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Prepared for  
Michigan Department of Transportation

**FINAL REPORT**

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**CONGESTION ANALYSIS OF SOUTHFIELD FREEWAY**

Prepared by

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## ACKNOWLEDGEMENTS

I am grateful for the financial support of this research by the Michigan Department of Transportation. I like to thank Dr. Kunwar Rajendra, Mr. Mark Grennell and Ms. Erin O'Brien for their interest and cooperation and Dr. Dale Lighthizer for his continuing collaboration and assistance. I would also like to acknowledge the support provided by Ford Motor Company, and thank Mr. J.F. Derkowski for his enthusiastic involvement in our effort. Finally, I want to express my appreciation to Dr. William C. Taylor for his helpful suggestions and comments.

Virginia P. Sisiopiku

## EXECUTIVE SUMMARY

This research studied the nature, location and extend of congestion along Southfield Freeway. Southfield is located in the Metropolitan Detroit region, an area that has undergone considerable demographic changes in the recent years.

The study design focused on three elements:

- a. Survey of current traffic conditions through field observations;
- b. Survey of users perception regarding the performance of the study facility; and
- c. Study of traffic volume and crashes distributions from historical data.

Current traffic conditions were observed through a series of field trips, including three vehicle trips and two helicopter rides. The site visits provided insight into traffic flow conditions during peak hours, and information of the physical properties of Southfield Freeway.

A questionnaire was developed and distributed to Southfield commuters, requesting information on their travel patterns, perception about congestion, and user profile. 792 responses were obtained and analyzed and perceived cause, location, and duration of congestion was determined.

Finally, historical traffic and incident records were analyzed and high risk locations along the study section were identified.

Field observations indicated minor congestion occurrence in both directions. The observed length of stopped queue was typically in the range of 0.10 to 0.20 miles and the total duration of observed congestion was up to 3 minutes. It was also observed that merging and weaving resulted in higher traffic concentration and shorter distance headways upstream of major on-ramps, conditions that are indicative of speed reduction and delays for the

mainline flows. Long queues were present on the on-ramp from I-96 to Southfield. Collection and analysis of flow and speed data is desirable for assessing congestion in greater detail.

Analysis of the questionnaire survey revealed that the majority of commuters find Southfield Freeway to be always congested (58% of the respondents). Congestion occurs between the 8 Mile Rd and Ford Rd both during the morning and afternoon rush. Delays in the range of 6-15 minutes are reported as a result of congestion. Nine out of ten respondents using I-96/Southfield interchange as an access point, reported problems associated with its operation. Excessive traffic demand, poor design, reckless driving and slow incident response are perceived as the major reasons for poor operation of the facility.

Analysis of historical crash records indicated that the majority of the crashes are of the rear-end type (approximately 50% out of the total). The highest crash rates were observed between the 8 Mile Rd and I-96, for both directions.

Based on the results from the analyses discussed above, specific congestion-relief measures and actions were proposed to improve the level of service of the facility, reduce delays and travel time, facilitate smoother flow of vehicles during the peak periods, and improve the level of satisfaction of the average user. Such measures include initiation of flex-time and pre-trip travel information programs, implementation of corridor control strategies, upgrade of pavement conditions on Southfield freeway and service drives and initiation of a public education campaign to inform motorists of alternative routes.

# Contents

<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
<b>2</b>	<b>LITERATURE REVIEW</b>	<b>1</b>
<b>3</b>	<b>BACKGROUND</b>	<b>2</b>
<b>4</b>	<b>STUDY DESCRIPTION</b>	<b>3</b>
4.1	PROBLEM DEFINITION . . . . .	3
4.2	STUDY OBJECTIVES . . . . .	3
4.3	DESCRIPTION OF STUDY SITE . . . . .	4
<b>5</b>	<b>METHODOLOGY AND RESULTS</b>	<b>4</b>
5.1	STUDY DESIGN . . . . .	4
5.2	DATA COLLECTION AND REDUCTION . . . . .	7
5.2.1	Field Conditions . . . . .	7
5.2.2	Survey of Users . . . . .	8
5.2.3	Historical Data . . . . .	10
5.3	DATA ANALYSIS AND RESULTS . . . . .	16
5.3.1	Field Conditions . . . . .	16
5.3.2	Users Responses . . . . .	17
5.3.3	Crash Analysis . . . . .	31
<b>6</b>	<b>SUMMARY OF CONCLUSIONS</b>	<b>38</b>
6.1	STUDY OF FIELD CONDITIONS . . . . .	38
6.2	STUDY OF USERS RESPONSES . . . . .	38
6.3	CRASH ANALYSIS . . . . .	39
<b>7</b>	<b>RECOMMENDATIONS FOR ACTION</b>	<b>39</b>
7.1	Background . . . . .	39
7.2	Proposed Congestion Relief Strategies . . . . .	40
<b>8</b>	<b>APPENDIX</b>	<b>45</b>

# List of Tables

1	Classification of Users Responses by Frequency of Use . . . . .	10
2	Segmentation of Study Site . . . . .	11
3	Crash Frequencies by Time of Day . . . . .	12
4	Crash Frequencies by Crash Type . . . . .	13
5	Average Daily Traffic . . . . .	14



## List of Figures

1	Study Site Location . . . . .	5
2	Schematic of the Study Site . . . . .	6
3	AM Peak Hour Volume Distribution –Southbound Direction . . . . .	15
4	PM Peak Hour Volume Distribution –Northbound Direction . . . . .	15
5	Age Distribution of Respondents . . . . .	17
6	Distribution of Estimated Home-to-Work Trip Length . . . . .	18
7	Distribution of Morning Section Usage – Southbound Direction . . . . .	19
8	Distribution of Morning Section Usage – Northbound Direction . . . . .	20
9	Distribution of Entering Traffic by Ramp – Morning . . . . .	21
10	Distribution of Exiting Traffic by Ramp – Morning . . . . .	22
11	Distribution of Arrival Times – Morning . . . . .	23
12	Distribution of Perceived Trip Duration – Morning . . . . .	24
13	Perceived Excess Travel Time Due to Morning Congestion . . . . .	25
14	Perceived Excess Travel Time Due to Evening Congestion . . . . .	26
15	Distribution of Perceived Evening Congestion for Various Departure Times . . . . .	27
16	Perceived Morning Congestion for Various Study Sections and Times . . . . .	28
17	Perceived Evening Congestion for Various Study Sections and Times . . . . .	28
18	Perceived Morning Congestion Versus Frequency of Incidents . . . . .	29
19	Perceived Evening Congestion Versus Frequency of Incidents . . . . .	30
20	Annual Crash Distribution –Northbound Direction . . . . .	32
21	Annual Crash Distribution –Southbound Direction . . . . .	33
22	Crash Distribution by Time of Day . . . . .	34
23	Distribution of Crash Rate – Both Directions Combined . . . . .	35
24	Crash Distribution During Peak Periods –Northbound Direction . . . . .	36
25	Crash Distribution During Peak Periods –Southbound Direction . . . . .	37

# CONGESTION ANALYSIS OF SOUTHFIELD FREEWAY

## 1 INTRODUCTION

In the recent years, traffic congestion in urban and suburban areas has grown from a mere annoyance to a severe problem. Although traffic congestion is not a new problem for urban residents, it has spread and intensified to envelop the urban fringe and outlying suburban areas. [1]

The recent phenomenon of suburban migration of both businesses and residential properties, coupled with the increased use of automobiles, resulted in a continuously increasing number of commuters driving to/from work during peak traffic periods. This change in commuting patterns, in combination with limited construction of new highway facilities since the completion of the Interstate system in the 1970s, has clogged local street networks and highway facilities.

Transportation systems operating under similar congestion levels experience similar problems. Such problems include increased delay, reduced travel speed, increased number of queued vehicles, increased emission and vehicle operating costs, and increased drivers' frustration. Although the results from urban congestion in the various systems where it occurs are similar, the causes of congestion itself vary considerably from one system to another. For this reason localized studies are necessary to determine the roots of a congestion problem for a transportation network, facility, or specific location and propose appropriate solutions for their cure.

## 2 LITERATURE REVIEW

A great deal of research has been done on congestion issues. Several studies discuss congestion estimates and trends in major urbanized areas (e.g., [2], [3], [4]) while others focus on congestion quantification (e.g., [1], [5], [6].) A large number of research work focuses on approaches and techniques for alleviating traffic congestion (e.g., [7], [8], [9], [10], [11], [12], [13].) Finally, some studies address issues related to congestion costs and economic effectiveness of available strategies to reduce congestion (e.g., [14], [15].)

In brief, the literature review indicates that researchers agree on the following:

- Congestion is the major operational problem on urban freeways in the United States.

- Congestion is characterized by slower-than-desired travel speeds, increased and unpredictable travel times, erratic stop-and-go driving, increased vehicle operating costs and other undesirable conditions resulting in user dissatisfaction.
- Congestion on urban freeways is of two types: recurring and nonrecurring. [16] Congestion that occurs regularly at particular locations during certain time periods is said to be recurring in nature. Conversely, congestion caused by such random irregular events as crashes, disabled vehicles, and other special situations is referred to as nonrecurring. Nationwide studies report that delay from nonrecurring congestion accounts for more than half of the urban freeway congestion problem. [5]
- Occurrence of freeway congestion is the result of traffic demand exceeding capacity. This is due to either excessive demand or reduction in freeway capacity. Excessive demand is frequently caused by unrestrained access to the freeway, exit ramp queues due to inadequate ramp storage, special events or poor planning. Reduction in freeway capacity often results from geometric and physical features, including lane drops, horizontal curvature, ramp design, weaving sections, inadequate shoulders and vertical alignment, as well as the presence of incidents.
- At least two broad methods can be applied to reduce traffic congestion, namely transportation supply expansion, and travel demand management. The former approach provides congestion relief by increasing the effective capacity of transportation facilities. The latter approach proposes the implementation of travel demand dispersion and reduction actions for congestion reduction.
- The selection of appropriate strategies to relieve congestion should be based on localized studies that identify the nature, cause and extent of the congestion problem, and suggest solutions that conform to local needs, socio-economic factors, and feasibility considerations.

### 3 BACKGROUND

Traffic congestion has become a primary concern for the residents of the Detroit Metropolitan region costing them an estimated \$220 million per year. In recent years, a dramatic change in the demographics took place, shifting residential and business growth from the downtown Detroit area to the suburbs. As a result, facilities once constructed to carry low volume traffic are now used as major commuting routes. Southfield Freeway (M-39) is such an example.

The population and employment growth in the surrounding area as well as the commercial and retail development along the freeway resulted in a significantly increased demand for travel on the Southfield Freeway. Failure of the facility to serve the existing demand during peak hours has been reported and the validity of such claims is being investigated in this study through congestion analysis.

More specifically, this report summarizes the results of an effort to study:

- a. current traffic conditions along the Southfield Freeway;
- b. users perceptions regarding the operation of the study freeway; and
- c. incident records, and specifically crash frequencies, types and locations.

In addition, this report identifies potential congestion-relief measures and actions for alleviating existing congestion problems on and around the Southfield Freeway. Implementation of such actions is expected to improve the level of service of the facility, reduce delays and travel time, and facilitate smoother flow of vehicles during the peak periods. The performance evaluation and/or implementation of the proposed congestion reduction strategies were beyond the scope of the proposed study.

## **4 STUDY DESCRIPTION**

### **4.1 PROBLEM DEFINITION**

Southfield Freeway (M-39) in Metropolitan Detroit area is experiencing heavy traffic demand through peak periods of the day. In addition to carrying local and commercial traffic, this freeway serves commuting needs of Ford Motor Company employees who work for the World Headquarters and other Ford Divisions located in the Dearborn, Michigan area.

Several complaints have been addressed to MDOT regarding the poor performance of Southfield Freeway and its reduced ability to serve daily commuting traffic between I-94 and M-10 in an efficient manner. A need has been identified to determine the problem(s) that are causing excessive delays on Southfield Freeway, in general, and in the vicinity of Ford Motor Company, in particular, and recommend steps that can be taken to improve the operation of the facility and reduce congestion.

### **4.2 STUDY OBJECTIVES**

The objectives of this project were to:

- a. Determine primary perceived cause, location, and duration of congestion based on the analysis of users travel patterns and perceptions;
- b. Identify high risk locations along the Southfield Freeway based on the review of crash records; and
- c. Recommend strategies for action to improve traffic conditions in the vicinity of Southfield Freeway.

### 4.3 DESCRIPTION OF STUDY SITE

Southfield Freeway is an important element of the Detroit metropolitan freeway system. The study section extends southward from the 8 Mile Rd to I-94 and is the major carrier of north/south traffic west of Detroit Metro. The location of the study freeway within the Greater Detroit Metropolitan area is displayed in Figure 1.

Southfield intersects with two major interstate highways (I-94, I-96), U.S. US-12, state highways M-153, M-5, M-102 and M-10), and several local arterials, totaling 15 interchanges along its 14.2 miles. A sketch of the study section is depicted in Figure 2.

The freeway has three, 11.2-ft wide lanes per direction and handles an average daily traffic (ADT) of up to 190,000 vehicles. Although not designed for that purpose, the south most part of the study section now serves the transportation needs of the world headquarters of Ford Motor Company. Ford, one of the major traffic generators on the Southfield, is also the largest employer in the area.

Slopes typically change from -3% to +3% near underpasses as the freeway dives under the crossroads. Service drives, parallel to the freeway, are available along most of the study section, but considerably underutilized. The posted speed limit on Southfield Freeway is 55mph.

## 5 METHODOLOGY AND RESULTS

### 5.1 STUDY DESIGN

The study was designed so that it would allow qualitative estimates of both recurring and nonrecurring congestion as defined in Section 2. Recurring congestion is the congestion occurring on a daily basis due to normal heavy traffic while non-recurring congestion is congestion caused by incidents (disabled vehicles and crashes).

The study design focused on three elements:

- a. Survey of current traffic conditions through field observations;
- b. Survey of users perception regarding the performance of the study facility; and
- c. Study of traffic volume and crashes distributions from historical data.

Field trips were used to obtain preliminary data on traffic and geometric conditions in the study area. The main purpose of the field trips was to offer an insight on the magnitude and nature of congestion problems along the study site and help define the problem statement and the study design.

