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

July 1, 1980 - June 30, 1981

MICHIGAN DEPARTMENT OF TRANSPORTATION

August 31, 1981

This report was prepared by the Traffic and Safety, Local Government, and Maintenance Divisions, and the Railroad Engineering Section, Bureau of Highways.

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Introduction

This is the 8th Annual Report of Michigan's Overall Highway Safety Improvement Program. We are pleased to report that over $185 million was allocated to safety projects during fiscal 1980-81. This is the greatest commitment of funds to safety ever in Michigan, 23 percent higher than the nearly $150 million reported last year. Significant increases were noted in the special bridge replacement program (over $15 million compared to $4.4 million last year) and in federal aid systems funds allocated to safety ($56.8 million compared to $22.5 million last year).

However, severe funding restrictions in Michigan sharply limited available monies available for all state financed transportation programs including our highly cost-effective "Ms" safety program and other safety related "M" programs. The "Ms" program funded at $3.7 million during fiscal year 79-80 expended less than $700,000 last year. With the exception of the miscellaneous "M" construction program, from which slightly less than $27 million was allocated compared to $18.3 million last fiscal year, the remaining Michigan financed programs reported on this year evidenced dramatic and severe funding decreases to $2.9 million from over $20 million during fiscal 1979-80. We do not expect relief from this situation in the immediate future and must continue to rely heavily on federal assistance to ensure the viability of Michigan's safety effort. Over $5.5 million in projects originally programmed as "Ms" were transferred to other funding sources last year. Many of these projects were ultimately funded by the federal aid primary program. Nearly three times as much federal aid primary money was allocated to state trunkline safety work compared to that reported last year. To partially offset financing problems Michigan is reassessing the relative cost-effectiveness of previously identified and programmed projects and is increasing emphasis on low cost operational actions such as sign and signal improvements, new or modified pavement markings, parking restrictions, etc.

In this year's report we have attempted to expand and improve on our evaluation of the various safety programs. Evaluation of the Ms and HES programs continues to prove them as highly cost-effective allocations of safety funds. In this year's report we have included detailed evaluation data on many HES projects including analysis of the impact of the program on accident types.

An analysis of the pavement marking program is included for the first time. This analysis confirms the positive benefits of this program. Also included is a brief assessment of the impact of rail crossing safety programs on car-train fatalities.

In an effort to measure the impact of our yellow book safety program, accidents along the freeway system were reviewed. The interstate yellow book work is 78 percent complete with nearly all of the remaining work programmed or in design. Noninterstate yellow book work is 51 percent complete or under contract. The study reveals that while total accidents have not changed substantially in recent years, fixed object fatal accidents are declining, particularly those involving guardrail, abutments, and utility poles.

Section four of our report details new developments in highway safety and special studies completed this past year relevant to safety. We are particularly proud that while finances are restricted we are able to continue to search and find new methods and techniques for serving the safety needs of our motoring public.

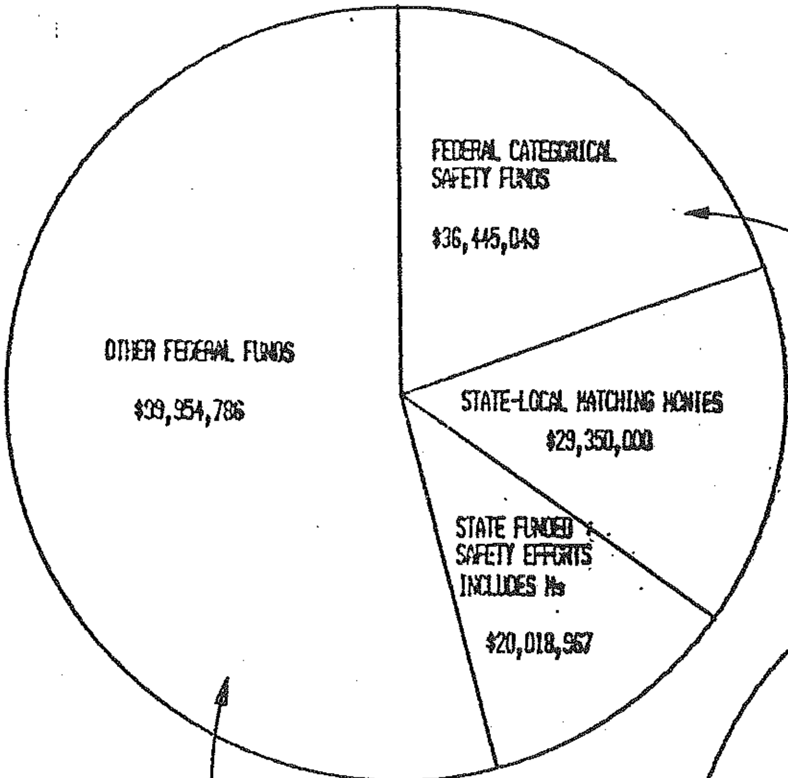
Finally, of special note, is inclusion of Michigan's safety improvement process in the appendix of this report. This material serves to document the planning, implementation, and evaluative processes followed by Michigan in the pursuit of safety projects. The report highlights many of the innovative techniques used in Michigan to identify and analyze high accident locations on the state trunkline system.

