THIRTEENTH ANNUAL REPORT OF MICHIGAN'S OVERALL HIGHWAY SAFETY IMPROVEMENT PROGRAM

July 1, 1985 - June 30, 1986

August 31, 1986

This report was prepared by the Traffic and Safety Division. The opinions, findings, and conclusions expressed in this publication are those of the Traffic and Safety Division and not necessarily those of the Federal Highway Administration.

TABLE OF CONTENTS

Introduction

This is the Thirteenth Annual Report of Michigan's Highway Safety Improvement Program. The report covers the period July 1, 1985 through June 30, 1986.

The Highway Safety Program summary is found on page 3. In general, all of the categorical projects were identified and selected following the Highway Safety Improvement Process, outlined in the Appendix of this report. Over $83 million of safety projects were identified in this years report. This is about the same as last year; but is significiantly greater then in recent years, due to increased federal and state funding levels.

In addition to implementing safety projects identified and justified by our Statewide Accident Surveillance Program, the department continues to include safety enhancements on 3R/4R type construction projects. These projects are all reviewed to insure that documented concentrations of accidents are addressed and, in addition, that a roadside environment compatible with department guidelines is assured.

This report includes the customary evaluation of the HES program. The evaluation incorporates statistical controls which account for accident trends and "expected" changes in before-and-after accidents.

Also in this report is a slightly revised Highway Safety Improvement Process (HSIP).

Highway Safety in Michigan - The Year In Review

Last year (1985), 1569 persons died in traffic accidents on Michigan highways. This is nearly identical to the 1556 killed in 1984. Due to increased travel however, the death rate actually decreased to 2.3 deaths per 100 million vehicle miles traveled. Total accidents during 1985 increased from 335,200 to 386,900 and injuries also increased from 150,700 in 1984 to 157,400 in 1985.

Two factors involved in crashes and crash severity showed significant improvement in 1985, drinking related fatal accidents and seat belt usage.

The involvement of drinking drivers in fatal accidents was 45.7 percent in 1985 compared to 50.6 percent in 1984 and 53.3 percent in 1983. This significant reduction may reflect that recent changes in the drunk driving laws, and a general toughening of judicial and public attitudes may be beginning to yield results.

Likewise, Michigan's safety belt use law is saving lives! During the first year following enactment of the law (July 1985 - July 1986) vehicle occupant death, decreased by 95, or about 9.2 percent. The impact of the belt law may actually have been greater since fatality trends indicated a projected 18 percent increase in deaths. This trend is somewhat confirmed by noting the increases in total accidents in 1985.

Use of safety belts has leveled off at about 43 percent. During 1985 - 51.5 percent of all vehicle occumpants involved in accidents were reported as using belts compared to 22.7 percent in 1984. In contrast, only 20.5 percent of occupants killed in motor vehicle crashes were belted.

We believe that past and future reductions in highway crashes and casualties depend on the continued commitment of the entire highway safety community to the "3 E's", Engineering, Enforcement, and Education.

The assumption that any single program can solve this problem is illogical. While highway safety programs administered by this department have been consistently proven to reduce accidents, deaths, and injuries, we will continue to work and cooperate with others who share our commitment to highway safety.

Highway Safety Program Summary (Obligated)
July 1, 1985 - June 30, 1986

Federal Categorical	
Hazard Elimination Safety	7,993,672
Rail/Highway Crossings	4,674,255
Other Federal Funds	
Interstate	36,104,013
Primary	15,009,753
Seconday	1,448,010
Urban	6,505,234
State Funded	
	2,557,675
State/Local Match	
	9,300,000
TOTAL	83,592,612

Federal Funding of Highway Safety Improvements in Michigan

As of June 30, 1986, Michigan had obligated $117.5 million or nearly 96 percent of its combined federal aid safety construction funds apportioned since 1974. That total includes obligations from the following active categorical programs:

Program	Obligated (Millions)	Percent of Apportionment
Rail-Highway Combined		
ON System	60.8	97
OFF System	8.6	99
HES	48.1	94

Three discontinued programs; High Hazard, Roadside Obstacle, and the Pavement Marking Demonstration had $25 million apportioned and obligated during the same 12-year period.

From July 1, 1985 to June 30, 1986 nearly $8 million of HES funds were obligated with $1.1 million being for Yellow Book type work and over $5.5 million used for intersection improvements. Signing, resurfacing, crossover construction, and minor improvements used the remaining $1.4 million. The Rail-Highway combined program included the following project types and costs:

Project Type	$ Obligated (Thousands)
Crossing/Track Removal	386.8
Reconst. Crossing/Approach Work	1,626.1
New Signals/Reconst. Crossing/Approach Work	1,961.6
New Signals/Crossing Surf/Track & Signal Removal	698.7
TOTAL	4,674.2

As noted on the "Highway Safety Program Summary" $36.1 million of Interstate and $22.9 million of Federal Aid Primary, Secondary, and Urban funds were identified as being obligated for projects primarily justified based on safety.

TABLE 1

STATE Michigan — FIPS CODE (Alpha): H I

HIGHWAY SAFETY IMPROVEMENT PROGRAM
ANNUAL REPORT 1986
PROCEDURAL AND STATUS INFORMATION

Line	Highway System	HIGHWAY LOCATION REFERENCE SYSTEMS			TRAFFIC RECORDS SYSTEM		
		Miles Covered (Percent) (1)	Expected Completion (Year) (2)	Type of Location Reference Method (3)	Types of Data Collected and Maintained (4)	Automated Correlation of Accident and Highway Data (Percent) (5)	Automated Correlation of Accident and Volume Data (Percent) (6)
101	Interstate	100	N/A	H	AHT	100	0
102	State - F.A.	100	N/A	D-II	AHT	100	100
103	State - Non-F.A.	100	N/A	D-11	AHT	100	100
104	Local - F.A.	0	N/A	D-II	AT	0	0
105	Local - Non-F.A.	100	N/A	D-II	AT	0	0

Line	Highway System	HAZARD ELIMINATION		RAILROAD-HIGHWAY GRADE CROSSINGS					
		Criteria for Identifying Hazardous Locations, Sections and Elements *(7)	Criteria for Setting Project Priorities *(8)	Inventory Update *(9)	Project Priority Selection *(10)	Compliance With MUTCD: Crossings Upgraded **7/1/73-6/30/85 (11)	Not Complying: Number (12)	Not Complying: (13)	Compliance Target Date (14)
201	Interstate	AEHLRS	CEIPTV						
202	State - F.A.	AEHRS	CEIPTV	B	AHIMPTVW	N/A	0	0	N/A
203	State - Non-F.A.	AEHRS	CEIPTV	B	AHIMPTVW	N/A	0	0	N/A
204	Local - F.A.	AEHRS	CHIPTV	B	AHIMPTVW	N/A	0	0	N/A
205	Local - Non-F.A.	AEHRS	CHIPTV	B	AHIMPTVW	N/A	0	0	N/A

F.A. = Federal-Aid
* = If more than one code applies, show all appropriate codes.
** = See instructions.
Describe "Y" Codes on separate sheet and attach to this table.

Indicate reporting period:
7/1/73-6/30/86
7/1/85-6/30/86

TABLE 2

HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
ANNUAL REPORT 1986
EVALUATION DATA FOR COMPLETED IMPROVEMENTS

STATE: MICHIGAN — FIPS CODE (Alpha): M I

Line	Safety Improvement Program (1)	Safety Classification Code (2)	Total Cost of Evaluated Improvements ($1000) (3)	Quantity of Improvements (4)	Units (5)	Number of Accidents: Before Mos. (6)	Before Fat. (7)	Before Inj. (8)	Before PDO* (9)	Before Tot. (10)	After Mos. (11)	After Fat. (12)	After Inj. (13)	After PDO* (14)	After Tot. (15)	Evaluation Status (16)	Volume Information: Before AADT (17)	After AADT (18)	(19)	Rural or Urban (20)	Number of Lanes (21)	Divided or Undivided (22)
01	HE	1A3B	117.1	1	X	28	0	15 32	17	32	28	2 (2)	9 14	20	31	F				R	4	D
02																						
03	HE	1C	817.1	1.9	M	33	2 (2)	174 223	667	843	33	0	218 287	543	761	F				R	6	D
04	HE	1C3R	937.8	10.8	M	24	1 (1)	55 76	129	185	24	1 (1)	89 120	174	264	F				R	4	D
05	HE	1C3R	394.1	6.3	M	26	2 (2)	20 27	40	62	26	1 (1)	20 32	59	80	F				R	4	D
06																						
07			2149.0				5 5	249 326	836	1090		2 2	327 439	776	1105							
08																						
09	HE	3A3D3F	87.4	1	X	28	0	10 13	21	31	28	0	7 10	20	27	F				R	2	U
10	HE	3A3D	262.6	2	X	14	0	20 32	29	49	14	0	16 31	24	40	P				U	5	U
11																						
12	Sub	Total	350.0				0	30 45	50	80		0	23 41	44	67							
13																						
14	HE	3B3E3F	183.1	3	X	17	0	2 (2)	13	15	17	0	2 (2)	15	17	P				U	4	U
15																						

*Threshold for reporting PDO accidents that are included in this Table (i.e., minimum dollar value, towaway, etc.) $200

TABLE 2

HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
ANNUAL REPORT 1986
EVALUATION DATA FOR COMPLETED IMPROVEMENTS

STATE MICHIGAN — FIPS CODE (Alpha): M I

Line	Safety Improvement Program (1)	Safety Classification Code (2)	Total Cost of Evaluated Improvements ($1000) (3)	Quantity of Improvements (4)	Units (5)	Number of Accidents: Before Mos. (6)	Before Fat. (7)	Before Inj. (8)	Before PDO* (9)	Before Tot. (10)	After Mos. (11)	After Fat. (12)	After Inj. (13)	After PDO* (14)	After Tot. (15)	Evaluation Status (16)	Volume Information: Before AADT (17)	Volume Information: After AADT (18)	Volume Information: (19)	Rural or Urban (20)	Number of Lanes (21)	Divided or Undivided (22)
21	HE	3B3F	646.9	1	M	14	0	22 38	32	54	14	0	14 24	38	52	P				U	4	U
22	HE	3B3F	158.7	1	M	16	0	17 24	38	55	16	0	17 27	23	40	P				U	4	U
23																						
24	Subtotal		988.7				0	41 64	83	124		0	33 53	76	109							
25																						
26	HE	3C3K	270.5	1	M	28	0	2 (2)	4	6	28	0	4 (6)	4	8	F				R	4	U
27	HE	3F	67.0	3	X	30	0	58 96	96	154	30	0	46 69	118	164	F				U	4	D
28	HE	3K3R	548.1	30.7	M	25	4 (5)	34 45	128	166	25	1 (1)	43 68	154	198	F				R	4	D
29	HE	3M3N	231.5	1.3	M	17	0	14 16	65	79	17	1 (2)	21 29	64	86	P				U	4	D
30																						
31	Sub Total		1117.1				4 5	108 159	293	405		2 3	114 172	340	456							
32																						
33	Totals		4721.8				9 10	443 626	1279	1731		6 7	506 719	1257	1768							
34																						
35																						

*Threshold for reporting PDO accidents that are included in this Table (i.e., minimum dollar value, towaway, etc.) $200

A statistical evaluation of all projects using the Poisson technique, 95 percent level of confidence, based on one to three years of "before" and "after" accident data shows the following results:

$$E_f = B_{pf} \frac{A_{padt} A_{cf} B_{cadt}}{B_{padt} B_{af} A_{cadt}} = 1731 (1.08995 \times 1.262) (0.92) = 2185$$

B_{pf} = Before Period Accident Frequency (1731)

A_{pf} = After Period Accident Frequency (1768)

A_{cf} = After Control Group Accident Frequency
(Statewide Trunkline Accidents - 130, 752)

B_{cf} = Before Control Group Accident Frequency
(Statewide Trunkline Accidents - 103,604)

A_{padt}/B_{padt} = After Period ADT/Before Period ADT (1.0895)

E_f = After Expected Accident Frequency

The statewide trunkline accident figures used are the annual averages of 1981 - 1982, the "Before" period, and 1984 - 1985, the "After" period. The ADT data used reflects the same periods but is statewide.

Accidents in the "After" period were reduced by 417 when compared to the Expected Accident Frequency resulting in a 19.08 percent reduction which is statistically significant. Individual project types were not tested due to the small sample sizes.

Safety Program Activities

Our Safety Improvement Process is outlined in the Appendix. It includes a process for developing and implementing non-state trunkline HES projects. Engineering evaluation and analysis on the state trunkline system continues to be the primary responsibility of the Traffic and Safety Division's Safety Programs Unit. Major activities of the Safety Programs Unit are discussed below.

Crash Analysis/Roadside Safety Program

The Crash Analysis/Roadside Safety Program requires evaluation of approximately 2,000 trunkline locations which exceed predetermined thresholds of total accidents or accident types (including ran-off-road) over a two-year period. A more detailed discussion of the data analysis/evaluation/project selection process is included in the appendix "Safety Improvement Process."

In addition, in response to a Federal Highway Administration mandate that a safety analysis on all 3R/4R type projects be completed, approximately 150 accident analyses were conducted for road and bridge projects last year.

TOPICS Program

The Traffic Operations Program to Increase Capacity and Safety (TOPICS) is the traffic engineering element of the department's Transportation System Management (TSM) process.

The program encompasses both state trunklines and local streets in 32 cities with populations greater than 10,000 to assure a comprehensive, integrated effort to indentify and solve traffic engineering problems. The local street review is accomplished by our Community Assistance Program funded by Federal Section 402 funds distributed through the Office of Highway Safety Planning. The TOPICS reviews are closely coordinated with the Metropolitan Planning Organization (MPO) in 16 larger urbanized areas and with appropriate local officials in the smaller communities.

During the past year, we completed TOPICS studies in Battle Creek and Port Huron. The two studies involved review of 60 locations experiencing concentrations of accidents or congestion. Fifty-five percent of the locations were on the state trunkline system and 45 percent were on local street systems. Corrective recommendations totaled 79 and consisted of 65 low-cost operational actions and 14 capital outlay (construction) projects. Based on a conservative five percent expected reduction in total accidents for each of the operational recommendations and a $2,500 average implementation cost, the time of return (TOR) for the operational improvements is estimated to be less than two years.

Construction projects ranged from pavement friction improvements to intersection widenings. Eleven of the 14 projects potentially qualified for HES funding. Additional considerations, such as capacity, were involved in recommending the three other projects. The average cost of the 14 safety justified construction improvements was estimated to be $112,000 and the average annual benefit was estimated at $23,000, providing an average TOR of about five years. Approximately 75 percent of all 1982 through 1984 calendar year recommendations have been implemented. A minimum 90 percent final implementation recorded is anticipated.

Community Assistance Program

The Community Assistance Program assists in the identification, analysis, and correction of locations experiencing accident concentrations. The program is funded by a Section 402 grant administered by the Michigan Office of Highway Safety Planning.

We continue to emphasize integration of the Community Assistance Program with our TOPICS program as discussed previously. This results in a much higher level of activity and, we believe, a more efficient, cost-effective use of personnel. The Community Assistance Program does, however, continue to respond to any local agency requesting its services.

During fiscal 1985-86, the Community Assistance Program analyzed 45 locations. Thirty-eight were included as part of TOPICS reviews and 7 were completed on a special request basis.

APPENDIX I
SAFETY IMPROVEMENT PROCESS

Table of Contents

I. Planning

A. Data Collection

1. Accident Data

The Michigan Department of Transportation utilizes a computerized crash location reference and analysis system referred to as the Michigan Accident Location Index (MALI). The MALI system generates computerized descriptions of traffic crash locations directly from the information reported by the police officer. The system uses a street index composed of distances between intersections, alternate street names, and accurate city and township boundaries.