When available, congestion measures (such as travel speeds, delays and congestion duration) can be used to quantify the level of congestion on a system by assigning a quantitative value to the qualitative concept of congestion. Since historical data on congestion measures



### M-39 SOUTHFIELD FWY

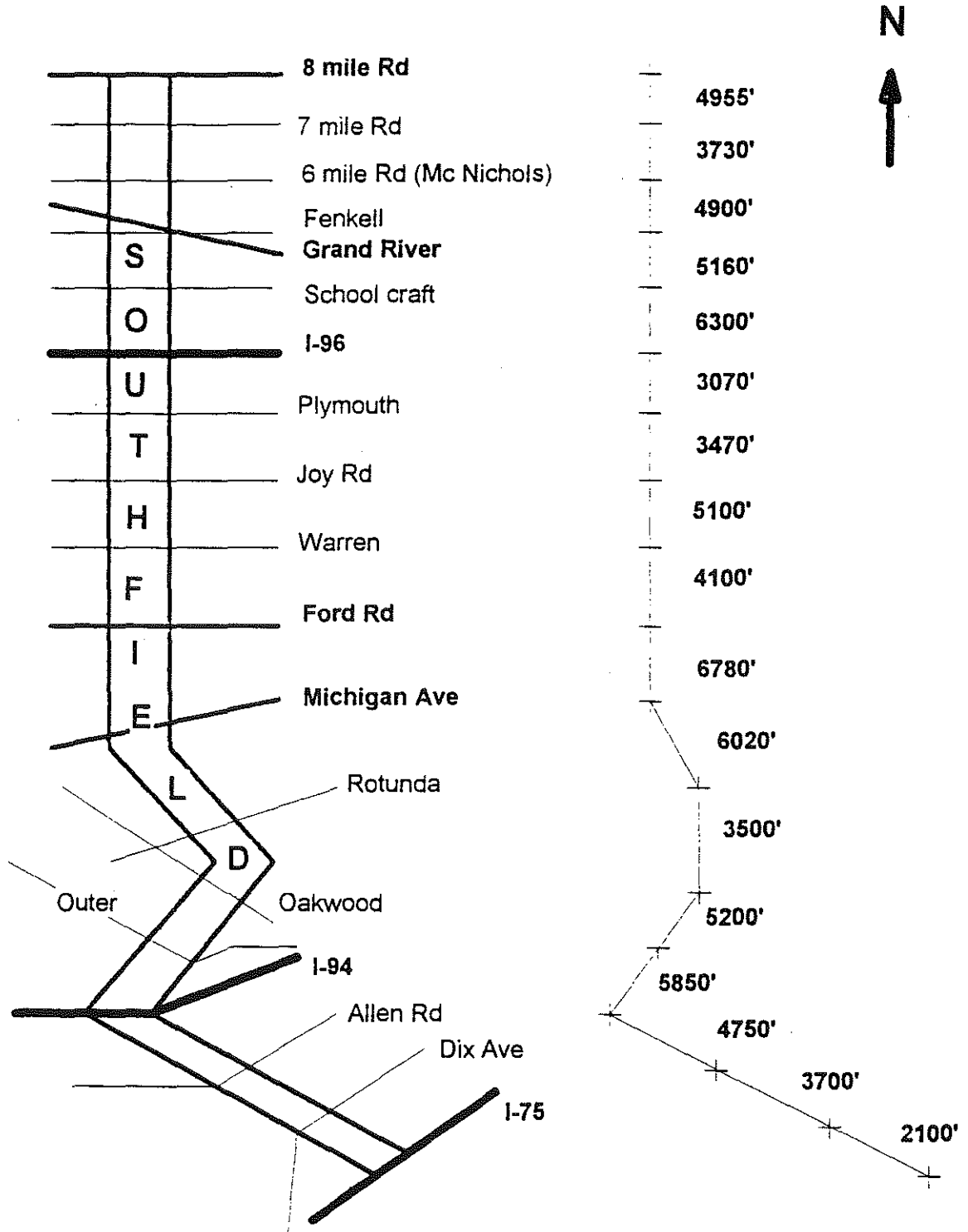


Figure 2: Schematic of the Study Site

were unavailable, this study assessed congestion problems along Southfield, in part, based on the analysis of travel patterns and perceptions of current users. This was done through the development and implementation of a mail-in survey of Southfield commuters with origins/destinations in the study site.

Consideration of congestion problems based on drivers' perspectives is helpful in preparing more effective action plans for reducing driver frustration and improvement of level-of-service and traffic operations.

Finally, consideration and interpretation of historical traffic and crash data is valuable toward identifying "problematic" locations along Southfield Freeway and setting priorities for congestion treatment.

## 5.2 DATA COLLECTION AND REDUCTION

### 5.2.1 Field Conditions

A number of site visits were performed in the early stages of this study to provide insight into traffic flow conditions during peak hours, as well as information on the physical properties of Southfield Freeway. Field conditions were observed during five site visits:

- a. Two reconnaissance on-site visits;
- b. One data collection field trip; and
- c. Two helicopter rides.

The reconnaissance field trips provided valuable input in the organization and execution of several study tasks. In addition to assisting in the familiarization with the study area, these trips offered an opportunity to observe both geometric and traffic conditions in the study area.

A preliminary data collection took place involving two vehicles running the study segment and reporting stopped vehicle queues in the opposite direction. Five such runs were performed during the afternoon peak (4:15 PM to 6:00 PM) on May 18, 1995. In order for the test vehicle to avoid joining a queue, the service roads were used, when possible.

Data were reported on worksheets, specifically developed for this purpose. The starting (reference) point, time and direction of movement were reported first. Then, the start and end time of each queue occurrence was reported. The distance from the reference point at the start and end of each queue was also recorded. Additional observations such as crashes, disabled vehicles, visibility limitations etc were also noted.

Data reduction provided information on queue lengths and durations, location and time of congestion occurrence and special problems encountered during the experimental field data collection.



Finally, two helicopter rides were arranged with METRO TRAFFIC which allowed observation of traffic concentration and limited filming of traffic conditions. The rides took place during the evening peak but the surveillance of the study was limited since no major incidents were reported during the observation period.

Aerial observations offered a uniquely detailed picture of the study site and traffic movements on the freeway and the supporting transportation network. However, amateur video taping and photographing from the helicopter proved to be a difficult task and resulted in a very limited amount of usable data.

### 5.2.2 Survey of Users

The objective of this part of the study was to collect and analyze information on drivers:

- a. usage of Southfield Freeway;
- b. perception of congestion problems during commuting times;
- c. perception of incident related problems during commuting times; and
- d. needs and priorities.

The greatest advantage from pursuing a survey of users is gaining an understanding of congestion problems as perceived by the general public. Motorists' perception of problems and desired solutions may be different from those of the engineers who study them. Understanding the users' needs and priorities helps engineers to respond better to existing problems and offer solutions that improve traffic flow while, at the same time, increase drivers' satisfaction.

Surveys of this nature may suffer from bias when some respondents choose to magnify existing problems in an effort to attract attention. Efforts were made to assure that the survey questions elicit valid responses from interviewees and that inconsistent replies are eliminated from the sample during the data analysis. Two important considerations were needed in order to perform a survey of users, 1. Selection of an appropriate study group, and 2. Development of a survey instrument.

Respondents of interest to the survey should:

- Live and/or work in a location that is in the proximity of Southfield Freeway
- Be familiar with the study area
- Commute to work using an automobile
- Currently use or have the reasonable option of using, the entire length or part of Southfield Freeway for their commute, and
- Be willing to participate.

An appropriate study group would consist of individuals that meet the above mentioned criteria, and represent a reasonable mix of socioeconomic characteristics (such as age, sex, race, education, and income). Important considerations in the study group selection included minimization of sample selection bias, ease of contacting the study subjects and securing reasonable rate of return.

The early interest of Ford Motor Company in the subject study and the willingness of the top management to assist in the distribution of the survey instrument to their employees resolved the study group selection problem in the most satisfying way. Considering the location of Ford Motor Company and the diversity in the demographic and socioeconomic characteristics of its employees, selection of Ford's personnel as the subject study group was a natural choice.

The development of a survey instrument met the following criteria:

- Statement of the study purpose and importance for participation
- Clear definition of questions
- Reasonable length
- Avoidance of any offensive or personal questions
- Format appropriate for distribution via E-mail
- Format appropriate for easy data reduction and coding.

The questions contained in the questionnaire covered the following areas of interest:

- a. Travel patterns of the user (origin, destination, time of travel, trip length);
- b. User perception about congestion on Southfield (location, extent, frequency and cause of observed congestion); and
- c. User profile (age, sex, occupation).

Limited pretest of the survey instrument took place at MSU, before its distribution to the study group. The survey pretest was useful in providing a final check on the format and understandability of the wording, as well as a check of instrument length. The final survey form had 22 questions, and required approximately five minutes to be completed. A copy of the survey instrument is shown in the APPENDIX.

Soon after the development and pretest of the survey instrument, Ford Motor Company set up an efficient mechanism for distributing the survey to hundreds of its employees and forwarding the survey returns in a timely manner. An impressive number of completed surveys was returned, totaling 1,059 questionnaires. The completed questionnaires were classified in three categories using as criterion the frequency of use of the facility. Category 1 included responses of everyday commuters, Category 2 consisted of survey returns from occasional

users while Category 3 included responses from non-users. Table 1 shows the number of questionnaires received in each category.

Table 1: Classification of Users Responses by Frequency of Use

Category	User Type	No. of Responses
1	Frequent	792
2	Occasional	154
3	Non-Users	113
<b>TOTAL</b>		1,059

The analysis of the questionnaires and the conclusions offered in the following paragraphs are based on responses from frequent users only (Category 1). This subset of respondents was given a higher priority due to their greater exposure to the traffic situation along the study segment.

Each direction of traffic was considered separately. Northbound and Southbound directions were denoted as N and S respectively. Reports on morning and afternoon conditions were analyzed separately. To assist in the data reduction effort, the study section was divided into three subsections, namely Upper Section, U; Middle Section, M; and Lower Section, L. Upper Section, U, extends from 8 Mile Rd to I-96, Middle Section, M, extends from I-96 to Ford Rd and Lower Section, L, from Ford Rd to I-75. A finer segmentation was used for the analysis of traffic and crash data as shown in Table 2.

The definitions above allowed to group responses from users that traveled the same subsections of the study freeway. For example, morning commuters that traveled through the Upper and Middle Sections on the southbound direction were classified as UMS users, those that traversed the entire segment from north to south were UMLS users, and so on.

### 5.2.3 Historical Data

Compilation of incident data was limited to crash data from the 1993 Michigan Master Crash File. A decision was made to analyze crashes over an entire year period (as opposed to a four week period initially proposed) since very few crashes occur at certain locations or segments during a four week period.

Compilation of an annual crash database allowed for data stratification and offered a better understanding of the distribution of crashes by time of day, location and type. An

Table 2: Segmentation of Study Site

Segment	From	To	Section
8 mile Rd	8 mile Rd	7 mile Rd	U
7 mile Rd	7 mile Rd	6 mile Rd	U
6 mile Rd	6 mile Rd	Grand River	U
Grand River	Grand River	Schoolcraft	U
Schoolcraft	Schoolcraft	I-96	U
I-96	I-96	Plymouth	M
Plymouth	Plymouth	Joy Rd	M
Joy Rd	Joy Rd	Warren	M
Warren	Warren	Ford Rd	M
Ford Rd	Ford Rd	Michigan Ave	L
Michigan Ave	Michigan Ave	Rotunda	L
Rotunda	Rotunda	Oakwood	L
Oakwood	Oakwood	Outer	L
Outer	Outer	I-94	L
I-94	I-94	Allen Rd	L
Allen Rd	Allen Rd	Dix Ave	L
Dix Ave	Dix Ave	I-75	L
I-75	I-75	Fort	L

inventory-type incident database for Southfield Freeway was developed in a computer spreadsheet format based on crash records for 1993.

Summary tables were developed to provide crash frequency data by segment and direction for various time of day intervals as shown in Table 3. The study section was divided in 18 segments, each named after its northbound cross road boundary. Crashes reported on each section include crashes both on the mainline and on entry and exit ramps. Definition of the various segments is shown in Table 2 above.

Frequencies of crashes by crash type and segment were also summarized. Such data are illustrated in Table 4.

In addition to the 1993 crash records, 1993 traffic volume data were obtained and analyzed. Table 5 displays a summary of the 1993 Annual Daily Traffic (ADT) data, as obtained from MDOT records.

Peak hour volume data were also compiled, based on traffic counts obtained at ramps and certain mainline stations during a 1993 MDOT study. Figures 3 and 4 display the distribution of morning and afternoon highest peak hour volumes for the south- and northbound

Table 3: Crash Frequencies by Time of Day

**Crash Distribution by Time of Day--North Direction**

Segment	7-9 am	10-12 pm	1-3 pm	4-6 pm	7-9 pm	10-12 am	1-3 am	4-6 am	Unknown	Total
8 mile road	10	9	12	16	5	4	4	0	1	61
7 mile road	17	15	16	30	9	13	9	3	0	112
6 mile road	5	9	10	13	16	1	2	0	2	58
Grand River	8	7	23	45	15	9	8	0	0	115
Schoolcraft	7	4	6	14	6	6	1	1	0	45
I-96	2	2	1	8	3	2	0	0	0	18
Plymouth	11	8	13	13	10	4	4	1	0	64
Joy Road	7	1	6	24	5	6	2	2	0	53
Warren	9	7	8	26	10	5	4	1	3	73
Ford Road	5	6	12	23	9	9	2	1	1	68
Michigan	22	14	12	11	12	10	4	4	2	91
Rotunda	7	2	5	1	5	0	1	0	1	22
Oakwood	9	4	2	3	3	6	0	0	2	29
Outer	4	0	0	6	3	0	0	0	0	13
I-94	9	12	17	12	7	2	0	3	1	63
Allen road	16	12	13	15	10	4	1	0	0	71
Dix Avenue	12	5	10	8	1	0	2	3	1	42
I-75	0	0	2	3	0	0	0	0	0	5
<b>Total</b>	<b>160</b>	<b>117</b>	<b>168</b>	<b>271</b>	<b>129</b>	<b>81</b>	<b>44</b>	<b>19</b>	<b>14</b>	<b>1003</b>

**Crash Distribution by Time of Day--South Direction**

Segment	7-9 am	10-12 pm	1-3 pm	4-6 pm	7-9 pm	10-12 am	1-3 am	4-6 am	Unknown	Total
8 mile road	6	3	4	6	4	1	0	0	0	24
7 mile road	7	4	17	16	10	10	7	2	0	73
6 mile road	11	8	12	17	18	9	13	3	0	91
Grand River	18	10	19	11	12	12	4	2	0	88
Schoolcraft	16	5	7	14	2	3	3	0	0	50
I-96	5	0	4	8	2	1	2	0	0	22
Plymouth	12	1	12	19	10	11	6	4	0	75
Joy Road	7	9	6	14	5	4	2	6	0	53
W. Warren	16	5	9	12	8	5	0	0	1	56
Ford Road	12	14	21	20	19	6	2	2	2	98
Michigan	2	2	12	11	3	13	5	5	2	55
Rotunda	1	0	4	4	3	1	1	1	1	16
Oakwood	2	1	8	10	2	3	5	0	0	31
Outer	0	0	4	6	2	8	4	2	0	26
I-94	9	11	14	19	7	5	1	1	1	68
Allen road	6	9	7	8	3	1	2	1	1	38
Dix Avenue	1	3	2	5	4	0	0	0	0	15
I-75	0	2	0	1	0	0	0	0	0	3
<b>Total</b>	<b>131</b>	<b>87</b>	<b>162</b>	<b>201</b>	<b>114</b>	<b>93</b>	<b>57</b>	<b>29</b>	<b>8</b>	<b>882</b>