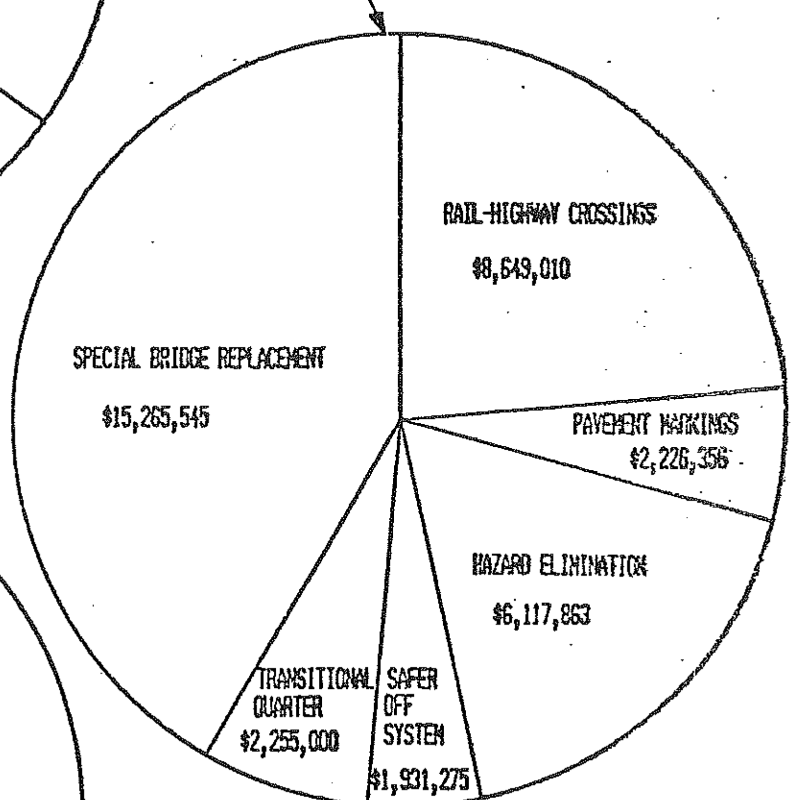
PROGRAM SUMMARY
FISCAL YEAR 1980-81

		Total Costs
FEDERAL CATEGORICAL SAFETY FUNDS-OBLIGATED		
Rail-Highway Crossings		$ 8,649,010
Pavement Marking Demonstration Program		2,226,356
Hazard Elimination		6,117,863
Safer Off-System Safety		1,931,275
Special Bridge Replacement		15,265,545
~~Transitional Quarter Funds~~		2,255,000
	Total	$ 36,445,049
OTHER FEDERAL FUNDS		
Interstate Safety (Is)		7,831,000
Yellow Book Program		9,500,000
Urban Programs		25,800,000
Federal Aid Primary Program		44,323,786
Federal Aid Secondary Program		12,500,000
~~Federal Aid Off System~~		-00-
	Total	$ 99,954,786
STATE FUNDED SAFETY PROJECTS		
Ms - safety program		$ 656,000
OTHER STATE FUNDED PROJECTS (Safety Items Only)		
Mb - bituminous resurfacing		$ 127,767
Mbr - bituminous reconstruction		828,000
M - miscellaneous construction		16,975,200
Mnm - nonmotorized vehicle facility		68,000
Msh - shoulder edge treatment		491,000
Mbd - bridge deck		126,000
Mtb - turnback		305,000
~~MCP - Minor Construction Program~~		442,000
	Total	$19,362,967
SPECIAL PROJECTS		
Impact Attenuators (cost included in Ms and HH totals)		$
STATE-LOCAL MATCHING MONIES		29,350,000
	Total Safety Expenditures	$185,768,802
		155,709,705

