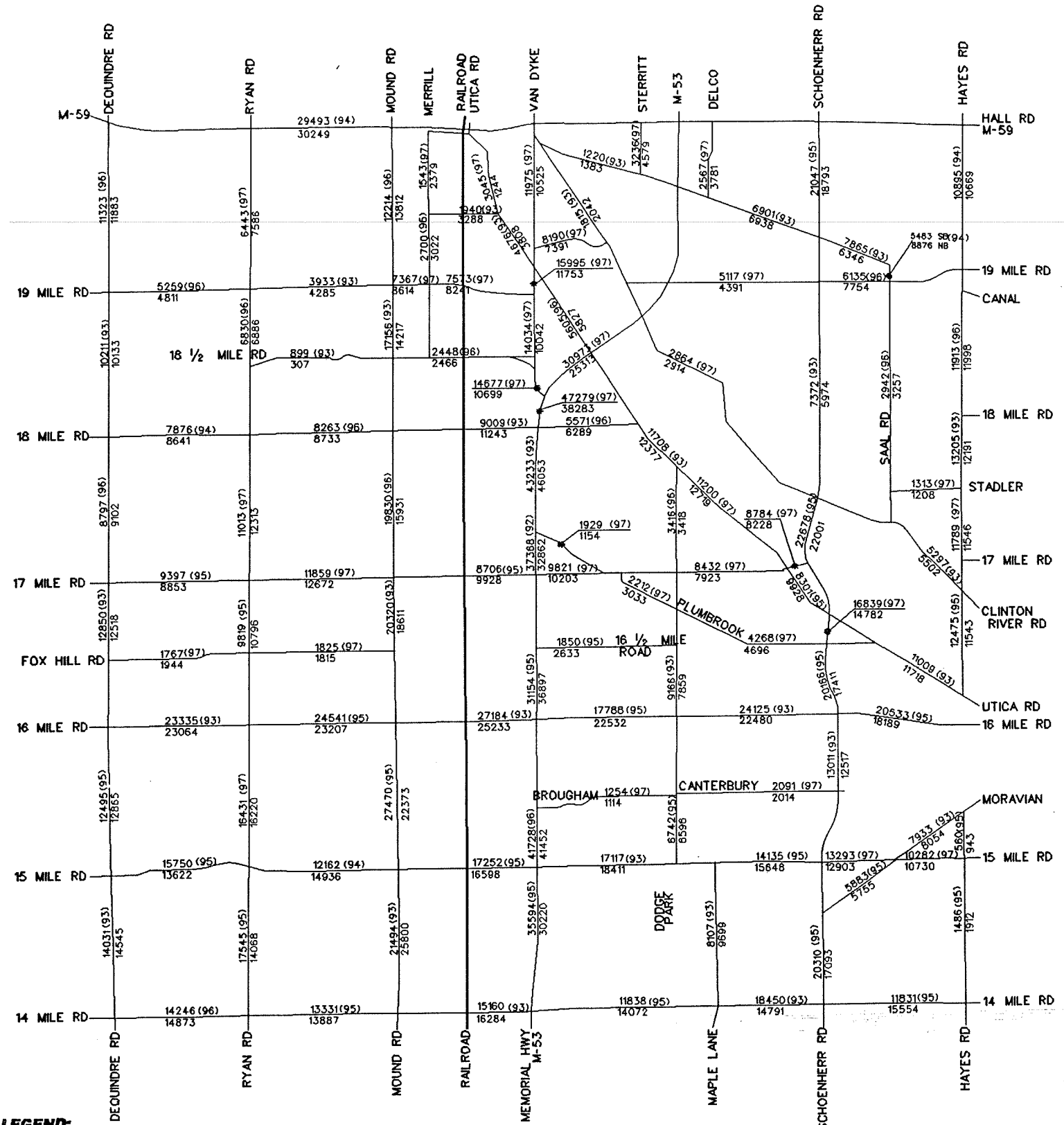
Last Updated: August 15, 1997

Notes:

1) M-59 (Hall Road) - Dequindre to Delco Blvd., is under construction. Information in this summary is current as of August 1997

Legend:

LT-left turn RT-right turn T-through L - left turn phase * - no movement on this leg



LEGEND:

XXXX (XX) 24 HOUR TRAFFIC VOLUMES
(YEAR FOR TRAFFIC VOLUMES IN BOTH DIRECTIONS)

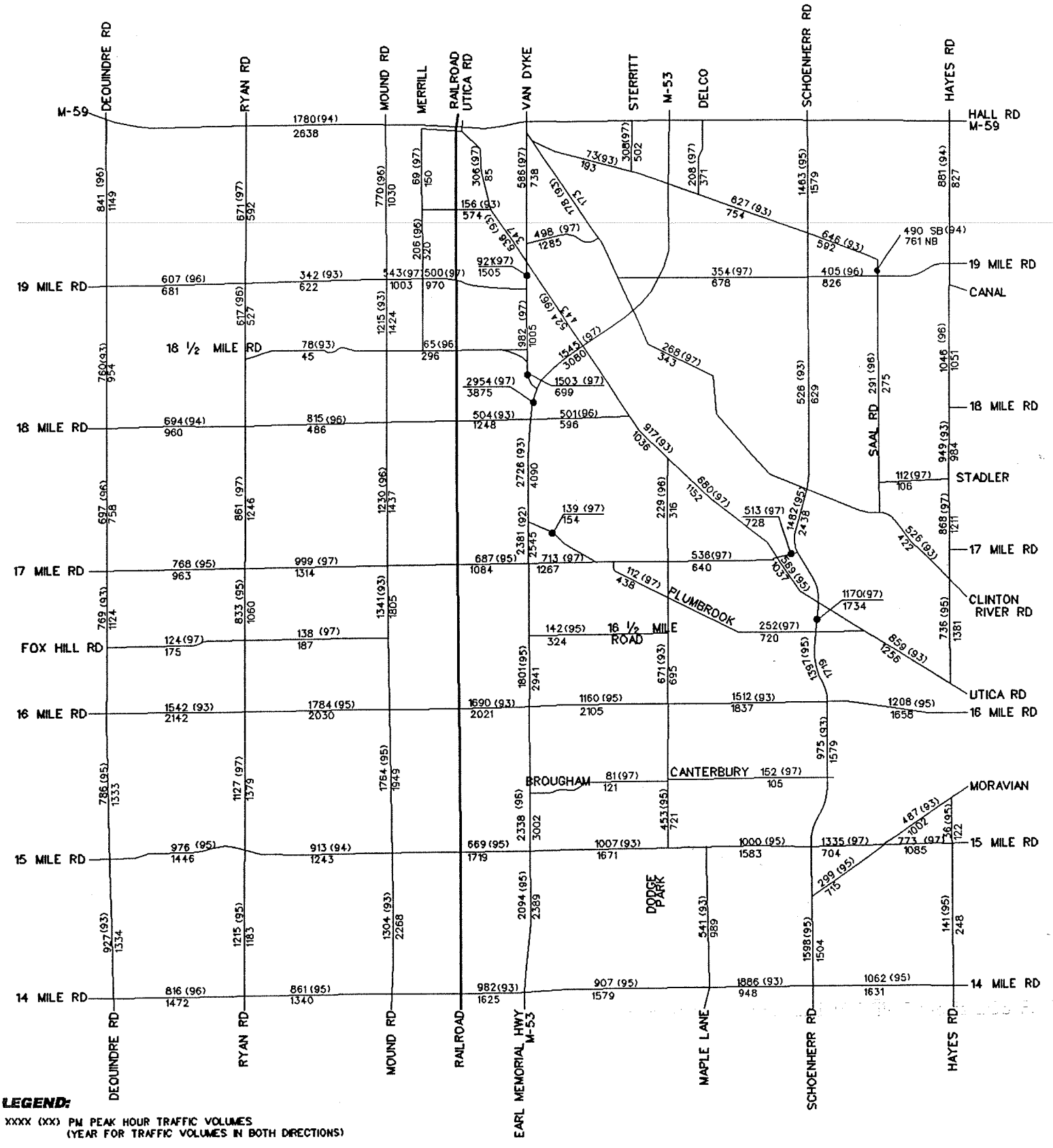
FIGURE 2

STERLING HEIGHTS MASTER ROAD PLAN UPDATE

PB 100 YEARS

AVERAGE DAILY TRAFFIC VOLUMES FOR EXISTING CONDITIONS

SCALE:	NTS
DATE:	3-27-98
PAGE:	14



LEGEND:

XXXX (XX) PM PEAK HOUR TRAFFIC VOLUMES
(YEAR FOR TRAFFIC VOLUMES IN BOTH DIRECTIONS)

FIGURE 3

STERLING HEIGHTS MASTER ROAD PLAN UPDATE

PB 100 YEARS

PM PEAK HOUR TRAFFIC VOLUMES (5:00 to 6:00 PM) FOR EXISTING CONDITIIONS

SCALE:	NTS
DATE:	3-27-98
PAGE:	15

LEVEL OF SERVICE

The SEMCOG roadway capacities were utilized along with the traffic volumes to determine the volume-to-capacity (V/C) ratio for the roadway segments within the City. The V/C ratio is the ratio of vehicles traveling the roadway (demand flow rate) to the capacity of the roadway segment. The *Transportation Handbook*, by the Institute of Transportation Engineers (ITE) states that "roadway capacity represents the maximum number of vehicles that can pass a given point during a specified time period with reasonable expectancy under prevailing traffic and environmental conditions." The V/C ratio indicates how the roadway is operating. The V/C can be equated to a level of service (LOS) which is another way of evaluating the roadway system. There are six levels of service, a condition as perceived by users of the roadway system. Level of service is similar to a grading scale where LOS A represents uncongested conditions and LOS F represents a breakdown in traffic flow. Table 4 provides definitions for the V/C ratio and level of service.

Table 4--Volume-to-Capacity Level of Service Definitions

Level of Service	Interpretation	V/C Ratio
A	Uncongested operations. The operation of vehicles is virtually unaffected by the presence of other vehicles.	Less Than 0.600
B	Very light congestion. Travel speeds tend to be the same as in LOS A, but drivers have slightly less freedom to maneuver.	0.600-0.699
C	Light congestion; occasional backups. The ability to maneuver within the traffic stream is affected by the presence of other vehicles.	0.700-0.799
D	Significant congestion. The ability to maneuver is severely restricted because of congestion. Travel speed begins to be reduced by increasing volumes.	0.800-0.899
E	Severe congestion. Operations are at or near capacity and is quite unstable.	0.900-0.999
F	Total breakdown, stop-and-go operation. Vehicles are arriving at a greater rate than they can discharge. Vehicles experience brief periods of movement followed by stoppages.	1.000 and Greater

Source: *ITE Transportation and Traffic Engineering Handbook*

The street summary information along major roadways within the City of Sterling Heights is shown in Table 5. The summary contains the roadway segment, the year the traffic count was taken, ADT and PM peak hour traffic volumes, daily and hourly capacities, total number of lanes, V/C by direction and combined (both directions), and a combined level of service for the daily and PM peak hour. The first entry in Table 5 is Dequindre Road between M-59/Hall Road and 19 Mile Road. The count was taken in 1996. Northbound (NB) Dequindre Road ADT is 11,883 vehicles per day and southbound (SB) Dequindre Road ADT is 11,323 vehicles per day. The daily capacity is 9,500 vehicles per day per direction. There are four lanes south of M-59/Hall Road reducing to two lanes. The daily V/C for NB Dequindre Road is 1.251, SB Dequindre Road is 1.192, and both directions of Dequindre Road (combined) is 1.221. The combined daily level of service on Dequindre Road between M-59/Hall Road and 19 Mile Road is LOS F. The PM peak hour (5:00 to 6:00 PM) on NB Dequindre Road volume is 1,149 vehicles per hour and SB Dequindre Road is 841 vehicles per hour. The hourly capacity is 950 vehicles per hour per lane. The PM peak hour for V/C for NB Dequindre Road is 1.209 (LOS F), SB Dequindre Road is 0.885 (LOS D), and a combined V/C is 1.047 with LOS F.

Figure 4 shows a graphical representation of the daily level of service and crash rates (1994 through 1996) for the existing conditions. The crash rates are discussed in the Crash Data section of the report. The City of Sterling

Table 5--Street Summary Information - Daily and PM Peak Hour V/C

			Daily									PM Peak Hour (5:00 to 6:00 PM)									
Street Segment	From	To	ADT Year	NB/EB ADT	SB/WB ADT	Daily Capacity	Total # Lanes	NB/EB V/C	SB/WB V/C	Combined V/C	Combined LOS	NB/EB PM PK	SB/WB PM PK	Hourly Capacity	Total # Lanes	NB/EB V/C	NB/EB LOS	SB/WB V/C	SB/WB LOS	Combined V/C	Combined LOS
Dequindre	Hall/M-59	19 Mile	1996	11883	11323	9500	4/2	1.251	1.192	1.221	F	1149	841	950	4/2	1.209	F	0.885	D	1.047	F
Dequindre	19 Mile	18 Mile	1993	10133	10211	9500	2	1.067	1.075	1.071	F	954	760	950	2	1.004	F	0.800	D	0.902	E
Dequindre	18 Mile	17 Mile	1996	9102	8797	9500	2	0.958	0.926	0.942	E	758	697	950	2	0.798	C	0.734	C	0.766	C
Dequindre	17 Mile	Fox Hill	1993	12518	12850	9500	2	1.318	1.353	1.335	F	1124	769	950	2	1.183	F	0.809	D	0.996	E
Dequindre	Fox Hill	16 Mile	1993	12518	12850	9500	2	1.318	1.353	1.335	F	1124	769	950	2	1.183	F	0.809	D	0.996	E
Dequindre	16 Mile	15 Mile	1995	12865	12495	20900	5	0.616	0.598	0.607	B	1333	786	2090	5	0.638	B	0.376	A	0.507	A
Dequindre	15 Mile	14 Mile	1993	14545	14031	19800	5	0.735	0.709	0.722	C	1334	927	1980	5	0.674	B	0.468	A	0.571	A
Ryan	Hall/M-59	19 Mile	1997	7586	6443	7500	2	1.011	0.859	0.935	E	592	671	750	2	0.789	C	0.895	D	0.842	D
Ryan	19 Mile	18 1/2 Mile	1996	6886	6830	7500	2	0.918	0.911	0.914	E	527	617	750	2	0.703	C	0.823	D	0.763	C
Ryan	18 Mile	17 Mile	1997	12313	11013	16500	5	0.746	0.667	0.707	C	1246	861	1650	5	0.755	C	0.522	A	0.638	B
Ryan	17 Mile	Fox Hill	1995	10796	9819	16500	5	0.654	0.595	0.625	B	1060	833	1650	5	0.642	B	0.505	A	0.574	A
Ryan	Fox Hill	16 Mile	1995	10796	9819	16500	5	0.654	0.595	0.625	B	1060	833	1650	5	0.642	B	0.505	A	0.574	A
Ryan	16 Mile	15 Mile	1997	16220	16431	15400	5	1.053	1.067	1.060	F	1379	1127	1540	5	0.895	D	0.732	C	0.814	D
Ryan	15 Mile	14 Mile	1995	14068	17545	15400	5	0.914	1.139	1.026	F	1183	1215	1540	5	0.768	C	0.789	C	0.779	C
Mound	Hall/M-59	19 Mile	1996	13812	12214	26125	6	0.529	0.468	0.498	A	1030	770	2613	6	0.394	A	0.295	A	0.344	A
Mound	19 Mile	18 1/2 Mile	1993	14217	17156	26125	6	0.544	0.657	0.600	B	1424	1215	2613	6	0.545	A	0.465	A	0.505	A
Mound	18 Mile	17 Mile	1996	15931	19830	26125	6	0.610	0.759	0.684	B	1437	1230	2613	6	0.550	A	0.471	A	0.510	A
Mound	17 Mile	Fox Hill	1993	18611	20320	36575	8	0.509	0.556	0.532	A	1805	1341	3658	8	0.494	A	0.367	A	0.430	A
Mound	Fox Hill	16 Mile	1993	18611	20320	36575	8	0.509	0.556	0.532	A	1805	1341	3658	8	0.494	A	0.367	A	0.430	A
Mound	16 Mile	15 Mile	1995	22373	27470	36575	8	0.612	0.751	0.681	B	1949	1764	3658	8	0.533	A	0.482	A	0.508	A
Mound	15 Mile	14 Mile	1993	25800	21494	34650	8	0.745	0.620	0.682	B	2268	1304	3465	8	0.655	B	0.376	A	0.515	A
Merrill	Hall/M-59	19 1/2 Mile	1997	2379	1543	6050	3	0.393	0.255	0.324	A	150	69	605	3	0.248	A	0.114	A	0.181	A
Merrill	19 1/2 Mile	19 Mile	1996	3022	2700	6050	3	0.500	0.446	0.473	A	320	206	605	3	0.529	A	0.340	A	0.435	A
Old Van Dyke	Clinton River	Riverland	1997	10525	11975	14300	5	0.736	0.837	0.787	C	738	586	1430	5	0.516	A	0.410	A	0.463	A
Old Van Dyke	Utica	19 Mile	1997	11753	15995	14300	5	0.822	1.119	0.970	E	1505	921	1430	5	1.052	F	0.644	B	0.848	D
Old Van Dyke	19 Mile	18 1/2 Mile	1997	10042	14034	14300	5	0.702	0.981	0.842	D	1005	982	1430	5	0.703	C	0.687	B	0.695	B
Old Van Dyke	18 1/2 Mile	M53 Split	1997	10699	14677	13000	5	0.823	1.129	0.976	E	699	1503	1300	5	0.538	A	1.156	F	0.847	D
Van Dyke/M-53	Hall/M-59	M53 Split	1997	25313	30973	37000	4	0.684	0.837	0.761	C	3080	1545	3700	4	0.832	D	0.418	A	0.625	B
Van Dyke/M-53	M53 Split	18 Mile	1997	38283	47279	28500	6	1.343	1.659	1.501	F	3875	2954	2850	6	1.360	F	1.036	F	1.198	F
Van Dyke/M-53	18 Mile	Plumbrook	1993	46053	43233	25500	6	1.806	1.695	1.751	F	4090	2726	2550	6	1.604	F	1.069	F	1.336	F
Van Dyke/M-53	Plumbrook	17 Mile	1992	32862	37368	25500	6	1.289	1.465	1.377	F	2545	2381	2550	6	0.998	E	0.934	E	0.966	E
Van Dyke/M-53	16 1/2 Mile	16 Mile	1995	36897	31154	25500	6	1.447	1.222	1.334	F	2941	1801	2550	6	1.153	F	0.706	C	0.930	E
Van Dyke/M-53	Brougham	15 Mile	1996	41452	41728	25500	6	1.626	1.636	1.631	F	3002	2338	2550	6	1.177	F	0.917	E	1.047	F
Van Dyke/M-53	15 Mile	14 Mile	1995	30220	35594	25500	6	1.185	1.396	1.290	F	2389	2094	2550	6	0.937	E	0.821	D	0.879	D
Sterritt	Hall/M-59	Canal	1997	4579	3236	5500	2	0.833	0.588	0.710	C	502	308	550	2	0.913	E	0.560	A	0.736	C
Dodge Park	Utica	17 Mile	1996	3418	3416	7500	2	0.456	0.455	0.456	A	316	229	750	2	0.421	A	0.305	A	0.363	A
Dodge Park	16 1/2 Mile	16 Mile	1993	7859	9166	7500	2	1.048	1.222	1.135	F	695	671	750	2	0.927	E	0.895	D	0.911	E
Dodge Park	16 Mile	Brougham or Canterbury	1995	6596	6742	7500	2	0.879	0.899	0.889	D	721	453	750	2	0.961	E	0.604	B	0.783	C
Dodge Park	Brougham or Canterbury	15 Mile	1995	6596	6742	7500	2	0.879	0.899	0.889	D	721	453	750	2	0.961	E	0.604	B	0.783	C
Delco	Hall/M-59	Canal	1997	3781	2567	5500	2	0.687	0.467	0.577	A	371	208	550	2	0.675	B	0.378	A	0.526	A
Maple Lane	15 Mile	14 Mile	1993	9699	8107	7500	2	1.293	1.081	1.187	F	989	541	750	2	1.319	F	0.721	C	1.020	F
Schoenherr	Hall/M-59	Canal	1995	18793	21047	25500	6	0.737	0.825	0.781	C	1579	1463	2550	6	0.619	B	0.574	A	0.596	A
Schoenherr	19 Mile	Clinton River	1993	5974	7372	19000	4	0.314	0.388	0.351	A	629	526	1900	4	0.331	A	0.277	A	0.304	A
Schoenherr	Clinton River	17 Mile	1995	22001	22678	18000	4	1.222	1.260	1.241	F	2438	1482	1800	4	1.354	F	0.823	D	1.089	F
Schoenherr	Utica	Plumbrook	1997	14782	16839	19000	4	0.778	0.886	0.832	D	1734	1170	1900	4	0.913	E	0.616	B	0.764	C
Schoenherr	Plumbrook	16 Mile	1995	17411	20166	19000	4	0.916	1.061	0.989	E	1719	1397	1900	4	0.905	E	0.735	C	0.820	D
Schoenherr	16 Mile	Canterbury	1993	12517	13011	20900	5	0.599	0.623	0.611	B	1579	975	2090	5	0.756	C	0.467	A	0.611	B
Schoenherr	Canterbury	15 Mile	1993	12517	13011	20900	5	0.599	0.623	0.611	B	1579	975	2090	5	0.756	C	0.467	A	0.611	B
Schoenherr	Moravian	14 Mile	1995	17093	20310	20900	5	0.818	0.972	0.895	D	1504	1598	2090	5	0.720	C	0.765	C	0.742	C
Saal	Canal	19 Mile	1994	8876	5483	6500	2	1.366	0.844	1.105	F	761	490	650	2	1.171	F	0.754	C	0.962	E
Saal	19 Mile	Stadler	1996	3257	2942	6500	2	0.501	0.453	0.477	A	275	291	650	2	0.423	A	0.448	A	0.435	A

Table 5--Street Summary Information - Daily and PM Peak Hour V/C

			Daily									PM Peak Hour (5:00 to 6:00 PM)									
Street Segment	From	To	ADT Year	NB/EB ADT	SB/WB ADT	Daily Capacity	Total # Lanes	NB/EB V/C	SB/WB V/C	Combined V/C	Combined LOS	NB/EB PM PK	SB/WB PM PK	Hourly Capacity	Total # Lanes	NB/EB V/C	NB/EB LOS	SB/WB V/C	SB/WB LOS	Combined V/C	Combined LOS
Hayes	Hall/M-59	19 Mile	1994	10669	10895	14300	5	0.746	0.762	0.754	C	827	881	1430	5	0.578	A	0.616	B	0.597	A
Hayes	Canal	18 Mile	1996	11998	11913	7500	2	1.600	1.588	1.594	F	1051	1046	750	2	1.401	F	1.395	F	1.398	F
Hayes	18 Mile	Stadler	1993	12191	13205	7500	2	1.625	1.761	1.693	F	984	949	750	2	1.312	F	1.265	F	1.289	F
Hayes	Stadler	17 Mile	1997	11546	11789	7500	2	1.539	1.572	1.556	F	1211	868	750	2	1.615	F	1.157	F	1.386	F
Hayes	Clinton River	Utica	1995	11543	12475	7500	2	1.539	1.663	1.601	F	1381	736	750	2	1.841	F	0.981	E	1.411	F
Hayes	Moravian	15 Mile	1995	943	560	7500	2	0.126	0.075	0.100	A	122	36	750	2	0.163	A	0.048	A	0.105	A
Hayes	15 Mile	14 Mile	1995	1912	1486	7000	2	0.273	0.212	0.243	A	248	141	700	2	0.354	A	0.201	A	0.278	A
Hall/M-59	Ryan	Mound	1994	30249	29493	37000	4	0.818	0.797	0.807	D	2638	1780	3700	4	0.713	C	0.481	A	0.597	A
19 1/2 Mile	Merrill	Utica	1993	3288	1940	5500	2	0.598	0.353	0.475	A	574	156	550	2	1.044	F	0.284	A	0.664	B
19 Mile	Dequindre	Ryan	1996	4811	5259	7500	2	0.641	0.701	0.671	B	681	607	750	2	0.908	E	0.809	D	0.859	D
19 Mile	Ryan	Mound	1993	4285	3933	7500	2	0.571	0.524	0.548	A	622	342	750	2	0.829	D	0.456	A	0.643	B
19 Mile	Mound	Merrill	1997	8614	7367	6600	3	1.305	1.116	1.211	F	1003	543	660	3	1.520	F	0.823	D	1.171	F
19 Mile	Merrill	Old Van Dyke	1997	8241	7573	6600	3	1.249	1.147	1.198	F	970	500	660	3	1.470	F	0.758	C	1.114	F
19 Mile	Clinton River	Schoenherr	1997	4391	5117	7500	2	0.585	0.682	0.634	B	678	354	750	2	0.904	E	0.472	A	0.688	B
19 Mile	Schoenherr	Saal	1996	7754	6135	7500	2	1.034	0.818	0.926	E	826	405	750	2	1.101	F	0.540	A	0.821	D
18 1/2 Mile	Ryan	Mound	1993	307	899	6000	2	0.051	0.150	0.101	A	45	78	600	2	0.075	A	0.130	A	0.103	A
18 1/2 Mile	Merrill	Old Van Dyke	1996	2466	2448	5500	2	0.448	0.445	0.447	A	296	65	550	2	0.538	A	0.118	A	0.328	A
18 Mile	Dequindre	Ryan	1994	8641	7876	9500	2	0.910	0.829	0.869	D	960	694	950	2	1.011	F	0.731	C	0.871	D
18 Mile	Ryan	Mound	1996	8733	8263	9500	2	0.919	0.870	0.895	D	486	815	950	2	0.512	A	0.858	D	0.685	B
18 Mile	Mound	Van Dyke/M-53	1993	11243	9009	8500	2	1.323	1.060	1.191	F	1248	504	850	2	1.468	F	0.593	A	1.031	F
18 Mile	Van Dyke/M-53	Utica	1996	6289	5571	9500	2	0.662	0.586	0.624	B	596	501	950	2	0.627	B	0.527	A	0.577	A
Stadler	Saal	Hayes	1997	1208	1313	5500	2	0.220	0.239	0.229	A	106	112	550	2	0.193	A	0.204	A	0.198	A
17 Mile	Dequindre	Ryan	1995	8853	9397	16500	5	0.537	0.570	0.553	A	963	768	1650	5	0.584	A	0.465	A	0.525	A
17 Mile	Ryan	Mound	1997	12672	11859	16500	5	0.768	0.719	0.743	C	1314	999	1650	5	0.796	C	0.605	B	0.701	C
17 Mile	Mound	Van Dyke/M-53	1995	9928	8706	14300	5	0.694	0.609	0.652	B	1084	687	1430	5	0.758	C	0.480	A	0.619	B
17 Mile	Van Dyke/M-53	Plumbrook	1997	10203	9821	6050	3	1.686	1.623	1.655	F	1267	713	605	3	2.094	F	1.179	F	1.636	F
17 Mile	Dodge Park	Utica	1997	7923	8432	6050	3	1.310	1.394	1.352	F	640	536	605	3	1.058	F	0.886	D	0.972	E
17 Mile	Utica	Schoenherr	1997	8228	8784	6050	3	1.360	1.452	1.406	F	728	513	605	3	1.203	F	0.848	D	1.026	F
Plumbrook	Van Dyke/M-53	17 Mile	1997	1154	1929	6500	2	0.178	0.297	0.237	A	154	139	650	2	0.237	A	0.214	A	0.225	A
Plumbrook	17 Mile	Dodge Park	1997	3033	2212	6500	2	0.467	0.340	0.403	A	438	112	650	2	0.674	B	0.172	A	0.423	A
Plumbrook	Dodge Park	Schoenherr	1997	4696	4268	6500	2	0.722	0.657	0.690	B	720	252	650	2	1.108	F	0.388	A	0.748	C
Fox Hill	Dequindre	Ryan	1997	1944	1767	5500	2	0.353	0.321	0.337	A	175	124	550	2	0.318	A	0.225	A	0.272	A
Fox Hill	Ryan	Mound	1997	1815	1825	5500	2	0.330	0.332	0.331	A	187	138	550	2	0.340	A	0.251	A	0.295	A
16 1/2 Mile	Van Dyke/M-53	Dodge Park	1995	2633	1850	6500	2	0.405	0.285	0.345	A	324	142	650	2	0.498	A	0.218	A	0.358	A
16 Mile	Dequindre	Ryan	1993	23064	23335	28500	6	0.809	0.819	0.814	D	2142	1542	2850	6	0.752	C	0.541	A	0.646	B
16 Mile	Ryan	Mound	1995	23207	24541	28500	6	0.814	0.861	0.838	D	2030	1784	2850	6	0.712	C	0.626	B	0.669	B
16 Mile	Mound	Van Dyke/M-53	1993	25233	27184	17000	4	1.484	1.599	1.542	F	2021	1690	1700	4	1.189	F	0.994	E	1.091	F
16 Mile	Van Dyke/M-53	Dodge Park	1995	22532	17788	19000	4	1.186	0.936	1.061	F	2105	1160	1900	4	1.108	F	0.611	B	0.859	D
16 Mile	Dodge Park	Schoenherr	1993	22480	24125	19000	4	1.183	1.270	1.226	F	1837	1512	1900	4	0.967	E	0.796	C	0.881	D
16 Mile	Schoenherr	Utica	1995	18189	20533	19000	4	0.957	1.081	1.019	F	1658	1208	1900	4	0.873	D	0.636	B	0.754	C
Brougham	Van Dyke/M-53	Dodge Park	1997	1114	1254	5500	2	0.203	0.228	0.215	A	121	81	550	2	0.220	A	0.147	A	0.184	A
Canturbury	Dodge Park	Schoenherr	1997	2014	2091	5500	2	0.366	0.380	0.373	A	105	152	550	2	0.191	A	0.276	A	0.234	A
Moravian	Schoenherr	15 Mile	1995	5755	5883	7500	2	0.767	0.784	0.776	C	715	299	750	2	0.953	E	0.399	A	0.676	B
Moravian	15 Mile	Hayes	1993	8059	7933	7500	2	1.075	1.058	1.066	F	1002	487	750	2	1.336	F	0.649	B	0.993	E
15 Mile	Dequindre	Ryan	1995	13622	15750	15400	5	0.885	1.023	0.954	E	1446	976	1540	5	0.939	E	0.634	B	0.786	C
15 Mile	Ryan	Mound	1994	14936	12162	15400	5	0.970	0.790	0.880	D	1243	913	1540	5	0.807	D	0.593	A	0.700	C
15 Mile	Mound	Van Dyke/M-53	1995	16598	17252	14300	5	1.161	1.206	1.184	F	1719	669	1430	5	1.202	F	0.468	A	0.835	D
15 Mile	Van Dyke/M-53	Dodge Park	1993	18411	17117	16500	5	1.116	1.037	1.077	F	1671	1007	1650	5	1.013	F	0.610	B	0.812	D
15 Mile	Maple Lane	Schoenherr	1995	15648	14135	16500	5	0.948	0.857	0.903	E	1583	1000	1650	5	0.959	E	0.606	B	0.783	C
15 Mile	Schoenherr	Moravian	1997	12903	13293	16500	5	0.782	0.806	0.794	C	1335	704	1650	5	0.809	D	0.427	A	0.618	B
15 Mile	Moravian	Hayes	1997	10730	10282	16500	5	0.650	0.623	0.637	B	1085	773	1650	5	0.658	B	0.468	A	0.563	A