The MALI system enables the user to identify locations on all roads and streets with concentrations of correctable accident types.

2. Traffic Volume Data

The department utilizes Permanent (automatic) Traffic Recorders (PTR), portable traffic recorders, and manual recording techniques to collect traffic volume data on the trunkline system. The counting network consists of 110 PTR's, 393 portable traffic recorder "A: stations, and 2858 portable traffic recorder "C" stations. PTR data is used to establish seasonal and annual volume trends (refer to Exhibit I). "A" stations are counted for one week, three times a year and are used to determine where patterns change. "C" stations (short counts) are counted once a year for 48 to 96 hours and are used to identify volume changes.

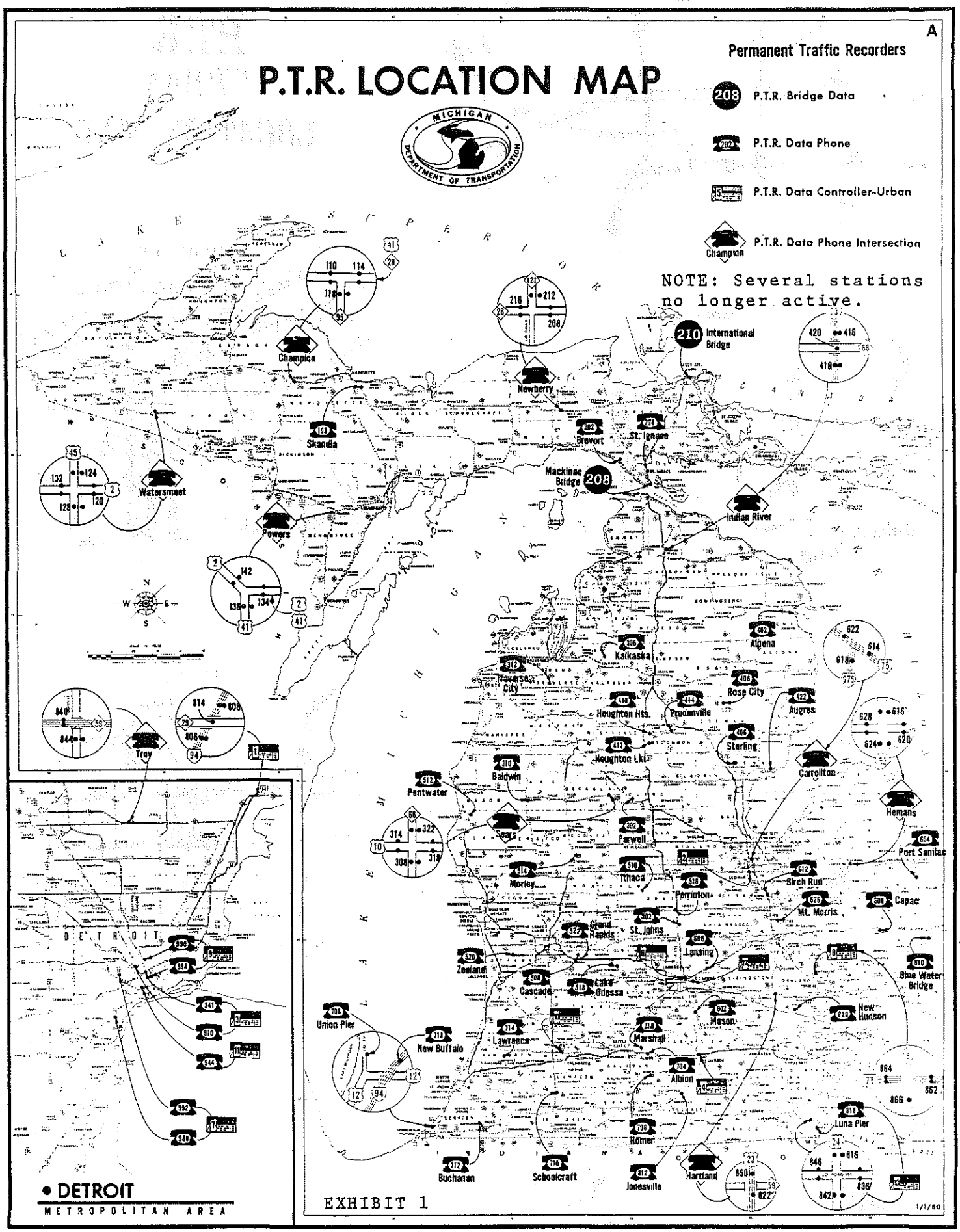
Vehicle classification surveys are conducted year-round at all the permanent traffic count stations by manual observation for 8 and 16 hour periods. This data is used to determine the mix of commercial traffic on the trunkline system.

Special intersection traffic surveys are conducted on a "request basis" primarily for traffic engineering analyses. These surveys usually include 8-hour manual turning movement counts and 24-hour machine counts. Backup, gap-and-delay studies and pedestrian volumes are included, when appropriate.

All traffic volume data is stored on magnetic tape in the department's central computer. This information is used to estimate present and future traffic on the state trunkline system, analyze traffic flow at specific locations, and monitor annual and seasonal traffic trends.

Data from the PTR stations are published in a monthly report (MDOT #65) which is available to the public. A magnetic tape of this information is also transmitted to the FHWA in Washington, D.C., to assist in identifying national traffic trends.

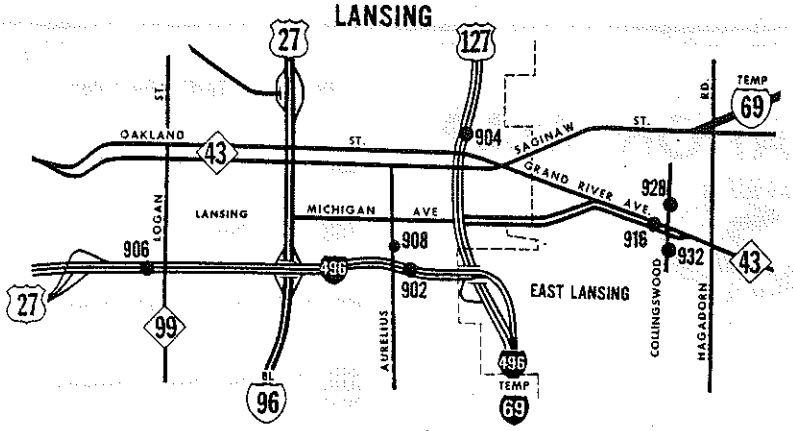
On the local road system, the counties and cities submit traffic volume data and vehicle miles of travel, which is incorporated into the "Statewide Needs Program." In addition the MDOT has begun collecting traffic volume data on a limited number of county primary roads as part of the Highway Performance Monitoring System (HPMS),


A
P.T.R. LOCATION MAP
Permanent Traffic Recorders
208 P.T.R. Bridge Data
202 P.T.R. Data Phone
15 P.T.R. Data Controller-Urban
Champion P.T.R. Data Phone Intersection
NOTE: Several stations no longer active.
MICHIGAN DEPARTMENT OF TRANSPORTATION
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
CANADA
210 International Bridge
Champion
Newberry
Brevort
St. Ignace
Mackinac Bridge 208
Skandia
Watersmeet
Powers
Indian River
Kalkaska
Algena
Hawers City
Houghton Hts.
Prudenville
Rose City
Augres
Houghton Lkt.
Sterling
Carrollton
Baldwin
Pentwater
Hemans
Scars
Farwell
Port Sanilac
Morley
Ithaca
Perrinton
Birch Run
Mt. Morris
Capac
Grand Rapids
St. Johns
Lansing
Zeeland
Cascade
Lake Odessa
Blue Water Bridge
Union Pier
New Buffalo
Lawrence
Marshall
Mason
New Hudson
Albion
Luna Pier
Homer
Buchanan
Schoolcraft
Jonesville
Hartland
Troy
DETROIT
• DETROIT
METROPOLITAN AREA
EXHIBIT 1
1/1/80

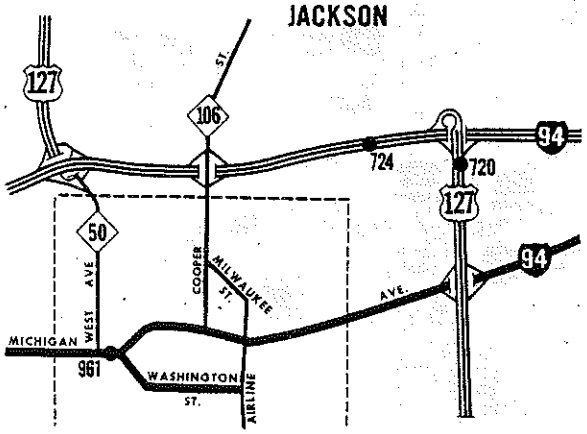
B

P.T.R.
URBAN
LOCATION MAP

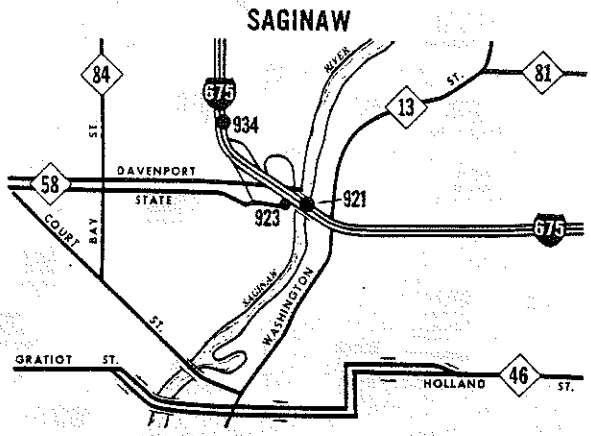
LANSING



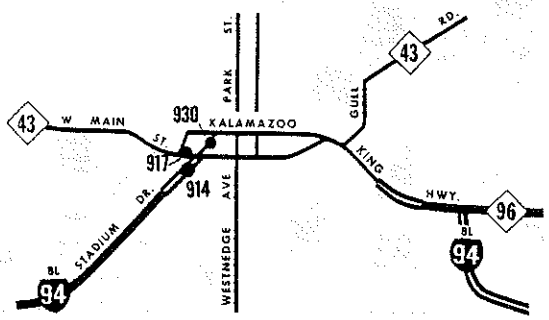
JACKSON



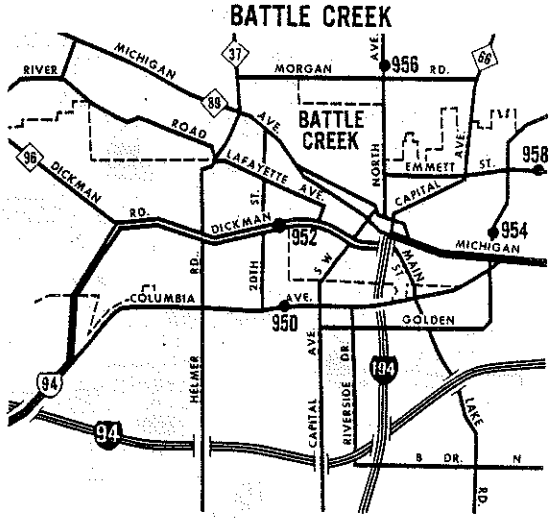
SAGINAW



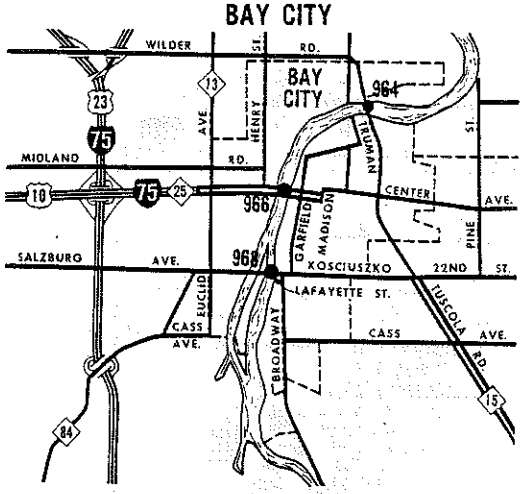
KALAMAZOO



BATTLE CREEK



BAY CITY



which is reported to the FHWA. This data is collected on a sampling basis and expanded. This traffic volume collection effort may be expanded within the next five years.

As required by the Surface Transportation Act, vehicle speed data is also collected statewide. This information is collected using automatic equipment from 44 stations (see Exhibit II). The data is sent to the FHWA in Washington D.C. on a quarterly and annual basis as part of Michigan's Annual Certification. This certification is accomplished in cooperation with the Department of State Police and the Office of Highway Safety Planning.

The department also conducts spot speed surveys, primarily to evaluate the need for new or modified speed limits. This data is maintained in a computerized file, tabulations of which are available in the Traffic and Safety Division.

3. Highway Information

The department maintains several inventories relating to the roadway and highway environment. These data include traffic control devices (signs and signals), horizontal roadway alignment, railroad crossing locations, speed controls, bridge and structure information, intersection geometry, interchange configurations, and roadside roadway features.

Roadside features relate to the highway environment. They include guardrail, utilities, and driveways. Roadway features directly affect capacity and operation and include facility type, laneage, "on-street" parking, lane and shoulder widths, surface type, type of shoulder and curb, type of median, and no-passing zones.

Computerization of the department's highway information has improved the utility, accessibility, and transferability of the data. These inventories are continually being improved and integrated to form the highway component of the departments's evolving transportation information system.

The following highway data systems warrant special mention:

a. Photolog

The department maintains a photolog system which provides a 35mm sequential film library of all state trunkline roadways and federal forest highways. The system includes a control section-milepoint reference system which is coordinated with the MALI system.

The photolog and viewing equipment are located in the department's Traffic and Safety Division.

The system is used to document and evaluate roadway geometrics traffic control devices and is updated periodically.