MICHIGAN'S OVERALL SAFETY EXPENDITURES

FY 81 $185,768,802

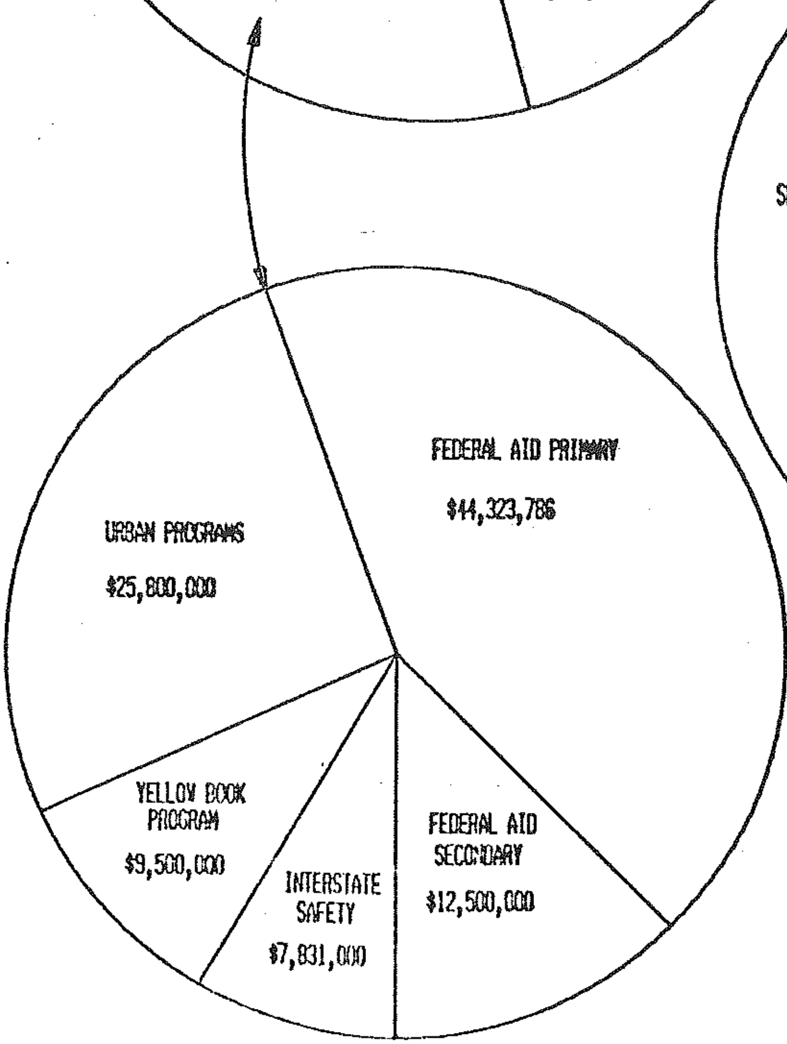




FEDERAL CATAGORICAL SAFETY FUNDS OBLIGATED

1980-81 FY

$36,445,049



OTHER FEDERAL FUNDS

FY 81 $99,954,786

Michigan State Safety Commission

The Michigan State Safety Commission has been involved in safety activities throughout the state since its legislative establishment in 1941. The commission membership is composed of the Governor (Honorary Chairman), Secretary of State, Superintendent of Public Instruction, State Transportation Director, and Director of State Police. The commissions three objectives are to: (1) improve awareness and liaison among persons, affiliated with the commission who have a continuing professional interest in traffic safety, (2) discuss among the commissioners pending or proposed legislation, and (3) monitor monthly crash trends.

In order to assist the commission in accomplishing its objectives, the Michigan Traffic Safety Information Council was established in 1970. The Information Council is responsible for coordinating the activities of their member departments and carrying out the public information and education activities of the commission. In addition, the Information Council is responsible for the development of cooperative public information and education efforts between public and private sector agencies.