Table 5--Street Summary Information - Daily and PM Peak Hour V/C

			Daily									PM Peak Hour (5:00 to 6:00 PM)									
Street Segment	From	To	ADT Year	NB/EB ADT	SB/WB ADT	Daily Capacity	Total # Lanes	NB/EB V/C	SB/WB V/C	Combined V/C	Combined LOS	NB/EB PM PK	SB/WB PM PK	Hourly Capacity	Total # Lanes	NB/EB V/C	NB/EB LOS	SB/WB V/C	SB/WB LOS	Combined V/C	Combined LOS
14 Mile	Dequindre	Ryan	1996	14873	14246	19800	5	0.751	0.719	0.735	C	1472	816	1980	5	0.743	C	0.412	A	0.578	A
14 Mile	Ryan	Mound	1995	13887	13331	19800	5	0.701	0.673	0.687	B	1340	861	1980	5	0.677	B	0.435	A	0.556	A
14 Mile	Mound	Van Dyke/M-53	1993	16284	15160	19800	5	0.822	0.766	0.794	C	1625	982	1980	5	0.821	D	0.496	A	0.658	B
14 Mile	Van Dyke/M-53	Maple Lane	1995	14072	11838	20900	5	0.673	0.566	0.620	B	1579	907	2090	5	0.756	C	0.434	A	0.595	A
14 Mile	Maple Lane	Schoenherr	1993	14791	18450	20900	5	0.708	0.883	0.795	C	948	1886	2090	5	0.454	A	0.902	E	0.678	B
14 Mile	Schoenherr	Hayes	1995	15554	11831	20900	5	0.744	0.566	0.655	B	1631	1062	2090	5	0.780	C	0.508	A	0.644	B
Riverland	Old Van Dyke	Clinton River	1997	7391	8190	5500	2	1.344	1.489	1.416	F	1285	498	550	2	2.336	F	0.905	E	1.621	F
Clinton River (N-S)	Canal	Riverland	1993	2042	1815	7500	2	0.272	0.242	0.257	A	173	178	750	2	0.231	A	0.237	A	0.234	A
Clinton River (N-S)	19 Mile	Schoenherr	1997	2914	2864	7500	2	0.389	0.382	0.385	A	343	268	750	2	0.457	A	0.357	A	0.407	A
Clinton River (N-S)	Saal	Hayes	1993	5297	5502	7500	2	0.706	0.734	0.720	C	526	422	750	2	0.701	C	0.563	A	0.632	B
Canal (E-W)	Clinton River	Sterritt	1993	1383	1220	7500	2	0.184	0.163	0.174	A	193	73	750	2	0.257	A	0.097	A	0.177	A
Canal (E-W)	Delco	Schoenherr	1993	6938	6901	7500	2	0.925	0.920	0.923	E	754	627	750	2	1.005	F	0.836	D	0.921	E
Canal (E-W)	Schoenherr	Saal	1993	6346	7865	5500	2	1.154	1.430	1.292	F	592	646	550	2	1.076	F	1.175	F	1.125	F
Utica (N-S)	M-59	19 1/2 Mile	1997	1244	3045	5500	2	0.226	0.554	0.390	A	85	306	550	2	0.155	A	0.556	A	0.355	A
Utica (N-S)	19 1/2 Mile	Old Van Dyke	1993	3808	4676	5500	2	0.692	0.850	0.771	C	347	636	550	2	0.631	B	1.156	F	0.894	D
Utica (N-S)	Old Van Dyke	18 Mile	1996	5827	5605	7500	2	0.777	0.747	0.762	C	443	524	750	2	0.591	A	0.699	B	0.645	B
Utica (N-S)	18 Mile	Dodge Park	1993	11708	12377	7500	2	1.561	1.650	1.606	F	917	1036	750	2	1.223	F	1.381	F	1.302	F
Utica (N-S)	Dodge Park	17 Mile	1997	12719	11200	7500	2	1.696	1.493	1.595	F	1147	688	750	2	1.529	F	0.917	E	1.223	F
Utica (N-S)	17 Mile	Schoenherr	1995	8301	9928	7500	2	1.107	1.324	1.215	F	569	1037	750	2	0.759	C	1.383	F	1.071	F
Utica (N-S)	Plumbrook	Hayes	1993	11009	11718	7500	2	1.468	1.562	1.515	F	859	1256	750	2	1.145	F	1.675	F	1.410	F

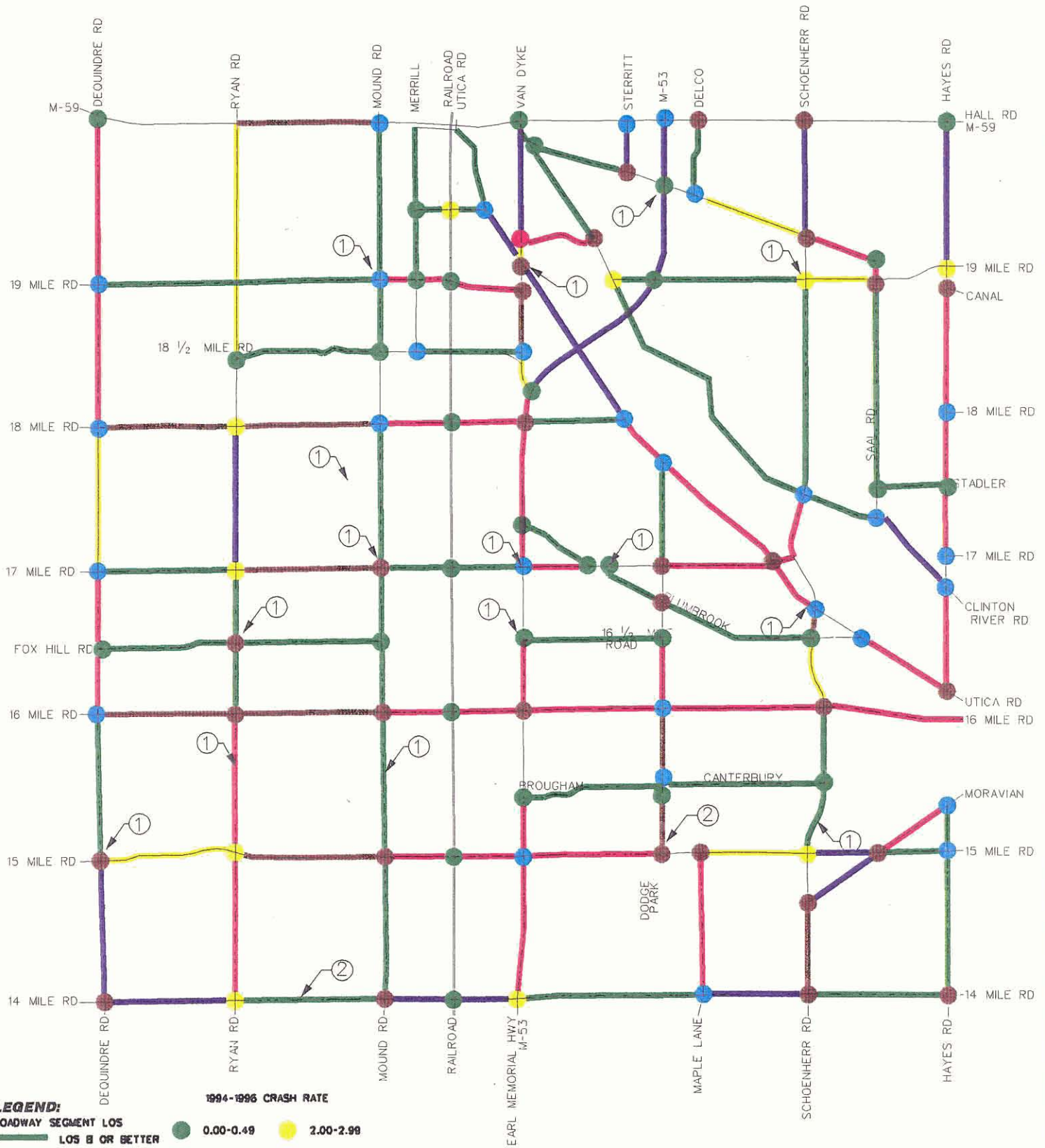


FIGURE 4

STERLING HEIGHTS MASTER ROAD PLAN UPDATE

PB 100 YEARS

ACCIDENT RATE DEFINITION DAILY STREET SEGMENT LEVEL OF SERVICE AND INTERSECTION ACCIDENT RATES (1994-1996) FOR EXISTING CONDITIONS

SCALE: NTS

DATE: 3-27-98

PAGE: 20

Heights roadway segment level of service can be seen in Figure 4. Some of the roadway segments that are operating poorly throughout the day are: Dequindre Road, 15 Mile Road, between Dequindre Road and Ryan Road and Mound Road and Schoenherr Road; Van Dyke Road, south of 18 Mile Road; Hayes Road, north of Utica Road; Metropolitan Parkway (16 Mile Road), between Mound Road and Hayes Road; 18 Mile Road, between Mound Road and Van Dyke Road; 19 Mile Road, between Mound Road and Van Dyke Road; and Utica Road, southeast of 18 Mile Road to Hayes Road.

Figure 5 shows a graphical representation of the roadway segment level of service for the PM peak hour. The level of service does change between the daily and PM peak hour. These differences occur since the daily capacity of the roadway is assumed to be ten times the peak hour capacity. The capacity is determined by the functional class of the road, the area type, and the free-flow speed. The functional class is determined by whether the roadway is a freeway, a principal arterial, a minor arterial, a collector, a local street, a ramp, a freeway to freeway ramp, or a centroid collector. The City of Sterling Heights is made up of traffic analysis zones. These zones are usually one mile blocks and represent traffic traveling within that one mile area. Every road cannot be coded in the TRANPLAN model, so the centroid collectors represent those roadways. A centroid collector loads all the traffic within the traffic analysis zones to the local network; that is, it takes traffic from the neighborhoods (on residential streets) and loads them on the surrounding streets. The area types possible are urban business, urban residential, suburban residential, small urban residential, and rural residential. Depending on the segment and the volume by time of day there can be variability in the level of service performance between the daily and PM peak hour.

CRASH DATA

SEMCOG provided the crash data that was used for the Sterling Heights Master Road Plan Update. The crash data contained intersection crashes, which are crashes within 150 feet of the intersection, in Sterling Heights for the years 1994, 1995, and 1996. The intersection crash data received from SEMCOG contained, by year, the total number of crashes, the number of fatalities, the number of injuries, the number of fatal crashes, and the number of injury crashes. The data also included, by year, the type of crashes: head on, head on left-turn, rear end, side swipe, angle, single vehicle, and other crash types.

From the crash data obtained from SEMCOG, there were several intersections that had the crashes split up into quadrants of the intersections. Instead of having complete crash data at an intersection, all four legs of the intersection were represented separately (quadrants). The quadrant crash data needed to be combined into one complete intersection in order to determine the total number of crashes for that intersection, as well as the intersection crash rate. Table 6 summarizes the quadrants that were combined into one intersection.

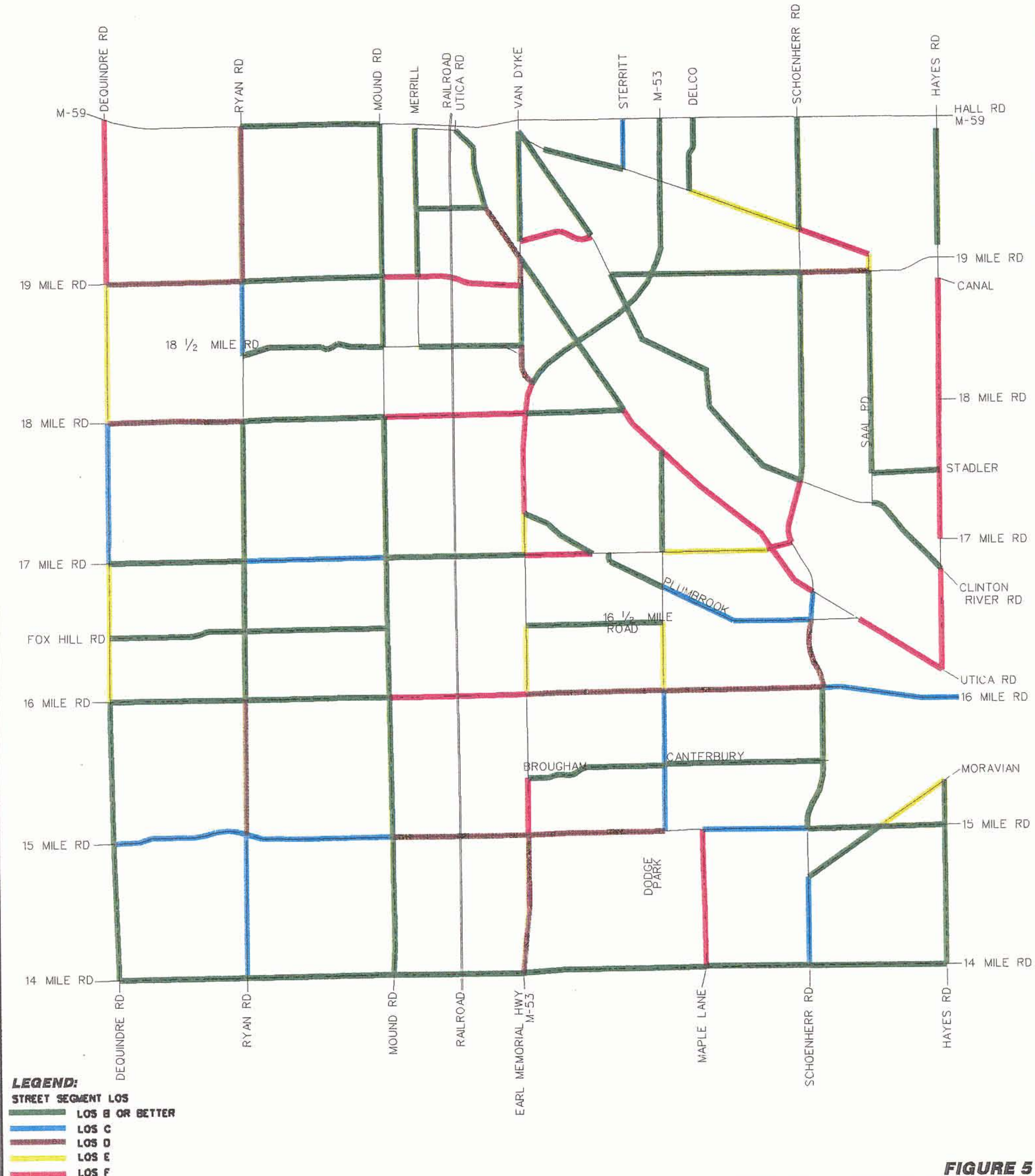


FIGURE 5

STERLING HEIGHTS MASTER ROAD PLAN UPDATE	PB 100 YEARS	PM PEAK HOUR (5:00-6:00 PM) STREET SEGMENT LEVEL OF SERVICE FOR EXISTING CONDITIONS	SCALE: NTS DATE: 3-27-98 PAGE: 22

Table 6--Summary of Crash Quadrants Combined into One Intersection

Intersection Name	Quadrants
Dodge Park and Metropolitan Parkway (16 Mile Road)	E Metropolitan Parkway (16 Mile Road) and Dodge Park W Metropolitan Parkway (16 Mile Road) and Dodge Park
Mound Road and Metropolitan Parkway (16 Mile Road)	E Metropolitan Parkway (16 Mile Road) and S Mound N Mound and E Metropolitan Parkway (16 Mile Road) N Mound and W Metropolitan Parkway (16 Mile Road) W Metropolitan Parkway (16 Mile Road) and S Mound
M-59/Hall and Mound Road	W M-59 and S Mound E M-59 and S Mound N Mound and E M-59 N Mound and W M-59
18 Mile Road and M-53	18 Mile and N M-53 18 Mile and S M-53
15 Mile Road and Mound Road	15 Mile and S Mound
14 Mile Road and Mound Road	14 Mile and N Mound 14 Mile and S Mound
M-53 and Metropolitan Parkway (16 Mile Road)	M-53 and E Metropolitan Parkway (16 Mile Road) M-53 and W Metropolitan Parkway (16 Mile Road)
M-53 and Canal Road	N M-53 and Canal (2.29 / 0.95) S M-53 and Canal (2.29 / 0.93)
M-53 and M-59/Hall Road	N M-53 and M-59/Hall (2.72 / 1.03) S M-53 and M-59/Hall (2.72 / 1.02)
M-53 and 19 Mile Road	N M-53 and 19 Mile (1.59 / 0.30) S M-53 and 19 Mile (1.59 / 0.27)
Mound Road and 17 Mile Road	N Mound and 17 Mile (9.19 / 2.06) 17 Mile and S Mound (2.03 / 0.62)
Schoenherr Road and Metropolitan Parkway (16 Mile Road)	Schoenherr and E Metropolitan Parkway (16 Mile Road) (8.22 / 5.15) Schoenherr and W Metropolitan Parkway (16 Mile Road) (8.24 / 9.31)
Old Van Dyke Road and Riverland Drive	Earl Memorial and Riverland Van Dyke and Riverland

To calculate the crash rate for all of the intersections, the volumes for each intersection had to be determined. The volume for each intersection was calculated from traffic volumes taken from the years 1991 to 1997. An average volume was determined for the primary street and the intersecting street. The intersection volume was found by adding the volume for the primary and intersecting street. The average volumes were used because the traffic counts were taken over a seven-year time period. The volumes for the crossover intersections were taken from volumes of the main line road where the crossover crosses. For example, when there is a crossover labeled W 14 MI/N M-53 and M-53, the combined north and south M-53 volume was used in the crash rate calculation. The equation used to determine the crash rate for both intersection and crossover worksheets is as follows:

Crash Rate = (Number of Crashes) * 1,000,000 / (Volume * 365 * Number of Years)

The crash rate, as well as an average crash rate, was determined for 1994, 1995 and 1996 for arterial highways and for arterial highways at crossovers. Figure 4 (previously provided on page 20) provides a graphical representation of the intersection crash rates for the City of Sterling Heights. There are 98 intersections that had crash rates calculated. Of those 98, there was only one intersection (Old Van Dyke Road at Riverland Drive) that had a crash rate over 3.00.

The crash frequency and crash rates, along with the intersection ADT, are shown in Tables 7 and 8. Table 7 concentrates on the arterial streets, where Table 8 concentrates on crashes located at crossovers. The rating system column will be described in section 4.0.

A summary of the crashes within Sterling Heights is provided in Table 9 for 1994 through 1996. The crash data in the table was provided by SEMCOG. It is worth mentioning again that this data is for intersections only. Crashes along a roadway segment greater than 150 feet from the intersection are not included. Crashes in this table are only for the major roadways, and a few minor roadways (Figures 1, 2, or 3 show the streets that crash data was collected). The crash data obtained from SEMCOG came from UD-10 reports and were then put into computer format. UD-10 reports are used by police departments (at the scene of an crash) when a vehicle(s) is involved in a crash. It records information about the crash, including, but not limited to, weather conditions, pavement conditions, type of crash, and any injuries that may have occurred. The individual crash reports were not used. There can be discrepancies between the individual crash reports and the computerized crash data.

Table 9--Sterling Heights Crash Summary

	1994	1995	1996	Total	Percentage
Total Number of Crashes	1,720	1,708	1,837	5,265	
Number of Fatal Crashes	4	2	2	8	0.15%
Number of Injury Crashes	512	483	511	1,506	28.60%
Number of Property Damage Only Crashes	1,204	1,223	1,324	3,751	71.24%
Crash Types					
Single Vehicle	52	69	86	207	3.93%
Head On	130	168	167	465	8.83%
Angle	454	392	436	1,282	24.35%
Rear End	892	870	901	2,663	50.58%
Sideswipe	168	182	203	553	10.50%
Other	24	27	44	95	1.80%

Based on SEMCOG intersection crash data for the major roadways within the City of Sterling Heights, the total number of crashes in the three year period is 5,265 total crashes. In that three-year period, there were eight fatal crashes, 1,506 injury crashes, and 3,751 property damage only crashes. There are three types of injury crashes: A, B and C. Injury A crashes involve any injury, other than fatal, which prevents the injured person from walking, driving or normally continuing the activities which he or she was capable of performing prior to the motor vehicle traffic crash. Injury B crashes involve any injury, other than fatal and incapacitating, which is evident at the scene of the crash. Injury C crashes involve any injury reported or claimed which is not fatal, incapacitating, or non-incapacitating evident injury. The SEMCOG crash data that was utilized in this study did not contain the breakdown of injury types. Figure 6 shows a graphical representation of the crash severity for Sterling Heights, as provided by SEMCOG.

The crash summary shows that 50.58% of the crashes are rear-end crashes. Rear-end crashes are usually more prevalent at signalized locations. Rear-end crashes usually do not cause serious injuries, but tend to have more property damage only (PDO) crashes. The second most prevalent crash type are angle crashes (24.35%), which generally occur at unsignalized intersections. Sideswipe crashes constitute 10.50% of the crashes and head-on crashes are at 8.83%. Single vehicle crashes where the vehicle hits a non-motorized vehicle or object, accounts for 3.93% of the crashes. The "other" crash types, at 1.80%, are crashes that do not fall into any of these categories. The crashes can be where one vehicle backs into another vehicle, for example. Figure 7 shows a graphical representation of the percent of crash types for the City, as provided by SEMCOG.

Table 7--Sterling Heights Crash Frequency and Crash Rates on Arterial Highways

PRIMARY STREET	INTERSECTING STREET	PRIMARY ADT	INTER-SECTING ADT	INTER-SECTION ADT	Crash Frequency				Crash Rates				
					1994 # Crashes	1995 # Crashes	1996 # Crashes	Total Crashes	1994	1995	1996	Average	Rating System
18 1/2 MILE	MERRILL	4,914	2,700	7,614	1	4	2	7	0.36	1.44	0.72	0.84	2
18 1/2 MILE	VAN DYKE	2,466	28,711	31,177	11	3	13	27	0.97	0.26	1.14	0.79	2
19 1/2 MILE	RAILROAD XING	5,288	0	5,288	1	12	0	13	0.52	6.22	0.00	2.25	3
CANAL	CLINTON RIVER	1,220	3,857	5,077	2	0	0	2	1.08	0.00	0.00	0.36	2
CANAL	DELCO	13,839	2,567	16,406	10	7	0	17	1.67	1.17	0.00	0.95	2
CANAL	SAAL	14,211	8,876	23,087	1	1	5	7	0.12	0.12	0.59	0.28	2
CANAL	SCHOENHERR	7,012	39,840	46,852	19	32	19	70	1.11	1.87	1.11	1.36	2
CANAL	STERRITT	2,603	7,815	10,418	4	6	2	12	1.05	1.58	0.53	1.05	2
CLINTON RIVER	HAYES	10,799	24,018	34,817	11	12	10	33	0.87	0.94	0.79	0.87	2
CLINTON RIVER	NINETEEN MI	3,857	6,025	9,882	7	8	8	23	1.94	2.22	2.22	2.13	2
CLINTON RIVER	SAAL	10,799	2,942	13,741	3	5	0	8	0.60	1.00	0.00	0.53	2
CLINTON RIVER	SCHOENHERR	3,857	29,012	32,869	9	9	12	30	0.75	0.75	1.00	0.83	2
DELCO	HALL\M59	3,781	59,742	63,523	38	25	27	90	1.64	1.08	1.16	1.29	2
DEQUINDRE	EIGHTEEN MI	19,121	16,517	35,638	14	9	14	37	1.08	0.69	1.08	0.95	2
DEQUINDRE	FIFTEEN MI	26,968	29,372	56,340	21	19	29	69	1.02	0.92	1.41	1.12	2
DEQUINDRE	FOURTEEN MI	28,576	29,119	57,695	21	37	15	73	1.00	1.76	0.71	1.16	2
DEQUINDRE	FOX HILL	25,368	3,711	29,079	2	7	2	11	0.19	0.66	0.19	0.35	2
DEQUINDRE	M59	24,283	59,742	84,025	3	3	6	12	0.10	0.10	0.20	0.13	2
DEQUINDRE	NINETEEN MI	21,775	10,070	31,845	11	4	8	23	0.95	0.34	0.69	0.66	2
DEQUINDRE	SEVENTEEN MI	21,628	18,250	39,878	13	9	18	40	0.89	0.62	1.24	0.92	2
DEQUINDRE	SIXTEEN MI	25,360	46,399	71,759	14	12	23	49	0.53	0.46	0.88	0.62	2
DODGE PARK	16 1/2 MILE	17,025	2,633	19,658	1	4	5	10	0.14	0.56	0.70	0.46	2
DODGE PARK	BROUGHAM	13,338	1,114	14,452	3	1	0	4	0.57	0.19	0.00	0.25	2
DODGE PARK	CANTERBURY	13,338	1,270	14,608	1	4	3	8	0.19	0.75	0.56	0.50	2
DODGE PARK	FIFTEEN MI	6,742	35,528	42,270	25	34	23	82	1.62	2.20	1.49	1.77	2
DODGE PARK	SEVENTEEN MI	6,834	13,389	20,223	8	12	11	31	1.08	1.63	1.49	1.40	2
DODGE PARK	SIXTEEN MI	17,025	43,462	60,487	13	14	22	49	0.59	0.63	1.00	0.74	2
EIGHTEEN MI	GULLIVER	16,517	0	16,517	9	5	7	21	1.49	0.83	1.16	1.16	3
EIGHTEEN MI	HAYES	575	25,396	25,971	4	6	8	18	0.42	0.63	0.84	0.63	2
EIGHTEEN MI	M53	16,056	89,486	105,542	54	57	66	177	1.40	1.48	1.71	1.53	2
EIGHTEEN MI	POND VIEW	16,517	0	16,517	1	0	3	4	0.17	0.00	0.50	0.22	1
EIGHTEEN MI	RAILROAD XING	20,252	0	20,252	2	1	0	3	0.27	0.14	0.00	0.14	2
EIGHTEEN MI	UTICA	6,289	24,085	30,374	7	10	16	33	0.63	0.90	1.44	0.99	2
FIFTEEN MI	MOUND	30,474	48,568	79,042	42	31	36	109	1.46	1.07	1.25	1.26	2
FIFTEEN MI	RAILROAD XING	33,850	0	33,850	4	5	3	12	0.32	0.40	0.24	0.32	2
FIFTEEN MI	SHELL	29,372	0	29,372	2	3	6	11	0.19	0.28	0.56	0.34	1
FOURTEEN MI	HAYES	27,385	3,398	30,783	15	21	26	62	1.34	1.87	2.31	1.84	2
FOURTEEN MI	M53	28,677	65,814	94,491	104	51	52	207	3.02	1.48	1.51	2.00	2
FOURTEEN MI	MAPLE LANE	29,576	17,806	47,382	8	15	11	34	0.46	0.87	0.64	0.66	2
FOURTEEN MI	MOUND	29,331	47,294	76,625	44	28	41	113	1.57	1.00	1.47	1.35	2
FOURTEEN MI	RAILROAD XING	31,444	0	31,444	3	3	4	10	0.26	0.26	0.35	0.29	2