55 M.P.H. SPEED MONITORING PROGRAM

Station Location Map

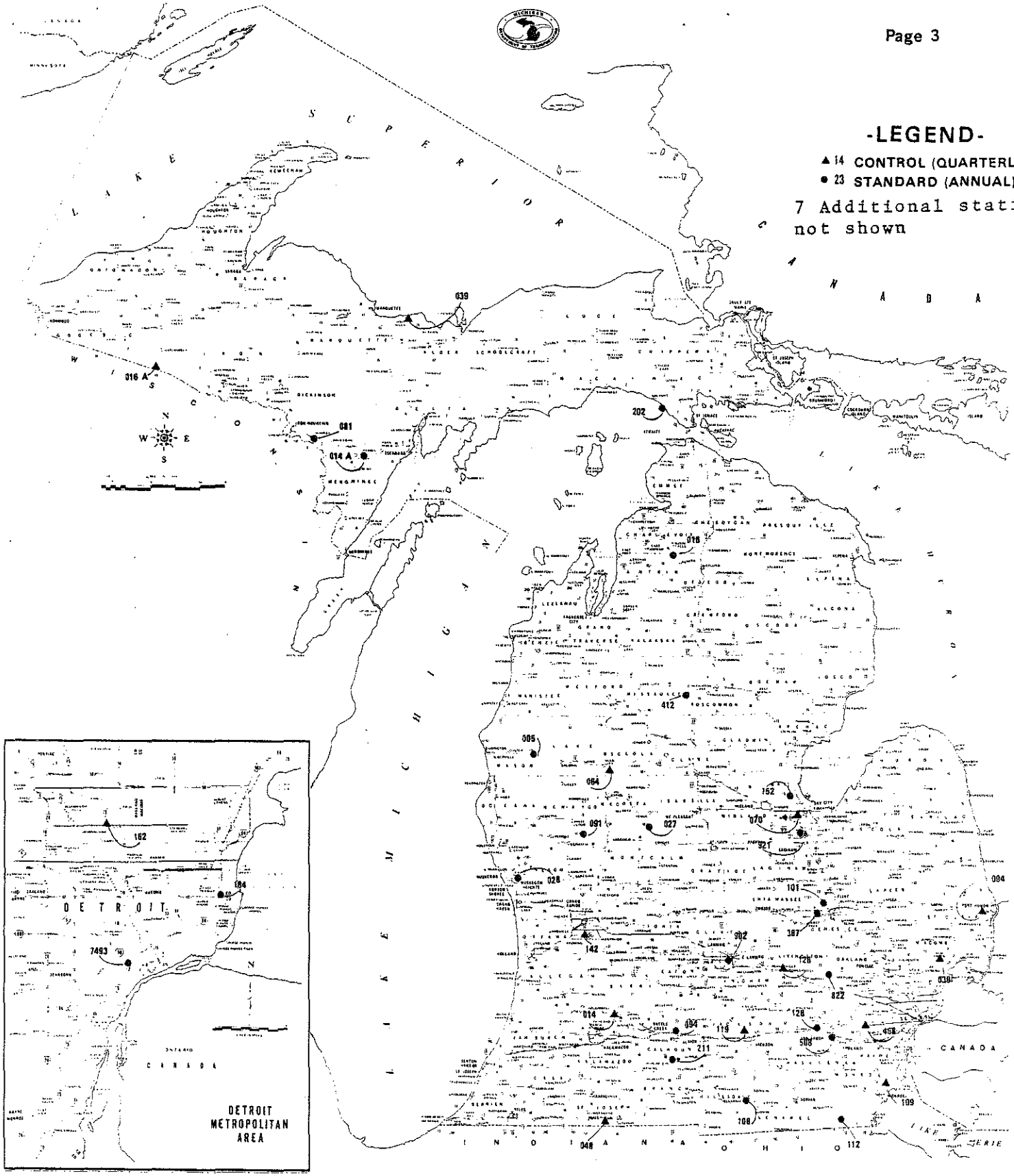


EXHIBIT II

6/1/81

b. Michigan Automated Records System (MARS)

For many years MDOT sought a reliable means of obtaining geometric data, in a relatively inexpensive way, that could be used to divide the trunkline system into "peer groups" for accident analysis. The development of MARS now gives us that data - not only on the trunkline system but on many miles of county primary roads. This expands the peer group data base and nontrunkline accidents can be added to the analysis. Being able to use a broader data base improves the overall quality of analysis work since a generally larger number of accidents can be included in the analysis.

The system consists of a standard van in which is mounted sensing devices, and computer hardware and software for gathering data for processing on the MDOT mainframe computer. It utilizes a crew of two. On-board equipment for electronic data collection includes: dual axis rotor tuned gyro, inclinometers, PDP 11/23 computer, disk drive, monitor and keyboard, laser equipped survey instrument, two LORAN-C receivers, and a Kennedy nine track mag tape drive for storing raw data.

Using federal and MDOT survey monuments for reference points, the vehicle follows a preplanned route beginning and ending at a monument. As the route is driven, raw data is collected and stored on the mag tape. The raw data is later processed into final form using the mainframe B7700 computer.

MDOT funds are being used to collect and process the data on trunklines and Federal 402 safety funds finance the the activity on local roads and streets.

c) Sufficiency Rating

MDOT uses a "Sufficiency Rating" system to rank highway segments on the basis of deficiencies in several areas, including safety, surface and base condition, capacity, drainage, and alignment. A completely adequate road would be rated 100. A lower score would reflect deficiencies, according to specific formulae and procedures.

The Safety element of the Sufficiency Rating has been completely revised, more accurately reflecting the area's accident characteristics. Under the new system, the highway network is divided into five roadway types, which are further sub-divided as rural and urban. Each roadway segment's safety rating is generated based on comparison of the segments accident rate with all segments in the same highway type category. A segment with no accidents is assigned the maximum of 30 points; a segment with an average accident rate is assigned 12 points. Segments with less than two rating points are considered in the first priority for improvement.

The Highway Sufficiency Rating Report is published biennially. Exhibit III explains the Sufficiency Rating in further detail.

d) Pavement Management System

The department is also developing a pavement management system (PMS) which rates the pavement surface, based on objective assessment of its quality. PMS is a uniform system which allows Districts to define the condition status of pavements; identify boundaries of potential rehabilitation projects; identify the most cost effective type of rehabilitation projects; establish accurate "lifecycle" rehabilitation cost estimates; forecast future pavement condition status and funding requirements. The system provides the information needed to identify where and how improvements can be made in the design, construction, and maintenance of pavements.

e) Railroad Crossing Data

The Railroad Safety and Tariffs Division, Bureau of Admministration, maintains a highway-railroad crossing inventory. Information for the inventory is obtained through site inspections and contacts with the various agencies involved and is recorded on grade crossing inspection reports. The inventory data is computerized to provide flexibiltiy in use, analysis and updating.

Addditional inventory information on state trunkline highway-railroad crossings is maintained by the Engineering Services Division, Bureau of Highways. The inventory is updated on a two-to-three year cycle and includes traffic control device information including location, type and condition, crossing surface type (length and condition), road approach type (width and condition), and track data in the immediate vicinity of the crossings.

Also, the following information on state highway-railroad crossings, obtained from other sources, is maintained by the Engineering Services Division: accident history at or near crossings; vehicular traffic volumes; rail abandonment data; and the Hazard Index Rating of all state trunkline crossings as established by the Railroad Safety and Tariffs Division.

B. Data Analysis

Prior to 1981, data analysis was done using the MIDAS statistically based peer group comparison system. Since the geometric features and traffic control devices were not updated, the "peer group" analysis was suspended temporarily. However "peer group" comparisons have now been reincorporated into the accident data package.

High accident locations are identified based on a minimum threshold table (Exhibit IV). Those thresholds are used to generate lists of locations which warrant further engineering review (Exhibit V). This list identifies each location where the number of accidents or

MICHIGAN DEPARTMENT OF TRANSPORTATION

1985 SUFFICIENCY RATING

MICHIGAN STATE TRUNKLINE HIGHWAYS

Prepared by:

Intercity Transportation Planning Division
Bureau of Transportation Planning

In Cooperation With:

Federal Highway Administration
U.S. Department of Transportation

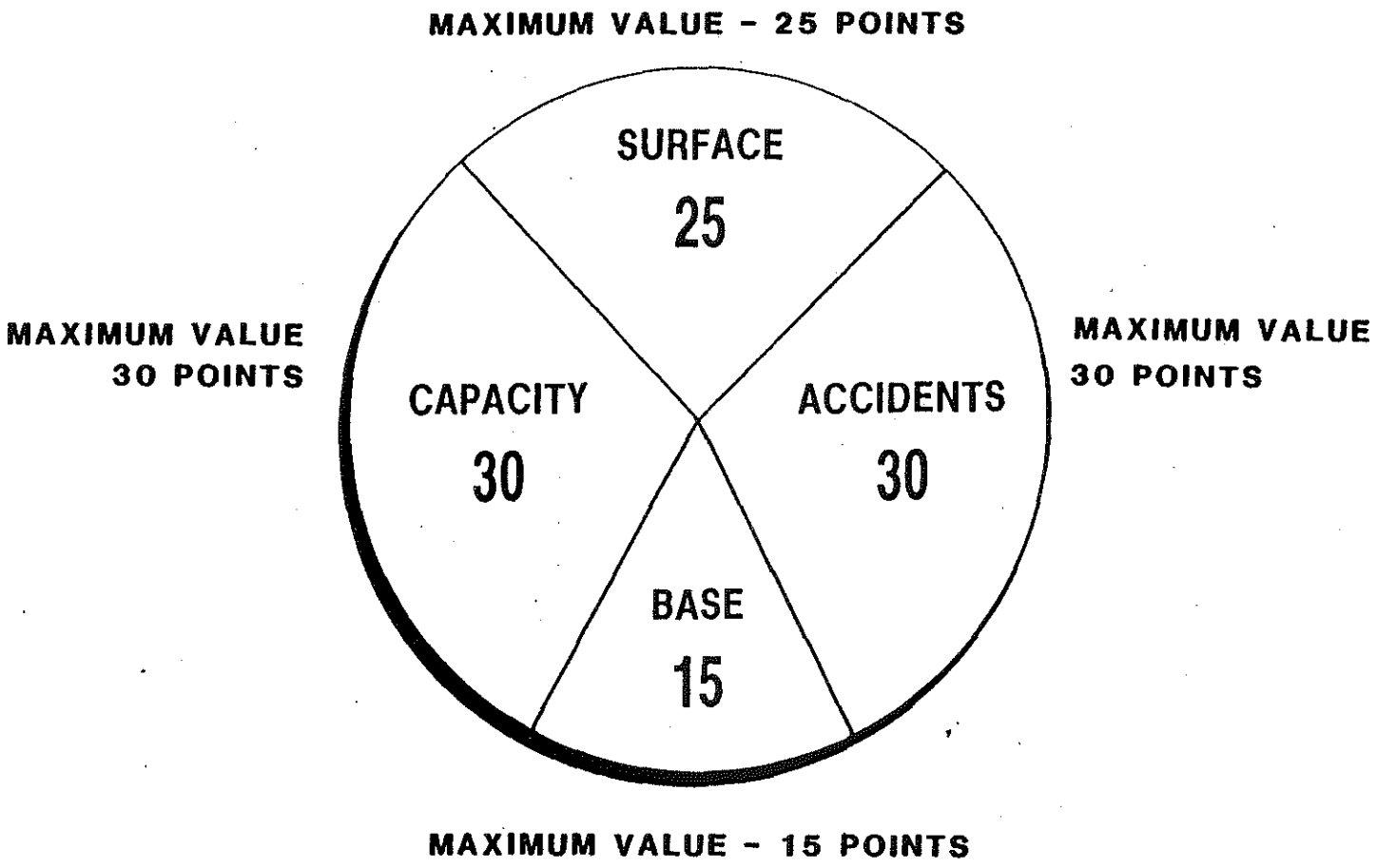
STATE TRANSPORTATION COMMISSION

William C. Marshall, Chairman
Rodger D. Young, Vice Chairman
Hannes Meyers, Jr.
Carl V. Pellonpaa
Shirley E. Zeller
William J. Beckham, Jr.

DIRECTOR
James P. Pitz

EXHIBIT III

1985 SUFFICIENCY RATING CATEGORIES
SURFACE - BASE - CAPACITY - ACCIDENTS



NOTE: • The maximum total sufficiency rating for a highway segment with optimal conditions is 100 points.

PURPOSE OF SUFFICIENCY RATING

The Michigan Department of Transportation has been conducting sufficiency ratings of the trunkline system since 1961. The sufficiency rating process illustrated in this report includes a systematic evaluation of the condition and relative performance of individual highway segments.

While considerable information is represented from a variety of sources, a key feature of the Michigan Sufficiency Rating is that the roadway condition ratings are made by a single panel of engineers who annually drive and rate the entire state trunkline system. This technique provides a rating system that is uniform in application throughout the state.

As illustrated in the accompanying exhibit, the sufficiency rating is actually made up of four separate rating categories: surface, base, safety, and accidents. The maximum point values assigned to each rating category represents their relative contribution to the total sufficiency rating.

The Sufficiency Rating Report graphically portrays the individual highway segment ratings and other related information for all state trunklines. For each district, the trunkline strip maps are arranged in the following sequence:

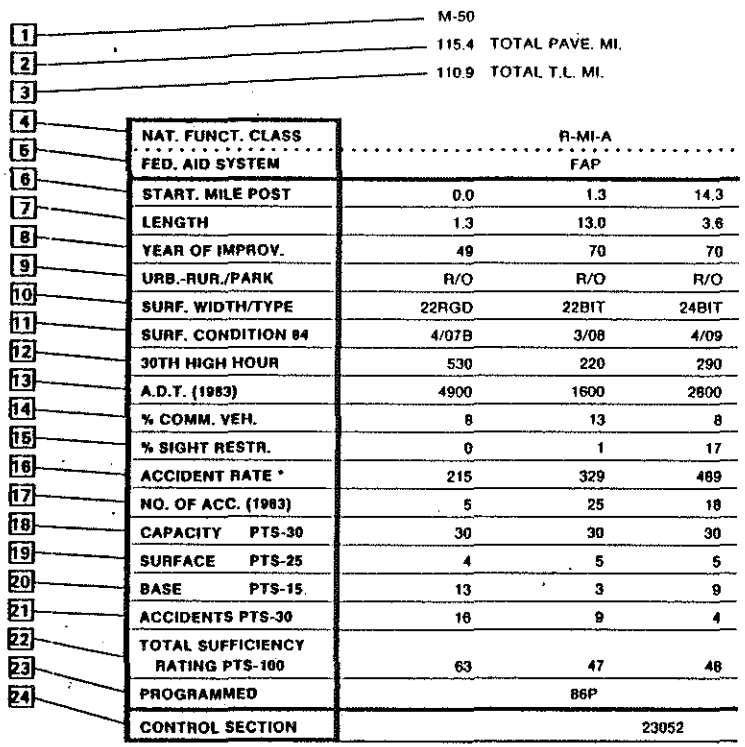
1. Michigan Routes 2. U.S. Routes 3. Interstate Routes 4. Connector Routes

The information contained in this report is intended to provide a general systems level overview of the relative condition of the state trunklines. It is intended to serve as an initial planning tool for staff and management to guide development of more comprehensive studies. It is not intended for setting project level priorities, which would require considerably more information than provided in this report.

In addition to the sufficiency ratings, this report also serves as a single-source document containing a variety of conditions and operational data on the entire trunkline system. It is the intent of the Michigan Department of Transportation, Bureau of Transportation Planning to update this document annually and continually revise and improve its format to better serve its users.

Description of Terms

The following is a brief description of the terms listed for each highway rating segment. If there is interest in a more technical explanation, please contact the Highway Transportation Planning Section.



NAT. FUNCT. CLASS	R-MI-A		
FED. AID SYSTEM	FAP		
START. MILE POST	0.0	1.3	14.3
LENGTH	1.3	13.0	3.6
YEAR OF IMPROV.	49	70	70
URB.-RUR./PARK	R/O	R/O	R/O
SURF. WIDTH/TYPE	22RGD	22BIT	24BIT
SURF. CONDITION 84	4/07B	3/08	4/09
30TH HIGH HOUR	530	220	290
A.D.T. (1983)	4900	1600	2600
% COMM. VEH.	8	13	8
% SIGHT RESTR.	0	1	17
ACCIDENT RATE *	215	329	489
NO. OF ACC. (1983)	5	25	18
CAPACITY PTS-30	30	30	30
SURFACE PTS-25	4	5	5
BASE PTS-15	13	3	9
ACCIDENTS PTS-30	16	9	4
TOTAL SUFFICIENCY RATING PTS-100	63	47	48
PROGRAMMED		86P	
CONTROL SECTION			23052

EXHIBIT IIIC

Description of Terms

1 **ROUTE NUMBER**

Routes are arranged numerically by "M" (Michigan) routes, "US" (United States) routes, and "I" (Interstate) routes. Business routes and Business loops or spurs follow their respective M, US or I designation and "connector" roadways are listed last. Unnumbered trunklines were not rated in this report. Route numbers followed by (PCN) identify routes on the state's Priority Commercial Network.

2 **TOTAL PAVEMENT MILES**

This is the total district mileage of the route being rated and considers the lengths of divided roadways separately. For example, one mile of I-94 is two pavement miles long. It does not include the mileage that duals with, and is assigned to another route.

3 **TOTAL TRUNKLINE MILES**

This is the total centerline mileage of the route number within the district. Route mileage that duals with another route is excluded and PCN portions of a route are considered separately.