Table 4: Crash Frequencies by Crash Type

**Crash Types--M-39--North direction**

Segment	Fixed object	Rear-end	Side-swipe	Others	Total
8 mile road	1	38	7	15	61
7 mile road	8	27	9	68	112
6 mile road	8	34	7	9	58
Grand River	14	75	8	18	115
Schoolcraft	1	33	0	11	45
I-96	2	9	2	5	18
Plymouth	7	31	5	21	64
Joy Road	7	30	6	10	53
Warren	12	35	4	22	73
Ford Road	9	29	9	21	68
Michigan	14	42	11	24	91
Rotunda	1	8	9	4	22
Oakwood	5	8	7	9	29
Outer	1	6	4	2	13
I-94	4	30	8	21	63
Allen road	3	29	11	28	71
Dix Avenue	4	21	6	11	42
I-75	0	2	1	2	5
<b>Total</b>	<b>101</b>	<b>487</b>	<b>114</b>	<b>301</b>	<b>1003</b>

**Crash Types--M-39--South Direction**

Segment	Fixed object	Rear-end	Side-swipe	Others	Total
8 mile road	4	12	3	5	24
7 mile road	4	47	5	17	73
6 mile road	7	49	11	24	91
Grand River	16	36	16	20	88
Schoolcraft	5	24	8	13	50
I-96	2	15	4	1	22
Plymouth	7	47	7	14	75
Joy Road	7	27	4	15	53
Warren	3	30	8	15	56
Ford Road	7	57	7	27	98
Michigan	7	25	4	19	55
Rotunda	4	6	1	5	16
Oakwood	5	17	4	5	31
Outer	4	12	2	8	26
I-94	4	35	12	17	68
Allen road	1	20	4	13	38
Dix Avenue	0	9	1	5	15
I-75	0	1	0	2	3
<b>Total</b>	<b>87</b>	<b>469</b>	<b>101</b>	<b>225</b>	<b>882</b>

Table 5: Average Daily Traffic

**1993 Average Daily Traffic Data**

	<b>Segment</b>		<b>ADT</b>
<b>Name</b>	<b>From</b>	<b>To</b>	
8 mile Rd	8 mile Rd	7 mile Rd	155599
7 mile Rd	7 mile Rd	6 mile Rd	165750
6 mile Rd	6 mile Rd	Grand River	177400
Grand River	Grand River	Schoolcraft	189465
Schoolcraft	Schoolcraft	I-96	168794
I-96	I-96	Plymouth	168003
Plymouth	Plymouth	Joy Road	168003
Joy Rd	Joy Road	Warren	146741
Warren	Warren	Ford Road	137593
Ford Rd	Ford Road	Michigan	111223
Michigan	Michigan	Rotunda	118190
Rotunda	Rotunda	Oakwood	103041
Oakwood	Oakwood	Outer	98146
Outer	Outer	I-94	88096
I-94	I-94	Allen road	83864
Allen Rd	Allen road	Dix Avenue	80317
Dix Ave	Dix Avenue	I-75	65397

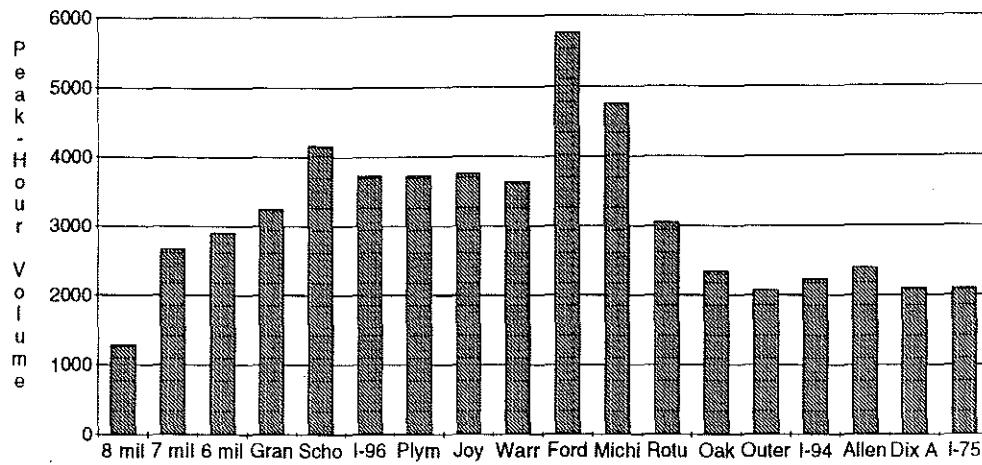


Figure 3: AM Peak Hour Volume Distribution -Southbound Direction

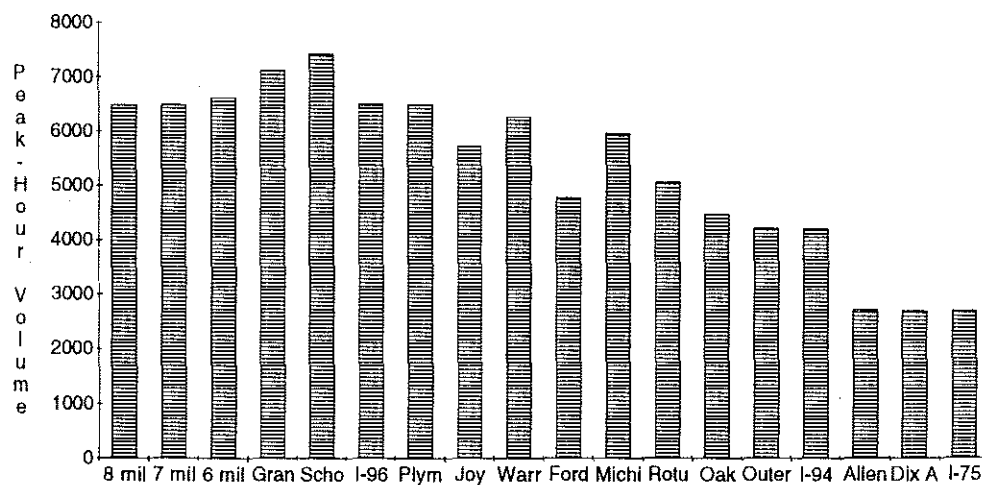


Figure 4: PM Peak Hour Volume Distribution -Northbound Direction



directions, respectively. Note that the highest peak hour volumes do not necessarily occur concurrently.

The objective of this part of the study was to develop an inventory that will assist in the determination of incident frequency by segment and time period, and the identification of problem locations for further consideration.

## 5.3 DATA ANALYSIS AND RESULTS

### 5.3.1 Field Conditions

A number of geometrical problems were observed during the reconnaissance on-site visits. These problems include:

1. Short on- and off-ramps to the service drive;
2. Short merging lanes for travel from the freeway to the arterial street network;
3. Discontinuity and underutilization of service drives;
4. Existence of a "rollercoaster" effect as the freeway dives under the crossroads and rises back up to the service drive grade to accommodate the local utilities.

Another important observation was that traffic in both directions moved fairly smoothly both evenings during which field drives took place. No crashes were observed and significant delays or major traffic backups were not noticed.

The experimental data collection field trip revealed the following problems:

1. The service drives are not continuous and frequent entering/exiting from the freeway to the service drives is difficult for the drivers of the vehicles, and
2. Obstruction of the view due to obstacles, tree foliage, distance from the opposing lane and/or grade limited the ease and accuracy of data collection.

The analysis of the data obtained from the data collection effort indicated no congestion occurrence in the southbound direction while the total duration of observed congestion in the northbound direction varied from 1 to 3 minutes. The observed length of stopped queue was typically in the range of 0.10 to 0.20 miles, with one exception in which case queued vehicles covered approximately 0.7 miles. It was also observed that mainline traffic slowed down at off-ramps and weaving areas, but stop-and-go conditions were very rarely observed during the data collection period.

Aerial view of traffic conditions supported earlier observations of lack of extreme congestion along the Southfield freeway. A crash was reported during one of the helicopter rides but was cleared within minutes causing no major obstruction to the traffic flow. Long queues were present at the on-ramp from I-96 to Southfield. Merging and weaving resulted in higher traffic concentration and shorter distance headways upstream of major on-ramps, conditions that are indicative of speed reduction and delays for the mainline flows.

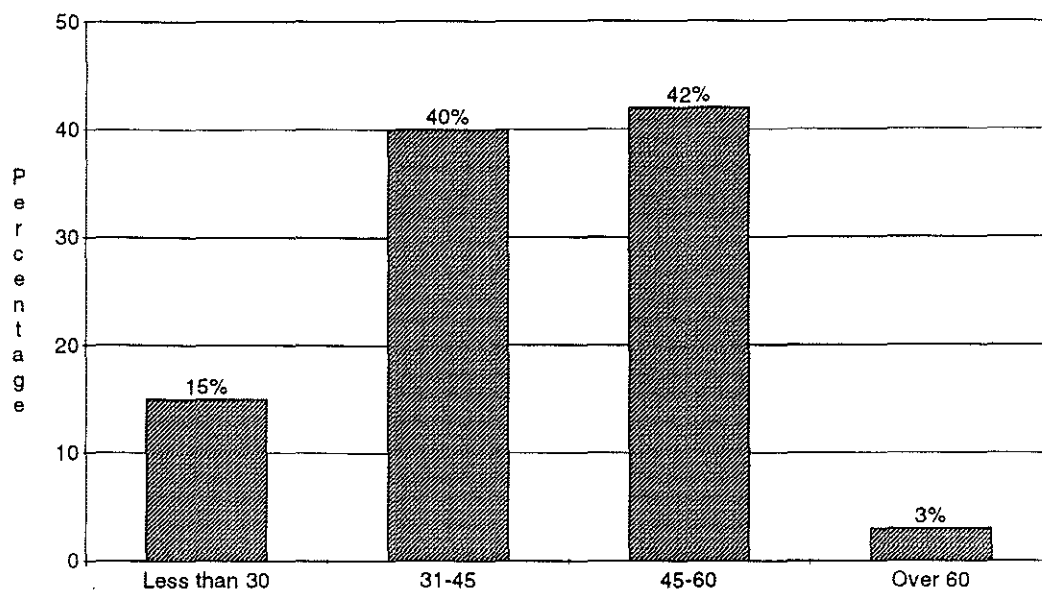


Figure 5: Age Distribution of Respondents

### 5.3.2 Users Responses

Presentation of summary results from the analysis and interpretation of the users responses follows. A summary of respondents comments on the major problems that they face as users of Southfield Freeway is also provided.

#### *Analysis of demographics of the study sample*

Out of the 792 selected respondents, 40% were female and 60% were male. The respondents were grouped into age groups as shown in Figure 5.

Using the residence zipcode and the employment location, approximate home-to-work trip lengths were determined. Based on the data reported, 42% of the respondents reside within 11 to 15 miles from work; 25% 16 to 20 miles from work and 16% between 6 and 10 miles. 11% reported that their approximate distance from home to work is greater than 20 miles while only 1% resides within 5 miles from their location of employment. The estimated length of home-to-work trip follows a normal distribution as shown in Figure 6.

#### *Use of the study site.*

For the purposes of this study, it was very important to determine the parts of Southfield freeway utilized by the responders during their morning and evening commute. Users that used similar parts of the freeway were grouped and a comparative evaluation of their reactions to similar questions was performed. This approach increased the accuracy of interpretation of the responses, and particularly those related to users perception of the extent of congestion, the time added to their trips due to congestion, and the frequency of observed crashes.