Table 7--Sterling Heights Crash Frequency and Crash Rates on Arterial Highways

PRIMARY STREET	INTERSECTING STREET	PRIMARY ADT	INTER-SECTING ADT	INTER-SECTION ADT	Crash Frequency				Crash Rates				
					1994 # Crashes	1995 # Crashes	1996 # Crashes	Total Crashes	1994	1995	1996	Average	Rating System
FOURTEEN MI	RYAN	27,218	31,613	58,831	42	50	55	147	1.96	2.33	2.56	2.28	2
FOURTEEN MI	SCHOENHERR	33,241	37,403	70,644	46	58	48	152	1.78	2.25	1.86	1.96	2
HALL\M59	HAYES	59,742	21,564	81,306	7	6	27	40	0.24	0.20	0.91	0.45	2
HALL\M59	SCHOENHERR	59,742	39,840	99,582	67	46	58	171	1.84	1.27	1.60	1.57	2
HALL\M59	STERRITT	59,742	7,815	67,557	20	33	18	71	0.81	1.34	0.73	0.96	2
HAYES	CANAL	23,911	6,140	30,051	17	20	20	57	1.55	1.82	1.82	1.73	2
HAYES	FIFTEEN MI	1,503	29,783	31,286	6	4	22	32	0.53	0.35	1.93	0.93	2
HAYES	MORAVIAN	943	15,992	16,935	1	6	4	11	0.16	0.97	0.65	0.59	2
HAYES	SHORELINE	21,564	0	21,564	7	8	9	24	0.89	1.02	1.14	1.02	3
HAYES	STADLER	25,216	1,208	26,424	1	0	2	3	0.10	0.00	0.21	0.10	1
M53	16 1/2 MILE	68,051	1,850	69,901	4	3	13	20	0.16	0.12	0.51	0.26	2
M53	BROUGHAM	81,790	1,254	83,044	15	2	5	22	0.49	0.07	0.16	0.24	2
M53	CANAL	49,159	13,839	62,998	6	5	3	14	0.26	0.22	0.13	0.20	2
M53	FIFTEEN MI	74,225	34,689	108,914	44	12	37	93	1.11	0.30	0.93	0.78	2
M53	HALL\M59	49,159	59,742	108,901	40	45	33	118	1.01	1.13	0.83	0.99	2
M53	NINETEEN MI	49,159	11,944	61,103	6	5	9	20	0.27	0.22	0.40	0.30	2
M53	SEVENTEEN MI	68,051	18,634	86,685	27	23	29	79	0.85	0.73	0.92	0.83	2
M53	SIXTEEN MI	68,051	46,368	114,419	47	22	65	134	1.13	0.53	1.56	1.07	2
M59	MOUND	59,742	26,026	85,768	16	14	44	74	0.51	0.45	1.41	0.79	2
MAPLE LANE	FIFTEEN MI	9,699	29,783	39,482	19	18	28	65	1.32	1.25	1.94	1.50	2
MERRILL	19 1/2 MILE	4,822	1,940	6,762	0	1	0	1	0.00	0.41	0.00	0.14	2
MORAVIAN	FIFTEEN MI	13,815	17,257	31,072	13	23	19	55	1.15	2.03	1.68	1.62	2
MOUND	18 1/2 MILE	31,373	1,206	32,579	3	5	5	13	0.25	0.42	0.42	0.36	2
MOUND	EIGHTEEN MI	35,761	16,996	52,757	19	19	17	55	0.99	0.99	0.88	0.95	2
MOUND	FOX HILL	38,931	1,815	40,746	0	1	0	1	0.00	0.07	0.00	0.02	1
MOUND	NINETEEN MI	28,700	8,218	36,918	9	11	10	30	0.67	0.82	0.74	0.74	2
MOUND	SEVENTEEN MI	37,346	15,207	52,553	28	25	20	73	1.46	1.30	1.04	1.27	2
MOUND	SIXTEEN MI	49,843	50,082	99,925	43	41	27	111	1.18	1.12	0.74	1.01	2
NINETEEN MI	HAYES	13,889	21,564	35,453	42	33	27	102	3.25	2.55	2.09	2.63	2
NINETEEN MI	MERRILL	15,814	5,722	21,536	4	5	2	11	0.51	0.64	0.25	0.47	2
NINETEEN MI	RAILROAD XING	15,814	0	15,814	0	1	0	1	0.00	0.17	0.00	0.06	1
NINETEEN MI	SAAL	13,889	8,740	22,629	10	8	10	28	1.21	0.97	1.21	1.13	2
NINETEEN MI	SCHOENHERR	12,917	12,346	25,263	21	23	18	62	2.28	2.49	1.95	2.24	2
NINETEEN MI	VAN DYKE	8,241	26,037	34,278	19	9	13	41	1.52	0.72	1.04	1.09	3
OLD VAN DYKE	RIVERLAND	22,500	8,190	30,690	30	39	33	102	2.68	3.48	2.95	3.04	5
PLUMBROOK	DODGE PARK	7,104	6,834	13,938	6	9	7	22	1.18	1.77	1.38	1.44	2
PLUMBROOK	UTICA	4,696	22,727	27,423	5	8	9	22	0.50	0.80	0.90	0.73	2
PLUMBROOK	VAN DYKE	1,929	79,758	81,687	0	1	7	8	0.00	0.03	0.23	0.09	1
PLUMBROOK S	SEVENTEEN MI	2,212	18,349	20,561	3	1	3	7	0.40	0.13	0.40	0.31	2
RIVERLAND	CLINTON RIVER	7,391	3,857	11,248	6	5	11	22	1.46	1.22	2.68	1.79	3
RYAN	18 1/2 MILE	13,716	899	14,615	1		0	1	0.19	0.00	0.00	0.06	1

Table 7--Sterling Heights Crash Frequency and Crash Rates on Arterial Highways

PRIMARY STREET	INTERSECTING STREET	PRIMARY ADT	INTER-SECTING ADT	INTER-SECTION ADT	Crash Frequency				Crash Rates				
					1994 # Crashes	1995 # Crashes	1996 # Crashes	Total Crashes	1994	1995	1996	Average	Rating System
RYAN	DICKSON	26,114	0	26,114	0	8	0	8	0.00	0.84	0.00	0.28	1
RYAN	EIGHTEEN MI	13,716	16,756	30,472	18	25	30	73	1.62	2.25	2.70	2.19	2
RYAN	FIFTEEN MI	31,613	28,235	59,848	49	44	57	150	2.24	2.01	2.61	2.29	2
RYAN	FOX HILL	20,615	3,675	24,290	14	12	10	36	1.58	1.35	1.13	1.35	2
RYAN	NINETEEN MI	12,563	10,644	23,207	5	7	11	23	0.59	0.83	1.30	0.91	2
RYAN	SEVENTEEN MI	20,615	15,015	35,630	19	36	34	89	1.46	2.77	2.61	2.28	2
RYAN	SIXTEEN MI	20,615	47,074	67,689	27	22	34	83	1.09	0.89	1.38	1.12	2
SCHOENHERR	**CANTERBURY**	25,528	2,402	27,930	5	7	0	12	0.49	0.69	0.00	0.39	1
SCHOENHERR	FIFTEEN MI	25,528	29,783	55,311	29	47	67	143	1.44	2.33	3.32	2.36	2
SCHOENHERR	**MORAVIAN**	37,403	5,883	43,286	10	17	27	54	0.63	1.08	1.71	1.14	2
SCHOENHERR	PLUMBROOK	37,577	8,964	46,541	6	5	8	19	0.35	0.29	0.47	0.37	2
SCHOENHERR	SIXTEEN MI	31,552	46,605	78,157	32	35	36	103	1.12	1.23	1.26	1.20	2
SCHOENHERR	UTICA	44,679	18,229	62,908	12	11	14	37	0.52	0.48	0.61	0.54	2
SEVENTEEN MI	**HAYES**	6,140	24,018	30,158	3	12	6	21	0.27	1.09	0.55	0.64	2
SEVENTEEN MI	**N PLUMBROOK**	18,249	3,148	21,397	2	7	2	11	0.26	0.90	0.26	0.47	2
SEVENTEEN MI	RAILROAD XING	18,634	0	18,634	1	2	0	3	0.15	0.29	0.00	0.15	2
SIXTEEN MI	RAILROAD XING	52,417	0	52,417	8	6	4	18	0.42	0.31	0.21	0.31	2
STADLER	SAAL	1,313	6,199	7,512	0	0	4	4	0.00	0.00	1.46	0.49	2
UTICA	19 1/2 MILE	6,387	3,288	9,675	1	4	2	7	0.28	1.13	0.57	0.66	2
UTICA	DODGE PARK	24,085	3,418	27,503	10	6	10	26	1.00	0.60	1.00	0.86	2
UTICA	**HAYES**	22,727	12,475	35,202	11	18	28	57	0.86	1.40	2.18	1.48	2
UTICA	OLD VAN DYKE	9,958	22,500	32,458	19	31	18	68	1.60	2.62	1.52	1.91	2
UTICA	**SEVENTEEN MI**	18,229	13,389	31,618	13	14	18	45	1.13	1.21	1.56	1.30	2
VAN DYKE	**EARL ME /S M53**	14,677	49,159	63,836		3	0	3	0.00	0.13	0.00	0.04	1
VAN DYKE	HALL/M59	22,500	59,742	82,242		2	0	2	0.00	0.07	0.00	0.02	1
VICEROY	**FIFTEEN MI**	0	29,372	29,372	5	5	7	17	0.47	0.47	0.65	0.53	2

Bolded Streets = T-Intersection

Crash Rate is Number of Crashes per 1,000,000 Vehicles Entering the Intersection

Table 8--Sterling Heights Crash Frequency and Crash Rates at Cross-overs

PRIMARY STREET	INTERSECTING STREET	PRIMARY ADT	INTER-SECTING ADT	INTER-SECTION ADT	Crash Frequency				Crash Rates				Rating System
					1994 # Crashes	1995 # Crashes	1996 # Crashes	Total Crashes	1994	1995	1996	Average	
E 16 M	S M53 /E METR	52,417		52,417	2	2	0	4	0.10	0.10	0.00	0.07	1
FIFTEEN MI	N M53 /W 15 M		30,220	30,220	6	6	0	12	0.54	0.54	0.00	0.36	2
FIFTEEN MI	S M53 /E 15 M		35,594	35,594	1	3	4	8	0.08	0.23	0.31	0.21	2
FIFTEEN MI	W 15 MI/N M53		35,594	35,594	1	0	0	1	0.08	0.00	0.00	0.03	1
FOURTEEN MI	N M53 /W 14 M		30,220	30,220	6	4	0	10	0.54	0.36	0.00	0.30	2
FOURTEEN MI	S M53 /E 14 M		35,594	35,594	1	3	0	4	0.08	0.23	0.00	0.10	2
FOURTEEN MI	W 14 MI/N M53		35,594	35,594	0	2	2	4	0.00	0.15	0.15	0.10	2
HALL\M59	N M53 /E HALL	59,742		59,742	5	7	8	20	0.23	0.32	0.37	0.31	2
HALL\M59	N M53 /W HALL	59,742		59,742	1	3	5	9	0.05	0.14	0.23	0.14	2
HALL\M59	S M53/ E HALL	59,742		59,742	1	2	8	11	0.05	0.09	0.37	0.17	2
M53	E 17 MI/S M53	68,051		68,051	4	3	11	18	0.16	0.12	0.44	0.24	2
M53	N M53 /W 15 M	73,107		73,107	10	5	7	22	0.37	0.19	0.26	0.27	2
M53	N M53 /W 17 M	70,230		70,230	3	1	0	4	0.12	0.04	0.00	0.05	1
M53	N M53 /W METR	70,268		70,268	12	4	5	21	0.47	0.16	0.19	0.27	2
M53	N M53/S M53	89,286		89,286	19	27	15	61	0.58	0.83	0.46	0.62	2
M53	S M53 /E 15 M	73,107		73,107	7	1	0	8	0.26	0.04	0.00	0.10	2
M53	S M53 /E METR	70,268		70,268	8	6	0	14	0.31	0.23	0.00	0.18	2
M53	W 15 MI/N M53	65,814		65,814	1	0	0	1	0.04	0.00	0.00	0.01	1
M53	W METRO/N M53	68,051		68,051	2	0	0	2	0.08	0.00	0.00	0.03	1
N M53	N M53 /EARL M	65,814		65,814	17	9	4	30	0.71	0.37	0.17	0.42	2
N M53 /W 14 M	M53		75,814	75,814	15	0	10	25	0.54	0.00	0.36	0.30	2
S M53	E HALL /S M53	24,388		24,388	1	1	0	2	0.11	0.11	0.00	0.07	1
S M53 /E 14 M	M53		65,814	65,814	5	1	3	9	0.21	0.04	0.12	0.12	2
SEVENTEEN MI	E 17 M /S M53		70,230	70,230	0	1	0	1	0.00	0.04	0.00	0.01	1
SEVENTEEN MI	N M53 /W 17 M		34,718	34,718	1	0	0	1	0.08	0.00	0.00	0.03	1
W 14 MI/N M53	M53		35,594	35,594	5	15	2	22	0.38	1.15	0.15	0.56	2
W 16 M	N M53 /W METR	27,184		27,184		2	0	2	0.00	0.20	0.00	0.07	1
W 16 M	S M53 /E METR	27,184		27,184		1	3	4	0.00	0.10	0.30	0.13	1
W 16 M	W METRO/N M53	40,320		40,320	1	2	0	3	0.07	0.14	0.00	0.07	1

Crash Rate is Number of Crashes per 1,000,000 Vehicles Entering the Intersection

Figure 6--Crash Severity for Sterling Heights for 1994-1996

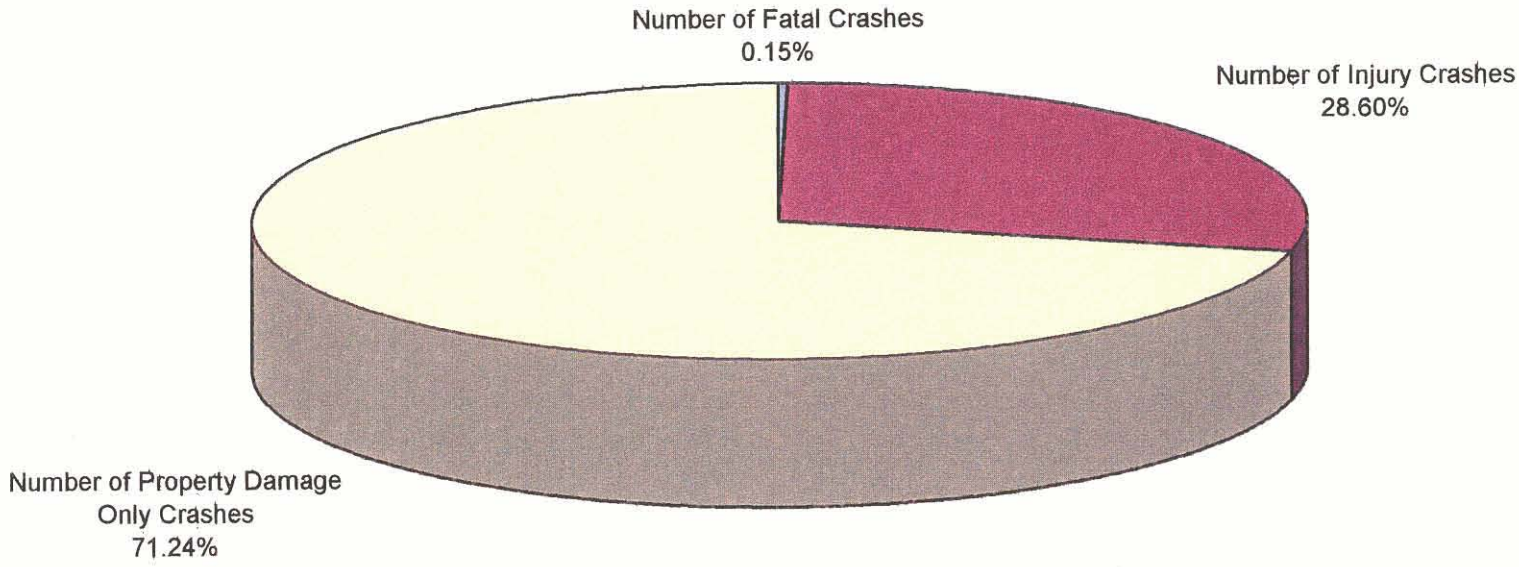
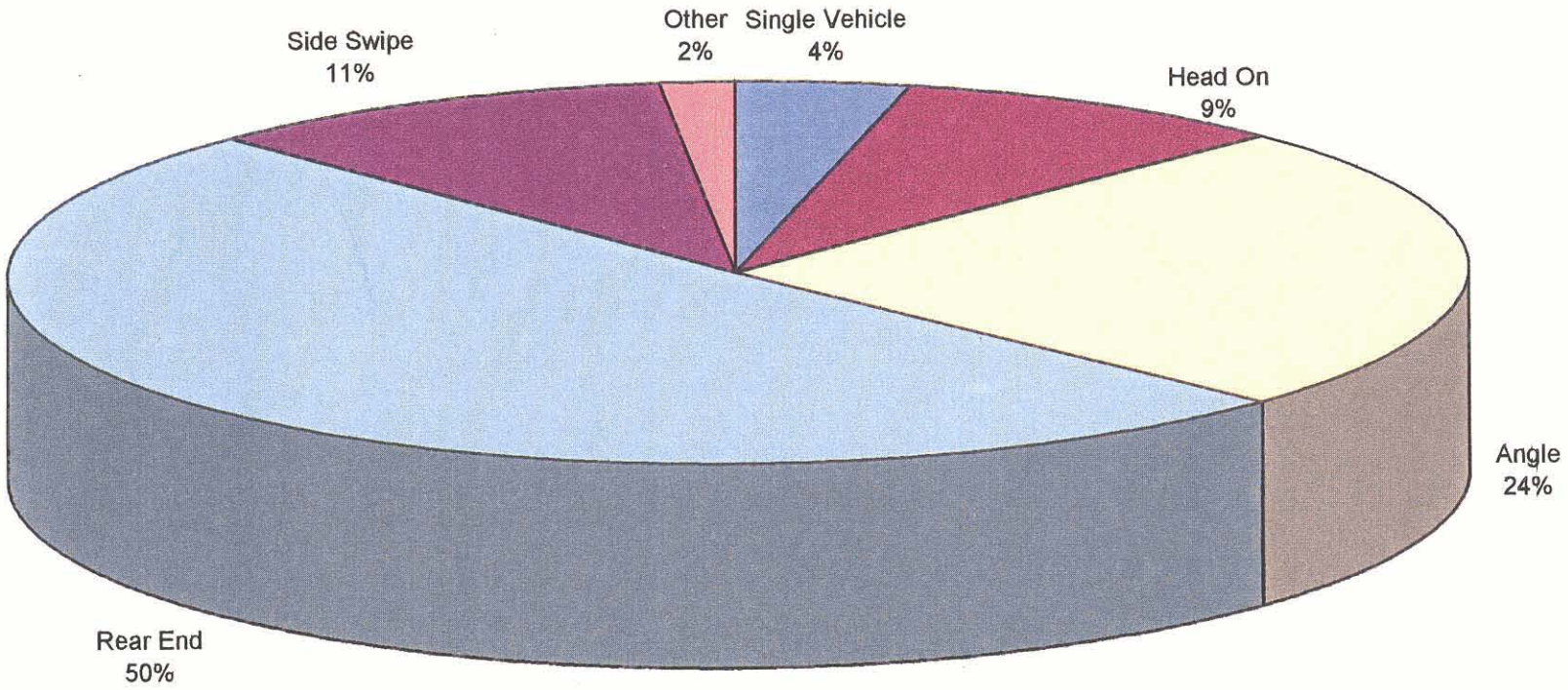


Figure 7--Percentage of Crash Types for 1994-1996



The Sterling Heights Police Department provided all the City's UD-10 crash reports containing fatal crashes for the years 1994 through 1996. The usage of UD-10 reports began in 1992 and they provide a more uniform way of compiling crash data. All local police departments, sheriff jurisdictions, and the Department of State Police must fill out the UD-10 reports at the crash scene. Michigan law requires that crash reports be forwarded to the Director of the Department of State Police. These forms are strictly for providing statistical information on crash data. A fatal injury is when a crash causes any injury that results in death due to a motor vehicle traffic crash. The fatal crash locations are listed in Table 10. There are more fatal crash locations listed in this table than in the table containing only the SEMCOG intersection crash data (Table 9). This is because eight of the intersections are not in the street network that we have been focusing the MRP Update on and one of those locations had a fatality in 1994 and 1995 (14 Mile and Ione). Another difference between data may be due to a coding error when moving from the UD-10 to the computerized format; or the locations are not within a 150 feet of an intersection.

Table 10--Location and Year of Fatal Crashes

Locations of Fatal Crashes	Year
15 Mile Road and Dodge Park Road	1994
14 Mile Road and Ione Road	1994
Mound Road and 19 Mile Road	1994
19 Mile Road and Schoenherr Road	1994
Schoenherr Road and Bathgate Drive	1994
Utica Road and Old Van Dyke Road	1994
Dequindre Road and 15 Mile Road	1995
14 Mile Road and Ione Road	1995
M-53 and Canal Road	1995
Mound Road and Center Drive	1995
Mound Road and 17 Mile Road	1995
Ryan Road and Veronica Road	1995
17 Mile Road and Poinciana Road	1995
Van Dyke Road and Willesdon Road	1995
Windham Road and Calvin Court	1995
Cloverlawn Road and Utica Road	1996
15 Mile Road and Dodge Park Road	1996
Ryan Road and Fox Hill Road	1996
17 Mile Road and Van Dyke Road	1996
Van Dyke Road and 16-1/2 Mile Road	1996

There are six crash types that are summarized by the UD-10 forms. The definitions of the crash types used in the UD-10 form are taken directly from the State of Michigan *UD-10 Traffic Crash Report Instruction Manual,* revised in September 1994. The manual was produced and distributed by the Michigan Department of State Police, and the Office of Highway Safety Planning. The crash types are based on the intended direction of travel, regardless of points(s) of impact or direction vehicles ultimately face after the crash.

1. Single Motor Vehicle: A single or multiple unit crash which involves only one motor vehicle as defined in the manual. This includes those cases in which a motor vehicle was: 1) the only traffic unit; and 2) the only motor vehicle involved in a collision with a bicyclist, pedestrian, animal, railroad train, or any other non-motorized object. Any motorized (i.e., self-propelled) vehicle or device is considered a "motor vehicle" even though the vehicle or device may not be defined as a motor vehicle on the Michigan Motor Vehicle Code or other applicable legislation.

2. Head On: The intended direction of travel of both vehicles must be towards each other. The direction that the vehicles are facing when they come to rest, or the points of impact on the vehicles, are not the determining factors.
3. Angle: This will be marked when the intended direction of travel is basically perpendicular for both drivers and there is a side impact of approximately 90°. If the side impact takes place during a "Head On-Left Turn", "Rear End-Left Turn", or "Rear End-Right Turn", it is not an "Angle".
4. Rear End: When the vehicles are traveling in the same direction, one behind the other, and no turn in involved. Area of damage on the vehicles is not the determining factor. Any crash involving any vehicle backing into another is not considered a "rear-end" crash.
5. Sideswipe: Vehicles traveling in the same direction, or vehicles traveling in opposite directions, making side contact or if a vehicle spins out of control and makes contact with another vehicle traveling in the same direction. "Sideswipe" differs from "Angle" in that a sideswipe is a glancing impact and should not in itself stop the forward movement of the vehicle. An angle crash is a more direct impact and may stop the forward movement of one vehicle.
6. Other/Unknown: The crash does not fit in one of the other selections.

The locations of fatal crashes are spread throughout the City. The fatal crash intersection locations do not indicate any type of unsafe pattern. There are only two locations that have had two fatalities in the three year period: 14 Mile Road/Ione Road and 15 Mile Road/Dodge Park Road. There were six fatal crashes in 1994, nine fatal crashes in 1995, and five fatal crashes in 1996. Figure 4, on page 20, shows graphically the location and number of fatal crashes in the City. The amount of fatal crashes within the City does not appear to be high compared to other areas of similar size within Macomb County. The number of fatal crashes compared to other communities of similar size are presented below.

Community	1994	1995	1996
Sterling Heights	6	9	5
Shelby Township	3	5	7
Warren	11	8	12

The Sterling Heights Police Department also provided a summary sheet listing the total number of crashes, number of injury accidents, and property damage only accidents for Sterling Heights, Shelby Township, and Warren. The number of crashes the City incurred within the three year span (1994 through 1996) is not out of line with communities of similar size. The crash comparison for the years 1994 through 1996 is shown below.

Community	Total Crashes	Injury Crashes	Property Damage Only
Sterling Heights	12,166	3,006	9,140
Shelby Township	5,053	1,488	3,550
Warren	18,213	4,828	11,354

CRITICAL CRASH LOCATIONS

In identifying critical crash locations for the City of Sterling Heights, two different methods were utilized: the Crash Frequency Method and the Crash Rate Method. The Crash Frequency Method ranks locations by descending crash frequency, that is the average number of crashes per year. The Crash Rate Method ranks locations by descending crash rate, that is the average number of crashes per volume of traffic per year. The Crash Frequency Method does not take into account the differing amounts of traffic at the locations compared. The method tends to rank a high-volume location as a high-crash location, even if the location has a relatively low number of crashes for its traffic volume. It is mainly used to select an initial list of suspect locations, and then evaluate the crash histories of the listed locations in greater detail using other methods. The Crash Rate Method compares the number of crashes to the volume of traffic, with the latter measured either as the number of vehicles crossing a spot in a given time period, or as the number of vehicle-miles of travel along a segment in that period. This method is less likely to unfairly condemn high-volume locations than when using the Crash

Frequency Method. It does tend to unfairly identify low-volume locations having relatively few crashes as high-crash.

Appendix A contains Tables 3-1 and 3-4 provided by SEMCOG. Table 3-1 contains Regional Critical Intersection Crash Rates, Frequencies, and Casualty Ratios: By Area Type. The area type is either urban or rural. Table 3-4 contains Regional Critical Intersection Crash Rates, Frequencies, and Casualty Ratios: By Presence or Absence of Signalization. Both of these tables require the ADT volume entering the intersection. The average crash frequency and the average crash rate are compared with the critical crash frequency and the critical crash rate. If the value is higher that the critical value, the intersection is a critical crash location. For example, the intersection of 19 Mile Road and Hayes Road has an intersection ADT of 35,453 and an average crash frequency of 34 crashes per year and an average crash rate of 2.63. Using Table 3-1 for an urban area (in Appendix A) with an intersection ADT between 30,001 and 40,000, the critical crash frequency is 25.37 and the critical crash rate is 1.62. The intersection has a critical value for both crash frequency and rate, which meets criteria 1 and 2 for being a critical crash location. Using Table 3-4 for a signalized intersection (in Appendix A) with an intersection ADT between 30,001 and 40,000, the critical crash frequency is 26.69 and the critical crash rate is 1.75. Once again, the intersection has a critical value for both crash frequency and rate, which meets criteria 3 and 4 for being a critical crash location. Therefore, the intersection of 19 Mile Road and Hayes Road meets all four criteria for being a critical crash location.

Figure 8 provides a graphic display of the critical crash locations based on 1994 through 1996 crash data. Intersections that meet all four of the critical crash location criteria are marked, as well as those that meet at least one of the four criteria. A critical crash location must meet at least one of the four criteria. The four criteria are based on the crash frequency and rate for an urban area (criteria 1 and 2) and the crash frequency and rate for a signalized intersection (criteria 3 and 4). Section 5.0 provides a special analysis of those critical crash locations that meet all four of the critical crash location criteria.