4 **NATIONAL FUNCTIONAL CLASSIFICATION**

This classification system was initiated by the U.S. Congress in 1968 and is based on the process by which streets and highways are grouped into classes according to the character of service they are intended to provide. Places with a population of 5,000 or more qualify as urban. The abbreviations for the classifications are as follows:

	Rural		Urbanized & Small Urban Areas
R-PA-I	Principal Art.-Interstate	U-PA-I	Principal Art.-Interstate
R-PA-O	Principal Arterial-Other	U-PA-FY	Principal Arterial-Other Fwys.
R-MI-A	Minor Arterial	U-PA-O	Principal Arterial-Other
R-MJ-C	Major Collector	U-MI-A	Minor Arterial
R-MI-C	Minor Collector	U-COL	Collector
R-LOC	Local Road	U-LOC	Local Street

5 **FEDERAL AID SYSTEM**

This designation refers to the four systems of major highways shown in the Federal-Aid Systems Atlas that qualify for federal funding assistance. The systems include:

FAI-Federal-Aid Interstate **FAP-Federal-Air Primary**
FAS-Federal-Aid Secondary **FAU-Federal-Aid Urban**

6 **STARTING MILE POST**

The starting point of each rating segment is measured from the beginning of the control section log record.

7 **LENGTH**

The length of the rating segment is measured to the nearest tenth of a mile. This length is determined by logical changes in pavement surface type, age, cross section, city/county boundary, classification, etc.

8 **YEAR OF IMPROVEMENT**

This represents the most recent year this rating segment received significant construction work that improved its driving surface condition. Minor work involving short pavement patching, joint repair, shoulder improvements, etc., are generally not identified.

9 **URBAN-RURAL/PARKING**

The entire rating segment is either in an urban (U), rural (R), or boundary area. Urban is defined as those incorporated (Act 51) cities or villages as identified by the Local Services Division. Rural is defined as a section outside the boundry of an incorporated city or village. Roadways that are on boundaries between urban and rural areas are shown as (UR), areas between two different urban areas as (UU), and the central business district is coded (CBD). Fringe areas located outside of incorporated city limits but having urban traffic characteristics are shown as (UA).

The Parking Codes are:
0 — No Parking
1 — Parking one side
2 — Parking both sides

Description of Terms . . . *Continued*

10 **SURFACE WIDTH/TYPE**

This is the predominate width (in feet) of the pavement for the rating segment. It represents the width of driving surface (excluding shoulders) in rural areas and the distance between curbs in urban areas.

The surface type codes are:

BIT — Bituminous over flexible or aggregate base
RGD — Concrete (Rigid)
CMP — Bituminous over concrete or brick (Composite)
BRK — Brick
SLC — Bituminous seal coat surface treatment

11 **SURFACE CONDITION**

There are two different evaluation systems represented on this line. The first number is based on the traditional 5 point scale (1 being the best) that subjectively evaluates the surface condition according to the criteria listed below. The extent of surface deterioration is based on the observed amount and severity of pavement cracking, faulting, wheel tracking, patching, etc.

Code	Description
1	Very little pavement deterioration
2	Some initial deterioration but not yet requiring appreciable amounts of maintenance
3	Occasional deterioration requiring routine maintenance operations
4	Frequent occurance of surface deterioration requiring more extensive maintenance
5	Extensive surface deterioration requiring heavy maintenance

The second number is based on the new 10 point scale (1 being the best) recently developed by the Materials and Technology Division. These ratings are more objective in that they are derived from an actual counting of cracks occuring in a 500 foot rating segment and quantifying the severity of pavement stress in designated categories. The number shown represents the evaluation made by the Bureau of Transportation Planning's engineers in conjunction with their normal field survey. The rating only represents one randomly selected 500 foot sample within the total sufficiency segment.

12 **30TH HIGH HOUR**

This term represents an estimated hourly traffic volume commonly used to guide future highway designs or measure existing traffic flow characteristics. The source of this estimate is the Trunkline Vehicle Miles (TVM) record developed in the Bureau of Transportation Planning.

13 **AVERAGE DAILY TRAFFIC (ADT)**

This is a basic traffic volume estimate that represents the number of vehicles passing a particular point on a highway during a period of 24 consecutive hours, averaged over 365 days. This statistic is also derived from the TVM record.

14 **PERCENT COMMERCIAL VEHICLES**

This estimated number is also taken from the TVM record and represents the percentage of larger single unit trucks or truck tractors with trailers or semi-trailers in the traffic stream.

15 **PERCENT SIGHT RESTRICTION**

This represents the proportional amount of marked "no passing zone" distance for the highway segment. Although only measured for one direction in the field, it is assumed to be the same for the other direction.

16 **ACCIDENT RATE**

In response to requests by the Traffic & Safety Division (June 1985), there are two separate accident rate calculations included in this report. For the longer rating segments (greater than 0.5 miles), the rate is calculated as the number of accidents occurring per 100 million vehicle miles of travel. For the shorter segments (0.5 miles or less) the rate is calculated as the number of accidents occurring per million vehicles. This latter accident rate calculation is intended to act more like a "spot" accident rate rather than an average per length and is considered more representative of accident analysis for shorter roadway segments. The 0.5 mile dividing point was initially selected as a trial for this report and the length may be revised in future reports. The accident rate calculations are based on 1983 traffic and accident data.

Description of Terms . . . *Continued*

17 **NUMBER OF ACCIDENTS**

This represents the number of accidents found on the rating segment. This statistic originates from the Accident Master data file for the year indicated. Sufficiency segment mile points are equivalenced with corresponding points referenced by the Michigan Accident Location Index (MALI) system.

18 **CAPACITY POINTS**

This item represents an evaluation of a section of highway to carry existing traffic volumes. A capacity index is computed and then related to a conversion table to determine the corresponding capacity value out of 30 possible points. Factors used in calculating the *rural* index include: 30th High Hour, lane width, percent sight restriction, percent commercial traffic, and the 1965 Highway Capacity Manual's Level of Service "D" hourly capacity volumes. The *urban* index capacity factors include: 30th High Hour, population and hourly capacities based on surface width, parking, type of traffic operation and its location within an urban area.

19 **SURFACE POINTS**

This item represents a relative evaluation of the pavement's surface, including its shoulders or curbing. The maximum value is 25 points and is calculated using a combination of factors like: surface life expectancy, lane and shoulder width design guidelines, and observed pavement deterioration.

20 **BASE POINTS**

This item has a maximum value of 15 points and represents an evaluation of the grading materials beneath the pavement surface. It is calculated using a combination of condition factors related to soil, sub-base, drainage and seasonal load restrictions.

21 **ACCIDENT POINTS**

This item is allocated a maximum of 30 points and is based on the relative accident experience of the particular roadway segment. The state's highway network is divided into five roadway types: freeway, divided, center lane for left turns, one-way and two-way undivided. Each type is further divided into urban/rural, and also segment length (greater or less than 0.5 miles). This produces 20 separate accident rate tables from which corresponding accident point values are derived. This methodology is based on the June 1985 recommendation of the Traffic & Safety Division.

22 **TOTAL SUFFICIENCY RATING**

This is the summation of the individual points assigned to the capacity, surface, base and accident categories. The maximum total sufficiency value for an optimal roadway segment is 100 points.

23 **PROGRAMMED**

This represents the major highway projects known to be programmed for the fiscal year indicated. The letter following the year indicates whether the project is categorized as either a Preserve, Improve, or Expand type of project. Only projects likely to alter the sufficiency ratings are included. For example, a resurfacing project would be listed, but bridge repair or landscaping projects would not be shown.

24 **CONTROL SECTION**

This represents the control section numbers identified in the MDOT Control Section Atlas.

M- 26

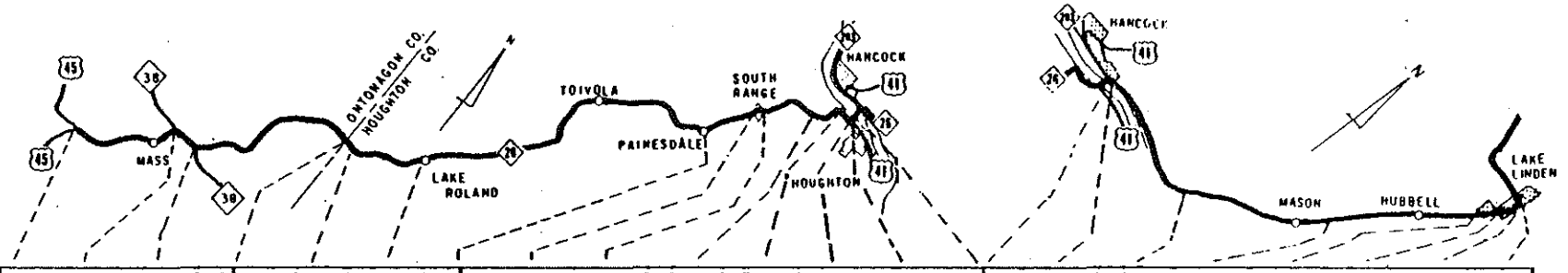
82.3 TOTAL PAVE. MI.
82.3 TOTAL T.L. MI.

EXHIBIT III G

1

26

NAT. FUNCT. CLASS / FED. AID SYSTEM	R-MI-A FAP	U-PA-O FAP	U-MI-A FAP	R-MJ-C FAP
START. MILE POST				
LENGTH				
YEAR OF IMPROV.				
URB.-RUR./ PARK				
SURF. WIDTH/TYPE				
SURF. CONDITION 84				
30TH HIGH HOUR				
A.D.T. (1983)				
% COMM. VEH.				
% SIGHT RESTR.				
ACCIDENT RATE *				
NO. OF ACC. (1983)				
CAPACITY PTS-30				
SURFACE PTS-25				
BASE PTS-15				
ACCIDENTS PTS-30				
TOTAL SUFFICIENCY RATING POINTS-100				
PROGRAMMED				



START. MILE POST	0.0	5.6	6.6	0.0	0.3	4.1	0.0	2.5	3.2	6.5	7.1	8.0		0.0	0.1	3.1	6.1	9.8	10.0	10.5
LENGTH	5.6	1.0	8.9	0.3	3.8	15.6	2.5	0.7	3.3	0.6	0.9	0.4	0.4	0.1	3.0	3.0	3.7	0.2	0.5	0.2
YEAR OF IMPROV.	84	79	70	70	75	60	69	69	69	83	79	79		79	79	79	81	81	81	81
URB.-RUR./ PARK	R /0	R /0	R /0	R /0	R /0	R /0	R /0	U /0	R /0	R /0	UA/0	U /0		U /0	R /0	R /0	R /0	R /0	U /2	U /2
SURF. WIDTH/TYPE	24BIT	36BIT	20BIT	20BIT	22BIT	24BIT	22BIT	22BIT	22BIT	52RGD	52RGD	52RGD		24CMP	24BIT	24CMP	24CMP	46CMP	40CMP	46CMP
SURF. CONDITION 84	1/01	3/07B	5/09A	5/09A	3/08A	4/08A	5/09A	5/09A	5/09A	1/01	1/02	1/02		2/02	2/06B	2/06	2/06	2/05	2/05	2/05
30TH HIGH HOUR	180	250	150	150	150	200	350	470	550	770	940	1150		1000	870	710	800	800	700	600
A.D.T. (1983)	1100	1500	800	1000	1000	1300	2400	3200	4000	6300	8400	10500		8000	6700	5100	6000	6000	5000	4000
% COMM. VEH.	15	11	18	13	13	12	10	8	8	6	5	5	DUALS	9	10	12	10	10	11	13
% SIGHT RESTR.	20	0	52	100	3	19	88	0	0	0	0	0	WITH	0	27	20	22	0	0	0
ACCIDENT RATE *	178	0	154	0.0	216	135	228	122	332	145	870	1.8	US 41	3.4	164	72	284	1.4	4.4	2.1
NO. OF ACC. (1983)	4	0	4	0	3	10	5	1	16	2	24	7		10	12	4	23	3	8	3
CAPACITY PTS-30	30	30	30	30	30	30	30	24	30	30	30	22		6	18	25	21	28	30	30
SURFACE PTS-25	25	12	2	2	9	2	2	2	1	25	25	25		14	12	14	16	16	24	24
BASE PTS-15	9	11	3	9	10	10	3	5	3	15	15	15		5	5	9	9	15	10	10
ACCIDENTS PTS-30	16	30	20	30	16	20	16	20	9	20	1	16		9	20	26	12	12	6	16
TOTAL SUFFICIENCY RATING POINTS-100	80	83	55	71	65	62	51	51	43	90	71	78		34	55	73	58	71	70	80
PROGRAMMED																				
CONTROL SECTION	66051			31011			31012							31013						

* ACC/100 MVM FOR LENGTH > 0.500 MI
ACC/ MV FOR LENGTH < 0.501 MI

1982-1984 Safety Programs Unit Minimum
Accident Thresholds

Accident Type	3 Years	or	Current Year	and	Minimum Percent
Injury	25		12		50
Fatal	2		2		
Wet	20		10		40
Icy	20		10		25
Dark	25		12		40
Overturned	3		2		
Train	2		2		
Parked Vehicle	20		10		
Multi Vehicle Other	15		8		
Pedestrian	3		2		
Fixed Object	10		5		
On Road Object	5		3		
Animal	12		6		
Bicycle	3		2		
Single Vehicle	15		8		
Head On	3		2		
Side Swipe Meet	5		3		
Side Swipe Pass	6		3		
Right Angle	15		8		
Left Turn	15		8		
Right Turn	6		3		
Rear End	20		10		
Backing	10		5		
Parking	20		10		

EXHIBIT IV

EXHIBIT V

1982-1984 INTERSECTION HIGH-ACCIDENT LISTING (Thresholds & Percents) PAGE 2

DISTRICT 5 CALCULATED AT 1 STD DEV

ACC TYPE	# ACC	STD DEV	MEAN	UCL	THRESHOLD NUMBER	PERCENT OF TOTAL
34061 13.40	M21/M66	STATE ROAD	IONIA CITY		TOTAL ACCIDENTS 44	
3 LOCATIONS	2 Lane-2 Way/Tangent/No Passng		Urban/Signal			11 ft. Lane/Curb
Rear-End	22				20	1 % OF 44 = 0
REMARKS:						
34062 00.85	M-21	JEFFERSON ROAD	IONIA CITY		TOTAL ACCIDENTS 15	
16 LOCATIONS	2 Lane-2 Way/Tangent/No Passng		Urban/No Signal			10 ft. Lane/Curb
Pedestrian	3	0.7	0.3	1.1	3	1 % OF 15 = 0
REMARKS:						
37011 02.59	US-27BR	BROOMFIELD ROAD	UNION TWP		TOTAL ACCIDENTS 94	
32 LOCATIONS	5 Lane-2 Way/Tangent		Urban/Signal			12 ft. Lane/Curb
Dark	39	13.7	19.7	33.4	25	40% OF 94 = 37
Right Angle	22	8.3	13.7	22.8	15	1 % OF 94 = 0
Left Turn	30	8.9	10.7	19.6	15	1 % OF 94 = 0
Rear-End	32	25.0	29.9	55.7	20	1 % OF 94 = 0
REMARKS:						
37011 03.08	US-27BR	PRESTON	UNION TWP		TOTAL ACCIDENTS 51	
32 LOCATIONS	5 Lane-2 Way/Tangent		Urban/Signal			12 ft. Lane/Curb
Rear-End	20	25.0	29.9	55.7	20	1 % OF 51 = 0
REMARKS:						
37011 03.34	US-27BR	BELLOWS	UNION TWP		TOTAL ACCIDENTS 42	
32 LOCATIONS	5 Lane-2 Way/Tangent		Urban/Signal			12 ft. Lane/Curb
Left Turn	16	8.9	10.7	19.6	15	1 % OF 42 = 0
REMARKS:						
37011 03.58	US-27BR	M20	UNION TWP		TOTAL ACCIDENTS 73	
31 LOCATIONS	4 Lane-2 Way/Tangent		Urban/Signal			12 ft. Lane/Curb
Rear-End	49	8.9	12.5	21.3*	20	1 % OF 73 = 0
REMARKS:						
37012 01.12	US-27BR	PICKARD ROAD	MT PLEASANT		TOTAL ACCIDENTS 61	
31 LOCATIONS	4 Lane-2 Way/Tangent		Urban/Signal			12 ft. Lane/Curb
Right Angle	19	5.9	8.4	14.5	15	1 % OF 61 = 0
Left Turn	15	4.5	4.6	9.4	15	1 % OF 61 = 0
REMARKS:						

accident type exceeded its threshold value. The thresholds can, at the analyst's option, be predetermined or calculated through statistical analysis techniques. There are threshold values for the total accidents and for 24 accident types. The threshold table lists each of those "outliers" and shows the number of accidents for each accident type for which the threshold was exceeded.