Figures 7 and 8 show the morning section usage for the southbound and northbound

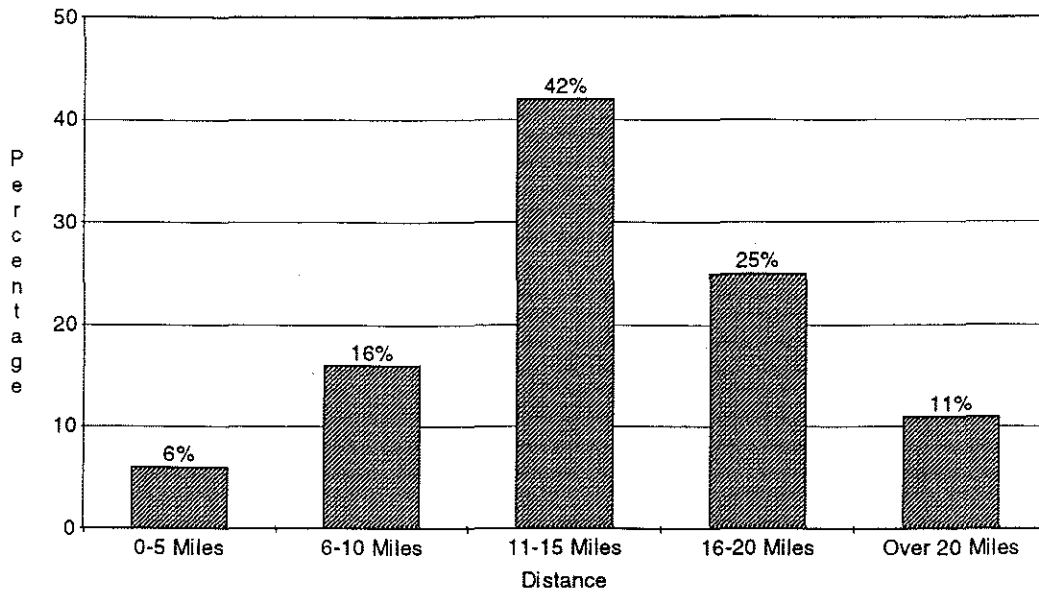


Figure 6: Distribution of Estimated Home-to-Work Trip Length

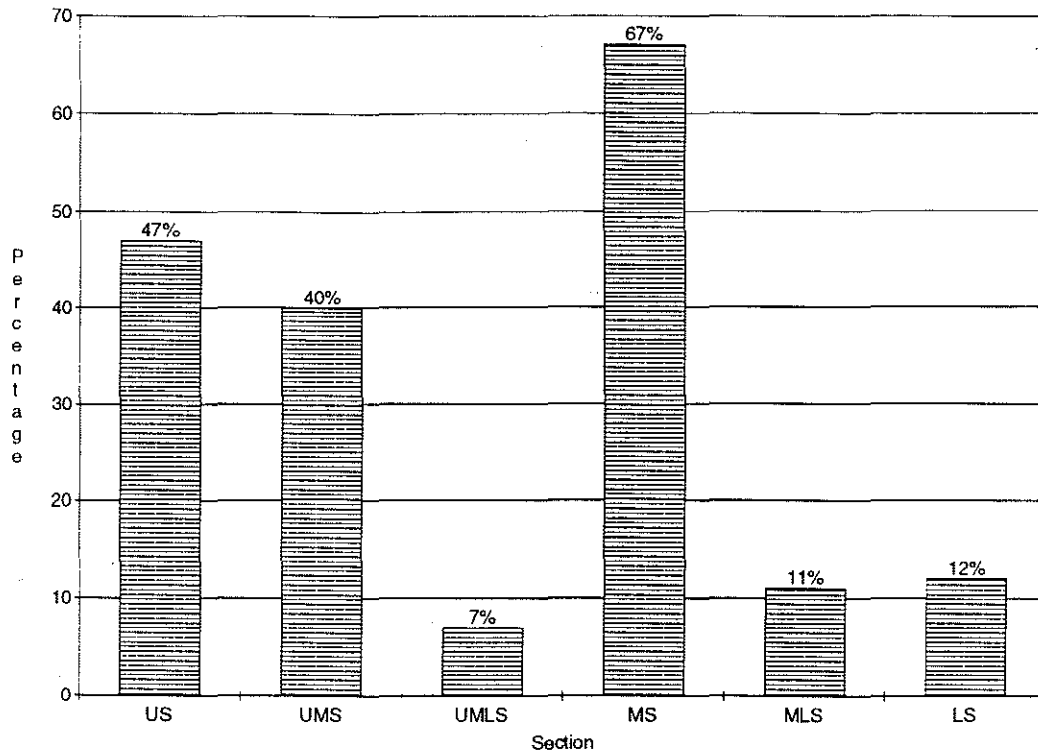
directions respectively. As Figures 7 and 8 illustrate, 40% of the respondents traveling in the southbound (S) direction utilized both the Upper and Middle sections (UMS users), 23% reported entering and exiting Southfield in the Middle Section (MS users) while 7% reported using all three sections (UMLS users). Only 26% reported traveling northbound, all of which used only the Lower Section for their trip to work (LN users).

When asked about the access points they use in the morning to enter Southfield freeway, 45% of the people surveyed stated that they enter Southfield north of 8-mile road. A large percentage (23%) uses the interchange at the I-96 while approaching from the eastbound direction. Only 2% utilized the westbound entrance from I-96. The distribution of entering traffic by ramp during the morning commute is depicted in Figure 9.

The majority of the respondents (61%) leave the Southfield freeway in the morning using the Ford Road exit. The Michigan Avenue exit is the second most favored exit point, and accounted for 36% of the responses (23% for northbound Michigan Avenue and 13% for the southbound direction). All of the other exit ramps combined received a negligible amount of exiting traffic (approximately 1% of the total number of questionnaires returned). The distribution of exiting traffic by ramp during the morning commute is shown in Figure 10.

#### Travel patterns.

Users were asked about the time they normally report to work in the morning and leave the office in the evening. Information of this type was useful for the analysis of congestion and incident related responses through time, as discussed in the paragraphs that follow. Figure 11 shows that over half of the users surveyed used the network prior to 7:30 AM, while another third used part of Southfield between 7:30 AM and 8:00 AM.



U= BETWEEN 8 MILE RD & I-96                      S= SOUTHBOUND  
 M= BETWEEN I-96 & FORD RD  
 L= BETWEEN FORD RD & I-94

Figure 7: Distribution of Morning Section Usage – Southbound Direction

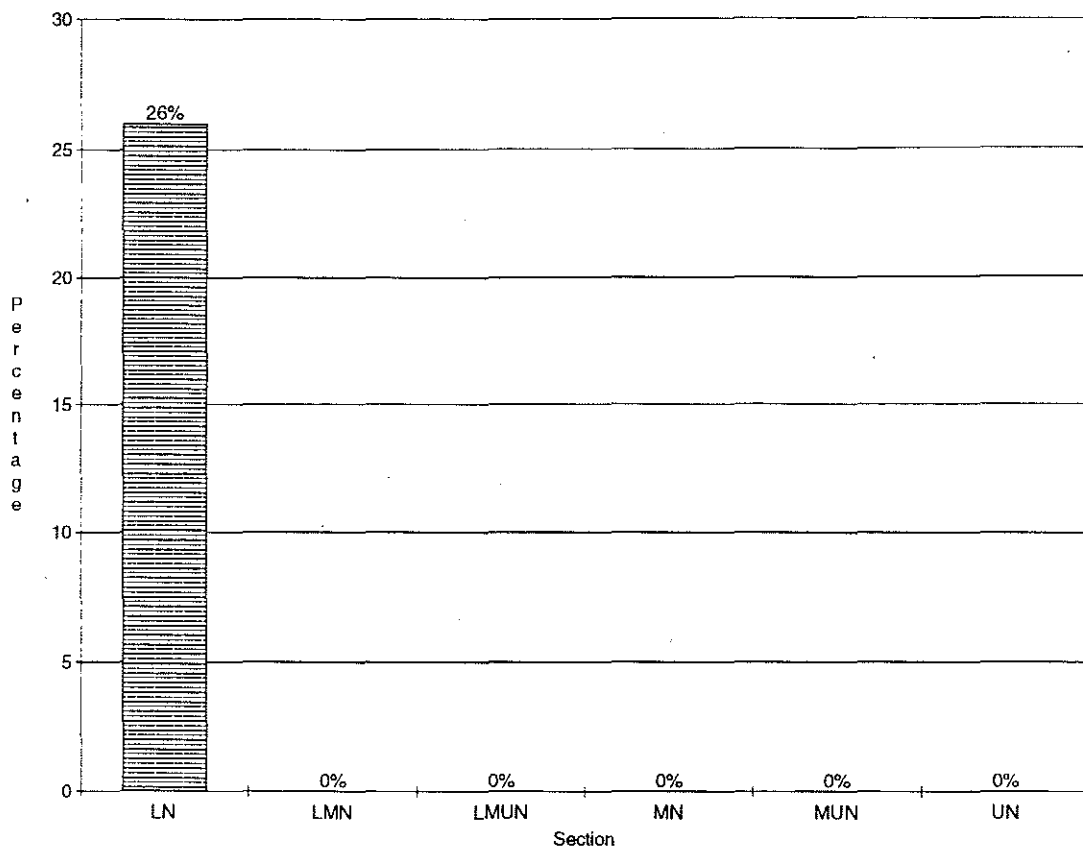
Analysis of the departure times indicated that 46% did not leave work until after 5:30 PM, thus reported traffic conditions observed on the study area between 5:30 and 6:00 PM.

As far as the mode used to reach the work place is concerned, only 1% of the surveys indicated carpooling, while 99% of the respondents drive their own vehicle to work.

The analysis of the responses on trip duration indicated that 63% of the respondents perceived their average home-to-work trip to exceed 30 minutes, and 32% stated an average trip duration of 15 to 30 minutes. These results are graphically shown in Figure 12.

Perceived Congestion.

An overwhelming 58% of the respondents reported that Southfield is always congested during



L= BETWEEN I-94 & FORD RD                      N= NORTHBOUND  
 M= BETWEEN FORD RD & I-96  
 U= BETWEEN I-96 & 8-MILE RD

Figure 8: Distribution of Morning Section Usage – Northbound Direction

their morning commute. One-third described the morning traffic conditions as sporadically congested, while only 10% stated no serious congestion problems along the Southfield freeway. Similar percentages were recorded for the perceived evening congestion.

Congestion is perceived to add a considerable amount of extra travel time to Southfield users trips. Evening congestion is believed to add even more delay time to their trips. The perceived excess travel time due to morning and evening congestion follow the normal distribution as shown in Figures 13 and 14 respectively.

As stated earlier, it was desirable to study in detail the responses of those users who traveled a significant part of the study section and thus had the ability to compare the performance of the various sections and provide specific information on problem locations along the Southfield Freeway. However, only 7% of the respondents traveled across all three

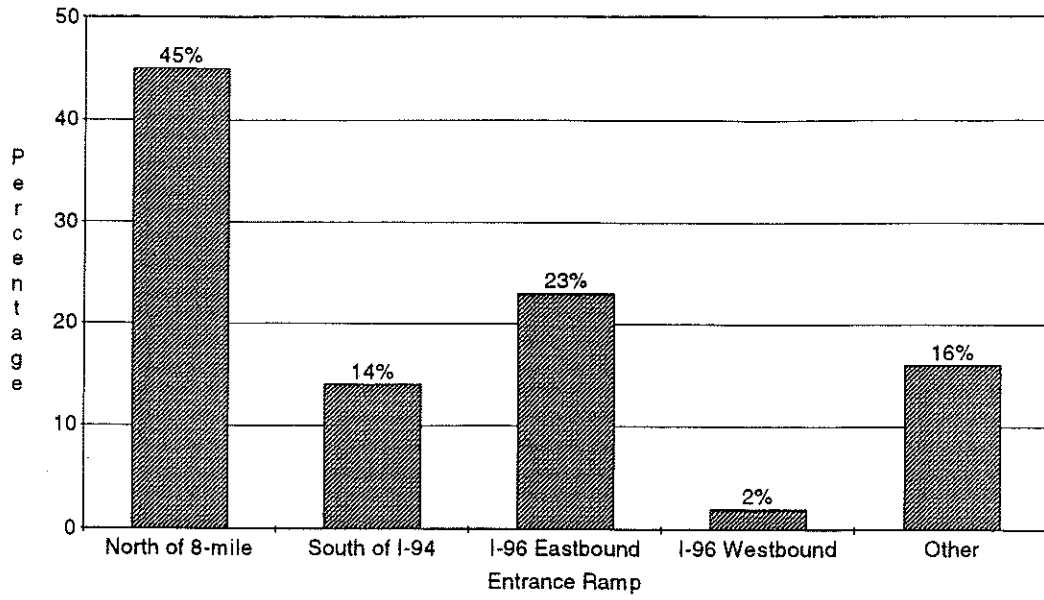


Figure 9: Distribution of Entering Traffic by Ramp – Morning

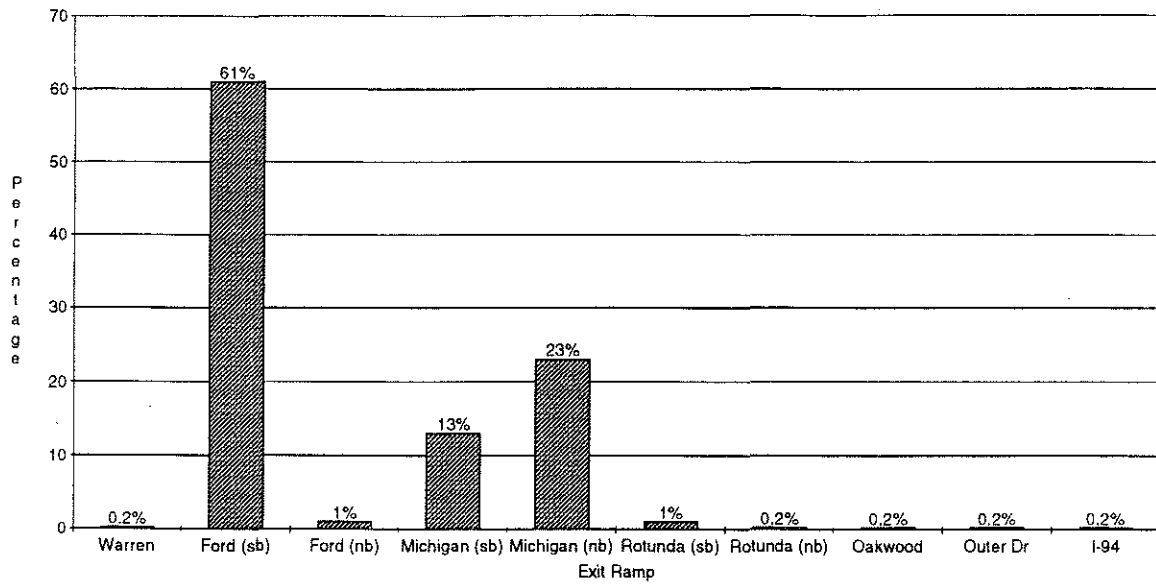


Figure 10: Distribution of Exiting Traffic by Ramp – Morning

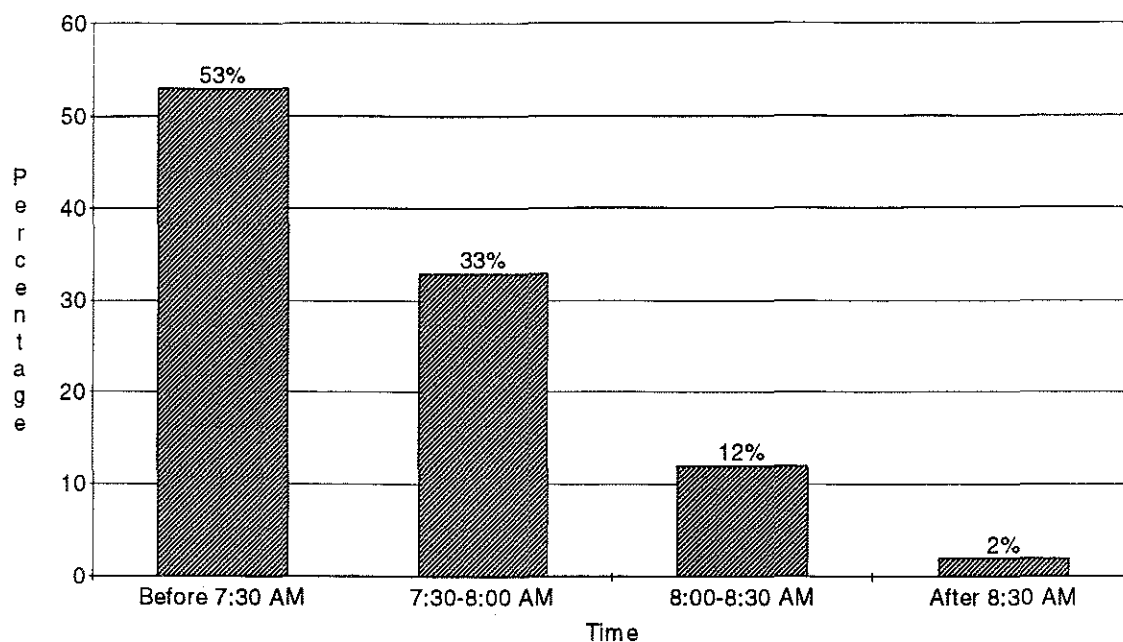


Figure 11: Distribution of Arrival Times - Morning

sections, resulting in a very small data sample (UMLS users). To expand the sample size, responses from the 40% who traversed both the Upper and Middle Sections (UMS users) were added to the pool of the UMLS users. The above subgroup was then used as a study group to further analyze the distribution of the perceived congestion in space and time.