There are 10 intersections that meet all four of the critical crash location criteria. Those intersections are:

1. 14 Mile Road and Ryan Road
2. 14 Mile Road and Van Dyke
3. 14 Mile Road and Schoenherr Road
4. 15 Mile Road and Ryan Road
5. 15 Mile Road and Schoenherr Road
6. Metropolitan Parkway (16 Mile Road) and Van Dyke
7. 17 Mile Road and Ryan Road
8. 19 Mile Road and Hayes Road
9. Riverland Drive and Old Van Dyke
10. M-59 and Schoenherr Road

There are 18 intersections that meet at least one of the four critical crash location criteria. They are as follows:

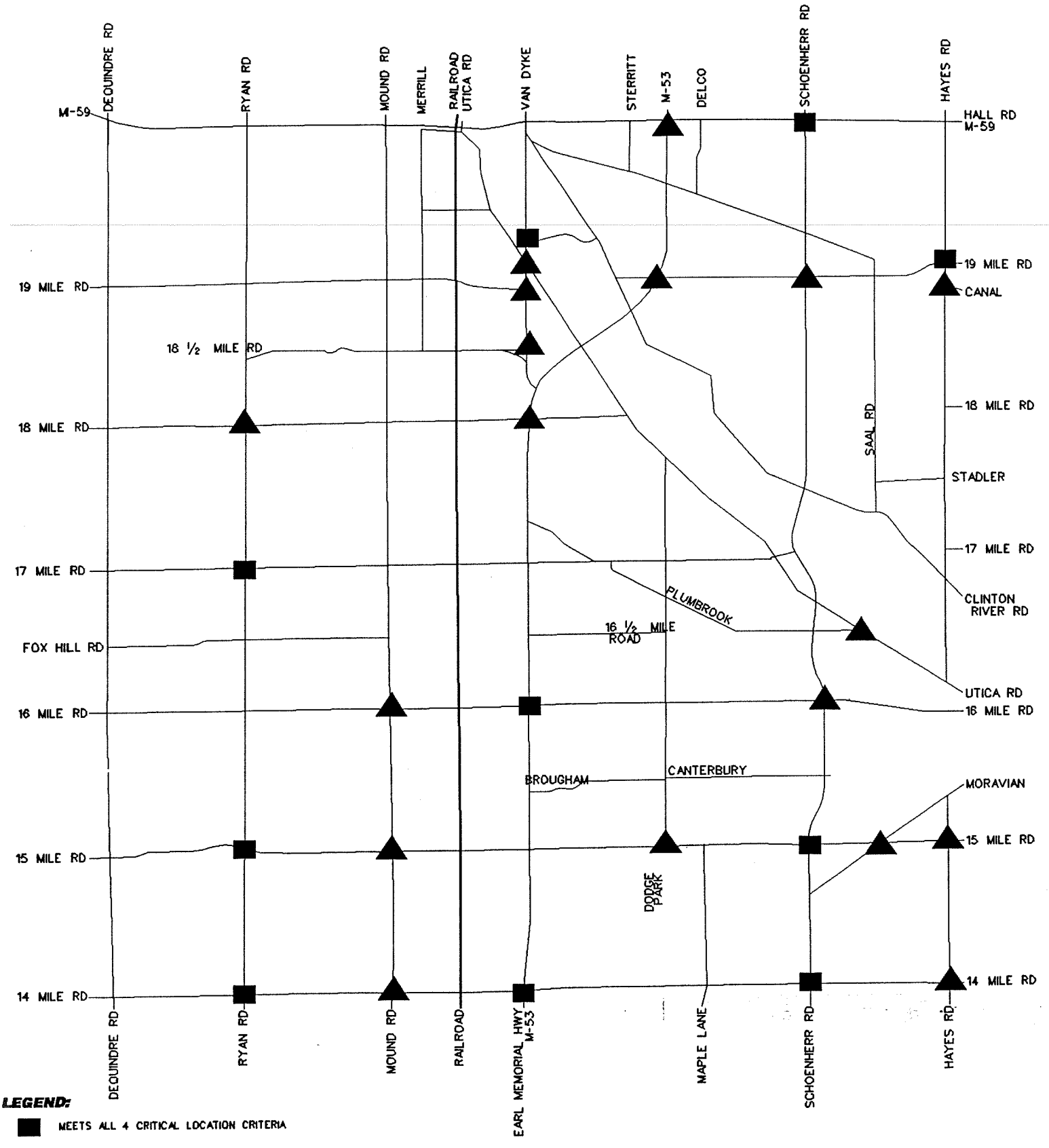
1. 14 Mile Road and Mound Raod
2. 14 Mile Road and Hayes Road
3. 15 Mile Road and Mound Road
4. 15 Mile Road and Dodge Park Road
5. 15 Mile Road and Moravian Road
6. 15 Mile Road and Hayes Road
7. Metropolitan Parkway (16 Mile Road) and Mound Road
8. Metropolitan Parkway (16 Mile Road) and Schoenherr Road
9. Plumbrook Road and Utica
10. 18 Mile Road and Ryan Road
11. 18 Mile Road and Van Dyke

12. 18 ½ Mile Road and Old Van Dyke
13. 19 Mile Road and Old Van Dyke
14. 19 Mile Road and the M-53 overpass
15. 19 Mile Road and Schoenherr Road
16. Canal Road and Hayes Road
17. Utica Road and Old Van Dyke
18. M-59 and M-53

Section 5.0, Special Analysis of Critical Crash Locations, focuses on the 10 critical crash locations that meet all four critical crash location criteria.

TRANSIT DATA

The SMART bus routes within the City of Sterling Heights are represented in Figure 9. The North Macomb Time Point represents smaller buses that travel every few hours in locations spread throughout Macomb County; for example, Armada and Lakeside Mall. The Sterling Heights senior van allows seniors to schedule rides to-and-from doctor appointments.

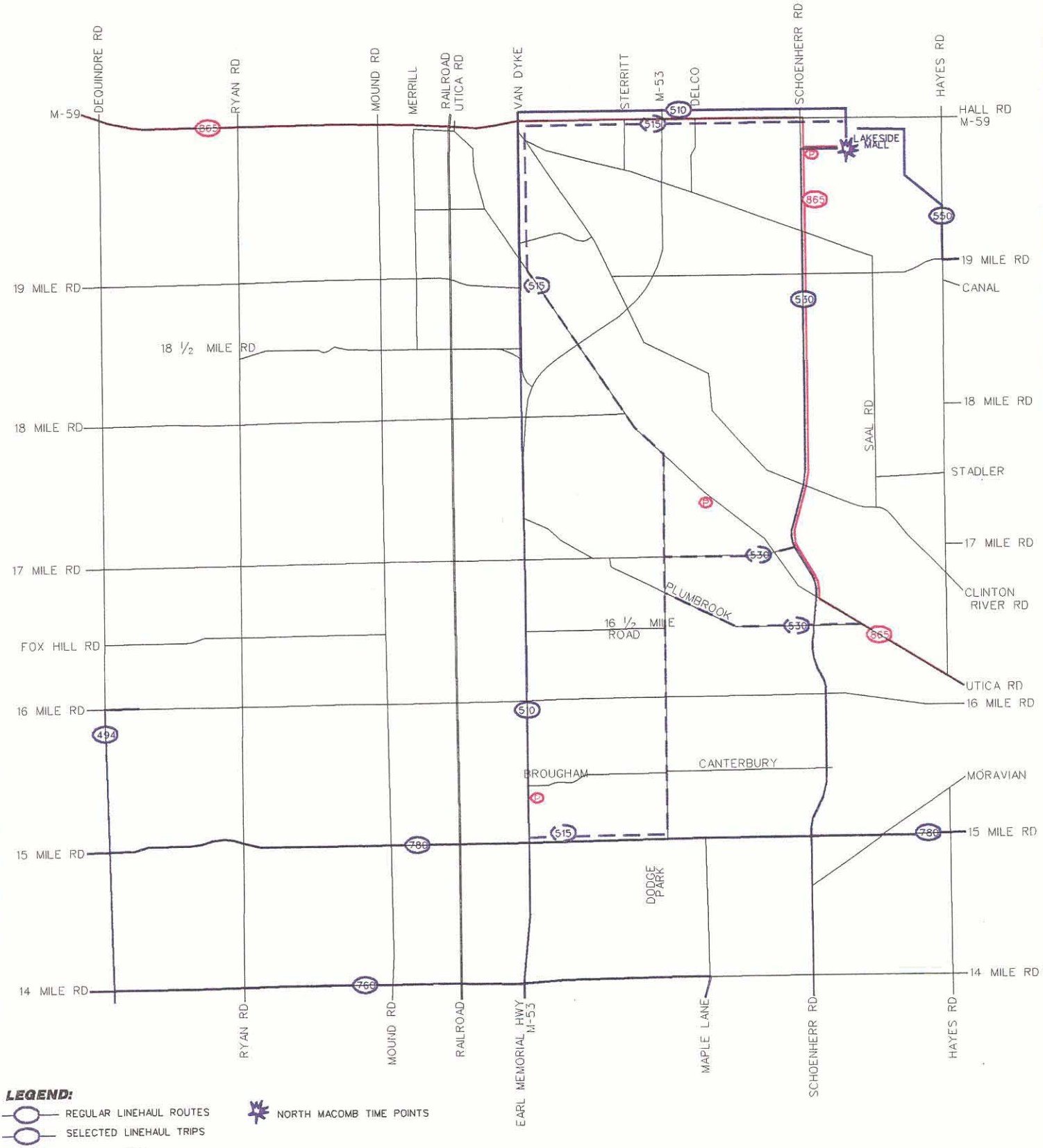


LEGEND:

- MEETS ALL 4 CRITICAL LOCATION CRITERIA
- MEETS AT LEAST 1 OF THE CRITICAL LOCATION CRITERIA

FIGURE 8

STERLING HEIGHTS MASTER ROAD PLAN UPDATE	PB 100 YEARS	**CRITICAL CRASH LOCATIONS BASED ON 1994-1996 CRASH DATA**	SCALE: NTS DATE: 3-27-98 PAGE: 35



LEGEND:

- REGULAR LINEHAUL ROUTES
- SELECTED LINEHAUL TRIPS
- PARK AND RIDE
- (P) PARK AND RIDE LOTS
- NORTH MACOMB TIME POINTS

FIGURE 9

STERLING HEIGHTS MASTER ROAD PLAN UPDATE	PB 100 YEARS	**SMART BUS ROUTES FOR THE CITY OF STERLING HEIGHTS SOURCE: SMART REGIONAL ROUTE MAP EFFECTIVE FEBRUARY 1997**	**SCALE:** NTS **DATE:** 3-27-98 **PAGE:** 36

$$$snapshot$$$

4.0 IDENTIFY ALTERNATIVES TO BE ANALYZED

This chapter will provide the programmed roadway improvements and the ranking process to be utilized.

PROGRAMMED ROADWAY IMPROVEMENTS

The following section provides the City of Sterling Heights programmed roadway capacity improvement projects from FY1996/97 through FY2000/01. The improvements are broken down by major roads, county roads, and state roads.

Presently Under Construction:
Major Roads
- None

County Roads
- None

State Highways
- M-59 (Hall Rd) - Dequindre to Delco Blvd.; Reconstruction to limited access highway

1998/99:
Major Roads
- 18 ½ Mile Road Bridge over Plumbrook Drain; Replace one lane bridge
- Ryan Road Bridge at 18 ½ Mile Road over Plumbrook Drain; Replace bridge

County Roads
- Dequindre Road - Metropolitan Parkway (16 Mile Road) to 17 Mile Road; Widening of Dequindre from 2 to 5 lanes
- Hayes Road - Utica Road north of 17 Mile Road; Widening from 2 to 5 lanes
- Hayes Road - north of 17 Mile Road to Canal Road; Widening from 2 to 5 lanes

State Highways
- None

1999/00:
Major Roads
- Ryan Road - south of 18 ½ Mile Road to Hall Road; Widening from 2 to 3 lanes

County Roads
- Dequindre Road - 17 Mile Road to 18 Mile Road; Widening from 2 to 5 lanes

State Highways
- None

2000/01:
Major Roads, County Roads, State Highways
- None

2001/02:
Major Roads
- None

County Roads
- Dequindre Road - 18 Mile Road to Hall Road; Widening from 2 to 5 lanes

State Highways
- None

2002/03:
Major Roads
- 17 Mile Road - Van Dyke Road to Utica Road; Widening from 3 to 5 lanes

County Roads
- None

State Highways
- None

Sources: City of Sterling Heights Municipal Improvement Program, dated January 1998; SEMCOG FY 1996-1998 Transportation Improvement Program for Southeast Michigan, dated April 1996

Figure 10 is a graphic representation of the number of lanes on major roadways within the City scheduled to occur by the year 2010.

RANKING PROCEDURE

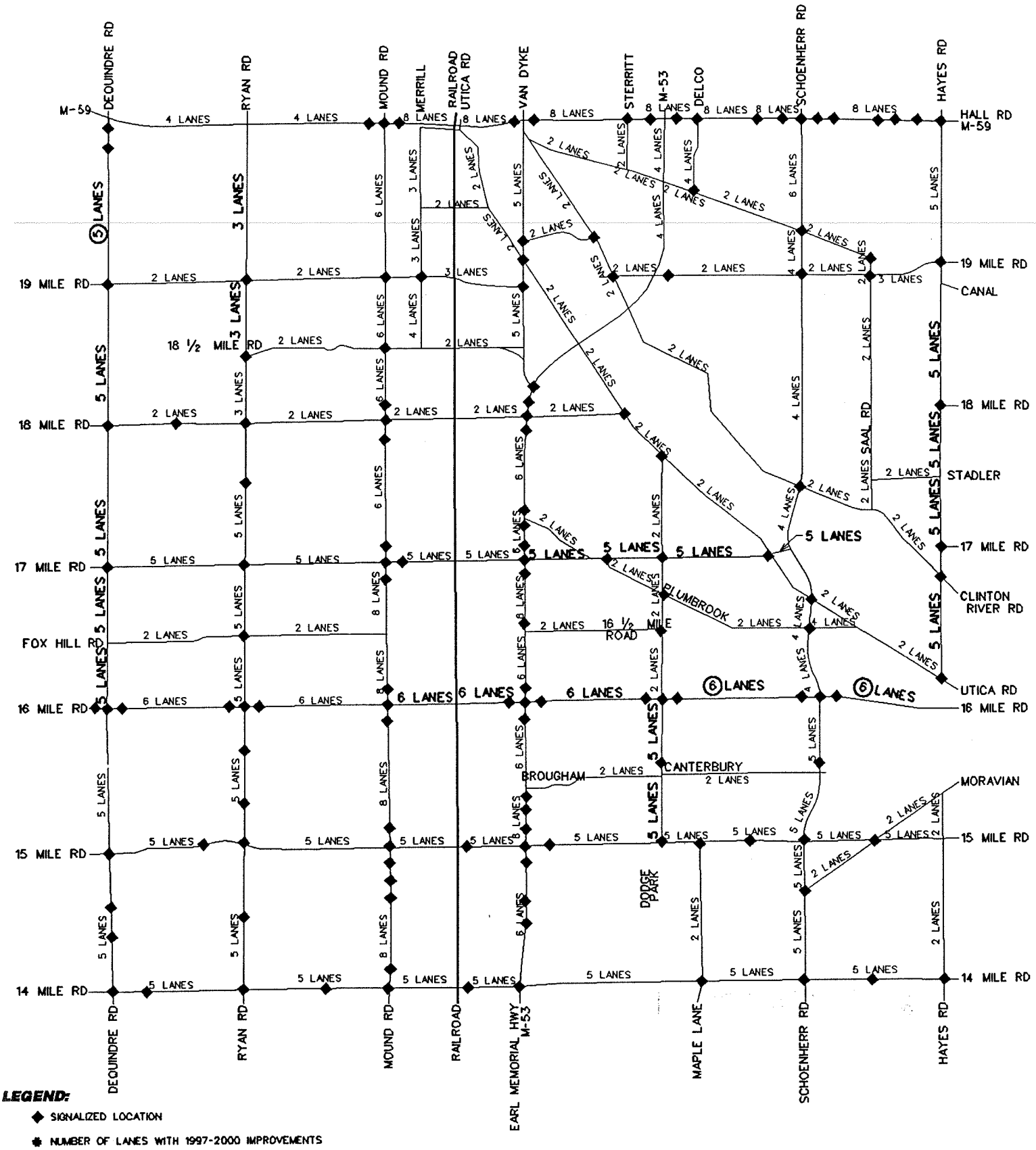
In order to develop a prioritized listing of proposed corridors for transportation improvement, a method of ranking is required that utilizes the various components that would be affected by the action. The Master Road Plan of 1980 contained a ranking procedure known as the Road Section Needs Score methodology. This ranking consisted of four parameters that were developed for each identified roadway segment in the City:

1. Traffic volumes
2. Levels of traffic service
3. Number of crashes
4. Crash rates

A point score (1-5) was determined for the different levels of each of the four parameters and a ranking was created based upon the point totals amassed for each identified roadway segment. This provided a prioritized listing of existing arterial roadways that required reconstruction. In keeping with previous work format, the following scoring format, as it relates to traffic volumes and levels of congestion is the first step in the review process.

Step 1: Review of Existing Traffic Volumes/Level of Service

Traffic Volumes (Existing):		Levels of Service(Existing):	
Vehicles/Day	Points	Level	Points
0 to 5,000	1	B or better	1
5,001 to 15,000	2	C	2
5,001 to 25,000	3	D	3
25,001 to 40,000	4	E	4
over 40,000	5	F	5



LEGEND:

- ◆ SIGNALIZED LOCATION
- ✱ NUMBER OF LANES WITH 1997-2000 IMPROVEMENTS
- ⑧ NUMBER OF LANES WITH 2001-2010 IMPROVEMENTS

FIGURE 10

STERLING HEIGHTS MASTER ROAD PLAN UPDATE	PB 100 YEARS	**FUTURE TOTAL NUMBER OF LANES**	SCALE: NTS DATE: 11-4-97 PAGE: 39

Step 2: Crash Review

Utilizing the crash data provided by SEMCOG, a review is made of the high crash intersections within the City. A crash rate summary is completed for the study intersections and points assessed on a corridor impact basis as follows:

Crash Rates (Existing)

Rates Per Million	Points
0.00 to 0.49	1
0.50 to 0.99	2
1.00 to 1.99	3
2.00 to 2.99	4
3.00 and over	5

Step 3: Additional Ranking Criteria (Preliminary Form)

Additional ranking criteria will be utilized based upon City concurrence. This additional criteria reflects the fiscal realities of transportation improvements. Cost estimates of proposed improvements are placed into the equation to ensure that low-cost improvements with significant needs are properly identified.

Project Estimated Cost

Estimated Cost	Points
greater than $3 million	1
$2 to 3 million	2
$1 to 2 million	3
$250k to $1 million	4
less than $250k	5

In addition to the areas stated above, other factors may dictate changes in the order in which projects are undertaken. Budgeting of projects with funding by other agencies, environmental clearances, private development participation, compatibility with City planning goals and public support are important facets of projects that must be brought to a successful conclusion prior to the progression of a design and construction phase. As the majority of these factors are either out of the control of the City or are subjective, an attempt to include these in the review process is not made as a part of this study.

Table 11 provides the ranking of the average daily traffic for the roadway segments, as well as providing the ranking of the daily level of service for the roadway segments based on Step 1. Table 7 (provided earlier on pages 23 through 25) provides the ranking of crashes by their corresponding crash rate based on Step 2.

Table 11--Existing Conditions Street Summary Information - Ranking of Roadway Segments by Average Daily Traffic and Level of Service

Street Segment	From	To	NB/EB ADT	SB/WB ADT	Total ADT	Combined *LOS	Ranking Tot.ADT	Ranking *LOS
Van Dyke/M-53	18 Mile	Plumbrook	46053	43233	89286	F	5	5
Van Dyke/M-53	M53 Split	18 Mile	38283	47279	85562	F	5	5
Van Dyke/M-53	Brougham	15 Mile	41452	41728	83180	F	5	5
Van Dyke/M-53	Plumbrook	17 Mile	32862	37368	70230	F	5	5
Van Dyke/M-53	16 1/2 Mile	16 Mile	36897	31154	68051	F	5	5
Van Dyke/M-53	15 Mile	14 Mile	30220	35594	65814	F	5	5
16 Mile	Mound	Van Dyke/M-53	25233	27184	52417	F	5	5
16 Mile	Dodge Park	Schoenherr	22480	24125	46605	F	5	5
Schoenherr	Clinton River	17 Mile	22001	22678	44679	F	5	5
16 Mile	Van Dyke/M-53	Dodge Park	22532	17788	40320	F	5	5
Hall/M-59	Ryan	Mound	30249	29493	59742	D	5	3
16 Mile	Ryan	Mound	23207	24541	47748	D	5	3
16 Mile	Dequindre	Ryan	23064	23335	46399	D	5	3
Van Dyke/M-53	Hall/M-59	M53 Split	25313	30973	56286	C	5	2
Mound	16 Mile	15 Mile	22373	27470	49843	B	5	1
Mound	15 Mile	14 Mile	25800	21494	47294	B	5	1
16 Mile	Schoenherr	Utica	18189	20533	38722	F	4	5
15 Mile	Van Dyke/M-53	Dodge Park	18411	17117	35528	F	4	5
15 Mile	Mound	Van Dyke/M-53	16598	17252	33850	F	4	5
Ryan	16 Mile	15 Mile	16220	16431	32651	F	4	5
Ryan	15 Mile	14 Mile	14068	17545	31613	F	4	5
Hayes	18 Mile	Stadler	12191	13205	25396	F	4	5
Dequindre	17 Mile	Fox Hill	12518	12850	25368	F	4	5
Dequindre	Fox Hill	16 Mile	12518	12850	25368	F	4	5
Schoenherr	Plumbrook	16 Mile	17411	20166	37577	E	4	4
15 Mile	Maple Lane	Schoenherr	15648	14135	29783	E	4	4
15 Mile	Dequindre	Ryan	13622	15750	29372	E	4	4
Old Van Dyke	Utica	19 Mile	11753	15995	27748	E	4	4
Old Van Dyke	18 1/2 Mile	M53 Split	10699	14677	25376	E	4	4
Schoenherr	Moravian	14 Mile	17093	20310	37403	D	4	3
Schoenherr	Utica	Plumbrook	14782	16839	31621	D	4	3
15 Mile	Ryan	Mound	14936	12162	27098	D	4	3
Schoenherr	Hall/M-59	Canal	18793	21047	39840	C	4	2
14 Mile	Maple Lane	Schoenherr	14791	18450	33241	C	4	2
14 Mile	Mound	Van Dyke/M-53	16284	15160	31444	C	4	2
14 Mile	Dequindre	Ryan	14873	14246	29119	C	4	2
Dequindre	15 Mile	14 Mile	14545	14031	28576	C	4	2
15 Mile	Schoenherr	Moravian	12903	13293	26196	C	4	2
Mound	18 Mile	17 Mile	15931	19830	35761	B	4	1
Mound	19 Mile	18 1/2 Mile	14217	17156	31373	B	4	1
14 Mile	Schoenherr	Hayes	15554	11831	27385	B	4	1
14 Mile	Ryan	Mound	13887	13331	27218	B	4	1

Table 11--Existing Conditions Street Summary Information - Ranking of Roadway Segments by Average Daily Traffic and Level of Service

Street Segment	From	To	NB/EB ADT	SB/WB ADT	Total ADT	Combined *LOS	Ranking Tot.ADT	Ranking *LOS
14 Mile	Van Dyke/M-53	Maple Lane	14072	11838	25910	B	4	1
Schoenherr	16 Mile	Canterbury	12517	13011	25528	B	4	1
Schoenherr	Canterbury	15 Mile	12517	13011	25528	B	4	1
Dequindre	16 Mile	15 Mile	12865	12495	25360	B	4	1
Mound	17 Mile	Fox Hill	18611	20320	38931	A	4	1
Mound	Fox Hill	16 Mile	18611	20320	38931	A	4	1
Mound	Hall/M-59	19 Mile	13812	12214	26026	A	4	1
Utica (N-S)	18 Mile	Dodge Park	11708	12377	24085	F	3	5
Hayes	Clinton River	Utica	11543	12475	24018	F	3	5
Utica (N-S)	Dodge Park	17 Mile	12719	11200	23919	F	3	5
Hayes	Canal	18 Mile	11998	11913	23911	F	3	5
Hayes	Stadler	17 Mile	11546	11789	23335	F	3	5
Dequindre	Hall/M-59	19 Mile	11883	11323	23206	F	3	5
Utica (N-S)	Plumbrook	Hayes	11009	11718	22727	F	3	5
Dequindre	19 Mile	18 Mile	10133	10211	20344	F	3	5
18 Mile	Mound	Van Dyke/M-53	11243	9009	20252	F	3	5
17 Mile	Van Dyke/M-53	Plumbrook	10203	9821	20024	F	3	5
Utica (N-S)	17 Mile	Schoenherr	8301	9928	18229	F	3	5
Maple Lane	15 Mile	14 Mile	9699	8107	17806	F	3	5
Dodge Park	16 1/2 Mile	16 Mile	7859	9166	17025	F	3	5
17 Mile	Utica	Schoenherr	8228	8784	17012	F	3	5
17 Mile	Dodge Park	Utica	7923	8432	16355	F	3	5
Moravian	15 Mile	Hayes	8059	7933	15992	F	3	5
19 Mile	Mound	Merrill	8614	7367	15981	F	3	5
19 Mile	Merrill	Old Van Dyke	8241	7573	15814	F	3	5
Riverland	Old Van Dyke	Clinton River	7391	8190	15581	F	3	5
Dequindre	18 Mile	17 Mile	9102	8797	17899	E	3	4
Old Van Dyke	19 Mile	18 1/2 Mile	10042	14034	24076	D	3	3
18 Mile	Ryan	Mound	8733	8263	16996	D	3	3
18 Mile	Dequindre	Ryan	8641	7876	16517	D	3	3
17 Mile	Ryan	Mound	12672	11859	24531	C	3	2
Ryan	18 Mile	17 Mile	12313	11013	23326	C	3	2
Old Van Dyke	Clinton River	Riverland	10525	11975	22500	C	3	2
Hayes	Hall/M-59	19 Mile	10669	10895	21564	C	3	2
15 Mile	Moravian	Hayes	10730	10282	21012	B	3	1
Ryan	17 Mile	Fox Hill	10796	9819	20615	B	3	1
Ryan	Fox Hill	16 Mile	10796	9819	20615	B	3	1
17 Mile	Mound	Van Dyke/M-53	9928	8706	18634	B	3	1
17 Mile	Dequindre	Ryan	8853	9397	18250	A	3	1
Saal	Canal	19 Mile	8876	5483	14359	F	2	5
Canal (E-W)	Schoenherr	Saal	6346	7865	14211	F	2	5
Ryan	Hall/M-59	19 Mile	7586	6443	14029	E	2	4

Table 11--Existing Conditions Street Summary Information - Ranking of Roadway Segments by Average Daily Traffic and Level of Service

Street Segment	From	To	NB/EB ADT	SB/WB ADT	Total ADT	Combined *LOS	Ranking Tot.ADT	Ranking *LOS
19 Mile	Schoenherr	Saal	7754	6135	13889	E	2	4
Canal (E-W)	Delco	Schoenherr	6938	6901	13839	E	2	4
Ryan	19 Mile	18 1/2 Mile	6886	6830	13716	E	2	4
Dodge Park	16 Mile	Canterbury	6596	6742	13338	D	2	3
Dodge Park	Brougham	15 Mile	6596	6742	13338	D	2	3
Moravian	Schoenherr	15 Mile	5755	5883	11638	C	2	2
Utica (N-S)	Old Van Dyke	18 Mile	5827	5605	11432	C	2	2
Clinton River (N-S)	Saal	Hayes	5297	5502	10799	C	2	2
Utica (N-S)	19 1/2 Mile	Old Van Dyke	3808	4676	8484	C	2	2
Sterritt	Hall/M-59	Canal	4579	3236	7815	C	2	2
18 Mile	Van Dyke/M-53	Utica	6289	5571	11860	B	2	1
19 Mile	Dequindre	Ryan	4811	5259	10070	B	2	1
19 Mile	Clinton River	Schoenherr	4391	5117	9508	B	2	1
Plumbrook	Dodge Park	Schoenherr	4696	4268	8964	B	2	1
Schoenherr	19 Mile	Clinton River	5974	7372	13346	A	2	1
19 Mile	Ryan	Mound	4285	3933	8218	A	2	1
Dodge Park	Utica	17 Mile	3418	3416	6834	A	2	1
Delco	Hall/M-59	Canal	3781	2567	6348	A	2	1
Saal	19 Mile	Stadler	3257	2942	6199	A	2	1
Clinton River (N-S)	19 Mile	Schoenherr	2914	2864	5778	A	2	1
Merrill	19 1/2 Mile	19 Mile	3022	2700	5722	A	2	1
Plumbrook	17 Mile	Dodge Park	3033	2212	5245	A	2	1
19 1/2 Mile	Merrill	Utica	3288	1940	5228	A	2	1
18 1/2 Mile	Merrill	Old Van Dyke	2466	2448	4914	A	1	1
16 1/2 Mile	Van Dyke/M-53	Dodge Park	2633	1850	4483	A	1	1
Utica (N-S)	M-59	19 1/2 Mile	1244	3045	4289	A	1	1
Canterbury	Dodge Park	Schoenherr	2014	2091	4105	A	1	1
Merrill	Hall/M-59	19 1/2 Mile	2379	1543	3922	A	1	1
Clinton River (N-S)	Canal	Riverland	2042	1815	3857	A	1	1
Fox Hill	Dequindre	Ryan	1944	1767	3711	A	1	1
Fox Hill	Ryan	Mound	1815	1825	3640	A	1	1
Hayes	15 Mile	14 Mile	1912	1486	3398	A	1	1
Plumbrook	Van Dyke/M-53	17 Mile	1154	1929	3083	A	1	1
Canal (E-W)	Clinton River	Sterritt	1383	1220	2603	A	1	1
Stadler	Saal	Hayes	1208	1313	2521	A	1	1
Brougham	Van Dyke/M-53	Dodge Park	1114	1254	2368	A	1	1
Hayes	Moravian	15 Mile	943	560	1503	A	1	1
18 1/2 Mile	Ryan	Mound	307	899	1206	A	1	1

*LOS = Level of Service

5.0 SPECIAL ANALYSIS OF CRITICAL CRASH LOCATIONS

Based on the reported crashes in the existing conditions section of this report, there were intersections identified as critical crash locations. This chapter addresses each of the locations identified and a possible solution.