The listing in Exhibit V also includes a minimum percent for certain acident types and the mean, standard deviation and upper confidence level for all locations with similar characteristics (the "peer group" comparison). This affords the engineer the opportunity to assess the significance of the accident pattern in the context of similar locations statewide.

Research continues towards integrating the best aspects of both the threshold and "peer group" techniques. The goal is to develop a system which identifies only locations with disproportionate and numerically significant accident patterns.

Development of the computerized freeway interchange/accident data system accomplished through a contract with Michigan State University, funded by the Office of highway Safety Planning is now essentially complete. This program allows us to summarize traffic and roadway accident data, and prioritize further analysis by type of freeway interchange and by similar elements (such as ramp type) within interchange areas. The system is accessible through any terminal connected to the MDOT computer and offers information in three different report formats.

The department continues to develop and enhance the MIDAS model. The system being designed includes an analysis of alternative corrective treatments now being developed as "MIDAS Predictor Equations" under contact by Michigan State University.

In-depth analyses of locations utilizes various MIDAS printouts (Exhibits VI - XII). This package includes a summary of accidents by approach; a one line printout of each accident; accident distribution by hour (with volume distribution), day, month, and year. The reports, in most cases, eliminate the need for collision diagrams. MIDAS also provides before-and-after accident information, which is helpful in the evaluation of safety improvements.

Accident information is available for the previous nine years and for a part of the current year.

C. Engineering Studies

Primary responsibility for accident surveillance on the state trunkline system is assigned to the Traffic and Safety Division's Safety Programs Unit. This surveillance/analysis effort is accomplished annually using the most recent three years of accident data as a basis. The threshold tables described in (B) are the source of the location review list.

INTERSECTION PROFILE

LOCATION: US-27BR AT BROOMFIELD ROAD

CITY/VILLAGE/TOWNSHIP: UNION TWP

COUNTY: ISABELLA COUNTY

INTERSECTION TYPE: 4 LEGS - CROSS - SIGNAL

DISTRICT	CONTROL SECTION	MILEPOINT MALI	MILEPOINT PHOTOLOG
5	37011	2.59	2.55

DATE REQUESTED: JANUARY 1, 1982 THRU DECEMBER 31, 1984 (3 YEARS, 0 MONTHS, 0 DAYS)

REPORT RUN BY: K MCDONALD

REASON FOR RUN: ANNUAL REPORT

AUGUST 25, 1986

EXHIBIT VI

I N T E R S E C T I O N P R O F I L E

DIST 5 CS 37011 MP 2.59 (MALI), 2.55 (PHOTOLOG) US-27BR AT BROOMFIELD ROAD UNION TWP ISABELLA COUNTY

I N T E R S E C T I O N G E O M E T R I C S

APPROACH DIRECTION	SPEED (MPH)	DAILY VOLUME	LANEAGE BASIC	LANEAGE LEFT	LANEAGE RIGHT	LEFT TURNS PROHIBITED	LEFT TURNS PHASE	DIST	CS	INFLUENCE ZONE MALI MP	INFLUENCE ZONE LENGTH	
NORTH BOUND	50	8,350	2			NO	NONE	5	37011	2.38- 2.59	0.21MI	1108FT
SOUTH BOUND	50	8,350	2			NO	NONE	5	37011	2.59- 2.73	0.14MI	739FT
EAST BOUND						NO	NONE	5	37011			
WEST BOUND						NO	NONE	5	37011			

I N T E R S E C T I O N A C C I D E N T S : 1- 1-82 THRU 12-31-84 (3.00 YEARS)

APPROACH DIRECTION	INJ ACC	FAT ACC	TOTL ACC	NUMBER OF ACCIDENTS BY TYPE: HEAD ON	SS PASS	SS MEET	ANGL	LEFT TURN	RIGHT TURN	REAR END	BACK UP	PARK	OTHER	PERCENT: WET	ICY	DARK	ACC PER MILLION VEHICLES
NORTH BOUND	8	0	24	0	0	0	4	9	0	11	0	0	0	29.2	16.7	25.0	2.62
SOUTH BOUND	11	0	30	0	1	0	7	9	0	9	1	0	3	36.7	13.3	50.0	3.28
EAST BOUND	3	0	25	1	0	1	5	10	0	7	0	0	1	24.0	20.0	48.0	0.00
WEST BOUND	4	0	15	1	0	0	6	2	1	5	0	0	0	6.7	13.3	40.0	0.00
3.00 YEAR TOTAL	26	0	94	2	1	1	22	30	1	32	1	0	4				
AVERAGE PER YEAR	8.7	0.0	31.3	0.7	0.3	0.3	7.3	10.0	0.3	10.7	0.3	0.0	1.3				
PERCENT OF TOTAL	27.7	0.0	100.0	2.1	1.1	1.1	23.4	31.9	1.1	34.0	1.1	0.0	4.3	26.6	16.0	41.5	
EXPECTED ACC.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DIFF IN ACCIDNT	8.7	0.0	31.3	0.7	0.3	0.3	7.3	10.0	0.3	10.7	0.3	0.0	1.3	8.3	5.0	13.0	

EXHIBIT VII

INTERSECTION PROFILE

DIST 5 CS 37011 MP 2.59 (MALI), 2.55 (PHOTOLOG) US-27BR AT BROOMFIELD ROAD UNION TWP ISABELLA COUNTY

INTERSECTION GEOMETRICS

APPROACH DIRECTION	SPEED (MPH)	DAILY VOLUME	LANEAGE BASIC	LANEAGE LEFT	LANEAGE RIGHT	LEFT TURNS PROHIBITED	LEFT TURNS PHASE	DIST	CS	INFLUENCE ZONE MALI MP	INFLUENCE ZONE LENGTH	
NORTH BOUND	50	8,350	2			NO	NONE	5	37011	2.38- 2.59	0.21MI	1108FT
SOUTH BOUND	50	8,350	2			NO	NONE	5	37011	2.59- 2.73	0.14MI	739FT
EAST BOUND						NO	NONE	5	37011			
WEST BOUND						NO	NONE	5	37011			

INTERSECTION ACCIDENTS: 1- 1-82 THRU 12-31-84 (3.00 YEARS)

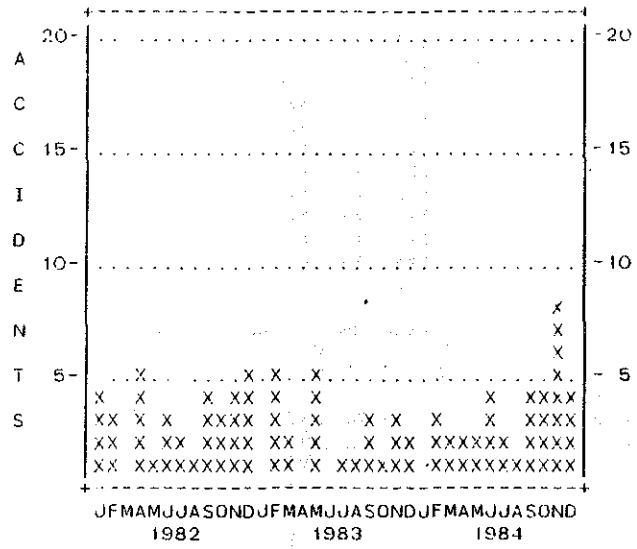
APPROACH DIRECTION	INJ ACC	FAT. ACC	TOTL ACC	NUMBER OF ACCIDENTS BY TYPE: HEAD ON	SS PASS	SS MEET	ANGL	LEFT TURN	RIGHT TURN	REAR END	BACK UP	PARK	OTHER	PERCENT: WET	ICY	DARK	ACC PER MILLION VEHICLES
NORTH BOUND	8	0	24	0	0	0	4	9	0	11	0	0	0	29.2	16.7	25.0	2.62
SOUTH BOUND	11	0	30	0	1	0	7	9	0	9	1	0	3	36.7	13.3	50.0	3.28
EAST BOUND	3	0	25	1	0	1	5	10	0	7	0	0	1	24.0	20.0	48.0	0.00
WEST BOUND	4	0	15	1	0	0	6	2	1	5	0	0	0	6.7	13.3	40.0	0.00
3.00 YEAR TOTAL	26	0	94	2	1	1	22	30	1	32	1	0	4				
AVERAGE PER YEAR	8.7	0.0	31.3	0.7	0.3	0.3	7.3	10.0	0.3	10.7	0.3	0.0	1.3				
PERCENT OF TOTAL	27.7	0.0	100.0	2.1	1.1	1.1	23.4	31.9	1.1	34.0	1.1	0.0	4.3	26.6	16.0	41.5	
EXPECTED ACC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DIFF IN ACCIDNT	8.7	0.0	31.3	0.7	0.3	0.3	7.3	10.0	0.3	10.7	0.3	0.0	1.3	8.3	5.0	13.0	

EXHIBIT VII

I N T E R S E C T I O N P R O F I L E

DIST 5 CS 37011 MP 2.59 (MALI), 2.55 (PHOTOLOG) US-27BR AT BROOMFIELD ROAD UNION TWP ISABELLA COUNTY

DISTRIBUTION BY MONTH



DISTRIBUTION BY YEAR

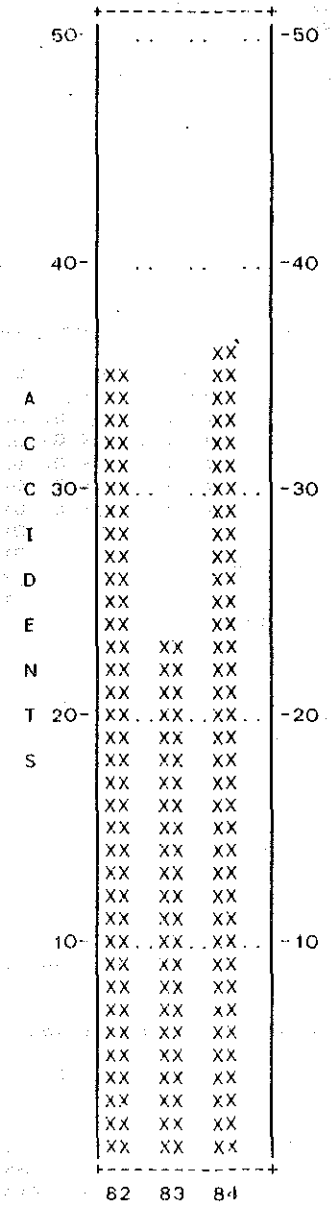


EXHIBIT VIII

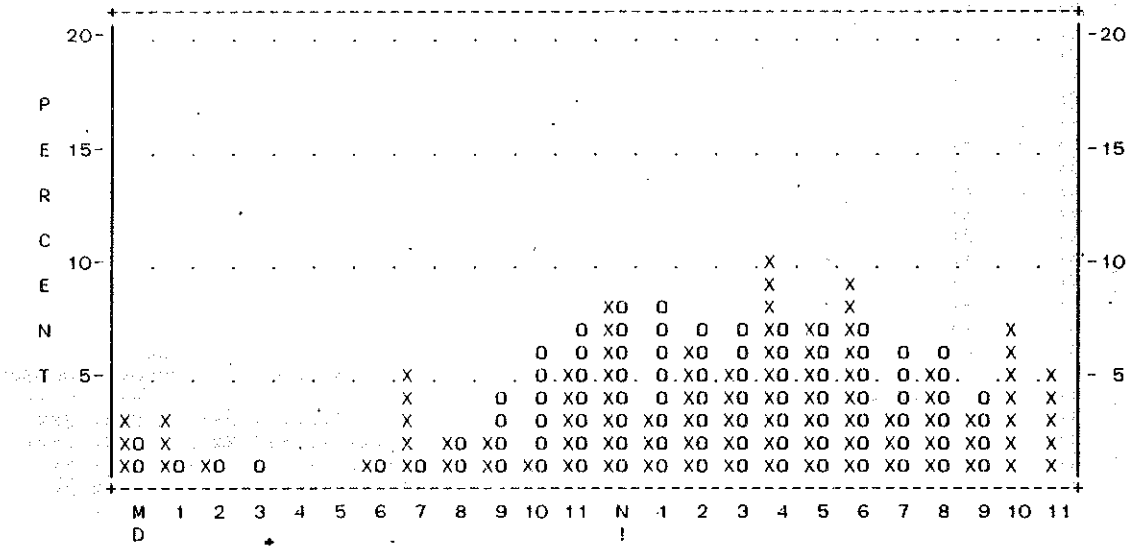
MICHIGAN DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION
MICHIGAN DIMENSIONAL ACCIDENT SURVEILLANCE SYSTEM (MIDAS)

INTERSECTION PROFILE

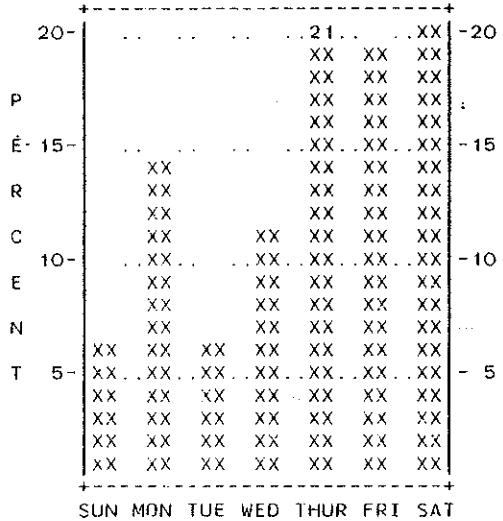
DIST 5 CS 37011 MP 2.59 (MALI), 2.55 (PHOTOLOG) US-27BR AT BROOMFIELD ROAD UNION TWP ISABELLA COUNTY