The effect of the arrival and departure time to the distribution of perceived congestion was first analyzed based on the answers reported by the UMLS and UMS users. In general, the relative proportion between the always congested, sporadically congested and non congested responses remain unaffected by the arrival or departure time, indicating a potential bias in the responses of users.

The largest percentage of users reporting severe morning congestion along Southfield travel the study section before 7:30 AM (0.37%.) 24% of UMLS and UMS users suggest that the study section is always congested between 7:30-8:00 AM while only 6% report severe congestion after 8:00 AM. Similarly, the percentage of those reporting occasional congestion drops from 18% (before 7:30 AM) to 4% (after 8:00 AM.)

In the evening, the responses support a reverse pattern. As congestion starts building up, the percentage of those reporting severe congestion increases continuously from 9% (4:00-



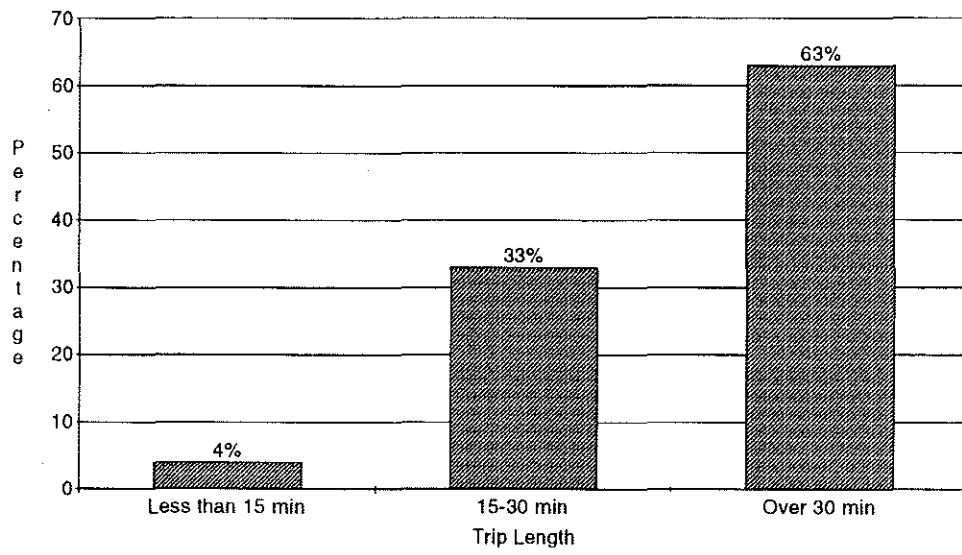


Figure 12: Distribution of Perceived Trip Duration - Morning

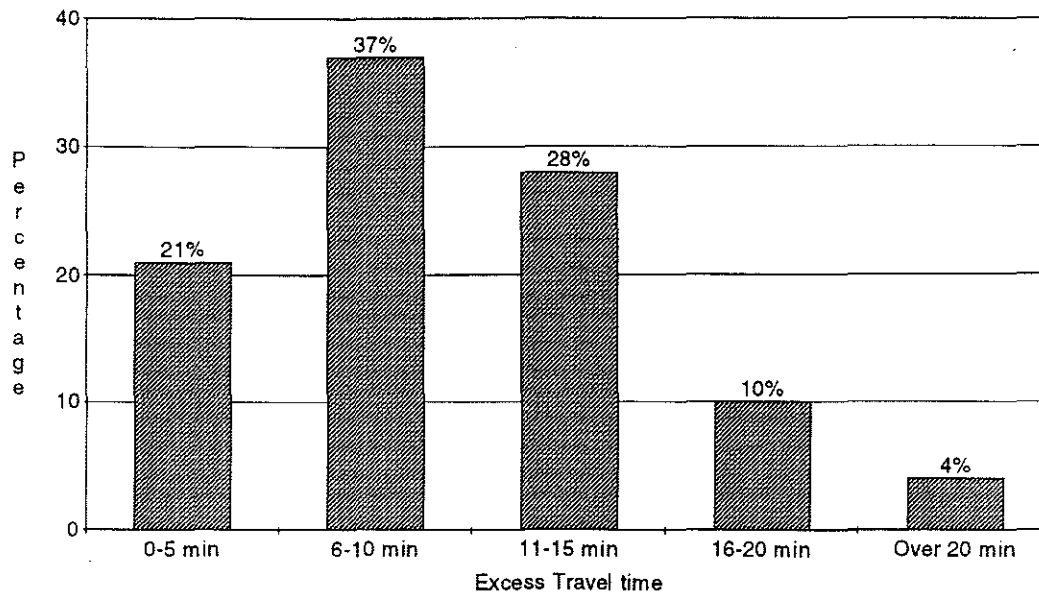


Figure 13: Perceived Excess Travel Time Due to Morning Congestion

4:30 PM) to 17% after 5:30 PM. Figure 15 illustrates the distribution of perceived evening congestion for various departure times.

The reported data were also used to analyze the possible location of congestion along Southfield during various time intervals. As Figure 16 shows, morning users who traverse more than one segments before 7:30 AM report that congestion occurs primarily in the Upper Section (north of I-96). After 7:30 AM, the Upper and Middle Section (between I-96 and Ford Rd) are equally loaded. Only a small percentage of users report significant congestion problems for the Lower Section (south of Ford Rd) during the morning commute.

In the evening, users who traverse more than one segments agree that the Middle Section, experiences the worst traffic conditions, regardless of the time the observations take place. The second most congested segment is the Upper Section (north of I-96) with the Lower Segment showing minor perceived congestion. Overall, the worst performance in space and time is reported for the Middle section after 5:30 PM. These findings are summarized in Figure 17.

#### Perceived Frequency of Incidents.

Another indicator of the level of congestion on Southfield freeway considered in this study was the number of observed incidents per week. Analysis of perceived frequency of incidents also offers an insight on the possible nature of congestion occurring at the study site (recurrent versus non-recurrent). Therefore, the drivers were asked about the number of incidents (crashes, abandoned vehicles, etc) that they observe in a week during their commuting trip

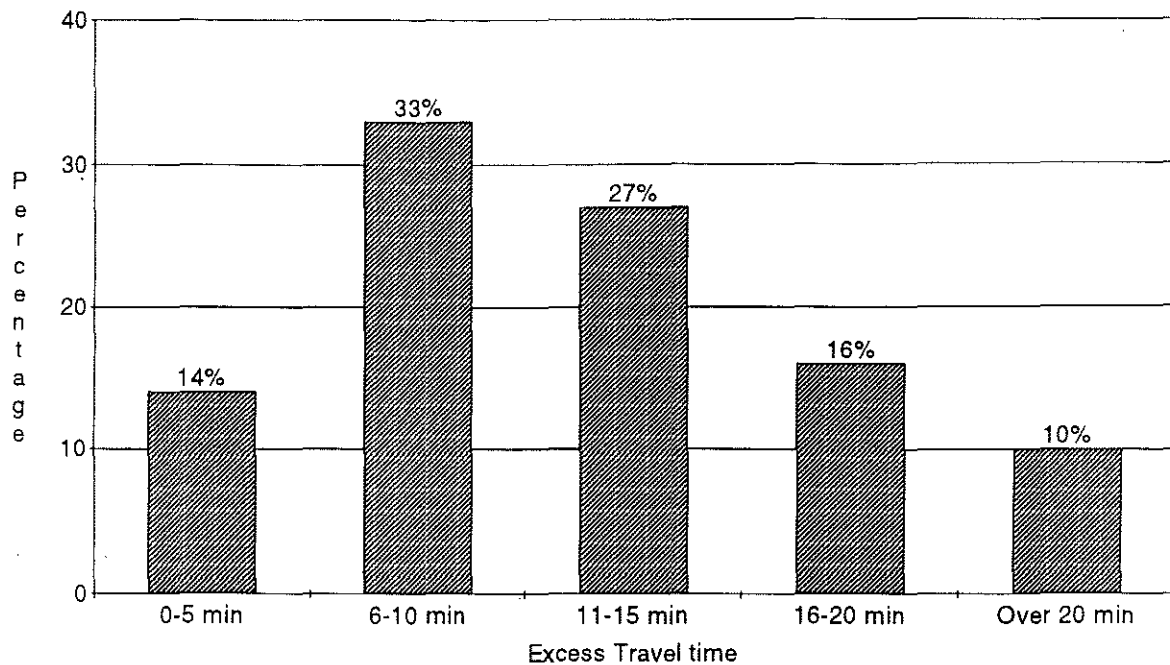


Figure 14: Perceived Excess Travel Time Due to Evening Congestion

to/from work. 65% of those questioned stated that they observed less than three incidents per week, 25% observed between 4 and 6 incidents while 10% reported seeing over 6 incidents weekly.

Finally, the distribution of the perceived congestion versus observed incidents for UMS and UMLS users was evaluated. The results are summarized in Figures 18 and 19. Over half of the UMS and UMLS respondents agreed that they observed no more than 3 incidents weekly (54% in the morning and 55% in the evening.) Interestingly, the majority of those who believe that the Southfield freeway is always congested also reported observing less than 3 incidents weekly (39% in the morning and 34% in the evening.)

#### Users Assessment of Major Problems

The interviewers were asked to identify the major problem they see as frequent users of Southfield Freeway. Out of 792 questioned, 724 provided specific comments to this question. The high response rate indicates the strong interest of Ford Motor Company employees in the survey as well as in contributing to the improvement of traffic conditions in the area surrounding the location of their employment.

A number of problems were identified varying from demand, to design, to behavior, to

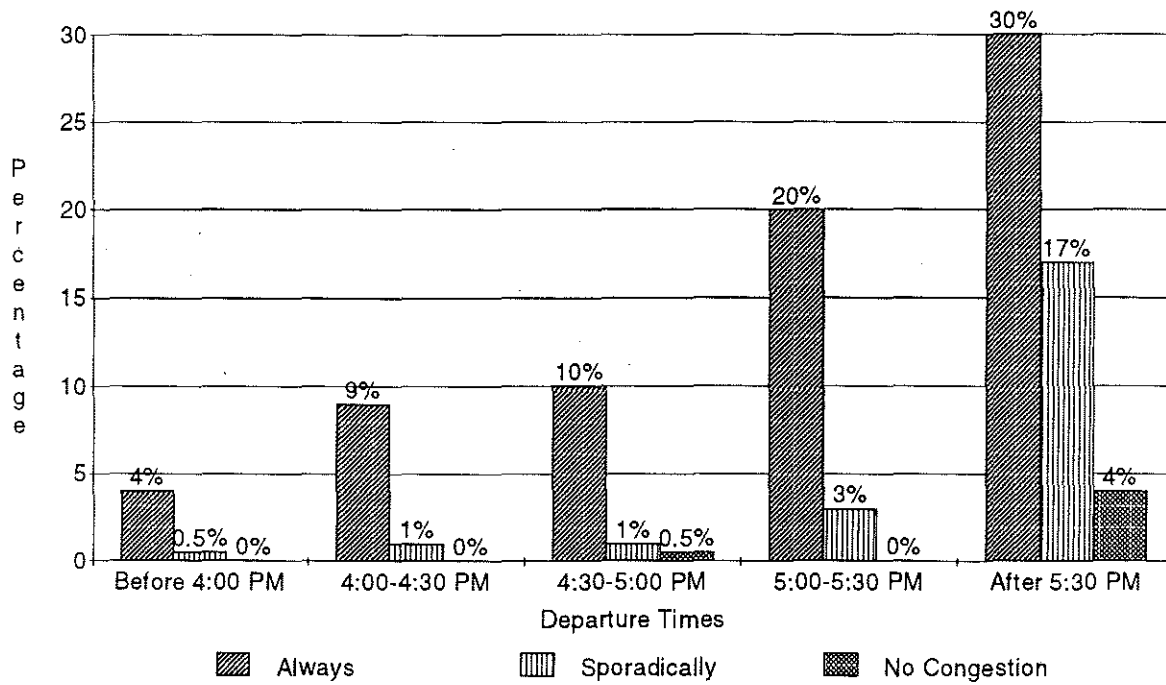


Figure 15: Distribution of Perceived Evening Congestion for Various Departure Times