The Sterling Heights Police Department provided a table detailing the types of crashes at each of the ten locations that met all four of the critical crash location criteria. These tables can be found in Appendix C of this report. The ten intersections that meet all four of the critical crash location criteria are as follows: 14 Mile Road and Ryan Road, 14 Mile Road and Van Dyke, 14 Mile Road and Schoenherr Road, 15 Mile Road and Ryan Road, 15 Mile Road and Schoenherr Road, Metropolitan Parkway (16 Mile Road) and Van Dyke, 17 Mile Road and Ryan Road, 19 Mile Road and Hayes Road, Riverland Drive and Old Van Dyke, and M-59 and Schoenherr Road. Individual crash reports (UD-10's) were not provided for each of these 10 intersections, but a summary detailing the types of crashes at each intersection was provided. Some of the intersections that are located on the border of Sterling Heights, did not have all the crashes that were reported by SEMCOG, provided by the Sterling Heights Police Department. This is due to the split jurisdiction of these intersections. This means that at these locations, unless the Sterling Heights Police Department reported the crash, they do not have the crash reports that different jurisdictions reported. The summaries provided only contained crashes that the Sterling Heights Police Department reported; usually the summaries are from only two of the four legs of the intersection.

In the SEMCOG *Traffic Safety Manual,* TSM, (Second Edition) from September 1997, SEMCOG studied several commonly recurring crash patterns and their typical causes. The analysis of the ten City of Sterling Heights critical crash locations examined the percentage of multiple-vehicle, single vehicle, and other type crash patterns. The types of multiple vehicle crash patterns include head on and sideswipe opposite direction, head on left and rear-end left, angle, rear-end left and sideswipe same direction.

Using Table 4-1 from the SEMCOG TSM, the crash pattern percentage from each location was then compared to the average crash pattern percentage found in Southeastern Michigan. Table 4-1, found in Appendix C, details the crash percentages at intersections by crash types, based upon the average daily traffic volume entering the intersection.

On the following pages, each of the ten Sterling Heights critical crash intersections are listed with the type of crash, number of crashes, and percentage of crash types based on volume for the years 1995 through 1997. If the crash pattern percentage for the intersection was found to be higher than that of the average for Southeastern Michigan, the crash type was highlighted. After determining the type of crash(s) that are above average, the possible cause can be determined. To determine the cause of the crash, background information for each intersection was listed, including the signalization, the number of lanes and any other pertinent. The Sterling Heights Police Department was contacted to discuss each of the ten intersections and help determine the cause of the high crash type percentage. Through this analysis, a mitigation strategy was determined for each intersection. The mitigation strategy is a possible solution to the cause of the high crash type percentage. The mitigation strategy can be found on the bottom of each intersection page.

Metropolitan Parkway and Van Dyke				
Crash Type	**1995**	**1996**	**1997**	**Total**
		114,419	**vehicles per day**	
Single Vehicle	3	6	9	18
Head On	1	1	0	2
Head On Left Turn	0	0	0	0
Angle	56	31	24	111
Rear End	64	97	80	241
Rear End Left Turn	0	0	0	0
Rear End Right Turn	0	4	1	5
Side Swipe Same (SS Same)	16	19	23	58
Side Swipe Opposite (SS Opp)	2	0	3	5
Other	0	0	1	1
Total Crashes	142	158	141	441
Crash Rate	3.40	3.78	3.38	3.52
Single Vehicle %	2.11%	3.80%	6.38%	4.08%
Head On / SS Opp %	2.11%	0.63%	2.13%	1.59%
Head On Left / Rear End Left %	0.00%	0.00%	0.00%	0.00%
Angle %	39.44%	19.62%	17.02%	25.17%
SS Same/ Rear End / Rear End Right %	56.34%	75.95%	73.76%	68.93%
Other %	0.00%	0.00%	0.71%	0.23%

Source: Sterling Heights Police Department

Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	SS Same/RE RE Right	Angle
Excessive Speed	x	x
Restricted Sight Distance		x
Slippery Surface	x	x
Narrow Lanes	x	
Inadequate Signal Change Interval		x
Turning Vehicles Slowing or Stopping	x	
Unexpected Slowing or lane changing	x	
Crossing Pedestrians	x	
Poor Visibility	x	x
Unexpected/Unnecessary Stops Due to signal	x	x
Unsafe Right Turns on Red	x	x
Proper Stopping Position unclear		x

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background information: In the summer of 1997, Metropolitan Parkway was widened through the intersection. The number of sideswipe same/rear end and rear end right turn crashes are very high. This may be due to the bridge on Metropolitan Parkway to the west of this intersection. The location and elevation of the bridge may cause some sight distance problems for drivers approaching the intersection from the west. Drivers approaching the intersection from the west may be unable to see any kind of backup from the intersection. This type of sight distance problem could explain the high percentage of SS same/rear end/rear end right turn crashes.

Mitigation Strategies: Because of the recent change in laneage for Metropolitan Parkway through this intersection, any immediate change could further confuse the driver. If the problem persists then perhaps a warning sign should be placed on the bridge for eastbound travelers indicating that there are vehicles stopped ahead or they should prepare to stop.

14 Mile and Van Dyke				
Crash Type	**1995**	**1996**	**1997**	**Total**
		94,491	**vehicles per day**	
Single Vehicle	4	2	1	7
Head On	0	0	0	0
Head On Left Turn	3	4	1	8
Angle	14	10	6	30
Rear End	18	19	21	58
Rear End Left Turn	0	1	0	1
Rear End Right Turn	0	0	0	0
Side Swipe Same (SS Same)	2	5	4	11
Side Swipe Opposite (SS Opp)	0	1	0	1
Other	0	0	0	0
Total Crashes	41	42	33	116
Crash Rate	1.19	1.22	0.96	1.12
Single Vehicle %	9.76%	4.76%	3.03%	6.03%
Head On / SS Opp %	0.00%	2.38%	0.00%	0.86%
Head On Left / Rear End Left %	7.32%	11.90%	3.03%	8.76%
Angle %	34.15%	23.81%	18.18%	25.86%
SS Same/ Rear End / Rear End Right %	48.78%	57.14%	75.76%	59.48%
Other %	0.00%	0.00%	0.00%	0.00%

Source: Sterling Heights Police Department

Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	Head-On Left Rear End Left	Angle
Excessive Speed	x	x
Restricted Sight Distance	x	x
Slippery Surface		x
Inadequate Signal Change Interval	x	x
Poor Visibility		x
Unexpected/Unnecessary Stops Due to signal		x
Unsafe Right Turns on Red		x
Proper Stopping Position unclear		x
Inadequate Gaps in Oncoming Traffic	x	
Inadequate Signalization for Left Turn Volume	x	

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has split jurisdiction with the City of Warren; this data only represents two of the four legs of the intersection. Van Dyke is a seven lane pavement and 14 Mile Road is a five lane pavement in the vicinity of the intersection. There is a high percentage of head on left turn and rear end right turn crashes at this location. 14 Mile Road has a left turn phase of 11 seconds in the peak hour and has a 5 second amber phase for the left turning traffic. The number of angle crashes is also very high for this intersection. In speaking with the Sterling Heights Police Department, they stated a large number of crashes occur where drivers from 14 Mile Road are turning left and are either hit by a driver from Van Dyke (angle crash) or a driver from 14 Mile Road (head on left turn crash).

Mitigation Strategy: An immediate solution may be to increase the amount of time of the left turn phase. A longer term solution, and the suggested strategy, would be to turn Van Dyke into a boulevard in that section and convert the direct lefts at the intersection into Michigan indirect lefts. This change would decrease the amount of crashes and shift the number of head on left turn crashes to rear end crashes, which are less severe.

14 Mile and Schoenherr				
Crash Type	**1995**	**1996**	**1997**	**Total**
		70,644	vehicles per day	
Single Vehicle	0	1	1	2
Head On	3	0	0	3
Head On Left Turn	4	9	1	14
Angle	16	8	14	38
Rear End	12	13	9	34
Rear End Left Turn	0	0	0	0
Rear End Right Turn	1	0	1	2
Side Swipe Same	1	4	0	5
Side Swipe Opposite	1	0	0	1
Other	0	0	0	0
Total Crashes	38	35	26	99
Single Vehicle %	0.00%	2.86%	3.85%	2.02%
Head On / SS Opp %	10.53%	0.00%	0.00%	4.04%
Head On Left / Rear End Left %	10.53%	25.71%	3.85%	14.14%
Angle %	42.11%	22.86%	53.85%	38.38%
SS Same/ Rear End / Rear End Right %	36.84%	48.57%	38.46%	41.41%
Other %	0.00%	0.00%	0.00%	0.00%

Source: Sterling Heights Police Department
Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	Head-On Left Rear End Left	Angle
Excessive Speed	x	x
Restricted Sight Distance	x	x
Slippery Surface		x
Inadequate Signal Change Interval	x	x
Poor Visibility		x
Unexpected/Unnecessary Stops Due to signal		x
Unsafe Right Turns on Red		x
Proper Stopping Position unclear		x
Inadequate Gaps in Oncoming Traffic	x	
Inadequate Signalization for Left Turn Volume	x	

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has split jurisdiction with the City of Warren; this data only represents two of the four legs of the intersection. There is left turn phasing for both north/south and east/west legs of the intersection. The angle crash percentage is high as well as the head on left turn/rear end left turn crash percentage. There are three gas stations adjacent to the intersection. In a conversation with the Sterling Heights Police Department, it was discussed that the number of driveways from the gas stations may be causing the angle crashes. The left turn phase for both Schoenherr Road and 14 Mile Road is approximately 10% of the cycle length.

Mitigation Strategies: Eliminate left turning movements from the gas stations adjacent to the intersection. Increase the amount of time for left turn movements during the left turn phase. Prohibiting left turning movements from the adjacent properties becomes an enforcement issue if implemented.

14 Mile and Ryan				
Crash Type	1995	1996	1997	Total
		58,831	vehicles per day	
Single Vehicle	0	1	0	1
Head On	0	0	0	0
Head On Left Turn	2	7	1	10
Angle	25	13	8	46
Rear End	14	16	8	38
Rear End Left Turn	1	2	0	3
Rear End Right Turn	0	1	0	1
Side Swipe Same (SS Same)	2	3	2	7
Side Swipe Opposite (SS Opp)	2	1	1	4
Other	1	0	0	1
Total Crashes	47	44	20	111
Single Vehicle %	0.00%	2.27%	0.00%	0.90%
Head On / SS Opp %	4.26%	2.27%	5.00%	3.60%
Head On Left / Rear End Left %	6.38%	20.45%	5.00%	11.71%
Angle %	53.19%	29.55%	40.00%	41.44%
SS Same/ Rear End / Rear End Right %	34.04%	45.45%	50.00%	41.44%
Other %	2.13%	0.00%	0.00%	0.90%

Source: Sterling Heights Police Department

Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	Head-On Left Rear End Left	Angle
Excessive Speed	x	x
Restricted Sight Distance	x	x
Slippery Surface		x
Inadequate Signal Change Interval	x	x
Poor Visibility		x
Unexpected/Unnecessary Stops Due to signal		x
Unsafe Right Turns on Red		x
Proper Stopping Position unclear		x
Inadequate Gaps in Oncoming Traffic	x	
Inadequate Signalization for Left Turn Volume	x	

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has split jurisdiction with the City of Warren; this data only represents two of the four legs of the intersection. This intersection has a 130 second cycle length during the peak hour. There is left turn phasing for both 14 Mile Road and Ryan Road, which is approximately 8 seconds and 8.8 seconds respectively. There is a high percentage of angle crashes and head on left/rear end left turn crashes at this location.

Mitigation Strategies: Adjust the left turn phasing to allow more time for left turning traffic on 14 Mile Road and Ryan Road.

17 Mile and Ryan				
Crash Type	**1995**	**1996**	**1997**	**Total**
		35,630	**vehicles per day**	
Single Vehicle	1	1	0	2
Head On	0	0	0	0
Head On Left Turn	5	10	6	21
Angle	22	8	10	40
Rear End	8	15	9	32
Rear End Left Turn	0	2	0	2
Rear End Right Turn	1	0	0	1
Side Swipe Same	1	2	5	8
Side Swipe Opposite	0	2	0	2
Other	0	0	1	1
Total Crashes	38	40	31	109
Crash Rate	2.92	3.08	2.38	2.79
Single Vehicle %	2.63%	2.50%	0.00%	1.83%
Head On / SS Opp %	0.00%	5.00%	0.00%	1.83%
Head On Left / Rear End Left %	13.16%	30.00%	19.35%	21.10%
Angle %	57.89%	20.00%	32.26%	36.70%
SS Same/ Rear End / Rear End Right %	26.32%	42.50%	45.16%	37.61%
Other %	0.00%	0.00%	3.23%	0.92%

Source: Sterling Heights Police Department
Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	Head-On Left Rear End Left	Angle
Excessive Speed	x	x
Restricted Sight Distance	x	x
Slippery Surface		x
Inadequate Signal Change Interval	x	x
Poor Visibility		x
Unexpected/Unnecessary Stops Due to signal		x
Unsafe Right Turns on Red		x
Proper Stopping Position unclear		x
Inadequate Gaps in Oncoming Traffic	x	
Inadequate Signalization for Left Turn Volume	x	

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has a 80 second cycle length and does not have a left turn phase for either street. Ryan Road and 17 Mile Road are both five lane sections at the intersection. There are not any sight distance problems at this intersection.

Mitigation Strategies: Due to the high percentage of left turn head on crashes, rear end left turn crashes and angle crashes, left turn phasing for both streets is recommended. The intersection is geometrically adequate for left turn phasing with left turn lanes in all directions.

19 Mile and Hayes				
Crash Type	1995	1996	1997	Total
		35,453	vehicles per day	
Single Vehicle	0	1	0	1
Head On	0	0	0	0
Head On Left Turn	4	2	2	8
Angle	12	8	1	21
Rear End (RE)	5	10	9	24
Rear End Left Turn	0	0	0	0
Rear End Right Turn (RE Right)	0	0	1	1
Side Swipe Same (SS Same)	0	1	2	3
Side Swipe Opposite (SS Opp)	0	1	0	1
Other	0	0	0	0
Total Crashes	21	23	15	59
Crash Rate	1.62	1.78	1.16	1.52
Single Vehicle %	0.00%	4.35%	0.00%	1.69%
Head On / SS Opp %	0.00%	4.35%	0.00%	1.69%
Head On Left / Rear End Left %	19.05%	8.70%	13.33%	15.25%
Angle %	57.14%	34.78%	6.67%	35.59%
SS Same/ Rear End / Rear End Right %	23.81%	47.83%	80.00%	47.46%
Other %	0.00%	0.00%	0.00%	0.00%

Source: Sterling Heights Police Department
Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	SS Same/RE RE Right	Angle	Head-On Left Rear End Left
Excessive Speed	x	x	x
Restricted Sight Distance		x	x
Slippery Surface	x	x	
Inadequate Signal Change Interval		x	x
Poor Visibility	x	x	
Unexpected/Unnecessary Stops due to signal	x	x	
Unsafe Right Turns on Red	x	x	
Proper Stopping Position unclear		x	
Inadequate Gaps in oncoming traffic			x
Inadequate Signalization for Left Turn Volume			x
Narrow Lanes	x		
Turning vehicles slowing or stopping	x		
Unexpected slowing or lane changing	x		
Crossing Pedestrians	x		

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has split jurisdiction with Clinton Township; this data only represents two of the four legs of the intersection. This intersection has an 80 second cycle length and Hayes Road has a left turn phase. This intersection is scheduled to have a left turn phase for 19 Mile Road added to the signal this summer.

Mitigation Strategy: Wait three years and perform another crash analysis. The first year after the installation may cause confusion to the drivers and crashes may go up at this intersection. The following two years will give sufficient information to determine whether a problem still exists at this intersection.

Riverland and Van Dyke				
Crash Type	1995	1996	1997	Total
		30,690	vehicles per day	
Single Vehicle	1	4	0	5
Head On	0	0	0	0
Head On Left Turn	7	8	11	26
Angle	27	15	13	55
Rear End	15	11	11	37
Rear End Left Turn	2	1	1	4
Rear End Right Turn	0	0	1	1
Side Swipe Same (SS Same)	4	2	2	8
Side Swipe Opposite (SS Opp)	1	2	1	4
Other	1	0	0	1
Total Crashes	58	43	40	141
Crash Rate	5.18	3.84	3.57	4.20
Single Vehicle %	1.72%	9.30%	0.00%	3.55%
Head On / SS Opp %	1.72%	4.65%	2.50%	2.84%
Head On Left / Rear End Left %	15.52%	20.93%	30.00%	21.28%
Angle %	46.55%	34.88%	32.50%	39.01%
SS Same/ Rear End / Rear End Right %	32.76%	30.23%	35.00%	32.62%
Other %	1.72%	0.00%	0.00%	0.71%

Source: Sterling Heights Police Department

Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	Head-On Left Rear End Left	Angle
Excessive Speed	x	x
Restricted Sight Distance	x	x
Slippery Surface		x
Inadequate Signal Change Interval	x	x
Poor Visibility		x
Unexpected/Unnecessary Stops Due to signal		x
Unsafe Right Turns on Red		x
Proper Stopping Position unclear		x
Inadequate Gaps in Oncoming Traffic	x	
Inadequate Signalization for Left Turn Volume	x	

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has a 90 second cycle length during the peak hour, and does not have left turn phasing for either Riverland Drive or Van Dyke. There is a high percentage of head on left turn crashes and angle crashes at this location. In speaking with the Sterling Heights Police Department, they stated that left turn phasing was not an option due to the limited capacity of Riverland Drive. The Riverland Drive bridge will be rebuilt, however, additional capacity will not be provided.

Mitigation Strategies: After the rebuild of the bridge on Riverland Drive, left turn phasing should be incorporated for this signal for southbound Van Dyke to Riverland Drive. The signal timing at Van Dyke at Riverland Drive and Riverland Drive at Clinton River should be coordinated to ensure that traffic does not queue on Riverland Drive. The signal timing may need to be increased to match the majority of the City signals, which is around 120 seconds during the peak hour. Once the left turn phasing has been added, right turn on red should be prohibited during the peak hour to reduce the number of angle crashes.

Hall Road and Schoenherr				
Crash Type	1995	1996	1997	Total
		99,582	vehicles per day	
Single Vehicle	1	1	1	3
Head On	1	0	0	1
Head On Left Turn	0	0	0	0
Angle	6	18	11	35
Rear End (RE)	12	24	27	63
Rear End Left Turn	0	0	0	0
Rear End Right Turn (RE Right)	2	1	0	3
Side Swipe Same (SS Same)	6	10	7	23
Side Swipe Opposite (SS Opp)	0	0	0	0
Other	2	1	0	3
Total Crashes	30	55	46	131
Single Vehicle %	3.33%	1.82%	2.17%	2.29%
Head On / SS Opp %	3.33%	0.00%	0.00%	0.76%
Head On Left / Rear End Left %	0.00%	0.00%	0.00%	0.00%
Angle %	20.00%	32.73%	23.91%	26.72%
SS Same/ Rear End / Rear End Right %	66.67%	62.64%	73.91%	67.94%
Other %	6.67%	1.82%	0.00%	2.29%

Source: Sterling Heights Police Department

Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	SS Same/RE RE Right	Angle
Excessive Speed	x	x
Restricted Sight Distance		x
Slippery Surface	x	x
Narrow Lanes	x	
Inadequate Signal Change Interval		x
Turning Vehicles Slowing or Stopping	x	
Unexpected Slowing or lane changing	x	
Crossing Pedestrians	x	
Poor Visibility	x	x
Unexpected/Unnecessary Stops Due to signal	x	x
Unsafe Right Turns on Red	x	x
Proper Stopping Position unclear		x

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has split jurisdiction with the City of Utica and Shelby Township; this data only represents two of the four legs of the intersection. Because Hall Road and Schoenherr Road are boulevards through this intersection, it actually makes it four different intersections. Hall Road has dual right turn lanes for both directions onto Schoenherr Road. Northbound Schoenherr Road at the intersection has a right turn only lane, a shared through/right turn lane and two through lanes. Schoenherr Road north of the intersection narrows to a two lane road. There is a very high percentage of side-swipe same, rear end and rear end right turn crashes at this location. These crashes may be due to the dual right turn lanes and the narrowing of Schoenherr Road north of the intersection; a closer look at the UD-10's for this intersection would determine this. Schoenherr Road from Hall Road to 21 1/2 Road is scheduled to be widened to 5 lanes from the years 2001-2005.

Mitigation Strategies: Painting radius curves for the dual right lanes on Hall Road and northbound Schoenherr Road so vehicles can track the turn; this will help eliminate side swipe same crashes. The widening of Schoenherr Road north of the intersection will also help to eliminate side swipe same crashes.

15 Mile and Ryan				
Crash Type	1995	1996	1997	Total
		59,848	vehicles per day	
Single Vehicle	1	3	2	6
Head On	0	1	1	2
Head On Left Turn	4	8	5	17
Angle	34	34	15	83
Rear End	21	20	16	57
Rear End Left Turn	1	0	2	3
Rear End Right Turn	1	2	0	3
Side Swipe Same (SS Same)	2	11	4	17
Side Swipe Opposite (SS Opp)	1	3	1	5
Other	1	1	2	4
Total Crashes	66	83	48	197
Crash Rate	3.02	3.80	2.20	3.01
Single Vehicle %	1.52%	3.61%	4.17%	3.05%
Head On / SS Opp %	1.52%	4.82%	4.17%	3.55%
Head On Left / Rear End Left %	7.58%	9.64%	3.58%	10.15%
Angle %	51.52%	40.96%	31.25%	42.13%
SS Same/ Rear End / Rear End Right %	36.36%	39.76%	41.67%	39.09%
Other %	1.52%	1.20%	4.17%	2.03%

Source: Sterling Heights Police Department
Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	Head-On Left Rear End Left	Angle
Excessive Speed	x	x
Restricted Sight Distance	x	x
Slippery Surface		x
Inadequate Signal Change Interval	x	x
Poor Visibility		x
Unexpected/Unnecessary Stops Due to signal		x
Unsafe Right Turns on Red		x
Proper Stopping Position unclear		x
Inadequate Gaps in Oncoming Traffic	x	
Inadequate Signalization for Left Turn Volume	x	

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has a left turn phase for each leg of the intersection. Ryan Road has approximately an 8 second left turn phase and 15 Mile Road has 10.8 seconds in the morning and 18.8 seconds in the evening for the left turn phase. There are two gas stations and a Boston Market adjacent to the intersection. There is a high percentage of angle crashes and head on left turn crashes. In speaking with the Sterling Heights Police Department, the major conflicts causing angle crashes are the gas station driveways and the Boston Market driveways.

Mitigation Strategies: Increase the amount of time for left turn phases. Prohibit left turn movements from the driveways surrounding the intersection. This would become an enforcement issue if implemented.

15 Mile and Schoenherr				
Crash Type	**1995**	**1996**	**1997**	**Total**
		55,311	**vehicles per day**	
Single Vehicle	4	4	0	8
Head On	1	0	0	1
Head On Left Turn	6	14	6	26
Angle	28	40	10	78
Rear End	31	43	9	83
Rear End Left Turn	0	0	0	0
Rear End Right Turn	1	0	0	1
Side Swipe Same (SS Same)	7	5	5	17
Side Swipe Opposite (SS Opp)	2	4	0	6
Other	1	1	1	3
Total Crashes	81	111	31	223
Crash Rate	4.01	5.50	1.54	3.68
Single Vehicle %	4.94%	3.60%	0.00%	3.59%
Head On / SS Opp %	3.70%	3.60%	0.00%	3.14%
Head On Left / Rear End Left %	7.41%	12.61%	19.35%	11.66%
Angle %	34.57%	36.04%	32.26%	34.98%
SS Same/ Rear End / Rear End Right %	48.15%	43.24%	45.16%	45.29%
Other %	1.23%	0.90%	3.23%	1.35%

Source: Sterling Heights Police Department

Shaded Areas indicate that percentage is higher than SEMCOG's Regional Crash Percentages at Intersections by Crash Types and Area Type

Possible Cause	Head-On Left Rear End Left	Angle
Excessive Speed	x	x
Restricted Sight Distance	x	x
Slippery Surface		x
Inadequate Signal Change Interval	x	x
Poor Visibility		x
Unexpected/Unnecessary Stops Due to signal		x
Unsafe Right Turns on Red		x
Proper Stopping Position unclear		x
Inadequate Gaps in Oncoming Traffic	x	
Inadequate Signalization for Left Turn Volume	x	

Source: SEMCOG Traffic Safety Manual (Second Edition) September, 1997

Background Information: This intersection has left turn phasing for both north/south and east/west legs of the intersection. The left turn phase is a leading phase, which means it precedes the through movement for that leg of the intersection. The left turn phases are approximately 10% of the cycle length for each road. In speaking with the Sterling Heights Police Department, the major problem is confusion of the drivers due to the leading left turn phase. They stated that within the last year, the confusion seemed to diminish, which shows in the number of crashes in 1997 (31 crashes).

Mitigation Strategies: Perform annual reviews of crash reports at this intersection over the next three years and determine if the problem still exists. If the problem reappears, then an crash analysis should be conducted on this intersection to determine the source of the problem.

6.0 FUTURE YEAR 2020 ALTERNATIVES ANALYSIS

This chapter will cover the future year 2020 alternatives analysis to determine the recommended 1998 Sterling Heights Master Road Plan. The chapter will be broken into several sections to describe the analysis. The sections include the individual alternatives analyzed, the combination of alternatives analyzed, the cost of the improvements analyzed, the ranking of alternatives, and the recommended 1998 Sterling Heights Master Road Plan.

It should be noted that although M-59 is currently under construction, it was analyzed as being fully functional in all alternatives. The results are reflective of all improvements that are to be made to M-59 when it is complete.

INDIVIDUAL ALTERNATIVES ANALYZED

Based on existing deficiencies within the City of Sterling Heights, as well as deficiencies that are expected to occur by the year 2020, a list of alternatives was developed. This list was prepared by the consultant based solely on existing and potential traffic deficiencies. These ideas were presented at a Traffic Advisory Committee (TAC) meeting. Monthly meetings were held with the TAC not only to obtain input, but as a review process as well. The TAC held a Public Informational Meeting to solicit additional problems and possible solutions from the City of Sterling Heights residents. The TAC and the public provided a few other alternatives to analyze.

These deficiencies were determined using the standard tools of transportation planners, vehicle-hours-of-travel and vehicle-miles-of-travel. Vehicle-miles-of-travel are summarized as the number of vehicles on a roadway segment multiplied by the length of that segment. Vehicle-miles-of-travel usually increase as roadways are widened. As roadways are widened they do attract more vehicles as their capacity increases. However the flow of traffic improves with the additional capacity. The vehicle-hours-of-travel are the number of vehicles on a roadway segment and the total accumulated time the vehicles spent on that segment. Based on the origins and destinations of the vehicles in the system, the model keeps track of the vehicle-hours- and vehicle-miles-of-travel for each link and for the entire network. It is hopeful that even if the vehicle-miles-of-travel may increase that the vehicle-hours-of-travel will not increase at the same rate, otherwise the alternative does not reduce congestion. Summaries were performed on the congested links vehicle-hours-of-travel to see if the delay was reduced on the congested links or roadway segments in the transportation network.

The initial list of 15 alternatives were tested using SEMCOG's TRANPLAN model of the seven county area of southeast Michigan for the year 2020. TRANPLAN is an integrated suite of programs for forecasting the impacts of alternative land use scenarios and/or transportation networks. It is used as a travel demand forecasting software which forecasts future year volumes. Existing socio-economic data (number of households, number of employees, etc.), number and type of trips which are generated by each type of land use based on trip generation rates, conducting trip diaries, and travel patterns make up the base year (1995) TRANPLAN model. A comprehensive Household Travel Survey was conducted for about 7,000 households in 1994, with the intention of incorporating the latest regional travel patterns and characteristics into the model refinement process. TRANPLAN then utilizes future socio-economic data, land use data, and travel patterns in order to forecast future trips along roadway segments. TRANPLAN allows for shifts in traffic patterns based on roadway improvements; that is, a roadway improvement can shift traffic from surrounding roadways onto the improved roadway. TRANPLAN is a better tool than simply factoring up existing traffic counts into the year 2020. Factoring traffic volumes would assume that travel patterns remain the same in the year 2020 and do not reflect any land use changes or economic changes.