X= ACCIDENT DISTRIBUTION O= VOLUME DISTRIBUTION

DISTRIBUTION BY HOUR OF DAY



DISTRIBUTION BY DAY OF WEEK



DISTRIBUTION BY MONTH OF ALL YEAR

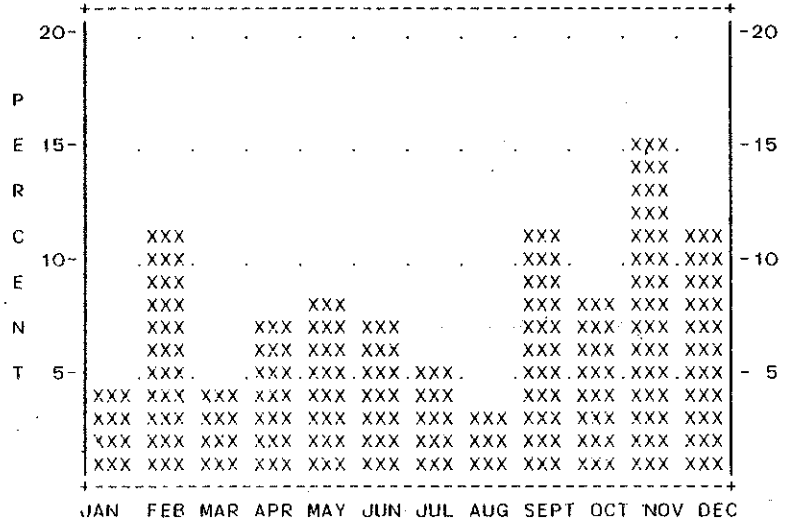


EXHIBIT IX

I N T E R S E C T I O N A C C I D E N T P R O F I L E

INTERSECTION TYPE : 5 LANE 2-WAY SIGNALIZED

LOCATION : US-27BR AT BROOMFIELD ROAD UNION TWP , ISABELLA COUNTY

DISTRICT 5 CONTROL SECTION 37011 MILEPOINT 2.59

DIST FROM ISCN	ACCIDENT TYPE	VIOLATOR (OR VEH 1) DR	INTENT	IMPACT	HAZRD ACT'N	SECOND VEHICLE DR	INTENT	IMPACT	HAZRD ACT'N	SRF WEATH	CND	LIGHT	VEH/ CIRCUM	NUMBER OF INJURIES INJURY CLASS F	A	B	C	O	PRP DMG	DATE OF ACCIDENT		ACCDNT REPORT NUMBER
2.59	2-VEH HD-LT	S	L-TURN	REAR-R	F YLD	N	GO STR	FRNT-R	NONE	CLEAR	WET	DK-SL		0	0	0	0	3	X	FRI 12/16/83	6PM	241372
2.59	2-VEH HD-LT	S	GO STR	FRONT	F YLD	N	L-TURN	SIDE-R	UNKN	CLEAR	DRY	DK-SL		0	2	1	0	0		MON 11/ 7/83	7PM	209745
2.59	2-VEH HD-LT	S	GO STR	FRONT	NONE	N	L-TURN	SIDE-R	NONE	RAIN	WET	DK-SL		0	0	0	1	3		THU 10/25/84	7PM	217135
2.59	2-VEH RE-ST	S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE	RAIN	WET	DK-SL	1/DUIL	0	0	0	0	3	X	SAT 10/27/84	11PM	229711
2.59	1-VEH FX OB	S	GO STR	FRONT	NONE		OFF RD			CLEAR	DRY	DAY		0	0	0	1	0		THU 5/31/84	6PM	110644
2.59	2-VEH RE-DR	S	STRTNG	FRONT	F YLD	W	GO STR	REAR-R	NONE	SNOW	WET	DAY		0	0	0	0	3	X	MON 3/ [illegible]/84	2PM	53983
2.59	2-VEH HD-LT	S	L-TURN	FRNT-L	F YLD	N	GO STR	FRNT-L	F YLD	CLEAR	DRY	DAY		0	0	0	0	2	X	THU 10/11/84	NOON	203082
2.59	1-VEH FX OB	S	R-TURN	SIDE-R	WR LN		ON RD			SNOW	ICY	DAY		0	0	0	0	1	X	THU 12/ 6/84	NOON	274999
2.59	2-VEH HD-LT	S	L-TURN	FRNT-R	F YLD	N	GO STR	FRONT	NONE	CLEAR	DRY	DK-SL		0	0	0	2	0		THU 11/29/84	10PM	237359
2.60	3-VEH RE-ST	S	GO STR	FRONT	CLOSE	S	STOPPD	FRONT	NONE	SNOW	WET	DAY		0	0	0	2	1		FRI 11/ 5/82	NOON	210267
2.60	2-VEH RE-ST	S	AV VEH	SIDE-R	NONE	S	AV VEH	REAR-L	NONE	SNOW	ICY	DAY		0	0	0	0	2	X	MON 1/ 4/82	4PM	15190
2.60	2-VEH RE-DR	S	GO STR	FRNT-R	CLOSE	S	R-TURN	REAR-L	NONE	RAIN	WET	DK-SL		0	0	0	0	7	X	WED 2/16/83	6PM	29458
2.60	2-VEH RE-ST	S	GO STR	FRNT-L	CLOSE	S	GO STR	SIDE-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	5	X	SUN 7/22/84	1AM	166850
2.61	2-VEH RE-ST	S	CHNG L	REAR-R	WR LN	S	GO STR	FRNT-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	6	X	SUN 12/11/83	2AM	241332
2.61	2-VEH SS-SM	S	CHNG L	FRNT-R	WR LN	S	GO STR	SIDE-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	4	X	MON 7/11/83	10PM	139022
2.61	2-VEH AN-DR	S	L-TURN	FRONT	F YLD	N	GO STR	SIDE-L	NONE	CLEAR	DRY	DK-SL		0	0	0	1	1		FRI 8/31/84	9PM	178904
2.62	2-VEH BCKNG	S	BACKNG	REAR-R	NONE	S	PASSNG	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	MON 6/ 4/84	4PM	112438
							EASTBOUND APPROACH															
2.58	2-VEH SS-OP	E	GO STR	FRONT	WR LN	W	STOPPD	FRONT	NONE	CLEAR	DRY	DK-SL		0	0	0	0	4	X	SAT 9/18/82	10PM	174997
2.58	2-VEH HD-LT	E	L-TURN	FRNT-R	F YLD	W	GO STR	FRONT	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	MON 11/22/82	NOON	228090
2.58	2-VEH HD-ON	E	R-TURN	SIDE-L	WR LN	W	L-TURN	FRNT-R	WR LN	CLEAR	DRY	DAY		0	0	0	0	3	X	SAT 3/ 5/83	2PM	44186
2.58	2-VEH HD-LT	E	GO STR	FRNT-L	WR LN	W	L-TURN	FRNT-L	F YLD	CLEAR	DRY	DK-SL		0	0	0	0	4	X	FRI 2/11/83	9PM	34733
2.59	2-VEH DU-LT	E	L-TURN	SIDE-R	TURN	E	L-TURN	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	5	X	MON 7/26/82	9AM	144304
2.59	2-VEH AN-ST	E	GO STR	FRONT	F YLD	S	GO STR	REAR-R	NONE	CLEAR	ICY	DAY		0	0	0	0	3	X	MON 2/ 1/82	11AM	40804
2.59	2-VEH AN-ST	E	GO STR	FRNT-R	F YLD	N	GO STR	FRONT	NONE	SNOW	WET	DK-SL		0	0	0	0	2	X	TUE 12/28/82	6PM	255364
2.59	2-VEH AN-ST	E	GO STR	FRONT	F YLD	S	GO STR	SIDE-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	TUE 12/21/82	7AM	255455
2.59	2-VEH RE-ST	E	GO STR	FRNT-L	CLOSE	E	L-TURN	REAR	NONE	SNOW	ICY	DK-SL		0	0	0	0	10	X	SAT 4/ 3/82	10PM	76179
2.59	2-VEH RE-ST	E	STOPPD	REAR	NONE	E	GO STR	FRNT-R	NONE	CLEAR	ICY	DAY		0	0	0	0	2	X	MON 2/ 1/82	11AM	40803
2.59	2-VEH HD-LT	E	L-TURN	REAR-R	F YLD	W	GO STR	FRNT-R	NONE	RAIN	WET	DAY		0	0	0	0	2	X	SAT 11/19/83	9AM	209801
2.59	2-VEH HD-LT	E	L-TURN	FRNT-L	F YLD	W	GO STR	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	MON 9/ 5/83	6PM	158838
2.59	2-VEH HD-LT	E	L-TURN	FRNT-R	F YLD	W	GO STR	FRNT-L	NONE	CLEAR	DRY	DK-SL		0	1	0	0	3		SAT 10/ 1/83	11PM	179854
2.59	2-VEH HD-LT	E	L-TURN	REAR-R	F YLD	W	GO STR	FRNT-R	NONE	RAIN	WET	DK-SL		0	0	0	0	2	X	FRI 2/18/83	6PM	29462
2.59	2-VEH HD-LT	E	L-TURN	FRNT-L	F YLD	W	GO STR	FRNT-L	NONE	RAIN	WET	DK-SL		0	0	0	0	6	X	SAT 11/19/83	8PM	209748
2.59	2-VEH RE-ST	E	GO STR	FRONT	NONE	E	STOPPD	REAR	NONE	CLEAR	DRY	DAY	1/DF E	0	0	0	0	9	X	WED 11/ 7/84	7AM	237397
2.59	2-VEH HD-LT	E	L-TURN	FRNT-R	F YLD	W	GO STR	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	FRI 11/16/84	11AM	237437
2.59	2-VEH RE-ST	E	GO STR	FRONT	CLOSE	E	L-TURN	REAR	NONE	CLEAR	WET	DAWN		0	0	0	1	2		MON 11/19/84	7AM	237436
2.59	2-VEH RE-ST	E	CHNG L	FRNT-L	CLOSE	E	STOPPD	REAR-R	NONE	CLEAR	DRY	DAY		0	0	0	0	4	X	THU 3/ 1/84	5PM	53986
2.59	1-VEH OTHER	E	GO STR	OTHER	NONE					CLEAR	DRY	DAY		0	0	0	0	2	X	SAT 2/11/84	3PM	35540
2.59	2-VEH RE-ST	E	GO STR	FRNT-R	FAST	E	STOPPD	REAR-L	NONE	SNOW	ICY	DK-SL	1/SKID	0	0	0	0	10	X	SAT 2/ 4/84	10PM	35558
2.59	2-VEH RE-ST	E	GO STR	FRONT	CLOSE	E	STOPPD	REAR	NONE	CLEAR	ICY	DK-SL		0	0	0	0	4	X	SAT 2/ 4/84	8PM	35559
2.59	2-VEH AN-TN	E	GO STR	SIDE-L	F YLD	S	GO STR	FRONT	NONE	CLEAR	DRY	DK-SL		0	0	0	1	2		THU 6/28/84	MIDN	141283

EXHIBIT X

I N T E R S E C T I O N A C C I D E N T P R O F I L E

INTERSECTION TYPE : 5 LANE 2-WAY SIGNALIZED

LOCATION : US-27BR AT BROOMFIELD ROAD UNION TWP , ISABELLA COUNTY

DISTRICT 5 CONTROL SECTION 37011 MILEPOINT 2.59

DIST FROM ISCN	ACCIDENT TYPE	VIOLATOR (OR VEH 1) DR	INTENT	IMPACT	HAZRD ACT'N	SECOND VEHICLE DR	INTENT	IMPACT	HAZRD ACT'N	WEATH	SRF CND	LIGHT	VEH/ CIRCUM	NUMBER OF INJURIES F	A	B	C	O	PRP DMG	DATE OF ACCIDENT	ACCDNT REPORT NUMBER
NORTHBOUND APPROACH																					
2.56	2-VEH RE-ST N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE		RAIN	WET	DK-SL		0	0	0	0	2	X	WED 12/12/84 6PM	275000
2.58	2-VEH RE-ST N	AV VEH	SIDE-R	CLOSE	N	STOPPD	REAR-L	NONE		CLEAR	DRY	DAY		0	0	0	1	4		SUN 9/19/82 4PM	174948
2.58	2-VEH RE-ST N	GO STR	FRONT	CLOSE	N	STOPPD	FRNT-R	NONE		FOG	DRY	DAWN		0	0	0	2	0		SAT 8/ 7/82 6AM	152147
2.58	2-VEH RE-ST N	AV VEH	FRONT	CLOSE	N	STOPPD	REAR-R	NONE		SNOW	ICY	DAY		0	0	0	0	4	X	MON 3/21/83 4PM	50697
2.58	2-VEH RE-ST N	GO STR	FRNT-L	CLOSE	N	STOPPD	SIDE-L	NONE		SNOW	ICY	DK-SL		0	0	0	0	3	X	THU 2/ 3/83 6PM	21601
2.58	2-VEH HD-LT N	GO STR	FRNT-L	F YLD	S	L-TURN	FRNT-R	NONE		CLEAR	DRY	DAY		0	0	0	0	4	X	MON 11/26/84 11AM	237376
2.58	2-VEH RE-ST N	CHNG L	FRNT-R	WR LN	N	GO STR	REAR-L	NONE		RAIN	WET	DAWN		0	0	0	0	4	X	WED 11/28/84 7AM	237360
2.59	2-VEH HD-LT N	L-TURN	FRNT-R	TURN	S	GO STR	FRNT-L	NONE		CLEAR	DRY	DAY		0	0	0	0	2	X	THU 9/ 9/82 3PM	174976
2.59	2-VEH HD-LT N	L-TURN	REAR-R	F YLD	S	GO STR	FRNT-R	NONE		CLEAR	DRY	DAY		0	0	0	0	3	X	FRI 4/23/82 2PM	91433
2.59	2-VEH HD-LT N	L-TURN	FRNT-R	TURN	S	GO STR	FRONT	NONE		CLEAR	DRY	DAY		0	0	1	0	1		WED 5/19/82 4PM	108040
2.59	2-VEH AN-ST N	GO STR	FRONT	F YLD	W	GO STR	FRNT-L	NONE		CLEAR	DRY	DUSK		0	2	0	0	0		THU 7/ 8/82 8PM	132962
2.59	2-VEH RE-ST N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE		RAIN	WET	DK-SL		0	0	0	0	5	X	THU 12/23/82 5PM	255469
2.59	2-VEH RE-ST N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE		SNOW	ICY	DAY	1/SKID	0	0	0	0	6	X	SAT 4/ 3/82 5PM	76176
2.59	2-VEH HD-LT N	L-TURN	SIDE-R	F YLD	S	GO STR	FRNT-R	NONE		CLEAR	DRY	DAY		0	0	0	2	2		SUN 10/10/82 4PM	188099
2.59	2-VEH HD-LT N	L-TURN	FRONT	F YLD	S	GO STR	FRONT	NONE						0	0	0	0	3	X	WED 5/25/83 2PM	85270
2.59	2-VEH HD-LT N	L-TURN	SIDE-R	F YLD	S	GO STR	FRONT	NONE		RAIN	WET	DK-SL		0	0	0	0	4	X	FRI 11/ 9/84 8PM	237361
2.59	3-VEH AN-ST N	GO STR	FRNT-R	F YLD	W	GO STR	REAR-L	NONE		FOG	WET	DAY		0	0	0	3	0		THU 10/11/84 7AM	207054
2.59	2-VEH RE-ST N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE		CLEAR	DRY	DUSK		0	0	0	0	2	X	FRI 9/21/84 5PM	182929
2.59	2-VEH HD-LT N	L-TURN	REAR-R	F YLD	S	GO STR	FRNT-R	NONE		CLEAR	DRY	DAY		0	0	0	0	2	X	WED 9/ 5/84 8AM	182140
2.59	3-VEH AN-ST N	GO STR	FRONT	F YLD	W	GO STR	SIDE-L	NONE		CLEAR	DRY	DAY		0	0	2	0	1		WED 9/19/84 4PM	182925
2.59	2-VEH RE-ST N	GO STR	FRNT-L	CLOSE	N	STOPPD	REAR-R	NONE		CLEAR	ICY	DARK		0	0	0	2	1		FRI 12/ 7/84 5PM	275101
2.60	2-VEH RE-LT N	L-TURN	OTHER	UNKN	N	GO STR	OTHER	NONE		CLEAR	DRY	DAY		0	0	0	0	2	X	FRI 12/ 7/84 3PM	275058
2.61	2-VEH AN-DR N	L-TURN	FRONT	F YLD	S	GO STR	SIDE-L	NONE		RAIN	WET	DAY		0	0	0	0	4	X	SAT 5/ 7/83 2PM	78771
2.62	2-VEH RE-DR N	L-TURN	REAR-R	CLOSE	S	GO STR	FRNT-L	NONE		RAIN	WET	DK-SL		0	0	0	0	5	X	THU 11/ 1/84 MIDN	237421
SOUTHBOUND APPROACH																					
2.56	2-VEH RE-ST S	CHNG L	REAR-L	WR LN	S	GO STR	FRNT-R	NONE		CLEAR	DRY	DAY		0	0	0	0	4	X	SAT 11/ 6/82 10AM	218316
2.58	3-VEH AN-ST S	GO STR	SIDE-R	F YLD	E	GO STR	FRONT	NONE		CLEAR	WET	DK-SL		0	0	0	2	4		FRI 4/ 2/82 8PM	76172
2.58	2-VEH HD-LT S	L-TURN	FRNT-R	F YLD	N	GO STR	FRONT	NONE		CLEAR	DRY	DAY		0	0	0	4	5		TUE 4/10/84 NOON	75560
2.58	2-VEH RE-ST S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE		CLEAR	DRY	DAY		0	0	0	0	4	X	FRI 4/20/84 11AM	75490
2.59	2-VEH HD-LT S	GO STR	FRONT	F YLD	N	L-TURN	REAR-R	NONE		CLEAR	DRY	DAY		0	0	0	0	4	X	FRI 9/24/82 6PM	174946
2.59	2-VEH AN-ST S	GO STR	FRONT	F YLD	W	GO STR	SIDE-R	NONE		CLEAR	WET	DARK		0	0	2	0	1		THU 12/ 2/82 11PM	233117
2.59	2-VEH AN-ST S	GO STR	SIDE-R	F YLD	E	GO STR	FRONT	NONE		RAIN	ICY	DK-SL		0	0	0	0	3	X	FRI 1/22/82 9PM	28758
2.59	1-VEH PEDES S	GO STR	SIDE-R	NONE						CLEAR	DRY	DAY		0	0	0	1	3		SAT 10/ 9/82 NOON	196893
2.59	2-VEH HD-LT S	GO STR	FRONT	F YLD	N	L-TURN	FRNT-R	F YLD		RAIN	WET	DK-SL		0	0	2	0	0		THU 11/11/82 5PM	218318
2.59	2-VEH AN-TN S	R-TURN	FRNT-L	FAST	E	STOPPD	SIDE-L	NONE		SNOW	ICY	DAY		0	0	0	0	3	X	SAT 1/16/82 NOON	15147
2.59	2-VEH AN-ST S	GO STR	FRNT-R	F YLD	E	GO STR	REAR-L	NONE		RAIN	WET	DAY		0	0	0	0	2	X	WED 6/ 9/82 4PM	115366
2.59	2-VEH HD-LT S	L-TURN	FRNT-R	F YLD	N	GO STR	REAR-L	NONE		RAIN	WET	DAY		0	0	0	0	2	X	FRI 5/ 6/83 1PM	85268
2.59	2-VEH AN-ST S	GO STR	FRONT	F YLD	W	GO STR	FRNT-R	NONE		CLEAR	DRY	DARK		0	0	0	0	3	X	SAT 9/24/83 7PM	170252