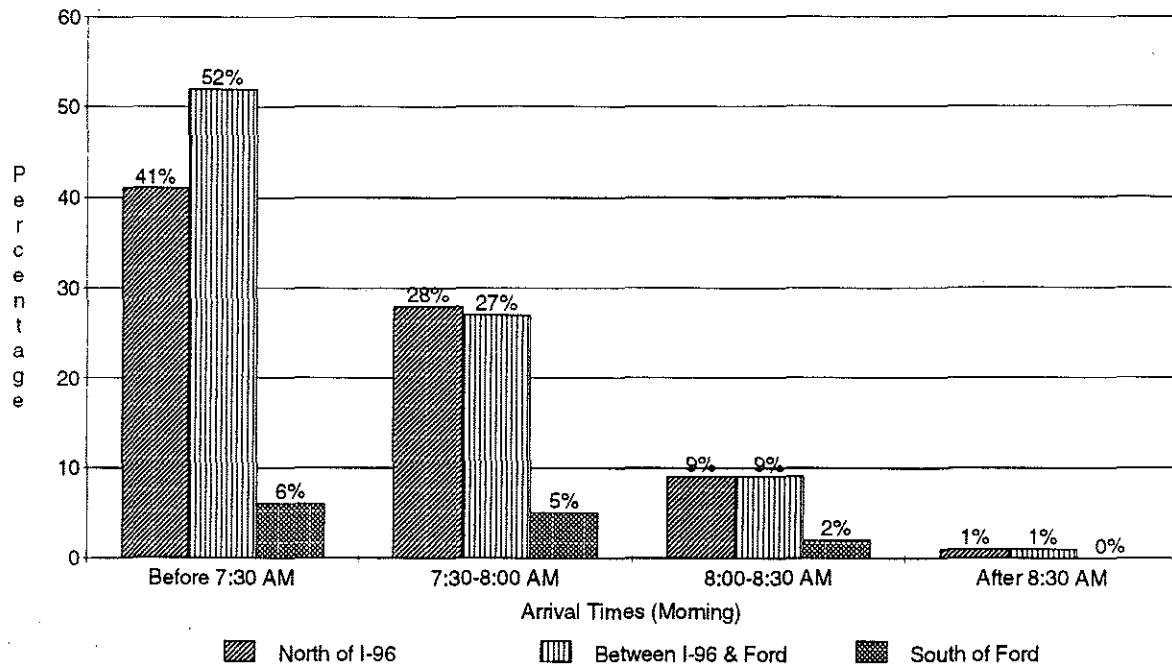


Figure 16: Perceived Morning Congestion for Various Study Sections and Times

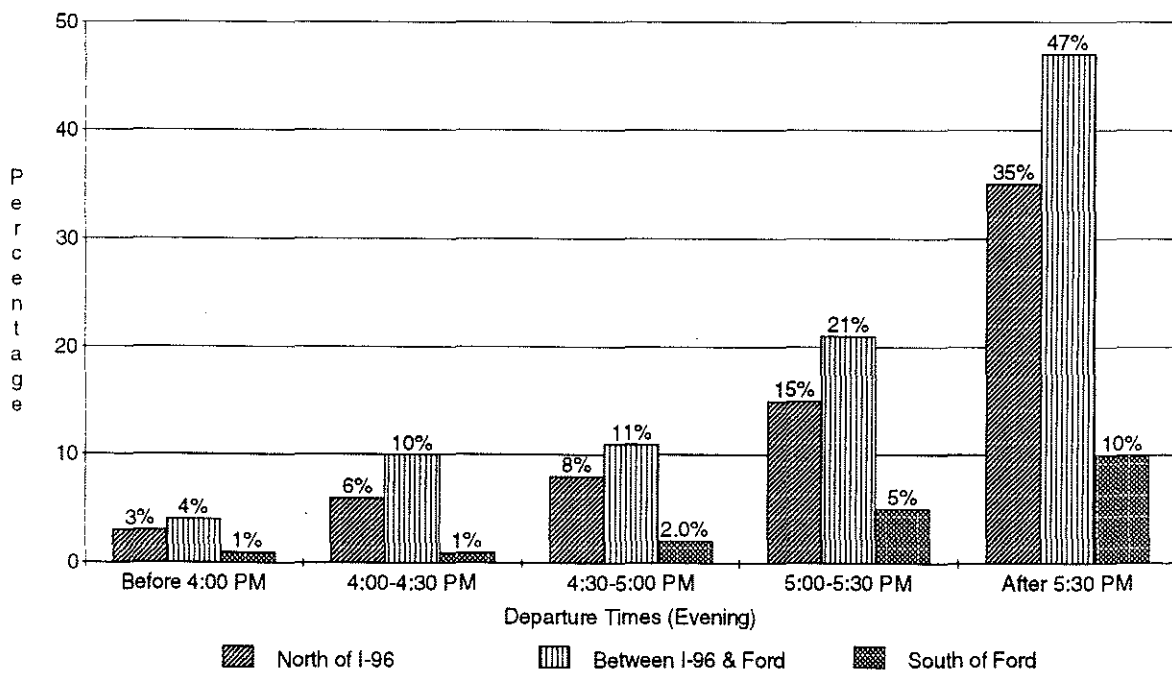


Figure 17: Perceived Evening Congestion for Various Study Sections and Times

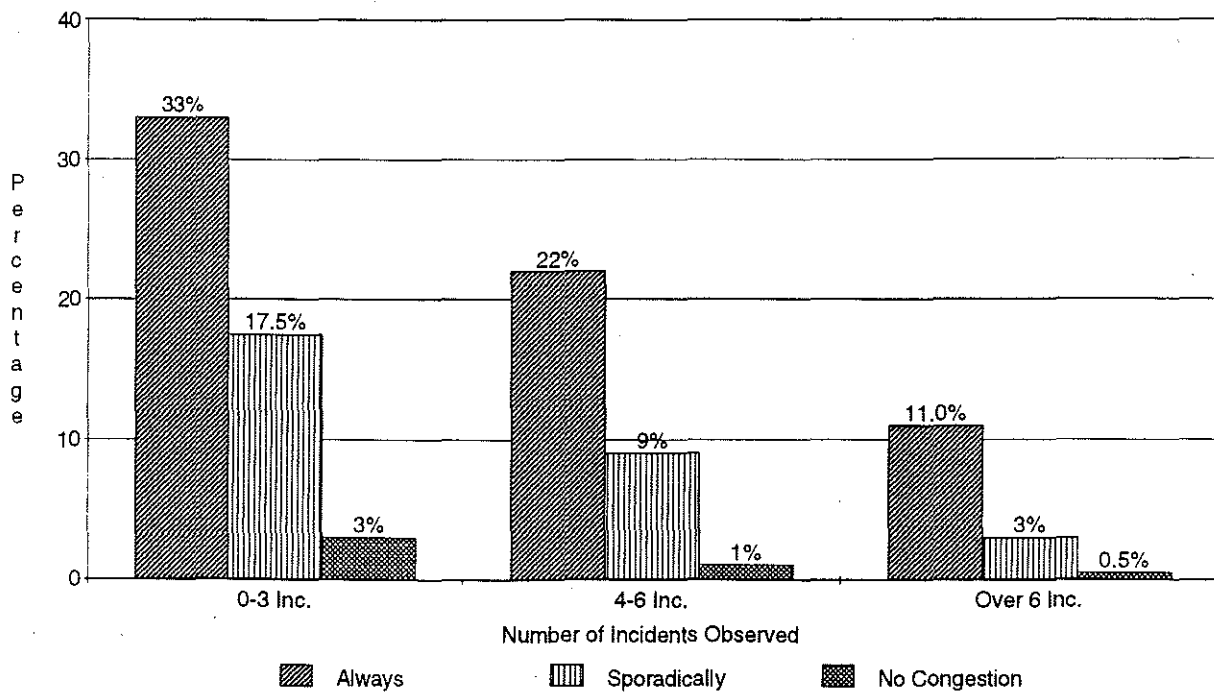


Figure 18: Perceived Morning Congestion Versus Frequency of Incidents

enforcement. This section provides a summary of the most significant problems listed, ordered by frequency of responses.

- Traffic Overload

The common theme among 333 respondents (42% out of the total) was “too much traffic, too little space”. They stated that the major problem on Southfield is excessive demand and insufficient number of lanes available to handle the demand under an acceptable level of service.

A number of drivers specifically stated that the freeway is obsolete for today’s traffic conditions, since it was built to serve a considerably lower projected demand without accounting for recent increases in employment, commercial, and retail development.

Finally, 23 respondents mentioned the lack of an acceptable alternative to carry north/south traffic as the major reason for the existing situation on Southfield Freeway.

- I-96 Ramp to Southfield (EB)

The ramp from I-96 to Southfield was viewed by 145 users as creating a major problem. The major reason stated was the lack of sufficient capacity to handle the demand, resulting in extensive on-ramp delays. Moreover, the lack of an adequate acceleration lane forces a speed reduction on the mainline traffic.

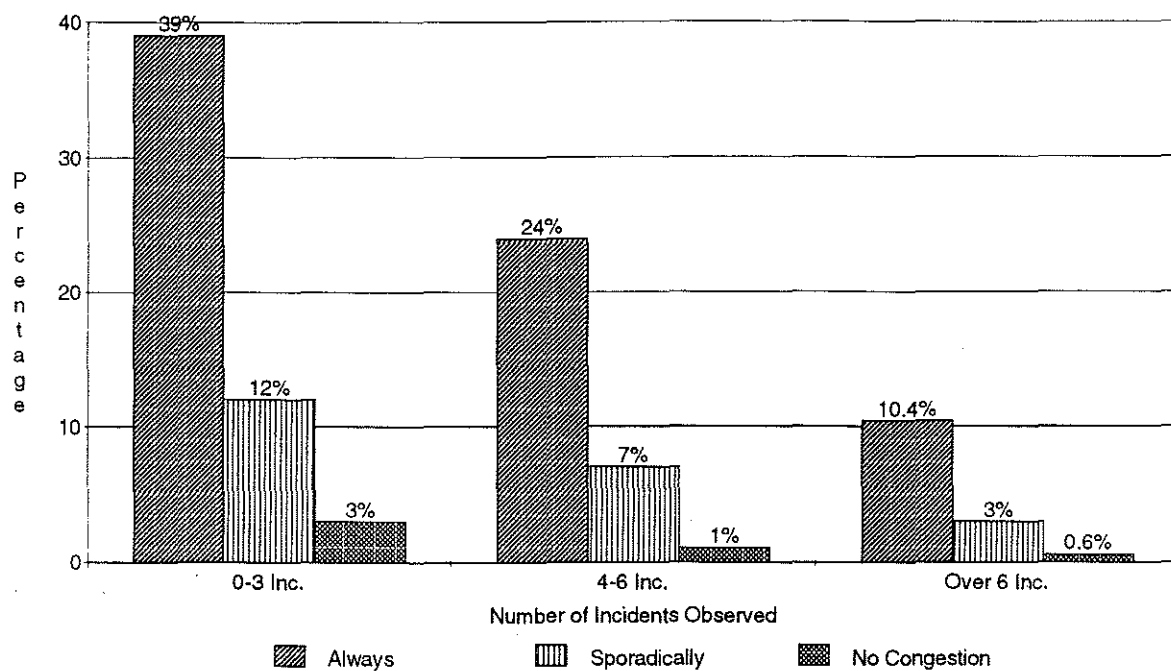


Figure 19: Perceived Evening Congestion Versus Frequency of Incidents

• Reckless Driving

A large number of respondents made strong comments about the behavior and skills of their fellow drivers. Poor driving skills and aggressive behavior were viewed as major problems by 75 respondents. The use of inappropriate speeds and last-minute merging were among the most common complains cited.

• Timing Problem

Over 20% of those that viewed traffic overload as the major problem on Southfield tied it with timing. Specifically, they said that there are too many vehicles at the same time, or excessive demand during morning and afternoon peak periods. Drivers listed staggered work hours, and congestion pricing as possible improvements to this problem.

• Poor Ramp Design

Over 60 respondents identified elements of ramp design as major reasons for congestion related problems along Southfield Freeway. Users agree that many of ramps are too short, that entry/acceleration lanes are not adequate (31 responses) and that they result in a number of merging problems (44 responses). Many attributed the congestion problems to the existence of too many entrance ramps (23 responses) and the close spacing between entrance and exit ramps that causes many weaving conflicts (12 responses).

• Poor Road Conditions

Poor maintenance was cited as an important problem by 54 respondents, many of whom seemed very dissatisfied by the existing road conditions. A number of issues were raised, both from the safety and comfort perspectives. Specific problems listed include potholes, pavement surfacing, poor drainage, and objects on the road surface that create a driving hazard. An additional 10 respondents mentioned limited visibility as a problem. Field of vision is reduced due to frequent grade changes under the underpasses.

- Inefficiency in removal of stalled vehicles and crashes

A significant number of respondents are concerned with the existence and timely removal of crashes from Southfield Freeway. More specifically, 45 people noted that there are no adequate shoulders for quick removal of stalled vehicles. As a result extensive delays are caused to the mainline traffic from vehicle breakdowns and crashes that cannot be removed to the shoulder quickly and efficiently. An additional 17 drivers mentioned poor emergency response and 22 complained about an unusually large number of crashes occurring on the Southfield due to poor design and operation.

- Ford Rd and Michigan Exits

In addition to the negative comments about the efficiency of the I-96 interchange, complaints have been cited for the operation of Ford Rd and Michigan Exits by 35 and 32 respondents, respectively. The drivers were concerned with delays and backups occurring primarily during their evening commute.

- Other problems

A number of other problems were reported by drivers including existence of narrow traffic lanes, poor design of service roads, inadequate enforcement and inspection of vehicle conditions, slowdowns caused by the presence of police at the roadside, and existence of slow moving vehicles in left lanes. Out of 724 drivers who responded about major problems on Southfield, only 14 (or 2%) found that there are no major problems and the quality of driving conditions is generally acceptable.

### 5.3.3 Crash Analysis

Figures 20 and 21 display the distribution of annual crashes on the study sight for the north- and southbound directions, respectively.

It can be observed that segments with the highest reported numbers of crashes in the Northbound direction are Schoolcraft to Grand River, 6 Mile Rd to 7 Mile Rd and Rotunda to Michigan Ave. The crashes on these three links combined account for over 30% of the total reported crashes on the 18 study segments. In the Southbound direction, the segment between Ford Rd and Michigan Ave suffers the highest number of crashes, followed by 6 Mile Rd to Grand River and Grand River to Schoolcraft. Similarly to the northbound direction, the crashes on these three links combined account for over 30% of the total reported crashes.

Consideration of crash distribution by time of day (Figure 22) indicates that the highest



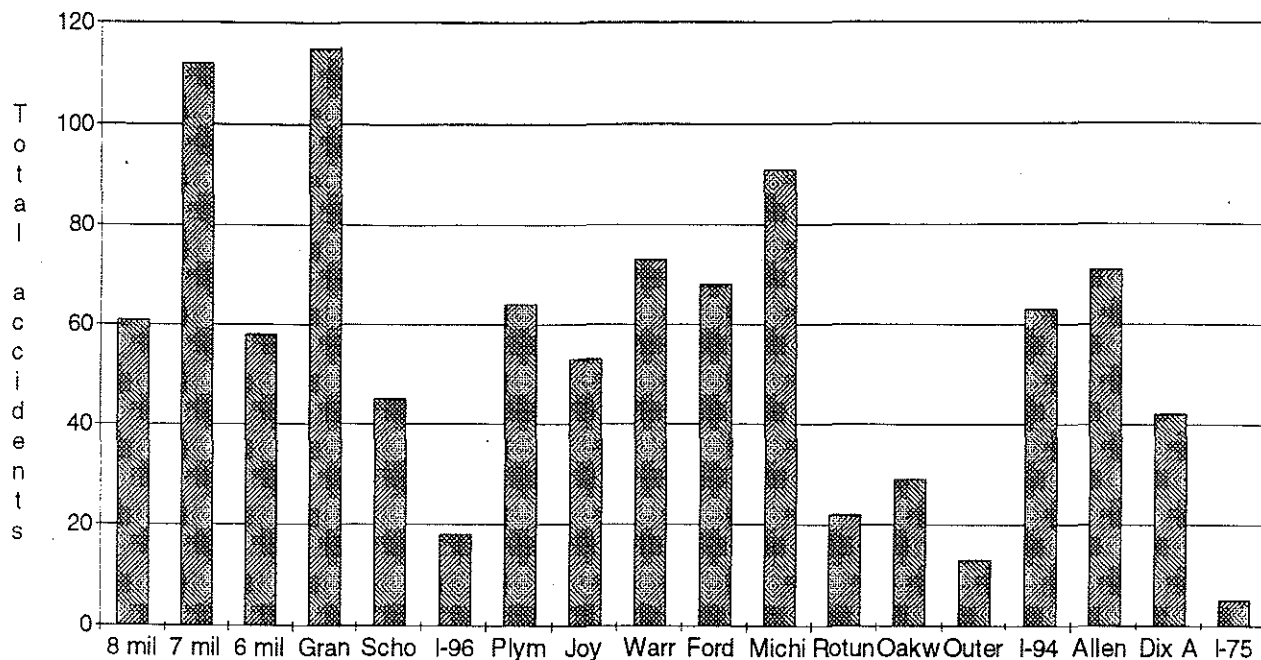


Figure 20: Annual Crash Distribution -Northbound Direction

percentage of crashes takes place during the evening commute. This is true for both directions of travel with a 27% and 23% of crashes occurring between 4:00 PM and 7:00 PM on the northbound and southbound direction respectively. It is also interesting to point out that the total number of crashes occurring between 1:00 PM and 4:00 PM outnumber the crashes during the morning commute for both directions.