Congested vehicle-hours-of-travel is a good measure of safety, flow, and capacity. The Do-Nothing Alternative is the base year 2020 roadway network based on the proposed roadway projects in the *2020 Regional Transportation Plan* (RTP) produced by SEMCOG and the *Municipal Improvement Program (MIP) 1998-2003* by the City of Sterling Heights. The SEMCOG plan provides roadway improvements for the seven county region of southeast Michigan planned up to the year 2020 and the MIP is for the years 1998-2003. The improvements included in these plans for Sterling Heights and the surrounding roadway network are included in Table 12. The purpose of the *2020 Regional Transportation Plan* is to provide a cooperative local/state process for developing programs that target available resources to the most regionally-significant projects. Under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), SEMCOG is required to develop both a long range Regional Transportation Plan with a 20-year horizon and an expanded annual three-year Transportation Improvement Program (TIP), both of which encompass a broad spectrum of issues, including intermodal facilities, air quality, and fiscal constraints. All alternatives are compared to the Do-Nothing Alternative for the year 2020 to assess their impact.

The preliminary list of alternatives evaluated for the year 2020, as stated previously, were based on existing and potential deficiencies, and ideas from the TAC meetings and a public informational meeting held between September 1997 - January 1998. Utilizing existing data, the Southeast Michigan Improvement Program information, and the travel demand forecasting data for the 2020 network, the following improvements were identified to be tested for the Master Road Plan Update. The following three north-south improvements were included in each of the east-west improvements evaluated: widen Ryan Road to five lanes between 18 Mile Road and M-59; widen Dodge Park to five lanes between Metropolitan Parkway (16 Mile Road) and Utica Road; and widen Maple Lane to five lanes between 14 Mile Road and 15 Mile Road.

East-West Improvements:

- Add on- and off-ramps to M-53 at Clinton River Road
- Mound Road to M-53 connector in the vicinity of 18 ½ Mile Road
- Widen Utica Road to five lanes from Van Dyke to Hayes Road
- Build 17 Mile Road as three lanes from Schoenherr Road to Hayes Road
- Build 17 Mile Road as five lanes from Schoenherr Road to Hayes Road
- Build 18 Mile Road as two lanes from Schoenherr Road to Hayes Road
- Widen 18 Mile Road to five lanes between Dequindre Road and Utica Road, and widen Utica Road to five lanes between 18 Mile Road and Hayes Road
- Build 18 Mile Road as two lanes from Utica Road to Hayes Road
- Widen 18 Mile Road to five lanes between Dequindre Road and Utica Road, and build 18 Mile Road as five lanes from Utica Road to Hayes Road
- Build 19 Mile Road from Van Dyke to Utica Road as three lanes
- Widen 19 Mile Road to five lanes between Dequindre Road and Van Dyke
- Build 19 Mile Road from Van Dyke to Clinton River Road as three lanes
- Widen 19 Mile Road to five lanes between Dequindre Road and Van Dyke, and build 19 Mile Road from Van Dyke to Clinton River Road as five lanes

North-South Improvements:

- Widen Ryan Road to five lanes between 18 Mile Road and M-59
- Widen Dodge Park to five lanes between Metropolitan Parkway (16 Mile Road) and Utica Road
- Widen Maple Lane to five lanes between 14 Mile Road and 15 Mile Road
- Build Hayes Road as two lanes between Moravian Road and Utica Road

Each of the alternatives were coded and analyzed using the SEMCOG's TRANPLAN PM peak hour travel forecasting model. Each alternative's results were plotted in a software package written by Parsons Brinckerhoff, called "XVIEW". XVIEW is used as a visual tool when looking at TRANPLAN output. The

Table 12--Southeast Michigan Council of Governments 2020 Regional Transportation Plan Widening Projects for Sterling Heights and Adjacent Communities

Deficiency Type	Project Location	Proposed Improvement	Total (in $000)
Fiscal Year 1996-2000			
Congestion	Dequindre Road from Metropolitan Parkway to 18 Mile	Widen to 5 lanes	$ 5,784 widen
Congestion	Hayes Road from Utica to Canal	Widen to 5 lanes	$13,216 widen
Congestion	Metropolitan Parkway from Mound to Dodge Park	Widen to 6 lane boulevard	$ 6,560 widen
Congestion	Schoenherr Road from I-696 to 14 Mile	Widen to 5 lanes	$ 8,400 widen
Fiscal Year 2001-2005			
Congestion	Dequindre Road from 18 Mile to Hall	Widen to 5 lanes	$12,000 widen
Congestion	Hayes Road from Hall to 23 Mile	Widen to 5 lanes	$12,000 widen
Congestion	Metropolitan Parkway from Dodge Park to Schoenherr	Widen to 6 lane boulevard	$ 4,800 widen
Congestion	Schoenherr Road from Hall to 23 Mile	Widen to 5 lanes	$16,400 widen
Fiscal Year 2006-2010			
Congestion	17 Mile Road from Utica to Van Dyke	Widen to 5 lanes	$ 3,846 widen
Congestion	19 Mile Road from Van Dyke to Utica	Pave, widen to 3 lanes	$ 856 widen
Congestion	Metropolitan Parkway from Schoenherr to Groesbeck	Widen to 6 lane boulevard	$17,440 widen
Fiscal Year 2011-2020			
None			

roadway segments were color coded by the level of service. Level of Service A through Level of Service D is coded as green, meaning that the level of service is good for the PM peak hour. Level of Service E is coded as yellow, meaning there is congestion and that the roadway segments are nearing capacity. Level of Service F is coded as red, meaning that there is severe congestion, and the vehicles experience stop and go operation. Appendix B contains a graphical representation of all the alternatives by level of service. This allows one to see graphically how one improvement can change the level of service on the surrounding roadways.

A program was written by Parsons Brinckerhoff to summarize the vehicle-hours-of-travel (VHT) and the congested VHT within the City of Sterling Heights. This information was utilized when running the initial list of alternatives. Increasing capacity on roadway segments, as well as adding river crossings, will naturally attract more traffic. This means that the VHT may increase. The distinguishing factor when evaluating alternatives is whether the congestion is decreasing. This is why congested VHT is evaluated. The Do-Nothing alternative becomes the basis of comparison when evaluating the alternatives. The "Do-Nothing" alternative is what would happen if no roadway improvements were made up to the year 2020, besides those already scheduled in the programmed roadway capacity improvement projects from FY1996/97 through FY2020. If an alternative had a reduction in congested VHT when compared to the Do-Nothing alternative, that alternative provided a benefit. It meant that the alternative reduced congestion. A "high" negative number reduces congestion more than a "low" negative number. An example would be alternative 13 and 15. Alternative 13, at -3.51%, has a much greater impact on reducing traffic congestion than alternative 15 at -1.29%. The alternatives that experienced a decrease in congested VHT were then combined into new alternatives.

The TRANPLAN VHT results are presented in Table 13, along with the percentage difference between each alternative's congested VHT and the Do-Nothing congested VHT. The VHT is a summation of all the vehicles on the roadway network and the time spent on each roadway segment in the network. The congested VHT only takes into account the vehicle-miles-of-travel on the congested links in the network, that is, Level of Service E or F. This will assess whether congestion is increasing or decreasing by adding an improvement. Sometimes when capacity is added to a roadway it attracts more vehicles and does not reduce the overall congestion of the roadway facility. As stated earlier, the goal is to accommodate the vehicles in a less congested fashion then prior to proposing the improvement.

Table 13 indicates that of the 15 alternatives tested, none of them individually solved the congestion problems in the City of Sterling Heights. The level of service exhibits for each alternative are included in Appendix B. Only eight (8) of the 15 alternatives tested reduced the congested VHT. These included the north-south improvements to Ryan, Dodge Park, and Maple Lane; building a connector from Mound to M-53 in the vicinity of 18 ½ Mile Road; widening Utica to five lanes from Van Dyke to Hayes; widening 18 Mile to five lanes from Dequindre to Utica and widening Utica to five lanes from 18 Mile to Hayes; widening 18 Mile to five lanes from Dequindre to Utica and building 18 Mile as five lanes from Utica to Hayes; building 19 Mile as three lanes from Van Dyke to Utica; widen 19 Mile to five lanes from Dequindre to Van Dyke; and widening 19 Mile to five lanes from Dequindre to Van Dyke and building 19 Mile as five lanes from Van Dyke to Clinton River. The best individual overall performer was widening 18 Mile to five lanes from Dequindre to Utica and building 18 Mile as five lanes from Utica to Hayes with a 3.54 percent decrease on the congested roadway segments.

A number of the alternatives did not perform well and actually increased congestion. Adding on- and off-ramps to M-53 at Clinton River Road was tested. It actually increased congestion by 2.53% over the Do-Nothing Alternative. The Michigan Department of Transportation was contacted and based on the location and the potential to increase congestion, they were not in favor of pursuing the additional on- and

Table 13--PM Peak Hour Alternatives Analysis: Comparison of Vehicle-Hours-Traveled and Congested Vehicle-Hours-Traveled within the City of Sterling Heights

Alternative (Year 2020)	Description	Vehicle Hours Traveled (VHT)	VHT Congested	Percent Difference in Congested VHT from Do-Nothing	Congestion Increased or Decreased
Do-Nothing	Proposed 2020 roadway network with no modifications	11352	8750		
1*	Widen Ryan to 5 lanes from 18 Mile to M-59; widen Dodge Park to 5 lanes from 16 Mile to Utica; & widen Maple Lane to 5 lanes from 14 Mile to 15 Mile	11343	8747	-0.03%	Decreased
7*	Add on- and off- ramps to M-53 at Clinton River	11425	8971	2.53%	Increased
2*	Build Hayes as 2 lanes from Moravian to Utica	11432	8895	1.66%	Increased
15*	Build Mound to M-53 connector in the vicinity of 18 1/2 Mile	11405	8637	-1.29%	Decreased
9*	Widen Utica to 5 lanes from Van Dyke to Hayes	11423	8742	-0.09%	Decreased
6*	Build 17 Mile as 3 lanes from Schoenherr to Hayes	11442	8808	0.66%	Increased
14*	Build 17 Mile as 5 lanes from Schoenherr to Hayes	11491	8934	2.10%	Increased
3*	Build 18 Mile as 2 lanes from Schoenherr to Hayes	11420	8828	0.89%	Increased
8*	Widen 18 Mile to 5 lanes from Dequindre to Utica; & widen Utica to 5 lanes from 18 Mile to Hayes	11392	8606	-1.65%	Decreased
5*	Build 18 Mile as 2 lanes from Utica to Hayes	11400	8920	1.94%	Increased
10*	Widen 18 Mile to 5 lanes from Dequindre to Utica; & build 18 Mile as 5 lanes from Utica to Hayes	11383	8440	-3.54%	Decreased
11*	Build 19 Mile as 3 lanes from Van Dyke to Utica	11371	8733	-0.19%	Decreased
12*	Widen 19 Mile to 5 lanes from Dequindre to Van Dyke	11421	8517	-2.66%	Decreased
4*	Build 19 Mile as 3 lanes from Van Dyke to Clinton River	11368	8807	0.65%	Increased
13*	Widen 19 Mile to 5 lanes from Dequindre to Van Dyke & build 19 Mile as 5 lanes from Van Dyke to Clinton River	11405	8443	-3.51%	Decreased

* = Alternative 1 roadway improvements are also included in this alternative

off- ramps to M-53 at Clinton River. Building Hayes as two lanes from Moravian to Utica increased congestion 1.66%. A letter from the Macomb County Road Commission, December 1991, to the City of Sterling Heights indicated a number of issues that would prevent the extension of Hayes Road from Moravian to Utica from occurring. Some of the issues, but not limited to, are: fill within the 100-year flood plain, mitigation of approximately 10 acres of wetlands, conflict with the existing Metropolitan Parkway bridge over the Red Run Drain, and possible conflicts with landfill area if alignment is shifted to the west. The 17 Mile Road connection increased congestion on the congested links from 0.66% to 2.10%. It was the only east-west connection that actually increased congestion instead of decreasing congestion. It appears that building 18 Mile and 19 Mile as two or three lanes does not solve the congestion problem either. Widening and/or building 18 Mile and 19 Mile Roads as five lanes does decrease congestion.

Ryan Road, between 18 Mile and M-59, was also originally tested as three lanes, but it did not appear to relieve congestion. As three lanes, the roadway segment operated at a LOS F north of 18 Mile. Ryan Road was then analyzed as five lanes between 18 Mile and M-59. It was then operating at a LOS E or better between 19 Mile and M-59, but still operating at a LOS F between 18 Mile Road and 19 Mile Road. It was determined that to be consistent with the roadway network to the south, that Ryan be analyzed as five lanes.

Even the best individual alternative did not solve the problems of the 2020 transportation network. Based on the individual results of the alternatives, eight combinations were tested. The next section provides those results.

COMBINATION OF ALTERNATIVES ANALYZED

Based on the results of the individual improvements tested, eight combinations were run to examine the effects on the roadway network. The combination of alternatives are listed in Table 14. All combinations listed in Table 14 contain the following (Alternative 1): widen Ryan Road to five lanes between 18 Mile Road and M-59; widen Dodge Park to five lanes between Metropolitan Parkway (16 Mile Road) and Utica Road; and widen Maple Lane to five lanes between 14 Mile Road and 15 Mile Road. These combinations were developed from comments received at the TAC meetings and by the consultants recommendations based on the technical results.

One of the eight combinations examined was the 1980 Master Road Plan. The 1980 Master Road Plan improvements that are in addition to the 2020 Regional Transportation Plan are provided in Table 15. The 1980 Master Road Plan had some excess laneage proposed that would not be viable today. This combination was used to test the results of the 1980 proposed widening for the community. The other combinations assessed 19 Mile Road crossing the river along with other roadway improvements, 18 Mile Road crossing the river as well as other roadway improvements, and combinations of 18 Mile Road and 19 Mile Road widenings/buildings and crossing the river. The most benefit appears to occur with the 1980 Master Road Plan improvements. The 1980 Master Road Plan improvements appear to be excessive and not feasible. When the 1980 Master Road Plan was adopted the City was not as developed as it is today. Since that time the right-of-way was not preserved to substantiate the proposed 1980 roadway cross-sections. The City has experienced a tremendous growth in development and with the widenings proposed (for example: 14 Mile/15 Mile Road as seven lanes) in the 1980 Master Road Plan, some of the developments may lose frontage to their businesses (if they had it to begin with) or may need to be relocated.

Table 14--PM Peak Hour Comparison of Vehicle-Hours-Traveled and Congested Vehicle-Hours-Traveled within the City

Alternative (Year 2020)	Description	Vehicle Hours Traveled (VHT)	VHT Congested (VHT)	Percent Difference in Congested VHT from Do-Nothing	Congestion Increased or Decreased
1819*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	11451	7847	-10.32%	Decreased
u1819*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Utica and from Clinton River to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	11436	7976	-8.85%	Decreased
19uc*	19 Mile, 5 lanes from Dequindre to Clinton River; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	11461	8649	-1.15%	Decreased
18u*	18 Mile as 5 lanes between Dequindre & Hayes; Utica as 5 lanes between Van Dyke & Hayes	11464	8346	-4.62%	Decreased
a20*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes; Moravian 5 lanes from Schoenherr to Hayes; Schoenherr, 6 lanes from 16 Mile to Canal; Mound, 8 lanes from 17 Mile to M-59	11500	7609	-13.04%	Decreased
a21*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Utica and from Clinton River to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes; Moravian, 5 lanes from Schoenherr to Hayes; Schoenherr, 6 lanes from 16 Mile to Canal; Mound, 8 lanes from 17 Mile to M-59	11541	7866	-10.10%	Decreased
final*	Preferred Alternative based on a20*, but includes 18 1/2 Mile as 5 lanes	11558	7601	-13.13%	Decreased
80mrp	1980 Master Road Plan Improvements	11644	6810	-22.17%	Decreased

* = Alternative 1 roadway improvements are also included in this alternative

Table 15--Improvements in the Sterling Heights 1980 Master Road Plan

Segment	Between this	and that	No. lanes	New River Crossing?
14 Mile	Dequindre	Hayes	7	
15 Mile	Mound	Moravian	7	
16 Mile	Mound	Hayes	8	
18 Mile	Dequindre	Mound	5	
18 Mile	Clinton River	Hayes	5	Yes
18 Mile	Clinton River	Mound	7	Yes
19 Mile	Schoenherr	Hayes	5	
19 Mile	Dequindre	Ryan	5	
19 Mile	Ryan	Schoenherr	7	Yes
Canal	Van Dyke	Hayes	4	
Clinton River	Canal	Hayes	4	
Dequindre	14 Mile	M-59	7	
Dodge Park	16 Mile	Utica	5	
Hayes	14 Mile	Moravian	5	
Maple Lane	14 Mile	15 Mile	5	
Moravian	Schoenherr	Hayes	5	
Riverland	Van Dyke	Clinton River	4	
Ryan	18 Mile	M-59	5	
Schoenherr	16 Mile	19 Mile	6	
Schoenherr	19 Mile	Hall	8	
Utica	Van Dyke	18 Mile	5	
Utica	Dodge Park	Hayes	5	
Utica	Van Dyke	19 1/2 Mile	4	
Utica	Dodge Park	18 Mile	7	
Van Dyke	18 1/2 Mile	Hall	7	

Note: These improvements will be used to form its own alternative and do not include the improvements suggested that have already been implemented into SEMCOG's 2020 TRANPLAN model.

The second best combination of improvements occurs when both 18 Mile and 19 Mile Roads are built as 5 lanes from Dequindre Road to Hayes Road; Utica Road is widened to five lanes from Van Dyke Road to Hayes Road; Clinton River is widened to four lanes from Canal Road to Hayes Road; Moravian Road is widened to five lanes from Schoenherr Road to Hayes Road; Schoenherr Road is widened to six lanes from Metropolitan Parkway (16 Mile Road) to Canal Road; Mound Road is widened to eight lanes from 17 Mile Road to M-59; and 18 ½ Mile Road is widened to five lanes from Mound Road to Van Dyke Road. This combination of improvements provides a 13.13% improvement on the congested links compared with the Do-Nothing Alternative for the year 2020 in the PM peak hour.

PRELIMINARY COST ESTIMATES

The steps taken as part of the analysis were to first create costs for the various individual improvements. Then, each of the alternatives analyzed had the cost of the roadway improvements totaled by alternative.

The items included the length of the roadway segment, the lane miles of the improvement, the roadway cost, the bridge/culvert cost, the identification of wetland impacts, the right-of-way (ROW) required, the structures impacted, the ROW costs, the preliminary construction costs, the

preliminary engineering costs, contingencies, and the total preliminary cost in 1998 dollars. Based on conversations with the City, County, and local construction projects the following costs were utilized in the estimates: the costs were calculated using $400,000 per lane mile, and costs received from the Sterling Heights Office of Assessing were used to develop land/property costs. The preliminary construction costs include the costs of the roadways, bridges/culverts, and ROW. The preliminary engineering is 20% of the costs of the roadways and bridges/culverts. The contingencies are 10% of the costs of the roadways and bridges/culverts. There are not any costs included for impacted wetlands. Wetland mapping for the City and the locations are noted by improvement, but the overall impact is beyond the scope of this project and a detailed wetland analysis will have to be performed on a project by project basis. Table 16 provides the preliminary cost estimates for the individual segments. The two columns on the right side of Table 16 provide the percentage share of the improvement by agency jurisdiction over the roadway and the cost to the City of Sterling Heights for each roadway improvement.

The largest impact to existing structures occurred in building 17 Mile Road from Schoenherr Road to Hayes Road. Based on engineering judgment, the required alignment of 17 Mile Road at Schoenherr Road, as well as the river crossing, the connection to Hayes Road would impact approximately 45 structures/homes. It was assessed to parallel the golf course, but the alignment and river crossing and connection at Hayes Road shift the connection further to the north through existing neighborhoods. The Mound Road connection to M-53 with service drives was the most expensive alternative at $22,300,000.

The Macomb County Road Commission provided information as to the feasibility of extending Hayes Road, north of Moravian. The issues that the County felt made the extension not feasible are the fill requirements within the 100 year flood plain, mitigation of approximately 10 acres of wetland, construction of a bridge over the Red Run Drain, the conflict with the existing Metropolitan Parkway bridge over the Red Run Drain, traffic operational problems with a new intersection (Hayes and Metropolitan Parkway) in proximity to the Utica Road intersection, possible conflicts with a landfill area if alignment is shifted to the west, encroachment into Freedom Hill County Park for a westerly alignment, and construction of an overpass to avoid an intersection with Metropolitan Parkway.

At the TAC meetings there were concerns raised over the extension of 18 Mile Road and 19 Mile Road over the Clinton River. Areas of concern addressed the close proximity of 19 Mile Road and Riverland Drive, since the Kleino bridge was removed when Schoenherr Road was widened. Upon reviewing the Kleino bridge removal it was discovered that the bridge was structurally old and badly in need of replacement. To maintain the location of the Kleino bridge would have required a much larger structure than was originally designed at Schoenherr or it would disturb the flow of the river. It was determined that between the cost associated with rebuilding the Kleino bridge crossing, as well as re-designing the Schoenherr bridge, that the Schoenherr bridge would be built and the Kleino bridge would be removed. Upon contacting the Michigan Department of Transportation Environmental Unit, there is not a spacing requirement for river crossings. The Department of Environmental Quality (DEQ) has buffer areas that restrict the harmful interference of inhibiting the river flow. The Flood Plain Regulatory Act does not allow the river to be inhibited more than 0.1 feet. Public Agencies can fill out a Preliminary Review Form and ask the DEQ to make a preliminary investigation as to a site.

Table 16--Preliminary Cost Estimate By Roadway Segment

ALTERNATIVE	Length (Miles)	Lane Miles	Roadway Cost (in $000)	Bridge/ Culvert (in $000)	Wetlands Impacted	ROW Required Parcels	ROW Required (Acres)	Structures Impacted	ROW Costs (in $000)	Preliminary Construction Cost (in $000)	Preliminary Engineering Cost 20%	Contingencies 10%	Total Preliminary Cost (in $000)	Percent Share of Cost	City's Cost (in $000)
East-West Improvements															
1. Build 17 Mile as 3 lanes from Schoenherr to Hayes	1.04	3.12	$1,248	$4,500	Clinton River			37-$150 8-$200	$5,550 $1,600	$13,398	$1,250	$625	$15,272	100% City	$15,272
2. Build 17 Mile as 5 lanes from Schoenherr to Hayes	1.04	5.20	$2,080	$4,500	Clinton River			37-$150 8-$200	$5,550 $1,600	$14,230	$1,416	$708	$16,354	100% City	$16,354
3. Build 17 Mile as 5 lanes from Schoenherr to Clinton River Road	0.90	4.50	$1,800	$4,500	Clinton River			37-$150	$5,550	$11,850	$1,260	$630	$13,740	100% City	$13,740
4. Build 18 Mile as 2 lanes from Schoenherr to Hayes	0.98	1.96	$784			5			$500	$1,284	$157	$78	$1,519	80/20	$215
5. Build 18 Mile as 5 lanes from Clinton River Road to Hayes	1.64	8.20	$3,280			5			$500	$3,780	$656	$328	$4,764	80/20	$739
6. Build 18 Mile as 2 lanes from Utica to Hayes	2.24	4.48	$1,792	$4,500	Clinton River	5		2-$150	$800	$7,092	$1,258	$629	$8,980	80/20	$1,401
7. Build 18 Mile as 5 lanes from Utica to Hayes	2.24	11.20	$4,480	$4,500	Clinton River	5		2-$150	$800	$9,780	$1,796	$898	$12,474	80/20	$1,966
8. Widen 18 Mile from 2-5 lanes Dequindre to Utica	3.71	11.13	$4,452	$500						$4,952	$990	$495	$6,438	80/20	$1,040
9. Build Mound Road to M-53 Connector at 18 1/2 Mile	2.42	14.52	$5,808	$9,400	Chrissman Drain		25.3		$2,530	$17,738	$3,042	$1,521	$22,300	80/20	$3,447
Build 18 1/2 Mile as five lanes from Mound to Van Dyke	1.00	3.00	$1,200	$500	Chrissman Drain					$1,700	$340	$170	$2,210	100% City	$2,210
10. Build on- and off- ramps to M-53 at Clinton River Road		0.80	$320		Clinton River		6	5-$150	$1,350	$1,670	$64	$32	$1,766	80/20	$202
11. Build 19 Mile as 3 lanes from Van Dyke to Utica	0.12	0.36	$144					3-$150 1-Business	$450 $200	$794	$29	$14	$837	100% City	$837
12. Build 19 Mile as 3 lanes from Van Dyke to Clinton River Road	0.70	2.10	$840	$4,500	Clinton River			5-$150 1-Business	$750 $200	$6,290	$1,068	$534	$7,892	100% City	$7,892
13. Build 19 Mile as 5 lanes from Van Dyke to Clinton River Road	0.70	3.50	$1,400	$4,500	Clinton River			5-$150 1-Business	$750 $200	$6,850	$1,180	$590	$8,620	100% City	$8,620
14. Widen 19 Mile from 2-5 lanes Dequindre to Van Dyke	3.01	9.03	$3,612			1 9-Partial		8-$150	$1,300 $450	$5,362	$722	$361	$6,446	100% City	$6,446
15. Widen 19 Mile from 2-5 lanes Clinton River to Saal & 3-5 lanes Saal to Hayes	2.39	6.85	$2,740							$2,740	$548	$274	$3,562	100% City	$3,562
16. Widen Utica from 2-5 lanes Van Dyke to 18 Mile	1.37	4.11	$1,644							$1,644	$329	$164	$2,137	80/20	$345
17. Widen Utica from 2-5 lanes 18 Mile to Hayes	2.89	8.67	$3,468							$3,468	$694	$347	$4,508	80/20	$728
18. Widen Utica from 2-5 lanes Van Dyke to Hayes	4.26	12.78	$5,112							$5,112	$1,022	$511	$6,646	80/20	$1,074

Note:

1. Costs are in 1998 dollars
2. Costs were calculated using $400,000 per lane mile
3. Bridge costs are from Macomb County Road Commission
4. Alternatives 1 & 2 includes $500,000 for sewer upgrade in Hayes
5. ROW costs were calculated using $100,000/Acre, $100,000/Parcel, and $50,000/Partial Parcel
6. Preliminary Construction Costs include costs of Roadways, Bridges/Culverts and ROW
7. Preliminary Engineering is 20% of costs of Roadways, and Bridges/Culverts
8. Contingencies are 10% of costs of Roadways, and Bridges/Culverts
9. Costs do not include any costs associated with Impacted Wetlands
10. Alternative 24 assumes no widening of structures at Plumbrook Drain or Chrissman Drain
11. Alternative 27 assumes no widening of structures at Plumbrook Drain or Clinton River
12. Percent Share of Cost: 80/20 = Federal Government pays 80% and City/County each pay 10%; 100% County = County and City pay 50%; 100% City = City of Sterling Heights pays 100%

Table 16 Continued--Preliminary Cost Estimate By Roadway Segment

ALTERNATIVE	Length (Miles)	Lane Miles	Roadway Cost (in $000)	Bridge/ Culvert (in $000)	Wetlands Impacted	ROW Required Parcels	ROW Required (Acres)	Structures Impacted	ROW Costs (in $000)	Preliminary Construction Cost (in $000)	Preliminary Engineering Cost 20%	Contingencies 10%	Total Preliminary Cost (in $000)	Percent Share of Cost	City's Cost (in $000)
North-South Improvements															
19. Widen Ryan from 3-5 lanes 18 Mile to 18 1/2 Mile	0.50	1.00	$400							$400	$80	$40	$520	100% City	$520
20. Widen Ryan from 2-3 lanes 18 1/2 Mile to 19 Mile	0.50	0.50	$200	$500						$700	$140	$70	$910	100% City	$910
21. Widen Ryan from 2-5 lanes 18 1/2 Mile to 19 Mile	0.50	1.50	$600	$500						$1,100	$220	$110	$1,430	100% City	$1,430
22. Widen Ryan from 2-3 lanes 19 Mile to M-59	1.09	1.09	$436			20		4-$150	$2,600	$3,036	$87	$44	$3,167	100% City	$3,167
23. Widen Ryan from 2-5 lanes 19 Mile to M-59	1.09	3.27	$1,308			20		4-$150	$2,600	$3,908	$262	$131	$4,300	100% City	$4,300
24. Widen Mound from 6-8 lanes 17 Mile to M-59	3.10	6.20	$2,480		Plumbrook Drain Chrissman Drain					$2,480	$496	$248	$3,224	80/20	$521
25. Widen Dodge Park from 2-5 lanes 16 Mile to Utica	1.70	5.10	$2,040		Plumbrook Drain	25-Partial			$1,250	$3,290	$408	$204	$3,902	100% City	$3,902
26. Widen Maple Lane from 2-5 lanes 14 Mile to 15 Mile	0.83	2.49	$996							$996	$199	$100	$1,295	100% City	$1,295
27. Widen Schoenherr from 4-6 lanes 16 Mile to Canal	3.35	6.70	$2,680							$2,680	$536	$268	$3,484	80/20	$563
28. Widen Moravian from 2-5 lanes Schoenherr to Hayes	1.65	4.95	$1,980							$1,980	$396	$198	$2,574	80/20	$416
29. Build Hayes as 2 lane from Moravian to Utica	0.95	1.90	$760	$2,000	Red Run Drain		13.8		$1,380	$4,140	$552	$276	$4,968	50% City 50% County	$2,484
30. Widen Clinton River Road from 2-4 lanes Canal to Hayes	4.69	9.38	$3,752			26		26-$150	$6,500	$10,252	$2,050	$1,025	$13,328	80/20	$2,153

Note:

1. Costs are in 1998 dollars
2. Costs were calculated using $400,000 per lane mile
3. Bridge costs are from Macomb County Road Commission
4. Alternatives 1 & 2 includes $500,000 for sewer upgrade in Hayes
5. ROW costs were calculated using $100,000/Acre, $100,000/Parcel, and $50,000/Partial Parcel
6. Preliminary Construction Costs include costs of Roadways, Bridges/Culverts and ROW
7. Preliminary Engineering is 20% of costs of Roadways, and Bridges/Culverts
8. Contingencies are 10% of costs of Roadways, and Bridges/Culverts
9. Costs do not include any costs associated with Impacted Wetlands
10. Alternative 24 assumes no widening of structures at Plumbrook Drain or Chrissman Drain
11. Alternative 27 assumes no widening of structures at Plumbrook Drain or Clinton River
12. Percent Share of Cost: 80/20 = Federal Government pays 80% and City/County each pay 10%; 100% County = County and City pay 50%; 100% City = City of Sterling Heights pays 100%

Concerns were also raised over the soils for the roadway extensions and widenings. At this point in time, those analyses are beyond the scope of this study. Existing data was requested from the State, County, and City regarding all alternatives analyzed. There was not any information available at this time to address the geotechnical nature of the alternatives.