EXHIBIT XI

I N T E R S E C T I O N A C C I D E N T P R O F I L E

INTERSECTION TYPE : 5 LANE 2-WAY SIGNALIZED

LOCATION : US-27BR AT BROOMFIELD ROAD UNION TWP , ISABELLA COUNTY

DISTRICT 5 CONTROL SECTION 37011 MILEPOINT 2.59

DIST FROM ISCN	ACCIDENT TYPE	VIOLATOR (OR VEH 1) DR	INTENT	IMPACT	HAZRD ACT'N	SECOND VEHICLE DR	INTENT	IMPACT	HAZRD ACT'N	SRF WEATH	SRF CND	SRF LIGHT	VEH/ CIRCUM	NUMBER OF INJURIES INJURY CLASS F	A	B	C	D	PRP DMG	DATE OF ACCIDENT		ACCDNT REPORT NUMBER
2.59	2-VEH HD-LT E	L-TURN	FRONT	F YLD	W	GO STR	FRONT	NONE	CLEAR	DRY	DAY		0	0	0	0	5	X	THU	5/ 3/84	3PM	107072
2.60	2-VEH AN-DR E	STRTNG	FRONT	F YLD	S	GO STR	SIDE-R	NONE	RAIN	WET	DK-SL	1/DUIL	0	0	0	0	2	X	THU	12/16/82	MIDN	255461
									WESTBOUND APPROACH													
2.57	2-VEH AN-DR W	STRTNG	FRNT-L	F YLD	N	GO STR	SIDE-R	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	SUN	6/20/82	NOON	122405
2.59	2-VEH HD-LT W	L-TURN	REAR-R	F YLD	E	GO STR	FRNT-R	NONE	CLEAR	DRY	DAY		0	0	0	0	6	X	THU	10/ 7/82	10PM	188091
2.59	2-VEH RE-ST W	GO STR	REAR-R	NONE	W	GO STR	FRNT-R	NONE	SNOW	ICY	DARK		0	0	0	0	3	X	WED	1/20/82	11PM	15184
2.59	2-VEH RE-RT W	R-TURN	FRNT-R	WR LN	W	GO STR	REAR-L	NONE	CLEAR	DRY	DAY		0	0	0	0	4	X	MON	6/28/82	2PM	122352
2.59	2-VEH RE-ST W	GO STR	FRONT	CLOSE	W	R-TURN	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	THU	4/ 8/82	3PM	76190
2.59	2-VEH AN-TN W	L-TURN	FRNT-R	F YLD	S	GO STR	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	1	3		WED	8/ 3/83	1PM	133840
2.59	2-VEH AN-TN W	GO STR	FRNT-L	FAST	S	L-TURN	SIDE-L	NONE	CLEAR	WET	DK-SL	1/DUIL	0	0	0	0	3	X	SUN	2/ 6/83	1AM	21589
2.59	2-VEH AN-DR W	CHNG L	FRNT-R	WR LN	W	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	7	X	THU	5/ 5/83	4PM	78764
2.59	2-VEH RE-ST W	GO STR	FRNT-L	NONE	W	GO STR	FRNT-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	SAT	9/17/83	10PM	170236
2.59	2-VEH HD-LT W	GO STR	SIDE-L	NONE	E	L-TURN	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	TUE	6/12/84	4PM	141285
2.59	2-VEH RE-ST W	GO STR	FRONT	CLOSE	W	STOPPD	REAR-L	NONE	CLEAR	DRY	DK-SL		0	0	0	1	3		FRI	7/13/84	11PM	135335
2.59	2-VEH HD-ON W	R-TURN	FRNT-L	NONE	E	L-TURN	REAR-R	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	TUE	9/ 4/84	5PM	182135
2.59	2-VEH AN-ST W	GO STR	FRONT	CLOSE	N	GO STR	FRNT-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	FRI	6/15/84	1AM	122527
2.61	3-VEH AN-DR W	L-TURN	SIDE-L	F YLD	N	GO STR	FRNT-L	NONE	SNOW	ICY	DK-SL		0	0	1	1	4		SAT	2/13/82	8AM	40755
2.61	2-VEH RE-DR W	L-TURN	REAR-L	F YLD	N	GO STR	FRONT	NONE	CLEAR	DRY	DAY		0	1	0	0	1		TUE	5/10/83	1PM	78760

EXHIBIT XII

As part of that effort, a TOPICS Program (Traffic Operations Program to Improve Capacity and Safety), managed by the Safety Programs Unit, is responsible for an intensive periodic review in 15 large urbanized areas and 17 smaller cities with population greater than 10,000. That effort includes coordinated identification and analysis of deficiencies on the local system by staff in the Safety Programs Unit funded by a Section 402 Community Assistance grant. The TOPICS studies are very comprehensive, including the identification of operational and capacity deficiencies. The program emphasizes lower cost corrective countermeasures such as improved signs, signals or pavement markings, parking prohibitions, traffic signal modifications, and minor construction projects.

The process followed to carry out accident surveillance is as follows:

1. Location Review List

Computer listings are generated of all locations exceeding minimum thresholds of accidents or exceeding a minimum threshold for any of 24 accident types. The listing can also be generated using statistical techniques.

A second source of review locations are the Traffic and Safety engineers, located in the department's district offices who are familiar with all state trunkline highways in their area. They are aware of new and proposed development and other conditions which will impact safety. In addition, the department is contacted by the public, police agencies, local governmental officials, and others calling attention to locations where accident concentrations are, or may be developing.

2. Preliminary Analysis

Additional accident data developed in conjunction with the location review list is preliminarily reviewed in the office. That effort may include review of the photolog, traffic signal inventory, signal timing, intersection drawings, and other information included in Traffic and Safety Division files. The purpose of this preliminary review is to determine if the identified accident concentration is unusual and warrants further review of if action has been initiated which addresses the accident concentration.

The entire list and those locations noted for further review are then sent to the district traffic and safety engineers and affected units in the Traffic and Safety Division for further review and comment.

3. Final Analysis and Identification of Corrective Countermeasures

After preliminary analysis, a field review may be scheduled including a Safety Programs Unit representative, the district traffic and safety engineer, and other affected Traffic and Safety Division staff and local interests. At that time possible corrective countermeasures are identified. The conclusions of that review are documented in correspondence prepared by the Safety Programs Unit.

If the proposed corrective countermeasure requires construction, the following process is followed:

a) The Geometrics Coordination Unit develops proposed alternate geometric schemes with cost estimates and transmits a recommended plan to the Safety Programs Unit.

b) Funding may be recommended by the Safety Programs Unit based on the projects anticipated cost-effectiveness. Candidate projects are generally recommended when the expected "time of return," in safety benefits, is less than 10 years.

c) State and federal environmental requirements are fulfilled and any impact reviews of the proposed project are initiated.

d) The recommended functional layout is transmitted to the district for review and for discussion with local officials. The district traffic and safety engineer secure informal concurrence from local agencies required to participate in the project.

e) The Geometrics Coordination Unit makes necessary changes resulting from the district review and transmits the plan to the Design Division for development of plans, estimates, and specifications.

The TOPICS reviews follow basically the same procedures, except that they include locations on both the state trunkline and nontrunkline systems. The resultant review is more comprehensive and detailed, identifying significant accident concentrations and operational deficiencies. The TOPICS reviews are conducted within the framework of local Metro Planning Organizations (MPOs) responsible for managing and coordinating transportation activities in the urbanized areas. The final TOPICS reports are offered as the traffic engineering element of the TSM process. Local agencies may apply for non trunkline HES funding through the Local Services Division (See Appendix II).

D. Establishing Priorities

1. Time-of-Return Analysis.

The Department determines the time-of-return (T.O.R.) or the number of years to amortize safety projects. If the anticipated TOR is less than ten years, programming of the project may be requested in a future fiscal year "call for projects."

The anticipated reduction in accidents at a given location is estimated using data collected from previous before-and-after accident studies. National Safety Council accident costs are used to establish economic benefits. Attached is a copy of a worksheet (Exhibit XIII) used to evaluate accident costs, expected accident reductions, and anticipated benefits.

EXHIBIT XIII

COMPUTED BENEFITS DERIVED THROUGH ACCIDENT REDUCTION

Location _____ City/Twp. _____ County _____

The method of evaluating accident costs, used below, is given on page 67 of Roy Jorgensen's report of Highway Safety Improvement Criteria, 1966 edition. This same method is given in the Bureau of Public Roads IM21-3-67.

In the following analysis the costs provided by the National Safety Council are: 1984 values

Death - $220,000

Nonfatal Injury - $9,300

Property Damage Accident - $1,190

$$B = \frac{ADT_a}{ADT_b} \times (Q\ R_1 + 1190\ R_2)$$

where

B = Benefit in dollars

ADT_a = Average traffic volume after the improvement _____

ADT_b = Average traffic volume before the improvement _____

R_1 = Reduction in fatalities and injuries combined _____

R_2 = Reduction in property damage accidents _____

Q = 9,300 if no fatal accidents occurred, and

$$Q = \frac{220{,}000 + (I/F \times 9{,}300)}{1 + I/F} = 11{,}460 \text{ if at least 1 fatality occurred.}$$

where

I/F = Ratio of injuries to fatalities that occurred statewide during the year 1984

$$= \frac{150{,}836}{1{,}560} = 96.69$$

Time of Return (T.O.R.) based on _____ years of data.

B = _____[(9,300 or 11,460) _____ + (1,190) _____] ÷ _____yrs.

B = _____[(_____) + (_____)] ÷ _____yrs. = _____

Annual B = _____ dollars

C = Total cost of project

$$T.O.R. = \frac{C}{B} = \text{_____} = \text{_____ years}$$

10-17-85
KAM:nkg(Form 3)

The estimated cost of each improvement is compared to the anticipated yearly benefit, resulting in the T.O.R. Presently, most safety related projects programmed amortize costs in approximately five to eight years. In general, a TOR of less than ten years is sufficient to justify a safety improvement project.

2. Cost and Resources

The ability of the department to program the recommended safety projects is, or course, limited by their cost and by available funds. All designated categorical funds (HES and R.R. Safety) are earmarked for safety projects. Other state and federal aid funds are used for safety projects as described in "Implementation" (II). "Annual" HES programs are devloped for at least the next two fiscal years. The programs are adjusted (projects added or deleted) based on continual assessment of each projects cost effectiveness.

3. Rail/Highway Grade Crossings Improvement Program

The Railroad Safety and Tariffs Division utilizes the Hazard Index Rating (HIR) described below to initiate grade inspections. Grade inspections can also be initiated by:

a. Complaints with regards to safety of the crossing.
b. Public or local agencies.
c. Railroad companies.
d. Private industries.

A diagnostic team is formed which includes the inspector from the Railroad Safety Section as team leader and representatives of the railroad company, road authority, state, county, city or village, police, school, private industry and concerned citizens. The team reviews safety conditions at the crossing and develops recommendations for improvements. The team leader is responsible for completing the Grade Inspection Report form (Exhibit XIV).

State trunkline railroad-highway improvement projects are selected based upon evaluaton of the following information and needs:

a. The Hazard Index Rating (H.I.R.) of state highway crossings is utilized to identify crossings that need additional traffic control devices. Projects to address those needs are given top priority.

b. The additional state trunkline crossing inventory data and information maintained by the Engineering Services Division, along with input from railroad companies and the Department's Maintenance, Planning and Traffic and Safety offices, is evaluated to select projects to: upgrade or modernize trafic control devices and circuitry; eliminate crossings; reduce the number of tracks at a crossing; reconstruct crossing surfaces; conduct research; relocate highways or railroads; construct or reconstruct grade separation structures.

EXHIBIT XIV
GRADE CROSSING ON-SITE REVIEW

1402A (3/85)

File No.	N.I. No(s).	Railroad(s)	M.P.
Road Authority		Road/Street Name	
Intersecting Roadway(s) Nearby		City/County	Section No. & Township

Direction of Roadway	Direction of Tracks	Angle	No. of Thru Traffic Lanes	No. of Parking Lanes
Roadway Width	Shoulder Width	Surface of Roadway		

Approaches	Electricity Nearby	No. of Tracks
Materials in Crossing Main Line(s) Siding(s)		Crossing Length

Sight Distances (Approx.)	NE Quad.	Obst.	NW Quad.	Obst.	SE Quad.	Obst.	SW Quad.	Obst.
100 Feet								
200 Feet								
300 Feet								

PHYSICAL CROSSING	CONDITION	RECOMMENDATIONS	QUANDRANTS	LOCATION	RECOMMENDATIONS
1. Existing Crossing			7. Vegetation		
2. Proposed Crossing			8. Structures		
3. Road Approaches			9. Embankments		
4. Devil Strip			10. Vehicle Parking		
5. Drainage			11. RR Car Storage		
6. Other			12. Other		

STATIC SIGNING	REMARKS	RECOMMENDATIONS	AUTO. DEVICES	REMARKS	RECOMMENDATIONS
13. Crossbucks			20. Flashing Lights		
14. Adv. Warning Signs			21. Side Lights		
15. Pavement Markings			22. Signals on Cants		
16. Overhead Lighting			23. Gates		
17. Stop Signs			24. Other		
18. Stop Ahead Signs					
19. Other					

RECOMM. CODES: 1-Repair 2-Rebuild 3-Extend 4-Remove 5-Close 6-Relocate 7-Modernize 8-Install 9-Approve 10-Deny 11-Restrict 12-Paint 13-Add 14-Adequate 15-

PARTY RESPONSIBLE FOR WORK CODES: RR-Railroad RD-Road Authority Identify Other: _____

Traffic Count	Posted Speed Limit	No. School Buses Using Crossing

Accident Record

Train Movements: Freight Passenger Switching

Speed: Freight	Passenger	Main Tracks	Siding/Spurs	Simultaneous Moves

REMARKS:

A. Existing situation adequate.
B. More information required (identify).
C. In accordance with Michigan statutes (1921 PA 270; MCLA 469.1 et al; MSA 22.761 et al), correction of item(s)_____ is the responsibility of the identified parties and should be accomplished as soon as possible. FURTHER NOTICE OF THESE DEFICIENCIES WILL NOT BE PROVIDED. Written confirmation of compliance should be provided to this Office to clear our computer record and file of these recommendations. Confirm to Michigan Department of Transportation, RR Safety & Tariffs, P.O. Box 30050, Lansing, Michigan 48909.