The conclusions above are based on the analysis of the total number of crashes per year. Alternatively, the performance of the various segments, during various time intervals could be assessed based on a measure of exposure. An appropriate measure of exposure would be the number of crashes per million vehicle miles traveled. Such an analysis is desirable but beyond the scope of this study, due to the lack of extensive traffic data collection along the study site.

In an effort to improve the accuracy of the conclusions derived from historical crash records, the distribution of bi-directional crash rates was studied. Crash rates were calculated as:

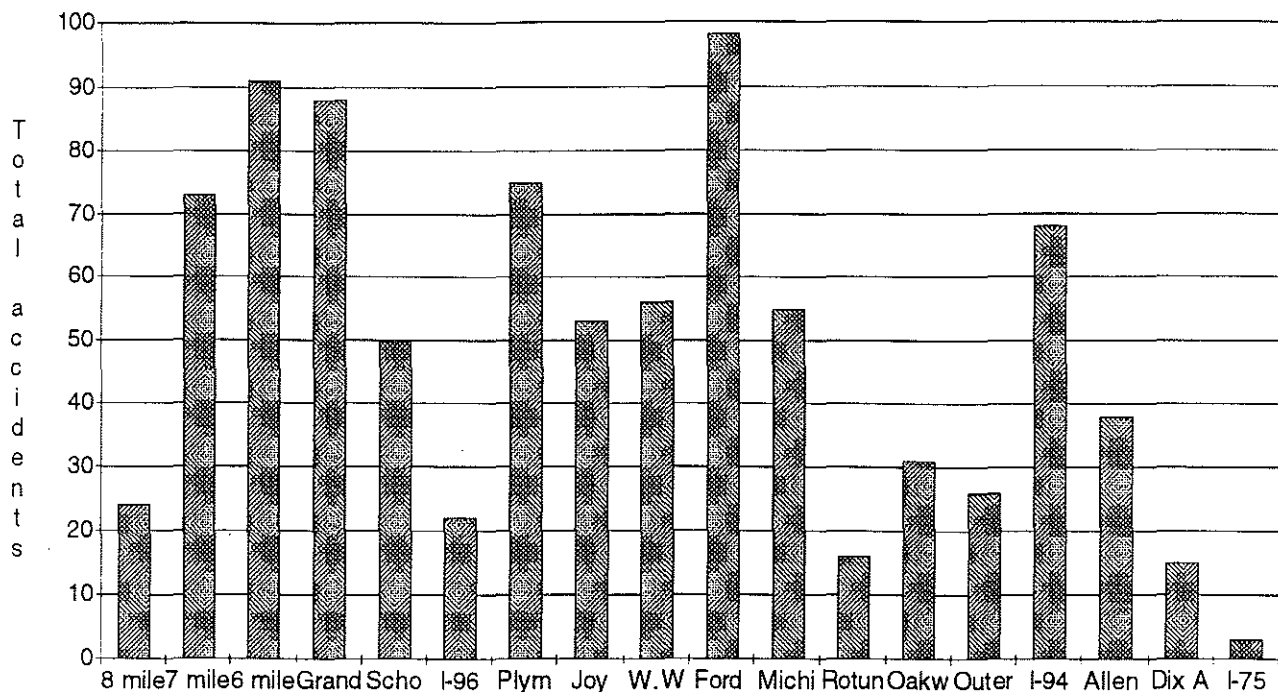


Figure 21: Annual Crash Distribution -Southbound Direction

$$\text{Crash Rate} = \frac{10^8 * (\text{Annual \# of Crashes})}{365 * \text{ADT} * (\text{Length of Segment})} \quad (1)$$

As Figure 23 shows, links with high absolute numbers of crashes are not necessarily the most critical ones, with respect to safety. For example, Grand River Ave to Schoolcraft, with 203 annual crashes on both directions shows a lower crash rate than Allen Rd to Dix Ave, for example, that reports a moderate total number of crashes (109 annual crashes, both directions). The segments with the three highest crash rates are:

1. Dix Ave to I-75;
2. Allen Road to Dix Avenue. and
3. 7 Mile Road to 6 Mile Road.

Based on available records, the crashes were classified by type and distributions of crashes types were considered for both directions. As reported in Table 4, the vast majority of crashes (nearly 50% of the total) are rear-end crashes. Other observed types of crashes include sideswipe and fixed object.

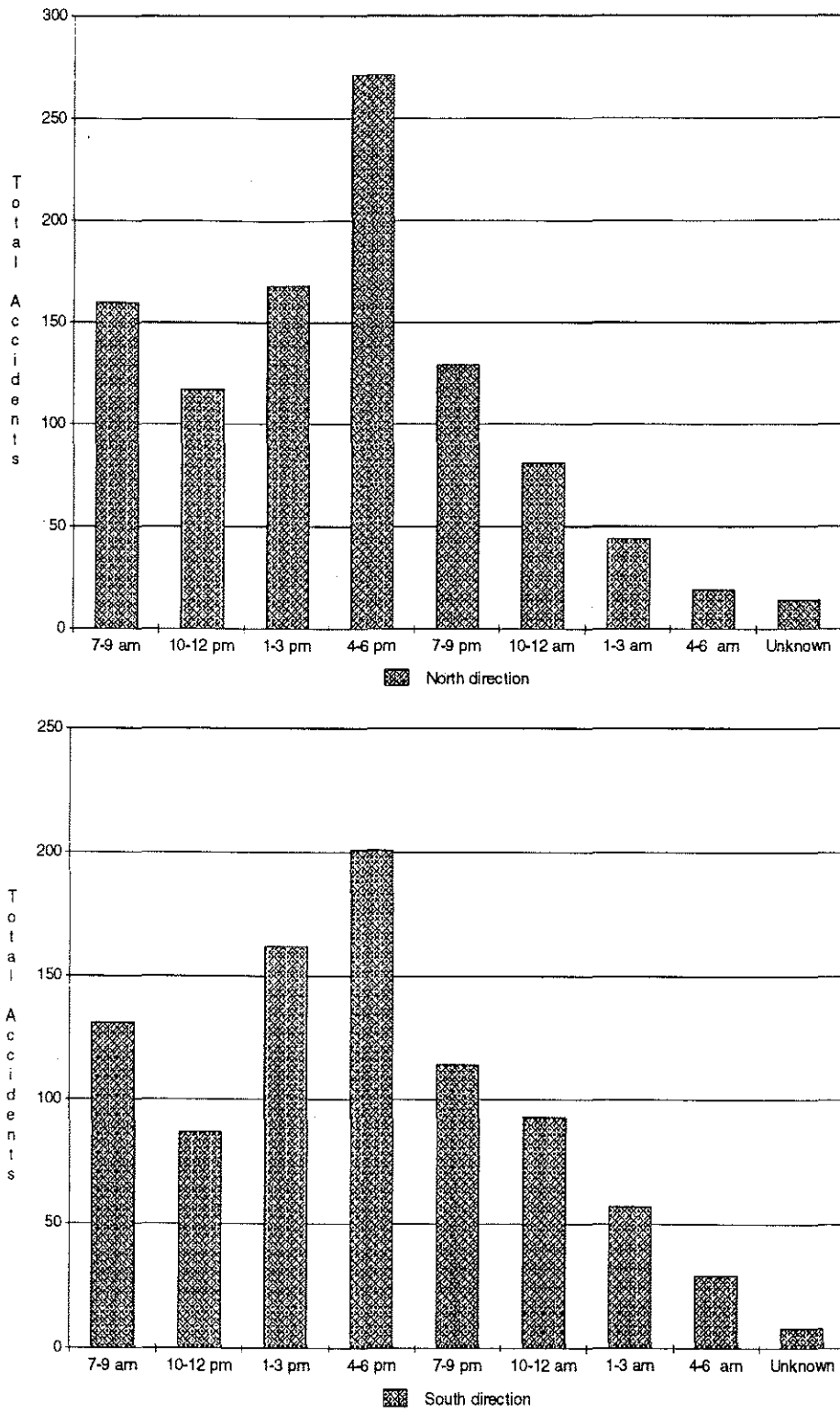


Figure 22: Crash Distribution by Time of Day

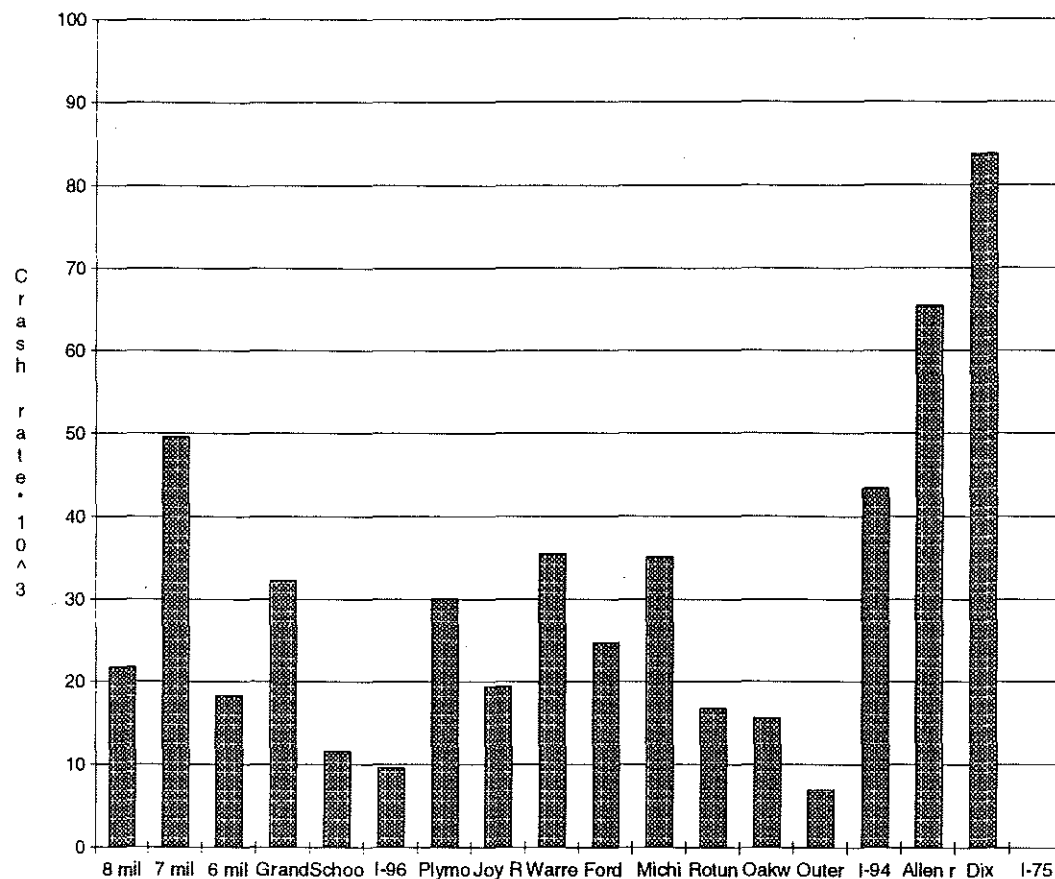


Figure 23: Distribution of Crash Rate – Both Directions Combined

Moreover, the crashes that occur during peak periods were analyzed for both directions of traffic (see Figures 24 and 25.) The morning peak period extended from 7:00 AM to 10:00 AM and the afternoon peak period from 4:00 PM to 7:00 PM. Approximately 30% of the crashes occur during the morning and afternoon peak periods combined, only slightly higher than the average figure.