While looking at the cost of each alternative is important, it is equally important to note the amount of money saved by reducing congestion. A dollar value of annual hour saved can be associated with reductions in congestion by comparing the congested VHT for each alternative compared to the Do-Nothing. The formula used to relate cost to reducing congestion is as follows:

$$-(\text{Congested VHT}_{\text{alternative}} - \text{Congested VHT}_{\text{Do-Nothing}}) * 365 \text{ day/yr.} * \$11.80/\text{hr} / 1{,}000$$

Table 17 provides the congested VHT, dollar value of annual hours saved, and estimated cost of each alternative. A positive (+) number indicates the dollar value of annual hours saved whereas a negative (-) number indicates the dollar value of annual hours lost. The combination of individual alternatives provide the largest dollar value of annual hours saved. The largest dollar value saved is for the 1980 Master Road Plan at $4.9 million. The alternatives that have both 18 Mile and 19 Mile crossing the river save approximately $3.8 million dollars per year.

Table 18 provides the cost for each alternative based on the individual roadway segment costs estimated in Table 16. It also shows the percent difference in congested VHT from the Do-Nothing.

Table 17--Comparison of Dollar Value of Annual Hours Saved and Estimated Cost by Alternative

Alternative (Year 2020)	Description	VHT Congested	Dollar Value of Annual Hours Saved* ($000)	Estimated Cost of Each Alternative ($000)
Do-Nothing	Proposed 2020 roadway network with no modifications	8750		
1*	Widen Ryan to 5 lanes from 18 Mile to M-59; widen Dodge Park to 5 lanes from 16 Mile to Utica; & widen Maple Lane to 5 lanes from 14 Mile to 15 Mile	8747	$13	$7,147
7*	Add on- and off- ramps to M-53 at Clinton River	8971	-$952	$1,766
2*	Build Hayes as 2 lanes from Moravian to Utica	8895	-$625	$4,968
15*	Build Mound to M-53 connector in the vicinity of 18 1/2 Mile	8637	$487	$22,300
9*	Widen Utica to 5 lanes from Van Dyke to Hayes	8742	$34	$6,646
6*	Build 17 Mile as 3 lanes from Schoenherr to Hayes	8808	-$250	$15,272
14*	Build 17 Mile as 5 lanes from Schoenherr to Hayes	8934	-$792	$16,354
3*	Build 18 Mile as 2 lanes from Schoenherr to Hayes	8828	-$336	$1,519
8*	Widen 18 Mile to 5 lanes from Dequindre to Utica; & widen Utica to 5 lanes from 18 Mile to Hayes	8606	$620	$10,946
5*	Build 18 Mile as 2 lanes from Utica to Hayes	8920	-$732	$8,980
10*	Widen 18 Mile to 5 lanes from Dequindre to Utica; & build 18 Mile as 5 lanes from Utica to Hayes	8440	$1,335	$18,912
11*	Build 19 Mile as 3 lanes from Van Dyke to Utica	8733	$73	$837
12*	Widen 19 Mile to 5 lanes from Dequindre to Van Dyke	8517	$1,004	$6,446
4*	Build 19 Mile as 3 lanes from Van Dyke to Clinton River	8807	-$245	$7,892
13*	Widen 19 Mile to 5 lanes from Dequindre to Van Dyke & build 19 Mile as 5 lanes from Van Dyke to Clinton River	8443	$1,322	$15,066

* = Alternative 1 roadway improvements are also included in this alternative for evaluating congested VHT

Dollar Value of Annual Hours Saved* = Dollar value based on $11.80 per hour per the US Office of Management and Budget

Dollar Value of Annual Hours Saved* => A positive (+) number indicates hours saved whereas a negative (-) number indicates hours lost

Table 17 Continued--Comparison of Dollar Value of Annual Hours Saved and Estimated Cost by Alternative

Alternative (Year 2020)	Description	VHT Congested (VHT)	Dollar Value of Annual Hours Saved* C.VHT ($000)	Estimated Cost of Each Alternative ($000)
1819*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	7847	$3,889	$57,514
u1819*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Utica and from Clinton River to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	7976	$3,334	$49,804
19uc*	19 Mile, 5 lanes from Dequindre to Clinton River; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	8649	$435	$35,040
18u*	18 Mile as 5 lanes between Dequindre & Hayes; Utica as 5 lanes between Van Dyke & Hayes	8346	$1,740	$25,558
a20*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes; Moravian 5 lanes from Schoenherr to Hayes; Schoenherr, 6 lanes from 16 Mile to Canal; Mound, 8 lanes from 17 Mile to M-59	7609	$4,914	$66,796
a21*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Utica and from Clinton River to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes; Moravian, 5 lanes from Schoenherr to Hayes; Schoenherr, 6 lanes from 16 Mile to Canal; Mound, 8 lanes from 17 Mile to M-59	7866	$3,807	$59,086
final*	Preferred Alternative based on a20*, but includes 18 1/2 Mile as 5 lanes	7601	$4,949	$69,006
80mrp	1980 Master Road Plan Improvements	6810	$8,356	$256,766

* = Alternative 1 roadway improvements are also included in this alternative for evaluating congested VHT

Dollar Value of Annual Hours Saved* = Dollar value based on $11.80 per hour per the US Office of Management and Budget

Dollar Value of Annual Hours Saved* => A positive (+) number indicates hours saved whereas a negative (-) number indicates hours lost

Table 18--Ranking of Congested Vehicle-Hours-Traveled and Cost for Each Alternative in the PM Peak Hour

Alternative (Year 2020)	Description	Percent Difference in Congested VHT from Do-Nothing	Ranking Congested VHT (5=best)	Estimated Cost of Each Alternative ($000)	Ranking Cost Estimates (5=best)
Do-Nothing	Proposed 2020 roadway network with no modifications				
1*	Widen Ryan to 5 lanes from 18 Mile to M-59; widen Dodge Park to 5 lanes from 16 Mile to Utica; & widen Maple Lane to 5 lanes from 14 Mile to 15 Mile	-0.03%	1.5	$7,147	5.0
7*	Add on- and off- ramps to M-53 at Clinton River	2.53%	1.0	$1,766	5.0
2*	Build Hayes as 2 lanes from Moravian to Utica	1.66%	0.5	$4,968	5.0
15*	Build Mound to M-53 connector in the vicinity of 18 1/2 Mile	-1.29%	1.5	$22,300	4.0
9*	Widen Utica to 5 lanes from Van Dyke to Hayes	-0.09%	1.5	$6,646	5.0
6*	Build 17 Mile as 3 lanes from Schoenherr to Hayes	0.66%	0.5	$15,272	4.0
14*	Build 17 Mile as 5 lanes from Schoenherr to Hayes	2.10%	1.0	$16,354	4.0
3*	Build 18 Mile as 2 lanes from Schoenherr to Hayes	0.89%	0.5	$1,519	5.0
8*	Widen 18 Mile to 5 lanes from Dequindre to Utica; & widen Utica to 5 lanes from 18 Mile to Hayes	-1.65%	1.5	$10,946	4.5
5*	Build 18 Mile as 2 lanes from Utica to Hayes	1.94%	0.5	$8,980	4.5
10*	Widen 18 Mile to 5 lanes from Dequindre to Utica; & build 18 Mile as 5 lanes from Utica to Hayes	-3.54%	2.0	$18,912	4.0
11*	Build 19 Mile as 3 lanes from Van Dyke to Utica	-0.19%	1.5	$837	5.0
12*	Widen 19 Mile to 5 lanes from Dequindre to Van Dyke	-2.66%	2.0	$6,446	5.0
4*	Build 19 Mile as 3 lanes from Van Dyke to Clinton River	0.65%	0.5	$7,892	4.5
13*	Widen 19 Mile to 5 lanes from Dequindre to Van Dyke & build 19 Mile as 5 lanes from Van Dyke to Clinton River	-3.51%	2.0	$15,066	4.5

*= Alternative 1 roadway improvements are also included in this alternative for evaluating congested VHT

Table 18 Continued--Ranking of Congested Vehicle-Hours-Traveled and Cost for Each Alternative in the PM Peak Hour

Alternative (Year 2020)	Description	Percent Difference in Congested VHT from Do-Nothing	Ranking Congested VHT (5=best)	Estimated Cost of Each Alternative ($000)	Ranking Cost Estimates (5=best)
1819*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	-10.32%	4.0	$57,514	1.5
u1819*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Utica and from Clinton River to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	-8.85%	3.5	$49,804	2.0
19uc*	19 Mile, 5 lanes from Dequindre to Clinton River; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes	-1.15%	1.5	$35,040	3.0
18u*	18 Mile as 5 lanes between Dequindre & Hayes; Utica as 5 lanes between Van Dyke & Hayes	-4.62%	2.5	$25,558	3.5
a20*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes; Moravian 5 lanes from Schoenherr to Hayes; Schoenherr, 6 lanes from 16 Mile to Canal; Mound, 8 lanes from 17 Mile to M-59	-13.04%	4.5	$66,796	1.0
a21*	19 Mile, 5 lanes from Dequindre to Hayes; 18 Mile, 5 lanes from Dequindre to Utica and from Clinton River to Hayes; Utica, 5 lanes from Van Dyke to Hayes; Clinton River, 4 lanes from Canal to Hayes; Moravian, 5 lanes from Schoenherr to Hayes; Schoenherr, 6 lanes from 16 Mile to Canal; Mound, 8 lanes from 17 Mile to M-59	-10.10%	4.0	$59,086	1.5
final*	Preferred Alternative based on a20*, but includes 18 1/2 Mile as 5 lanes	-13.13%	4.5	$69,006	1.0
80mrp	1980 Master Road Plan Improvements	-22.17%	5.0	$256,766	0.5

* = Alternative 1 roadway improvements are also included in this alternative for evaluating congested VHT

RANKING PROCEDURE FOR THE ALTERNATIVES

A ranking procedure was developed to assess the performance of the various alternatives tested. The rankings established were to be used for costs and for a measure to test the network improvement of capacity, safety, and flow. If the capacity is improved to a sufficient level the traffic will flow well, which improves safety.

The ranking procedure established was for both the congested VHT and the costs. These rankings will be applied to each alternative or combination of alternatives to determine the best overall improvements for the Master Road Plan Update. The ranking point system used is shown in Table 19.

Table 18 (previously provided on pages 69 and 70) provides each individual alternative and combination of alternatives analyzed, the percent difference in congested VHT from the Do-Nothing, the ranking of the alternative by congested VHT, the estimated cost of each alternative, and the ranking of the alternative by cost.

Table 19--Ranking Procedure for Alternatives

Percentage Difference in Congested VHT from the Do-Nothing Alternative	**Points**
> +2.00 %	0.5
0.00 % to +2.01 %	1.0
-2.00 % to -0.01 %	1.5
-4.00 % to -2.01 %	2.0
-6.00 % to -4.01 %	2.5
-8.00 % to -6.01 %	3.0
-10.00 % to -8.01 %	3.5
-12.00 % to -10.01 %	4.0
-14.00 % to -12.01 %	4.5
< -14.01 %	5.0
Range of Costs for the Alternatives in ($000)	**Points**
> $70,001	0.5
$61,601 to $70,000	1.0
$53,201 to $61,600	1.5
$45,601 to $53,200	2.0
$38,001 to $45,600	2.5
$30,401 to $38,000	3.0
$22,801 to $30,400	3.5
$15,201 to $22,800	4.0
$ 7,601 to $15,200	4.5
$ 0 to $ 7,600	5.0

A method needed to be developed to combine individual rankings of congested VHT and cost in order to determine which alternatives were performing the best. Based on engineering judgment, the congested VHT was weighted higher than cost when ranking the alternatives. This was due to the fact that the congested VHT deals with congestion, safety, and delay.

Ranking the alternatives, the congested VHT category counted twice that of the cost category, since the congested VHT deals with congestion, safety, and delay. So, the formula used in the final assessment is:

2:1* = Ranking = ((2 * congested VHT ranking) + (cost ranking)) / 3

It was suggested by the TAC that a ranking be performed with congested VHT and cost being ranked equally because cost is a major factor and should not be overlooked. The formula used in the assessment is:

1:1* = Ranking = (congested VHT ranking + cost ranking) / 2

The greater the reduction of congested VHT compared to the Do-Nothing Alternative the better. The higher the points received, the better the combination of improvements. The lower the cost of the improvement the better as well, so the points are higher for the least costly improvements. Thus, the higher the total combined score the better, as higher points are awarded for reducing congestion and the least cost.

Table 20 utilized both formulas described in order to obtain a ranking of the alternatives analyzed, but sorted them using the 2:1 ranking. The best performing alternative came in as the 1980 Master Road Plan. There are a lot of major improvements in this alternative. The 1980 Master Road Plan has some incredible costs, but also some substantial improvements to the transportation system. It does not appear to be as feasible to widen some of the roadways as originally planned in 1980, and the costs are over four times the estimates of the two second place alternatives. The two alternatives that tied for second place are A20 and the Final with a 2:1 ranking of 3.3 points out of 5.0. The only difference between the two alternatives is that in the Final, 18 ½ Mile Road is added as five lanes from Mound Road to Van Dyke Road; A20 does not have the 18 ½ Mile Road improvement. This improvement to 18 ½ Mile Road increases the cost slightly, but reduces congestion.

Table 21 also utilized both formulas described in order to obtain a ranking of the alternatives analyzed, but sorted them using the 1:1 ranking. The results differ considerably from Table 20. Reduction in congested VHT is not as big of a factor as the cost; therefore, the results do not provide an alternative that reduces the most congestion for the City. The alternative that ranked the best, using the equal ranking, was 12*, widening 19 Mile to 5 lanes between Dequindre and Van Dyke. This alternative only provides a 2.66% reduction in congested VHT whereas the alternative that ranked the best in Table 20 provides a 13.13% reduction in congested VHT. The ranking system used in Table 20 causes alternatives that do not provide the most relief in congested VHT to rank the best, instead of relieving congestion for the entire City.

The rankings provided in Table 20 were used in determining the alternative that would provide the most benefit to the City of Sterling Heights.

Table 20--PM Peak Hour Alternatives Analysis: Preliminary Ranking Comparison Sorted by 2:1 Ranking, Then by 1:1 Ranking

Alternative (Year 2020)	Percent Difference in Congested VHT from Do-Nothing	Ranking Congested VHT (5=best)	Estimated Cost of Each Alternative ($000)	Ranking Cost Estimates (5=best)	2:1* Ranking Points (5=best)	1:1* Ranking Points (5=best)
Do-Nothing	0.00%		$0		0.0	0.0
6*	0.66%	0.5	$15,272	4.0	1.7	2.3
5*	1.94%	0.5	$8,980	4.5	1.8	2.5
4*	0.65%	0.5	$7,892	4.5	1.8	2.5
19uc*	-1.15%	1.5	$35,040	3.0	2.0	2.3
14*	2.10%	1.0	$16,354	4.0	2.0	2.5
2*	1.66%	0.5	$4,968	5.0	2.0	2.8
3*	0.89%	0.5	$1,519	5.0	2.0	2.8
15*	-1.29%	1.5	$22,300	4.0	2.3	2.8
7*	2.53%	1.0	$1,766	5.0	2.3	3.0
8*	-1.65%	1.5	$10,946	4.5	2.5	3.0
10*	-3.54%	2.0	$18,912	4.0	2.7	3.0
1*	-0.03%	1.5	$7,415	5.0	2.7	3.3
9*	-0.09%	1.5	$6,646	5.0	2.7	3.3
11*	-0.19%	1.5	$837	5.0	2.7	3.3
18u*	-4.62%	2.5	$25,558	3.5	2.8	3.0
13*	-3.51%	2.0	$15,066	4.5	2.8	3.3
u1819*	-8.85%	3.5	$49,804	2.0	3.0	2.8
12*	-2.66%	2.0	$6,446	5.0	3.0	3.5
a21*	-10.10%	4.0	$59,086	1.5	3.2	2.8
1819*	-10.32%	4.0	$57,514	1.5	3.2	2.8
a20*	-13.04%	4.5	$66,796	1.0	3.3	2.8
final*	-13.13%	4.5	$69,006	1.0	3.3	2.8
80mrp	-22.17%	5.0	$256,766	0.5	3.5	2.8

* = Alternative 1 roadway improvements are also included in this alternative for evaluating congested VHT
2:1* = Ranking = ((2 * congested VHT ranking) + (cost ranking)) / 3
1:1* = Ranking = (congested VHT ranking + cost ranking) / 2

Table 21--PM Peak Hour Alternatives Analysis: Preliminary Ranking Comparison Sorted by 1:1 Ranking, Then by 2:1 Ranking

Alternative (Year 2020)	Percent Difference in Congested VHT from Do-Nothing	Ranking Congested VHT (5=best)	Estimated Cost of Each Alternative ($000)	Ranking Cost Estimates (5=best)	2:1* Ranking Points (5=best)	1:1* Ranking Points (5=best)
Do-Nothing	0.00%		$0		0.0	0.0
6*	0.66%	0.5	$15,272	4.0	1.7	2.3
19uc*	-1.15%	1.5	$35,040	3.0	2.0	2.3
5*	1.94%	0.5	$8,980	4.5	1.8	2.5
4*	0.65%	0.5	$7,892	4.5	1.8	2.5
14*	2.10%	1.0	$16,354	4.0	2.0	2.5
2*	1.66%	0.5	$4,968	5.0	2.0	2.8
3*	0.89%	0.5	$1,519	5.0	2.0	2.8
15*	-1.29%	1.5	$22,300	4.0	2.3	2.8
u1819*	-8.85%	3.5	$49,804	2.0	3.0	2.8
a21*	-10.10%	4.0	$59,086	1.5	3.2	2.8
1819*	-10.32%	4.0	$57,514	1.5	3.2	2.8
a20*	-13.04%	4.5	$66,796	1.0	3.3	2.8
final*	-13.13%	4.5	$69,006	1.0	3.3	2.8
80mrp	-22.17%	5.0	$256,766	0.5	3.5	2.8
7*	2.53%	1.0	$1,766	5.0	2.3	3.0
8*	-1.65%	1.5	$10,946	4.5	2.5	3.0
10*	-3.54%	2.0	$18,912	4.0	2.7	3.0
18u*	-4.62%	2.5	$25,558	3.5	2.8	3.0
1*	-0.03%	1.5	$6,284	5.0	2.7	3.3
9*	-0.09%	1.5	$6,646	5.0	2.7	3.3
11*	-0.19%	1.5	$837	5.0	2.7	3.3
13*	-3.51%	2.0	$15,066	4.5	2.8	3.3
12*	-2.66%	2.0	$6,446	5.0	3.0	3.5

* = Alternative 1 roadway improvements are also included in this alternative for evaluating congested VHT
2:1* = Ranking = ((2 * congested VHT ranking) + (cost ranking)) / 3
1:1* = Ranking = (congested VHT ranking + cost ranking) / 2

RECOMMENDED 1998 MASTER ROAD PLAN

The Master Road Plan Update is to assess the roadway needs for vehicular traffic in the year 2020. An important element to moving people from their origin to their destination can be through the use of alternate modes, such as transit and bicycle. The regional transit agencies do not foresee an expansion of the transit service in Sterling Heights at this time, so the same transit ridership is assumed to be maintained. Bike lanes on public roadways are a means of accommodating and promoting the use of bicycles. Bike lanes/routes should be developed to encourage the use of bicycles. Bike lanes can be built within the ROW. According to the 1993 Master Recreation Plan, the City requires the installation of sidewalks on both sides of all residential streets, providing pedestrian and bicycle movement within neighborhoods. Many of the City's existing parks offer trail systems. The future Master Recreation Plan will further address the actual locations of the bike lanes/routes within the City of Sterling Heights.

Based on the results of the analysis, the recommended 1998 Master Road Plan to facilitate transportation flow into the year 2020 is the one deemed the Final Alternative. The recommended 1998 Master Road Plan includes the following improvements in addition to the Municipal Improvement Program and the Regional Transportation Plan:

- Build/widen 19 Mile Road as five lanes from Dequindre Road to Hayes Road
- Build/widen 18 Mile Road as five lanes from Dequindre Road to Hayes Road
- Widen Utica Road to five lanes from Van Dyke Road to Hayes Road
- Widen Clinton River Road to four lanes from Canal Road to Hayes Road
- Widen Moravian Road to five lanes from Schoenherr Road to Hayes Road
- Widen Schoenherr Road to six lanes from Metropolitan Parkway (16 Mile Road) to Canal Road
- Widen Mound Road to eight lanes from 17 Mile Road to M-59
- Widen 18 ½ Mile Road to five lanes from Mound Road to Van Dyke Road
- Widen Ryan Road to five lanes from 18 Mile Road to M-59
- Widen Dodge Park to five lanes from Metropolitan Parkway (16 Mile Road) to Utica Road
- Widen Maple Lane to five lanes from 14 Mile Road to 15 Mile Road

RECOMMENDED ROADWAY AND RIGHT-OF-WAY STANDARDS

The standard lane width for freeways and high speed or high volume roadways is 12 feet. The Macomb County Road Commission and the City of Sterling Heights adopted a standard lane width of 11 feet.

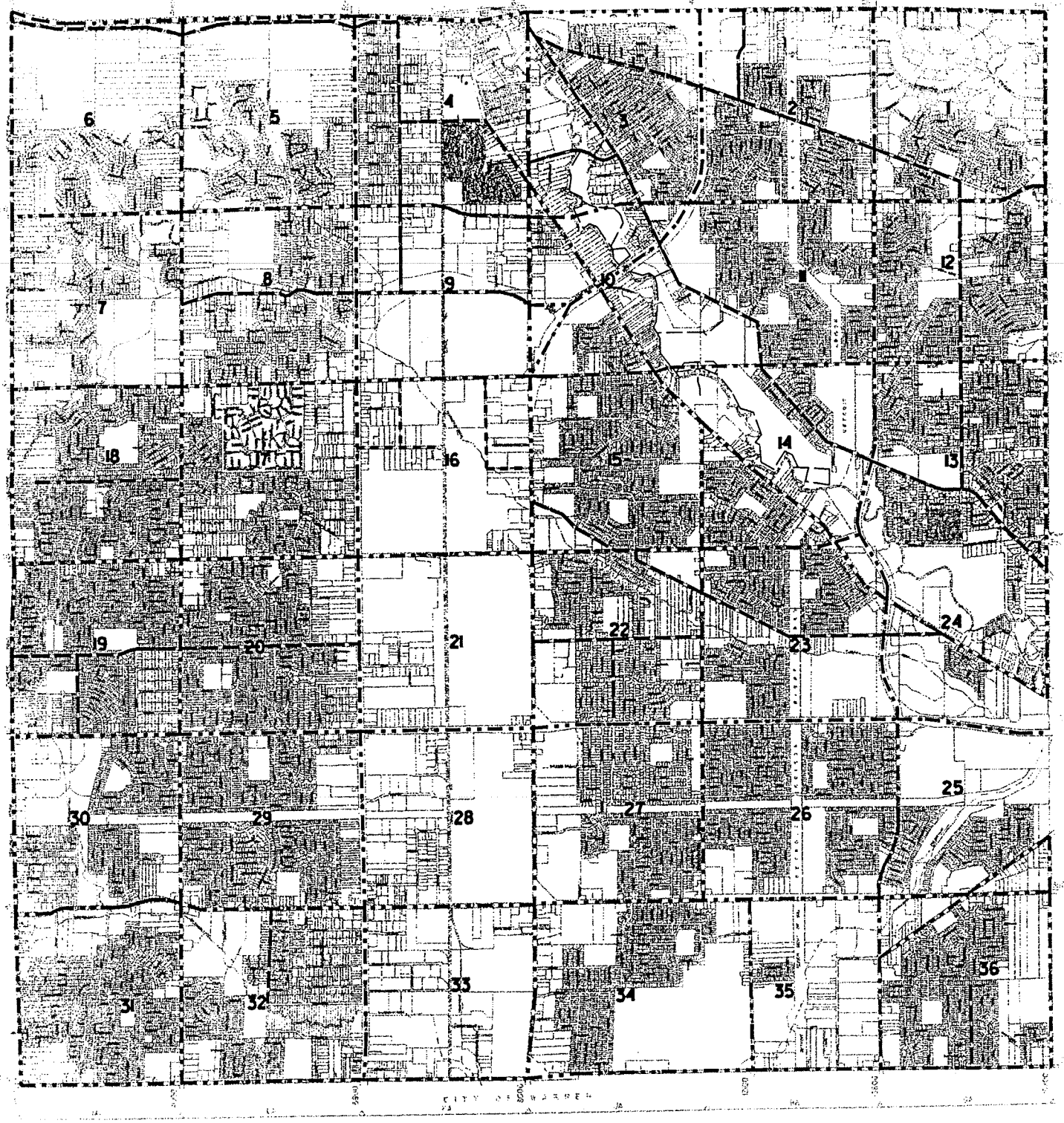
The City of Sterling Heights currently does not have a pavement management system. A Pavement Management System (PMS) tracks the pavements durability and quality. It is helpful for agencies to have a PMS, as it provides an estimate of pavement condition and related pavement performance and cost predictors as a function of time and traffic. A PMS would address the needs for maintenance/repair of the roadway system. This master road plan update does not address existing or proposed pavement conditions, but rather the need for roadway facilities. It is recommended that to maintain existing pavements that a PMS be developed for the City of Sterling Heights.

Table 22 provides recommended right-of-way (ROW) for various cross-sections for major thoroughfares and collector streets. Figure 11 provides the thoroughfare and collector road map for the recommended 1998 Master Road Plan. Figure 12 represents the laneage for the proposed 1998 Sterling Heights Master Road Plan. Right-of-way requirements are also provided in Figure 12.