PREPARED BY: _____ DATE: _____

PARTIES NOTIFIED OF WORK:

Mail _____ Phone _____ Railroad Representative _____ Date _____

Mail _____ Phone _____ Road Authority Rep. _____ Date _____

Mail _____ Phone _____ Representative _____ Date _____

Priority is given to projects where more than one improvement can be implemented and to improving railroad-highway crossings in conjunction with scheduled highway improvements.

On local roads, the HIR is utilized as a guide to determine which improvement projects are submitted for programming. In addition, projects to upgrade or modernize signal devices to current standards, eliminate crossings, reduce the number of tracks in a crossing, research, and reconstruction of crossing surfaces, which are not recognized in the H.I.R., may be submitted by local road authorities for programming. Further flexibility in the program is maintained by taking advantage of scheduled highway improvements to improve a rail-highway crossing. The crossing improved may not be the highest priority; but significant savings are realized by combining the two projects.

Hazard Index Ratings (HIR)

(HIR) = Average Daily Traffic (A.D.T.) x Average 24-hour Train movements x Protection Factor.

Protection Factors

1.00 - Reflectorized Crossbuck Sign
0.30 - Flashing Light Signals
0.27 - Flashing Light Signals with Cantilever Arms
0.24 - Flashing Light Signals with Cantilever Arms and Traffic Signal Interconnect
0.11 - Flashing Light Signals with Half-Roadway Gates
0.08 - Flashing Light Signals with Cantilever Arms and Half-Roadway Gates
0.05 - Flashing Light Signals with Cantilever Arms, Half-Roadway Gates, and Traffic Signal Interconnection

II. Implementation

The Department of Transportation schedules and implements safety projects through its Programming Section of the Bureau of Highways. The process is in accord with criteria outlined in the Federal-Aid Highway Program Manual, Volume 6, Chapter 3, Section 2, Subsection 2. The safety project identification/evaluation/selection process is described in Section I (Planning) of the Safety Improvement Process.

Hazard Elimination Funds are used to implement safety justified projects on all state roads, except Interstate. Approximately 50 percent of the HES funds are allocated to the state trunkline and 50 percent to the local system. State trunkline projects are primarily recommended by the Traffic and Safety Division and projects on local roads are administered by the Local Services Division. Guidelines for Federal funding of local road HES projects are included in Appendix II.

Rail Highway Crossing projects are selected as outlined in I, D., 3 of the Safety Improvement Process and Section IX of the Local Services Division Guide line for Federal Funding of Safety Projects. The process involves the Railroad Safety and Tariffs Division, the Engineering Services Division, and the Local Services Division. The Engineering Services

Division administers state trunkline projects and the Local Services Division administers those on local systems.

Section 144 of Title 23 of the United States Code provides financial assistance for replacing bridges over significant waterways or other topographical barriers which are unsafe because of structural deficiencies, physical deterioration, or functional obsolescence. The program in Michigan is administered by the department's Local Services Division.

Bridges under local jurisdiction have been surveyed for structural adequacy and are ranked for priority of replacement in accordance with critical need based on the local agency's financial resources, importance of the bridge to the area, and the structural condition of the existing bridge.

Other highway safety projects are funded with Federal-Aid Urban, Primary, and Secondary funds. Interstate safety projects are funded with interstate funds.

Contracts for highway safety improvements are awarded in accord with criteria and requirements outlined in FHPM 6-4-1-14.

III. Evaluation and Reporting

Evaluation of highway safety improvements are done in accord with reporting requirements outlined in the Federal Aid Highway Program Manual, Volume 8, Chapter 2, Section 3, Paragraph 8. Results of these evaluations are included in Michigan's annual report to the Federal Highway Administration of its overall highway safety improvement program.

The basic element of the evaluation process is completion of the "Table 2" for the federal categorical Hazard Elimination Safety (H.E.S.) programs. In addition, that form has been, and is, used to tabulate before-and-after data for safety projects funded by other federal/state highway funds. Since Rail Highway Safety Program projects are not justified primarily by accident data, a "program" analysis is conducted on a five-year cycle. The last such analysis was prepared in 1982. The next is planned for inclusion in the 1987 annual safety report.

The "Table 2" provides for the following information:

- Funding Source (Column 1)
- Improvement Type (Column 2)
- Cost (Column 3)
- Before-and-After Accident Data, Including Severity (Columns 7-15)
- Traffic Volume (Columns 17 and 18)

Since traffic volume data is not routinely collected when justifying or evaluating HES projects, a surrogate measure, statewide volume trends is used as an indication of volume changes. Our experience accuracy indicates that this is compatible with the level of significance and accuracy of the accident data.

The accident data summarized in the "Table 2's" may be assessed in different ways.

A. Time-of-Return

The time-of-return analysis computes before-and-after accident costs, utilizing National Safety Council cost data for fatalities, injuries, and property damage only crashes. Comparing the reduction of these costs (the "benefit") to project costs yields the time to recover the investment.

B. Statistical Analysis

Long term accident data is subject to increasing and decreasing trends, resulting from well known factors, such as safer vehicle designs, seat belt usage, the lower national speed limit, enforcement of drunk driving laws, and other less well understood factors which seem to affect crash and crash severity data. MDOT therefore utilizes statistically valid "control" groups to assess the expected impact of the "no build" alternative. This affords a more accurate assessment of the benefits of safety projects. "Controls" are usually groups of locations with characteristics similar to the project location. When entire safety programs are evaluated, statewide or system classification data may be used as a control.

C. Program Analysis

After several years of experience with one or more safety programs directed at specific road systems, or with similar types of projects or locations, a program analysis may be undertaken. Examples of such analyses included in previous annual safety reports are the Pavement Marking Demonstration Program (1981), the Rail/Highway Crossing Safety Program (1982), and the Roadside Safety Improvement Program on the Interstate System (1983). These types of analyses yield a broad perspective overview of the long term effect of safety programs on the targeted roadway systems.

D. Type of Improvement Analysis

MDOT regularly analyzes the impact of various types of roadside "hardware" and operational improvements. Examples include concrete median barrier walls, paved shoulders, traffic signal systems, 4-way stops in rural areas, and 2-way center left-turn lanes. These studies allow us to assess new "state of the art" traffic control devices and new or unique uses of existing devices.

The body of knowledge accumulated through these evaluations allows MDOT to assess the cost-effectiveness of specific safety programs, their impact on specific roadway classifications, and the impact of new or modified traffic control devices, highway appurtenance, or design techniques. This data assists us in future decisions as to what countermeasures will be most effective in alleviating accidents or reducing their severity.

The key to accumulation of post project accident data and accurate accident reduction factors associated with various types of construction countermeasures lies with automating the evaluation process. Under contract to MDOT, Michigan State university is studying this problem.

Appendix II
Guideline for Federal Funding of Safety Projects
Local System

MICHIGAN DEPARTMENT

OF

TRANSPORTATION

Local Services Division

Guideline for Federal Funding

of

Safety Projects

May 1985

I. GUIDELINE - Local Highway Agency Projects

This document is the guideline for accepting safety related projects for Federal Safety Funding. It applies to MDOT Local Services Division and Local Highway Agencies throughout the State. The Federal Programs involved are HES and RRS.

II. GOAL:

The Goal of this program is to reduce highway related accidents through Federal funding of projects determined to be at hazardous locations. Improvements are aimed at specific locations rather than general roadway construction. Funds are not intended for the purpose of increasing roadway capacity, however, capacity can be the primary cause of accidents and these projects will be eligible.

III. PROJECT TYPES

This guideline shall apply to the following types of projects described herein.

1. General Time of Return (TOR) Projects.
2. Nationally Recognized Cost Effective Projects.
3. Small Safety Projects.

IV. DATA COLLECTION & ANALYSIS

It is the responsibility of the Local Highway Agency to set priorities, collect and analyze accident information and to select projects for Federal funding. Those chosen should be the most effective in accident reduction for the individual governmental jurisdictional area.

Accident information available from Michigan's MALI system should be used as the basis for Priority setting by the Local Agency.

Information gathered and analyzed shall be retained in the Local Agency file.

To assist smaller agencies, MDOT makes available a section of its Traffic and Safety Division (402 Federally funded) to develop projects for funding. The service is available upon request and on a limited basis.

The following reports are desirable to properly develop a safety project and should be retained by the Local Agency.

1. Accident Reports - (MALI) A 3 year period is desirable.
2. Collision Diagrams - Helpful in analyzing accident problems.
3. Sketch of Existing Conditions - Sketch should show relevent information such as street and lane widths, alignment, and cross-section.
4. Traffic Volumes - Actual counts are desirable, however, estimates will suffice on low volume roads. Actual counts will be necessary where traffic signals are involved.
5. Photographs - Before and after are helpful in evaluation.

V. EVALUATION PRIOR TO PROJECT CONSTRUCTION

Cost Benefit Evaluation Prediction

Evaluation of projects shall be accomplished using the estimated time of return (T.O.R.) Formula included herein, using current National Safety Council values for property damage accidents, injuries, and fatalities. Those projects exhibiting the lowest T.O.R. factors are deemed to be the most cost effective and are therefore given the highest priority in the programming process.

The T.O.R. of the project cost, due to accident reduction, shall be 15 years for Local Highway Agency Projects. This will allow greater coverage of Safety projects in local areas that do not have an intense accident problem.

The T.O.R. computation shall be based on the engineers estimate as submitted for programming and shall be re-evaluated at a later date if cost has increased excessively.

This policy will apply to all Safety Projects, except those indicated as "Small Safety Projects" listed herein, Nationally Recognized Safety Projects and Rail-Highway Safety Projects.

Environmental Assessment

Environmental Evaluation shall follow the currect Federal Aid Urban and Federal Aid Secondary Guidelines for assessment and classification. It is expected that a considerable number of Safety projects will be classed as categorical exclusions. This will aid in limiting the time required for the development of projects and insure obligation of Federal funds in a timely manner.

VI. NATIONALLY RECOGNIZED COST EFFECTIVE SAFETY PROJECTS

The MDOT Local Services Division will allow certain types of safety improvement projects which have been shown to be cost effective by previous nationwide studies to be implemented without individual T.O.R. prediction. These projects are:

1. Traffic Sign
2. Railroad Signs, Markings, Signals & Gates
3. Pavement Markings and/or Delineators
4. Upgraded and New Guard Rail

5. Bridge Approach Guard Rail
6. Railroad Crossing Alignment Improvement
7. Removal of Roadside Obstacles
8. Upgrade Bridge Rail

The above will be eligible for Federal Funding without ADT limitations as this criteria is not relative.

VII. SMALL SAFETY PROJECTS

The Goal of this Policy is to better dispense and balance distribution of Federal Safety funds on a state-wide basis, by insuring that all Local Agencies are eligible to receive Federal Safety Funds.

Past experience has shown that very few outstate Local Agencies have the intense hazard problems as associated with the Detroit Metro and large city areas of the State. Yet these outstate areas have a strong need for Safety funds for worthy projects.

To further the Goal of highway safety awareness on a state-wide basis, "SMALL SAFETY PROJECTS" will be accepted for Federal Funding without individual T.O.R. procedures. This policy may involve approximately 30% of the HES state-wide Local Services Allocation per year. Each project will be reviewed for its worthiness and its overall cost, so as to keep it in the realm of a "SMALL SAFETY PROJECT." Each project will be accepted on the basis of a known history of accidents and/or has the potential for such accidents as determined by the city/county engineer. Projects shall be chosen as the most cost effective in accident reduction for the individual governmental jurisdictional areas. Types of projects are:

1. Intersectional improvements
2. Roadside obstacle removals
3. Guard rail installation and slope flattening
4. Shoulder widening and paving
5. Signal installation and modernization
6. Vertical and horizontal alignments improvements
7. Adding lanes (channelizing and turning)
8. Installation of attenuators
9. Texturizing of roadway surfaces
10. Traffic Signals - Safety related

Project selection will not be limited to the above and on a limited basis may include other highway safety improvements as "SMALL SAFETY PROJECTS."

VIII. ADMINISTRATIVE DEVELOPMENT FOR FEDERAL FUNDS

To develop funding procedures, after safety evaluation and priority selection, the regular Urban and Secondary guidelines will apply, as appropriate.

IX. RAIL-HIGHWAY CROSSINGS

The Grade Crossing Improvement Program utilizes the Hazard Index Rating (H.I.R.) to initiate grade inspections by a diagnostic team. Inspectors from the Department's Railroad Safety Section are the team leaders and are responsible for completing the Grade Inspection Report.

The remarks section of the form would include data relative to people, factors, and hazardous materials. The H.I.R. is then again utilized to determine the order in which improvement projects are submitted with one exception: Flexibility in the program is maintained by being able to take advantage of a scheduled highway improvement to include an improvement in a rail-highway crossing. The crossing improved may not appear near the top of the project listing, but by incorporating the two projects a lower cost can be utilized.

a. Hazard Index from State Inventory Program

$$\text{Hazard Index Rating (H.I.R.)} = \frac{\text{Average Daily Traffic (A.D.T.)}}{\text{x Average 24-hour Train Movements x Protection Factor}}$$

Protection Factors

1.00 - Reflectorized Crossbuck Sign
0.30 - Flashing Light Signals
0.27 - Flashing Light Signals with Cantilever Arms
0.24 - Flashing Light Signals with Cantilever Arms and Half-Roadway Gates
0.11 - Flashing Light with Half-Roadway Gates
0.08 - Flashing Light Signals with Cantilever Arms and Half-Roadway Gates
0.05 - Flashing Light Signals with Cantilever Arms, Half-Roadway Gates, and Traffic Signal Interconnection

NOTE: Railroad Safety does not account for interconnected traffic lights in their inventory data.

The MDOT Local Services Division may reserve certain portions of the annual RRS appropriation to fund worthy specialty projects such as, but not limited to, railroad consolidation projects. Evaluation and selection of these projects shall receive individual attention.

X. REPORTING EVALUATION OF COMPLETED HES PROJECTS

The Local Highway Agency shall be responsible for reporting to MDOT, evaluation of the Safety Project after construction and trial period. This may consist of the time of return comparison, before and after and/or a word report of the evaluation of the safety aspects of the project. The evaluation shall include as a minimum, a two year before/after accident comparison for the accident categories which the project was expected to address (shown on T&R analysis), and for overall accidents at that location. This report shall be submitted to the MDOT Local Services Division. Reporting before and after evaluations will not be required for "SMALL SAFETY PROJECTS" and "NATIONWIDE COST EFFECTIVE PROJECTS" as previously listed herein.