Finally, the actual frequency of crashes, as resulted from historical data, was compared to the perceived frequency of crashes, as reported by the analysis of questionnaires. Given the fact that the average user spends no more than one hour on Southfield freeway and considering total numbers of crashes from the historical database, during the morning and evening peak periods, a user is likely to observe 1 to 2 crashes weekly. In other words, when surveyed, Southfield users overestimated the number of crashes they observed. There are several explanations for this, including:

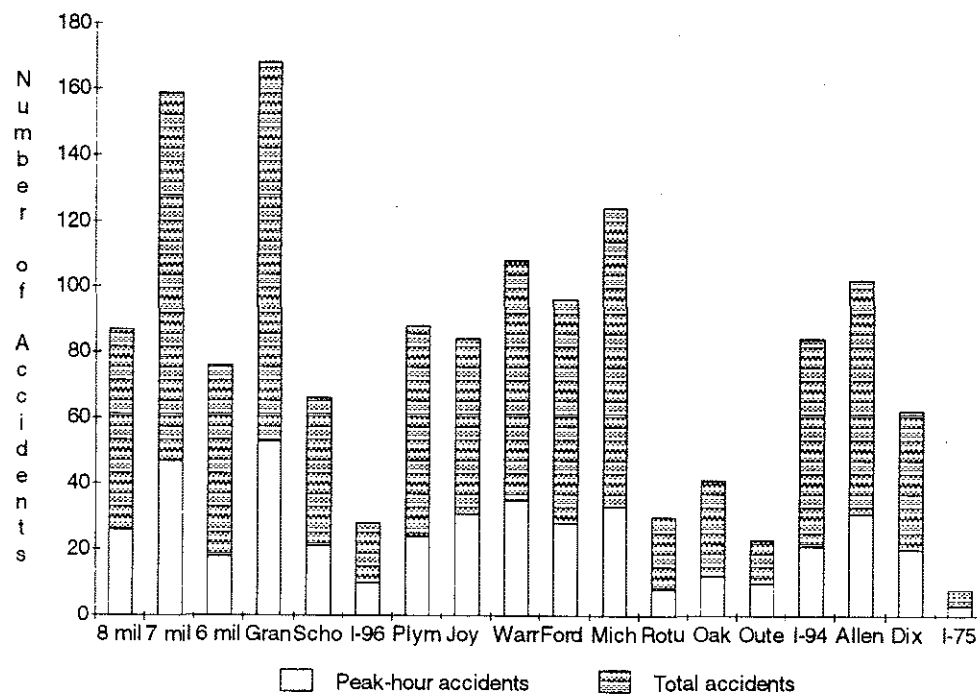


Figure 24: Crash Distribution During Peak Periods –Northbound Direction

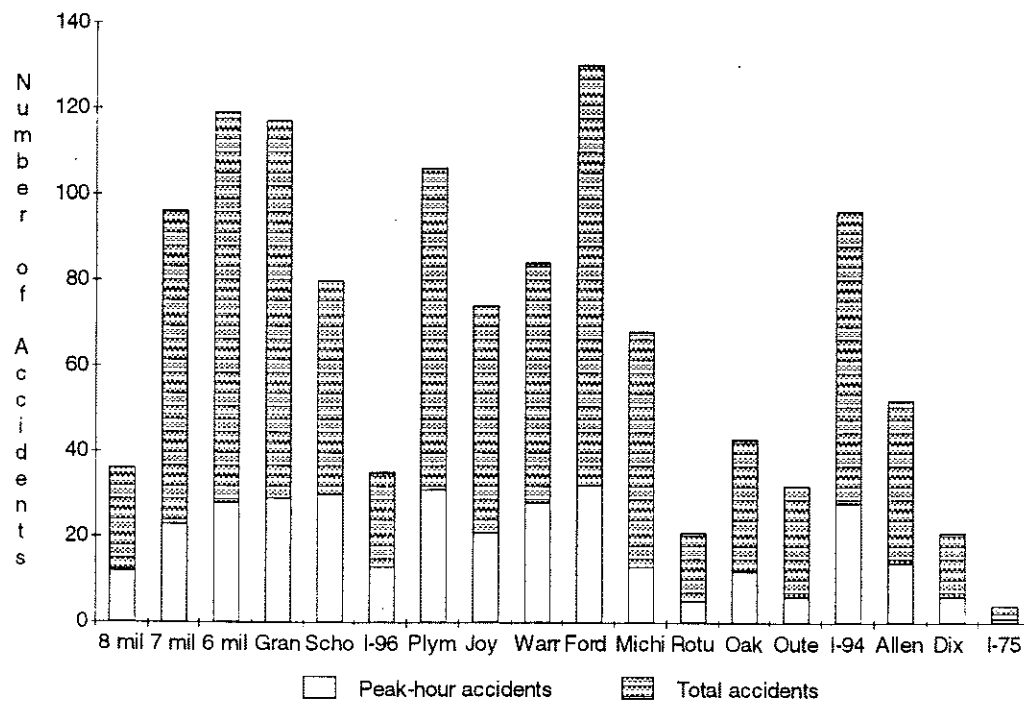


Figure 25: Crash Distribution During Peak Periods -Southbound Direction

1. A possible tendency of exaggeration, commonly observed in driver's surveys.
2. The likelihood of inadequate reporting of incidents, especially those that are cleared rapidly, without any police involvement, and
3. A combination of 1. and 2. above.

Based on the results obtained from the data analyses discussed above, a summary of conclusions is offered next.

## 6 SUMMARY OF CONCLUSIONS

### 6.1 STUDY OF FIELD CONDITIONS

The study of field conditions indicated the following:

- Short on- and off-ramps;
- Inadequate entry/acceleration lanes, short merging lanes;
- Poor maintenance of the facility and adjacent service drives;
- Discontinuity and underutilization of service drives;
- Long queues built up on I-96/Southfield interchange;
- Mainline flow is slowed down due to heavy merging and weaving flows.

### 6.2 STUDY OF USERS RESPONSES

Analysis of Southfield users responses revealed the following conclusions:

- Ford employees were a remarkably responsive study group for the subject research;
- During the morning commute, 74% of Ford employees travel on the southbound direction;
- Most favorable access points in the morning are: north of 8 mile Rd (45% of respondents) and I-96/Southfield interchange (from eastbound, 23% of respondents);
- Most favorable exit points in the morning are: Ford Rd exit (61% of respondents) and Michigan Ave exit (36% of respondents);
- Congestion occurs, primarily, on Sections I and II (8 Mile Rd to I-96 and I-96 to Ford Rd) both during the morning and afternoon rush;
- Delays in the range of 6-15 minutes are reported by the users as a result of congestion;

- The I-96/Southfield interchange is the most cited problem location. Nine out of ten respondents that use this interchange as an access point reported problems associated with its operation.
- Excessive traffic demand, lack of available capacity and poor design are among the top reasons perceived to create problems regarding the operation of Southfield;
- Reckless driving, slow incident response, and poor road conditions are also of concern to a large number of users of the study facility.

### 6.3 CRASH ANALYSIS

- The number of total crashes reported in the northbound direction outnumbers the total crashes in the southbound direction by 12%;
- In the northbound direction, three segments (out of 18) account for one third of the total crashes experienced along Southfield. These segments are listed in order of frequency below.
  1. Grand River to Schoolcraft Rd (11.5% of the total number of crashes reported)
  2. 7 Mile to 6 Mile Rd (11.0% of total crashes reported), and
  3. Michigan Ave to Rotunda (9.8% of total crashes reported).
- Consideration of the crash distribution along the southbound direction indicates that almost one third of all southbound Southfield freeway crashes occur on the following three segments
  1. Ford Rd to Michigan Ave (11.1% of the total number of crashes reported)
  2. 6 Mile to Grand River (10.0% of total crashes), and
  3. Grand River to Schoolcraft Rd (9.8% of total crashes).
- Over half of the crashes are of the rear-end type;
- On the northbound direction, Section I (8 Mile Rd to I-96) suffers the highest crash rate with 75.8 crashes per mile per year (acc/mi/yr), followed by Section II (I-96 to Ford Rd) with a reported 66 acc/mi/yr and Section III (Ford Rd to I-75) with 65 acc/mi/yr;
- The priority ranking by section for the southbound direction indicates that Section I (8 Mile Rd to I-96) experiences the highest rate of crashes with 95.6 acc/mi/yr, followed by Section II (78.1 acc/mi/yr) while Section III shows only 31.9 acc/mi/yr.



## 7 RECOMMENDATIONS FOR ACTION

### 7.1 Background

Two broad methods can be applied to tackle urban congestion, namely transportation supply expansion, and travel demand management. Both approaches are briefly introduced next.

The *transportation supply expansion* approach attempts to relieve traffic congestion by increasing the effective capacity of transportation facilities. Increased capacity may be achieved by geometric improvements of existing facilities (widening existing roadways, eliminating local bottlenecks) or expansion of facilities (construction of new roads). Advanced technologies offer additional options such as freeway ramp metering (which minimize queues and shock waves at entrance ramps) or tidal flow schemes within freeway control and adaptive traffic control systems which best utilizes the capacity of integrated facilities.

On the other hand, *travel demand management* offers congestion relief through the implementation of travel demand dispersion and reduction actions. Dispersion of travel demand can be achieved, for instance, by flex-time and staggering of employee work times while reduction in demand may result from service provision (e.g., HOV lanes) or demand management initiatives (e.g., ridesharing incentives, congestion pricing).

Although travel demand management is still a non-traditional approach, researchers agree that it is an effective tool for addressing urban traffic congestion [13]. On the contrary, while the traditional supply-side actions often provide short-term congestion relief, it is likely that the problem of congestion will regenerate as demand adjusts to take advantage of any reduction in congestion and time delay [17].

### 7.2 Proposed Congestion Relief Strategies

The most cost-effective alternative that could immediately address the problem is the optimal use of existing capacity by distributing traffic demand in space and time. Travel demand management techniques offer great opportunities toward this direction.

It is proposed that a study be initiated to analyze the perceptions of Ford employees regarding flex-time, staggering of work times, and their interest in using pre-trip travel information for selecting route and departure time. Pre-trip information will allow employees to check into computers (in their office, the lobby of their buildings, or at home) to obtain real-time information on crashes, congestion, and alternate routes. Given flexible work schedules and pre-trip information availability, employees will be able to make informed decisions and select their departure time and route according to current traffic conditions. Expected benefits from this system approach include: reduction in individual travel time and delay, reduction in the overall system congestion, and reduction in drivers' frustration and stress level, with possible positive impacts on productivity.

In addition, MDOT is encouraged to consider initiation of corridor control as a strategy for improvement of traffic conditions on and around Southfield. The benefit from this approach is twofold. First, it assists in the collection and dissemination of real-time information to Ford employees and, second, it will contribute to the improvement of traffic conditions for all users of Southfield freeway (including commuters and non-commuters, truck operators, visitors etc).

Corridor control provides an optimum utilization of all available facilities in the freeway corridor. In general, a freeway corridor is comprised of the freeway and its ramps, freeway frontage roads, parallel arterial streets that can be used as alternative routes, and cross streets that are links between the freeway ramps and the parallel arterials [16]. More specifically, the proposed freeway corridor will include Southfield freeway and its ramps, the existing services drives, Evergreen Rd and Greenfield Rd (considered as alternative routes) and cross streets from 8 Mile Rd to Rotunda Dr.

Implicit with the concept of corridor control is that it must be traffic-responsive to be meaningful. Also, a driver information system should be in place to assist in diversion of traffic from corridor segments with excess demand to segments with excess capacity. Essential components for such a system are:

1. A detection system;
2. A control center;
3. A communication system.

The detection system will provide real-time information on how the routes in the corridor are operating. The control center will transform the information into a control strategy and the communication center will advise drivers of the decisions of the control center.

The proposed approach is in line with MDOT initiatives toward the deployment of advanced technologies in the area. Under its ATMS/ATIS Deployment in Metropolitan Detroit Program, MDOT plans to place detectors on the Southfield Freeway in the summer of 1996. The planned detectors could be part of the corridor control system and additional detectors may be placed, as needed.

The proposed control corridor can serve as a model test bed for implementation of corridor control systems. The following specific actions are proposed for consideration as part of the corridor control program:

- Coordination of traffic signals on service drives and parallel arterials to allow efficient movement of diverting traffic.
- Coordination of the ramp control queue override feature with the frontage-road/cross-street intersection control to prevent queuing across these intersections.

- Provision of turning phases at parallel alternative route intersections with cross streets leading to freeway ramps, in coordination with driver information displays.
- Improved incident detection and response capabilities.

A study should be initiated to examine in detail the corridor control strategy proposed here, review similar efforts in the United States and abroad, estimate costs and benefits, and provide a detailed work plan for its implementation.

In addition to the above mentioned strategies for congestion reduction in the neighborhood of Southfield freeway, some immediate actions could be taken to reduce the level of user dissatisfaction and provide temporary congestion relief where they apply. Proposed actions are:

- Upgrade the appearance and pavement conditions on Southfield freeway and service drives.
- Develop public education initiatives to inform motorists recent improvements on Greenfield Rd, an alternative to Southfield Freeway.

It is also recommended that a more extensive field data collection effort takes place to allow for estimation of quantitative measures of traffic congestion.

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## 8 APPENDIX

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### SURVEY OF FREEWAY USERS

#### A. General Information

-----

A1. Where is your office located? (Number/Street or Building Number)

-----

A2. What is your home zip code? -----

A3. How do you reach your work place? -----

a. drive own vehicle to work   b. car-pool

A4. Do you use Southfield for your trip to/from work? -----

a. always   b. occasionally   c. rarely/never

A5. In the morning you ENTER Southfield freeway: -----

a. north of 8 Mile Rd

b. south of I-94

c. I-96 ramp Eastbound \_\_\_\_ Westbound \_\_\_\_

d. other location (please specify) -----

A6. In the morning which EXIT ramp do you use? (name) -----

A7. In the evening which ENTRANCE ramp do you use? (name) -----

A8. In the evening you EXIT Southfield freeway: -----

a. north of 8 Mile Rd

b. south of I-94

c. I-96 ramp Eastbound \_\_\_\_ Westbound \_\_\_\_

d. other location (please specify) -----

A9. What time do you report to work in the morning? \_\_\_\_\_  
a. before 7:30am b. 7:30-8:00am c. 8:00-8:30am d. after 8:30am

A10. What time do you leave your work place in the evening? \_\_\_\_\_  
a. before 4 PM b. 4-4:30 PM c. 4:30-5:00 PM d. 5:00-5:30pm  
e. after 5:30pm

A11. How long is your average trip to work? \_\_\_\_\_  
a. less than 15 min b. 15-30 min c. over 30 min

B. Your perception about congestion on Southfield (Southfield) Freeway  
-----

(If you have driven Southfield less than 3 times from or to work during  
the past week, please skip this section)

B1. What best describes the conditions on Southfield in the morning? \_\_\_\_\_  
a. always congested b. congestion occurs only sporadically  
c. no serious congestion problems along Southfield

B2. When there is congestion in the morning, what percentage of  
the time is it located:  
a. north of I-96 \_\_\_\_\_  
b. between I-96 and Ford Rd \_\_\_\_\_  
c. south of Ford Rd \_\_\_\_\_

B3. When there is congestion on Southfield in the morning how much additional  
travel time is added to your trip, on average? \_\_\_\_\_ minutes

B4. What best describes the conditions on Southfield in the evening? \_\_\_\_\_  
a. always congested b. congestion occurs only sporadically  
c. no serious congestion problems along Southfield

B5. When there is congestion in the evening, what percentage of  
the time is it located:  
a. north of I-96 \_\_\_\_\_

- b. between I-96 and Ford Rd -----
- c. south of Ford Rd -----

B6. When there is congestion on Southfield in the evening how much additional travel time is added to your trip, on average? ----- minutes

- B7. In the last week, how many incidents (accidents, abandoned vehicles) have you observed while driving to or from work? -----
- a. 0-3
  - b. 4-6
  - c. over 6

- B8. In your opinion, the major problem along Southfield is -----
- a. high traffic volume
  - b. difficulty to merge
  - c. many accidents
  - d. other -----
  - f. no major problems exist

C. The profile of a Southfield (Southfield ) user  
-----

(The following questions are important for statistical purposes only.  
Remember, all you answers will be kept confidential.)

- C1. What is your age? -----
- a. less than 30 years old
  - b. 31 to 45 years old
  - c. 45 to 60 years old
  - d. over 60 years old

- C2. What best describes your occupation? -----
- a. executive/Managerial
  - b. professional/Technical
  - c. office Worker/Secretary
  - d. other (please specify) -----

- C3. You are -----
- a. male
  - b. female

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