Table 22--Recommended Right-of-Way Requirements for Major Thoroughfares and Collector Streets

Thoroughfare	Section From	To	Number of Lanes	Recommended ROW (ft)
Dobry Drive	Dequindre	Mound	4	86
19 Mile	Dequindre	Hayes	5	120
18 Mile	Dequindre	Hayes	5	120
17 Mile	Dequindre	Schoenherr	5	120
Metropolitan Parkway	Dequindre	Hayes	6-divided	150
15 Mile	Dequindre	Hayes	5	120
14 Mile	Dequindre	Hayes	5	120
Dequindre	14 Mile	M-59/Hall	5	120
Ryan	14 Mile	M-59/Hall	5	120
Mound	14 Mile	M-59/Hall	8-divided	204
Van Dyke	14 Mile	M-53	6-divided	150
	M-53	M-59/Hall	5	120
Dodge Park	15 Mile	Utica	5	120
Schoenherr	14 Mile	Metropolitan Parkway	5	120
	Metropolitan Parkway	M-59/Hall	6-divided	150
Hayes	14 Mile	Moravian	2	86
	Utica	M-59/Hall	5	120
Moravian	Schoenherr	Hayes	5	120
Utica	Hayes	Van Dyke	5	120
	Van Dyke	M-59/Hall	2	86
Clinton River	Hayes	Canal	4	86
Canal	Saal	Clinton River	2	86

Note: 12 feet additional required for right turn lanes at major intersections



MAJOR THOROUGHFARE
SECONDARY THOROUGHFARE
PROPOSED COLLECTOR ROAD*

city of STERLING HEIGHTS

1998 MASTER ROAD PLAN

CITY STREET DIRECTORY

STERLING HEIGHTS, MICHIGAN

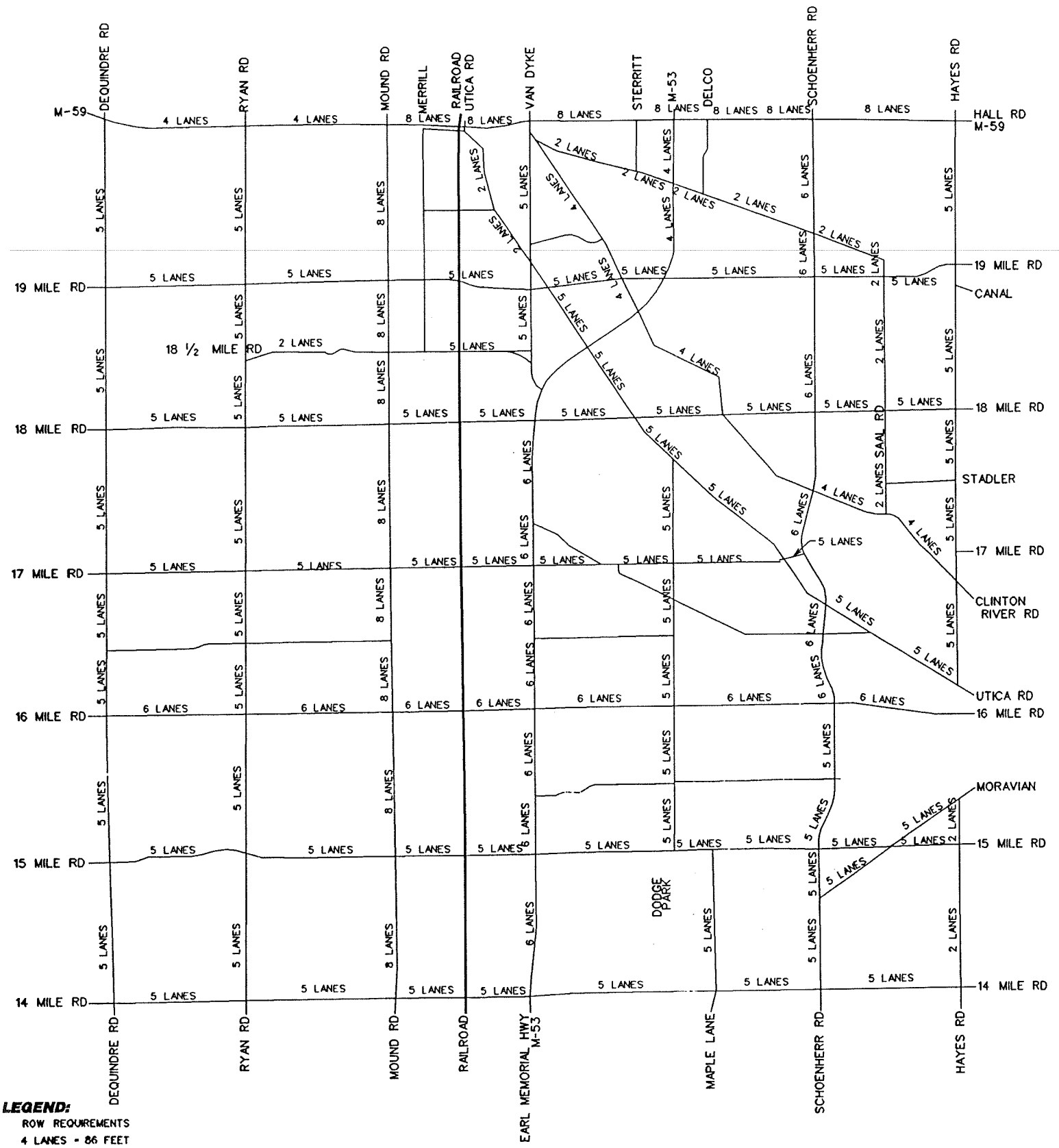
NORTH

SCALE IN FEET

PREPARED BY
ENGINEERING DEPARTMENT
REVISED 02-17-98

* The policy of establishing or completing 70' collector roads at the half mile road points should be continued in concept. However, every effort should be made to complete unfinished collectors in a manner which will discourage or eliminate cut through traffic and excessive speeds. Each new connection to a major thoroughfare should be analyzed to weigh the health and safety of the area residents (i.e. fire, fighting, police response and emergency response) against convenience.

FIGURE 11



LEGEND:

ROW REQUIREMENTS

- 4 LANES - 86 FEET
- 5 LANES - 120 FEET
- 6 LANES-DIVIDED - 150 FEET
- 8 LANES-DIVIDED - 204 FEET

FIGURE 12

STERLING HEIGHTS MASTER ROAD PLAN UPDATE	PB 100 YEARS	**RIGHT-OF-WAY (ROW) REQUIREMENTS FOR PROPOSTED ARTERIAL NETWORK FOR THE 1998 MASTER ROAD PLAN**	**SCALE:** NTS **DATE:** 3-27-98 **PAGE:** 78

STAGING OF IMPROVEMENTS

Based on the analysis of the proposed 1998 Master Road Plan, the following staging of the improvements in Table 23 is recommended. Other factors may dictate changes in the order in which projects are undertaken. Budgeting of projects with funding by other agencies, environmental clearances, private development participation, compatibility with City planning goals and public support are important facets of projects that must be brought to a successful conclusion prior to the progression of a design and construction phase. As the majority of these factors are either out of the control of the City or are subjective, an attempt to include these in the review process is not made as a part of this study. There are various opportunities for funding, which include grants from State, Federal, and private agencies. These opportunities will have to be investigated further at the time each of the roadway improvements are implemented.

The costs were escalated by year at a rate of 1.03% compounded yearly to address the inflationary value of time. The costs were inflated to the end of the time frame in each time segment. The time line for construction was based on a number of variables: congestion relief, construction timing with parallel facilities, cost, and the need for continuity. Based on the roadway, the percent share of the cost varies. If the road is a county road, the maximum split is that the County and City both pay 50-percent of the cost. If the road is a city road, then the City of Sterling Heights pays 100-percent of the cost, unless the road is eligible for federal funding. There are some roads that qualify for federal funds, that can obtain 80-percent federal funds, 10-percent city funds, and 10-percent county funds. Of those roads that have an 80/20 split, the 10-percent of the City share applies to the preliminary construction cost and the contingency, and 50-percent of the preliminary engineering cost.

In the fiscal year 2000 to 2005 time frame, four projects are recommended. The widening of 19 Mile Road to five lanes from Dequindre Road to Van Dyke Road provides over a 2.5-percent decrease in congestion; one of the highest percent decreases of any of the improvements. The building of 18 Mile Road to five lanes from Utica Road to Hayes Road has the second highest decrease in congestion, approximately 2.0-percent. The widening of 18 Mile Road to five lanes from Dequindre Road to Utica Road is anticipated to reduce congestion by approximately 1.65-percent. Widening Ryan Road to 5 lanes from 18 Mile to M-59 is also recommended in this time frame to reduce some congestion in the north-south direction. These are some aggressive projects to undertake in this time frame, but the congestion relief is significant once complete. The combination of these projects will reduce congestion by over 6-percent. The total estimated cost of these projects in the years 2000-2005 is $38,873,853 in 2005 dollars. The total City cost in the years 2000-2005 is estimated at $19,311,479 in 2005 dollars.

In the fiscal year 2006 to 2010 time frame, three projects are recommended. The projects of widening 18 ½ Mile Road to five lanes from Mound Road to Van Dyke Road, widening 19 Mile Road to five lanes from Van Dyke Road to Hayes Road, and widening Dodge Park to five lanes from Metropolitan Parkway (16 Mile Road) to Utica Road will reduce congestion totally by approximately 2.5-percent. The total estimated cost of these projects in the years 2006-2010 is $26,082,870 in 2010 dollars. The total City cost in the years 2006-2010 is estimated at $26,082,870 in 2010 dollars.

The projects listed in the fiscal year 2011 to 2020 time frame (shown in Table 22) complete the north-south and east-west improvements for the proposed 1998 Master Road Plan. The culmination of all of the above improvements should reduce congestion by over 13-percent from what is predicted will occur without these improvements in the year 2020. The total estimated cost of these projects in the years 2011-2020 is $55,023,358 in 2011 and 2020 dollars. The total City cost in the years 2011-2020 is $10,970,669.

The total estimated cost of all of the projects recommended in this 1998 Master Road Plan is $119,980,080, with the City of Sterling Heights share being $56,365,018.

Table 23--1998 Master Road Plan Roadway Improvement Timeline and Estimated Cost

Project Location	Proposed Improvement	Total	City Total
Fiscal Year 2000-2005			
19 Mile from Dequindre to Van Dyke	Widen to five lanes	$ 7,930,000	$ 7,930,000
18 Mile from Utica to Hayes	Build five lanes	$15,345,000	$ 2,420,000
18 Mile from Dequindre to Utica	Widen to five lanes	$ 7,920,000	$ 1,280,000
Ryan from 18 Mile to M-59	Widen to five lanes	$ 7,690,000	$ 7,690,000
Fiscal Year 2006-2010			
18 ½ Mile from Mound to Van Dyke	Widen to five lanes	$ 3,155,000	$ 3,155,000
19 Mile from Van Dyke to Hayes	Widen to five lanes	$17,370,000	$17,370,000
Dodge Park from 16 Mile to Utica	Widen to five lanes/boulevard	$ 5,565,000	$ 5,565,000
Fiscal Year 2011-2015			
Schoenherr from 16 Mile to Canal	Widen to six lanes	$ 5,760,000	$ 935,000
Utica from Van Dyke to Hayes	Widen to five lanes	$10,985,000	$ 1,775,000
Mound from 17 Mile to M-59	Widen to eight lanes	$ 5,330,000	$ 865,000
Fiscal Year 2016-2020			
Moravian from Schoenherr to Hayes	Widen to five lanes	$ 4,935,000	$ 800,000
Maple Lane from 14 Mile to 15 Mile	Widen to five lanes	$ 2,481,000	$ 2,481,000
Clinton River from Canal to Hayes	Widen to four lanes	$25,540,000	$ 4,130,000

Note: Costs were Compounded Annually by 3% to Upper Bound of Fiscal Year from 1998 Dollars

APPENDIX A

CRITICAL CRASH LOCATION CRITERIA

Table 3-1
Regional Critical Intersection Crash Rates, Frequencies and Casualty Ratios: By Area Type

Average Daily Traffic Volume Entering Intersection	Average Crash Rate	Critical Crash Rate	Average Crash Frequency	Critical Crash Frequency	Average Casualty Ratio	Critical Casualty Ratio	Number of Intersections Sampled[1]
URBAN AREA[2]	**1.45**	**2.08**	**12.50**	**25.25**	**0.29**	**0.44**	**2,925**
0 - 10,000	3.73	5.95	4.65	9.95	0.31	0.51	307
10,001 - 20,000	1.36	2.28	7.44	14.32	0.29	0.46	677
20,001 - 30,000	1.25	1.91	11.31	21.67	0.29	0.43	683
30,001 - 40,000	1.10	1.62	13.95	25.37	0.30	0.42	497
40,001 - 50,000	1.05	1.50	17.13	32.09	0.30	0.43	331
50,001 - 60,000	1.08	1.49	21.32	39.07	0.29	0.40	190
60,001 - 70,000	1.00	1.36	23.57	41.68	0.29	0.39	103
70,001 - 80,000	0.79	1.09	21.71	38.68	0.30	0.38	55
80,001 - 90,000	0.86	1.15	26.35	43.91	0.27	0.33	48
over 90,000	0.67	0.90	24.31	40.79	0.29	0.41	34
RURAL AREA[2]	**2.21**	**3.67**	**4.43**	**9.19**	**0.30**	**0.52**	**395**
0 - 10,000	2.71	4.84	2.71	4.95	0.29	0.54	260
10,001 - 20,000	1.21	2.10	6.34	11.21	0.31	0.51	107
over 20,000	1.38	2.06	13.17	21.36	0.29	0.41	28

[1] Size of sample taken from SEMCOG crash data for Southeast Michigan, 1993-1995.
[2] Values on this line are volume-independent. Rates are in crashes per million vehicles and frequencies are annual averages.

Table 3-4
Regional Critical Intersection Crash Rates, Frequencies and Casualty Ratios: By Presence or Absence of Signalization

Average Daily Traffic Volume Entering Intersection	Average Crash Rate	**Critical Crash Rate**	Average Crash Frequency	**Critical Crash Frequency**	Average Casualty Ratio	**Critical Casualty Ratio**	Number of Intersections Sampled[1]
SIGNALIZED[2]	**1.66**	**2.31**	**14.79**	**27.87**	**0.30**	**0.42**	**2,375**
0 - 10,000	6.13	8.88	6.42	11.36	0.33	0.49	158
10,001 - 20,000	1.70	2.70	9.38	16.56	0.30	0.43	507
20,001 - 30,000	1.43	2.13	12.95	23.54	0.29	0.42	579
30,001 - 40,000	1.21	1.75	15.38	26.69	0.30	0.42	437
40,001 - 50,000	1.14	1.60	18.52	33.62	0.30	0.42	298
50,001 - 60,000	1.18	1.61	23.37	41.08	0.29	0.38	169
60,001 - 70,000	1.06	1.43	25.03	42.93	0.30	0.39	96
70,001 - 80,000	0.83	1.14	22.85	39.60	0.30	0.38	52
80,001 - 90,000	0.89	1.19	27.25	44.64	0.26	0.32	46
over 90,000	0.69	0.92	24.99	41.24	0.29	0.40	33
Unsignalized on Next Page							

[1] Size of sample taken from SEMCOG crash data for Southeast Michigan, 1993-1995.
[2] Values on this line are volume-independent. Rates are in crashes per million vehicles and frequencies are annual averages.

Table 3-4
Regional Critical Intersection Crash Rates, Frequencies and Casualty Ratios: By Presence or Absence of Signalization (cont'd)

Average Daily Traffic Volume Entering Intersection	Average Crash Rate	**Critical Crash Rate**	Average Crash Frequency	**Critical Crash Frequency**	Average Casualty Ratio	**Critical Casualty Ratio**	Number of Intersections Sampled[1]
UNSIGNALIZED[2]	**1.23**	**2.07**	**3.37**	**7.05**	**0.28**	**0.51**	**945**
0 - 10,000	2.15	4.02	2.73	6.25	0.29	0.53	409
10,001 - 20,000	0.68	1.38	3.46	6.36	0.29	0.51	277
20,001 - 30,000	0.44	0.86	3.99	7.03	0.26	0.46	127
30,001 - 40,000	0.38	0.70	4.69	11.57	0.25	0.44	65
40,001 - 50,000	0.29	0.54	4.59	7.86	0.32	0.52	33
50,001 - 60,000	0.25	0.46	4.87	9.52	0.28	0.47	21
over 60,000	0.13	0.26	3.33	4.97	0.27	0.44	13

[1] Size of sample taken from SEMCOG crash data for Southeast Michigan, 1993-1995.
[2] Values on this line are volume-independent. Rates are in crashes per million vehicles and frequencies are annual averages.

APPENDIX B

TRANPLAN ALTERNATIVES ANALYSIS

FOR THE YEAR 2020

Proposed 2020 roadway network with no modifications

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

Widen Ryan to 5 lanes from 18 Mile to M-59; widen Dodge Park to 5 lanes from 16 Mile to Utica; widen Maple Lane to 5 lanes from 14 Mile to 15 Mile

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

Add on- and off-ramps to M-53 at Clinton River Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Build Hayes Road as 2 lanes between Moravian Road and Utica Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

Mound Road to M-53 connector in the vicinity of 18 ½ Mile Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

Widen Utica Road to 5 lanes from Van Dyke to Hayes Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

Build 17 Mile Road as 3 lanes from Schoenherr Road to Hayes Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Build 17 Mile Road as 5 lanes from Schoenherr Road to Hayes Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

Build 18 Mile Road as 2 lanes from Schoenherr Road to Hayes Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Widen 18 Mile Road as 5 lanes between Dequindre Road and Utica Road, and widen Utica Road to 5 lanes between 18 Mile Road and Hayes Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

Build 18 Mile Road as 2 lanes from Utica Road to Hayes Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Widen 18 Mile Road to 5 lanes between Dequindre Road and Utica Road, and build 18 Mile Road as 5 lanes from Utica Road to Hayes Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

Build 19 Mile Road as 3 lanes from Van Dyke to Utica Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Widen 19 Mile Road to 5 lanes between Dequindre Road and Van Dyke

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Build 19 Mile Road as 3 lanes from Van Dyke to Clinton River Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Widen 19 Mile Road to 5 lanes between Dequindre Road and Van Dyke, and build 19 Mile Road as 5 lanes from Van Dyke to Clinton River Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

19 Mile as 5-ln from Dequindre to Hayes; 18 Mile as 5-ln from Dequindre to Hayes; Utica as 5-ln from Van Dyke to Hayes; Clinton River as 4-ln from Canal to Hayes

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

19 as 5-ln from Deq. to Hayes; 18 as 5-ln from Deq. to Utica & Cl. River to Hayes; Utica as 5-ln from Van Dyke to Hayes; Clinton River as 4-ln from Canal to Hayes

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

19 Mile as 5-ln from Dequindre to Hayes; Utica as 5-ln from Van Dyke to Hayes; Clinton River as 4-ln from Canal to Hayes

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

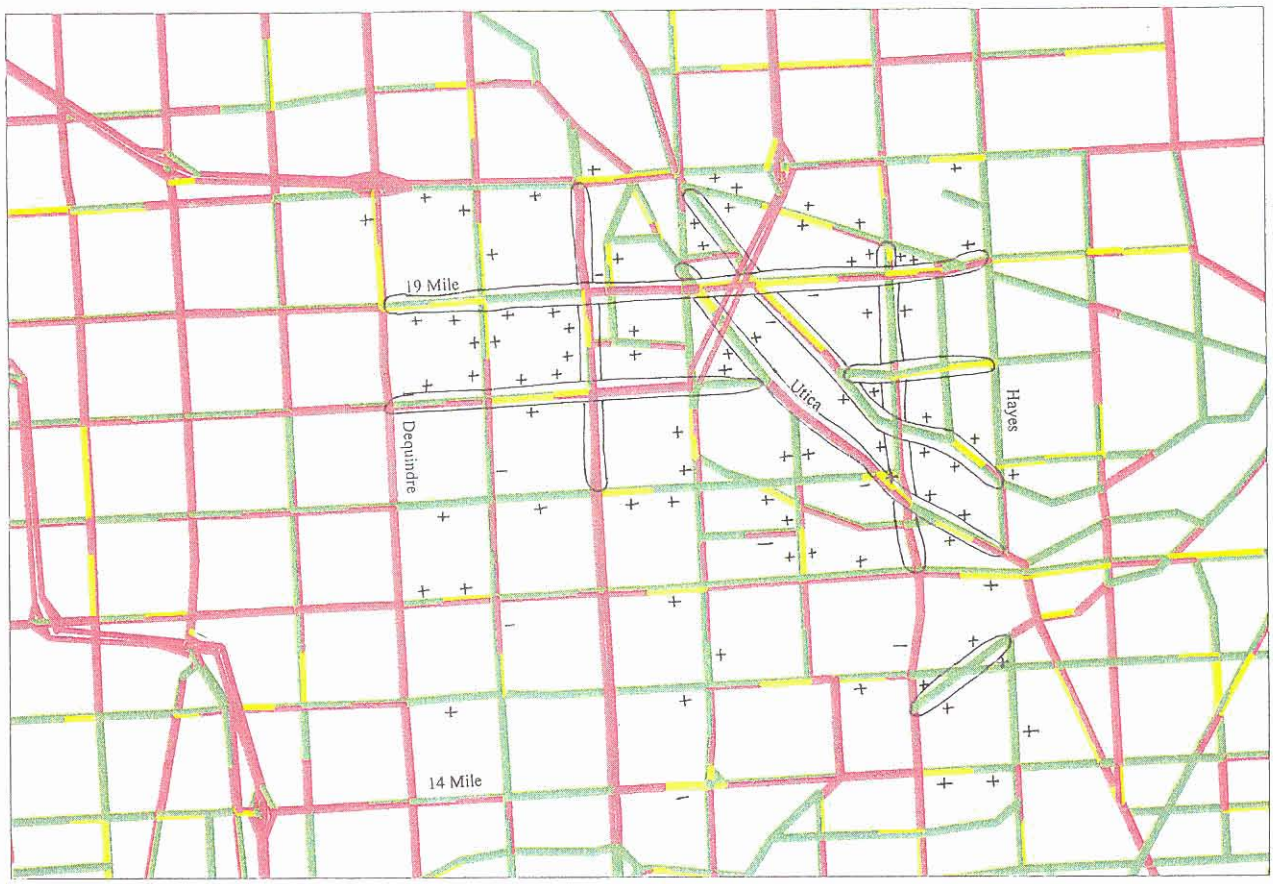
18 Mile as 5 lanes from Dequindre Road to Hayes Road; Utica as 5 lanes from Van Dyke to Hayes Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

19 as 5-ln, Deq. to Hayes; 18 as 5-ln, Deq. to Hayes; Utica 5-ln, V. Dyke to Hayes; Cl. River as 4-ln, Canal to Hayes; Moravian as 5-ln; Schoen. as 6-ln, 16 to Canal; Mound as 8-ln from 17 to M-59

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red



19 as 5-ln, Deq. to Hayes; 18 as 5-ln, Deq. to Utica & Cl. River to Hayes; Utica 5-ln, V. Dyke to Hayes; Cl. River as 4-ln, Canal to Hayes; Moravian as 5-ln; Schoen. as 6-ln, 16 to Canal; Mound as 8-ln from 17 to M-59

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Sterling Heights Master Road Plan Update

1980 Master Road Plan

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

Improvements made to 19 Mile Road; 18 Mile Road; Utica Road; Clinton River Road; Moravian Drive; Schoenherr Road; Mound Road; and 18 ½ Mile Road

Volume-to-Capacity Ratio Legend:
LOS A-D = Green LOS E = Yellow LOS F = Red

APPENDIX C

CRITICAL CRASH DATA FROM

THE CITY OF STERLING HEIGHTS

POLICE DEPARTMENT

Table 4-1
Regional Crash Percentages at Intersections by Crash Types: By Area Type

Average Daily Traffic Volume Entering Intersection	% Single-Vehicle	% Head-On & Sideswipe/ Opp.-Dir.	% Head-Left/ Rear- Left	% Angle	% Rear-End/ Rear-Right & Sideswipe/ Same-Dir.	% Uncoded & Other	Number of Intersections Sampled[1]
URBAN AREA[2]	**4.0**	**4.9**	**9.7**	**26.4**	**45.2**	**9.7**	**2,925**
0 - 10,000	9.1	5.9	9.8	31.4	32.3	11.5	307
10,001 - 20,000	6.0	5.8	10.5	27.8	39.1	10.8	677
20,001 - 30,000	4.2	5.3	11.3	26.2	42.6	10.5	683
30,001 - 40,000	3.8	5.3	11.0	26.7	42.8	10.5	497
40,001 - 50,000	3.2	4.3	10.4	26.5	46.7	8.8	331
50,001 - 60,000	2.8	4.4	8.2	26.0	50.4	8.3	190
60,001 - 70,000	2.5	4.3	6.6	26.4	52.2	8.0	103
70,001 - 80,000	3.1	3.7	6.1	24.8	54.1	8.4	55
80,001 - 90,000	3.0	3.4	5.1	21.0	59.5	8.0	48
over 90,000	3.0	2.8	2.8	22.4	61.8	7.2	34
RURAL AREA[2]	**13.1**	**5.1**	**9.1**	**27.9**	**36.2**	**8.7**	**395**
0 - 10,000	20.1	5.6	7.1	30.9	26.7	9.7	260
10,001 - 20,000	10.5	4.7	9.9	27.5	39.7	7.8	107
over 20,000	4.4	4.8	11.7	22.8	47.9	8.4	28

[1] Size of sample taken from SEMCOG crash data for Southeast Michigan, 1993-1995.
[2] Values on this line are volume-independent. All percentages are distributional averages.

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION	15 MILE ROAD & RYAN

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE		3		1	3	2	9
HEAD ON					1	1	2
HEAD ON L. TURN				4	8	5	17
ANGLE		80	72	34	34	15	236
REAR END				21	20	16	57
REAR END L. TURN				1		2	3
REAR END R. TURN				1	2		3
SIDE SWIPE SAME				2	11	4	17
SIDE SWIPE OPPSITE		2	1	1	3	1	8
OTHER- UNKNOWN				1	1	2	4
TOTAL BY YEAR		85	73	66	83	48	356

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION	15 MILE ROAD & SCHOENHERR

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE				4	4		8
HEAD ON				1		1	2
HEAD ON L. TURN				6	14	3	23
ANGLE			49	28	40	30	145
REAR END				31	43	32	106
REAR END L. TURN						2	2
REAR END R. TURN			1	1			2
SIDE SWIPE SAME				7	5		12
SIDE SWIPE OPPSITE				2	4	1	7
OTHER-UNKNOWN				1	1	2	4
TOTAL BY YEAR			50	81	112	71	311

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION	HALL ROAD & SCHOENHERR

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE			1	1	1	1	4
HEAD ON				1			1
HEAD ON L. TURN							
ANGLE			87	6	18	11	122
REAR END			1	12	24	27	64
REAR END L. TURN							
REAR END R. TURN				2	1		3
SIDE SWIPE SAME				6	10	7	23
SIDE SWIPE OPPSITE			1				1
OTHER-UNKNOWN				2	1		3
TOTAL BY YEAR			90	30	55	46	221

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION	14 MILE ROAD & VAN DYKE

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE			1	4	2	1	8
HEAD ON							
HEAD ON L. TURN				3	4	1	8
ANGLE			40	14	10	6	70
REAR END				18	19	21	58
REAR END L. TURN					1		1
REAR END R. TURN							
SIDE SWIPE SAME				2	5	4	11
SIDE SWIPE OPPSITE					1		1
OTHER-UNKNOWN							
TOTAL BY YEAR			41	41	42	33	157

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION	METROPOLITAN PARKWAY & VAN DYKE

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE			2	3	6	9	20
HEAD ON				1	1		2
HEAD ON L. TURN							
ANGLE			127	56	31	24	238
REAR END				64	97	80	241
REAR END L. TURN							
REAR END R. TURN					4	1	5
SIDE SWIPE SAME				16	19	23	58
SIDE SWIPE OPPSITE			3	2		3	8
OTHER-UNKNOWN						1	1
TOTAL BY YEAR			132	142	158	141	573

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION | RIVERLAND & VAN DYKE

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE				1	4		5
HEAD ON							
HEAD ON L. TURN				7	8	11	26
ANGLE			46	27	15	13	101
REAR END				15	11	11	37
REAR END L. TURN				2	1	1	4
REAR END R. TURN						1	1
SIDE SWIPE SAME				4	2	2	8
SIDE SWIPE OPPSITE				1	2	1	4
OTHER-UNKNOWN				1			1
TOTAL BY YEAR			46	58	43	40	187

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION	14 MILE ROAD & RYAN

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE					1		1
HEAD ON							
HEAD ON L. TURN				2	7	1	10
ANGLE			62	25	13	8	108
REAR END				14	16	8	38
REAR END L. TURN				1	2		3
REAR END R. TURN					1		1
SIDE SWIPE SAME				2	3	2	7
SIDE SWIPE OPPSITE			1	2	1	1	5
OTHER-UNKNOWN				1			1
TOTAL BY YEAR			63	47	54	20	174

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION	17 MILE ROAD & RYAN

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE				1	1		2
HEAD ON							
HEAD ON L. TURN			1	5	10	6	22
ANGLE			21	22	8	10	61
REAR END				8	15	9	32
REAR END L. TURN					2		2
REAR END R. TURN				1			1
SIDE SWIPE SAME				1	2	5	8
SIDE SWIPE OPPSITE					2		2
OTHER-UNKNOWN						1	1
TOTAL BY YEAR			22	38	40	31	131

STERLING HEIGHTS POLICE DEPARTMENT
ACCIDENT TYPE,LOCATION AND YEAR

LOCATION	14 MILE ROAD & SCHOENHERR

TYPE	YEAR	1993	1994	1995	1996	1997	TOTAL
SINGLE VEHICLE					1	1	2
HEAD ON				3			3
HEAD ON L. TURN				4	9	1	15
ANGLE			40	16	8	14	78
REAR END				12	13	9	34
REAR END L. TURN							0
REAR END R. TURN				1		1	2
SIDE SWIPE SAME			1	1	4		6
SIDE SWIPE OPPSITE			1	1			2
OTHER-UNKNOWN							0
TOTAL BY YEAR			42	48	35	26	142