A major accomplishment of the commission during this past year involved the activities of the Information Council. Programs implemented by the council were funded by the Michigan Office of Highway Safety Planning for $65,000. This money provided a wide-range of activities all designed to improve traffic safety through public information and education. For example, the Operation Lifesaver Program, which is discussed in more detail elsewhere in this report, is designed to reduce railroad related fatalities and injuries. A substance abuse program on alcohol awareness concentrated on high school seniors throughout the state. The state police developed a selective enforcement program at high crash locations in cooperation with the Regional Steering Committees and also a program to encourage compliance with the 55 mph speed limit. There were also additional programs designed to improve the safety of child pedestrians, bicyclists, motorcylists, and school bus passengers. A tourist guide to Michigan traffic laws was updated and distributed to assist visitors in driving our road system. During the next year, the Information Council will continue these activities in addition to new safety related projects with funding again provided by the Office of Highway Safety Planning.

Recently, the commission established a Professional Advisory Panel and Regional Steering Committees. The Professional Advisory Panel is composed of highway safety professionals and selected private citizens with an interest in highway safety. The Advisory Panel cooperates in the conduct of commission programs, investigates traffic safety problems, and makes recommendations to the commission. The Regional Steering Committees were developed as a means for disseminating information and coordinating traffic safety programs on a statewide basis. The Regional Steering Committees are composed of local representatives of the four major departments which make up the commission.

Another commission activity during the past year involved support for a statewide child passenger restraint law. Through the efforts of groups such as the State Safety Commission, the Michigan legislature has approved a bill requiring use of child restraints for infants and children up to four years of age. The bill which has been signed into law, will take effect on or about April 1, 1982.

The State Safety Commission and its organizational components are a unique concept to the state of Michigan. The commission is promoting highway safety in Michigan through the cooperation of the commissioners and their departments or agencies and such other public and private organizations as may be interested in highway safety. The principle intent of the commission is to move toward the greatest possible level of transportation safety for citizens and visitors to the state of Michigan.

SECTION 1

THE 1978

HIGHWAY SAFETY ACT IN MICHIGAN

PART 1

CATEGORICAL SAFETY PROGRAM SUMMARY

FISCAL YEAR 1980-81

The 1978 Highway Safety Act in Michigan

Michigan obligated over 73 percent of the 1981 FY funds apportioned by the 1978 Highway Safety Act between October 1, 1980, and June 30, 1981, plus $7,046,264 of the 1980 FY apportionment between July 1, 1980, and September 30, 1980.

Compared to last fiscal year, Rail Highway Crossing obligations were ~~up 19~~ percent; Pavement Marking Demonstration obligations, down 4 percent; Hazard Elimination obligations, up 5 percent; Special Bridge Replacement obligations, ~~up 248~~ percent, and Safer Off-System ~~and Transition Quarter~~ Funds down ~~9~~ percent ~~and 62 percent respectively~~.

Evaluation of completed Categorical Safety Program projects are included in Section I, Part II of this report. ~~Included for the first time is an evaluation of the Pavement Marking Demonstration Program. The evaluation confirms the benefits of this program.~~ Also included are ~~brief assessments~~ of ~~the~~ roadside obstacle removal (Yellow Book) and rail-highway crossing ~~programs~~.

Administrative responsibilities for the categorical safety subprograms included in the 1976 Highway Safety Act are assigned to the Michigan Department of Transportation's Local Government and Traffic and Safety Divisions. The Office of Highway Safety Planning, Michigan Department of State Police act as advisors for the Traffic and Safety Division's Community Assistance Program in their capacity as managers of the federally funded Section 402 grant.

Transition Quarter (TQ) funds received by Michigan when our fiscal year was extended to coincide with the federal fiscal year allowed the state to obligate an additional $25 million toward safety related work items. The letting of one project this year depleted this fund.

The following includes more detailed discussion of each element of the Categorical Programs and an evaluation of completed projects.

Rail-Highway Crossings

This Categorical Safety Subprogram is divided into Rail-Highway Crossing Protection (RRP) and Rail-Highway Crossing Safety (RRS).

The purpose of RRP is to eliminate hazards associated with rail-highway crossings through grade separation, reconstruction of existing structures, or the elimination of grade crossings by consolidating railways.

Construction costs may qualify for 100 percent federal funds while right-of-way costs are limited to a maximum of 70 percent federal participation. The cost to the railroad cannot exceed 5 percent. Title 23 Section 104 limits expenditures for rail crossing improvements to 10 percent or less of all funds apportioned to a state during any fiscal year.

The RRS element is directed at reducing accident severity through the installation of standard signs, pavement markings, train-activated warning devices, crossing illumination, improvements of the crossing surface, and consolidation or separation of crossings. All signing and pavement markings must conform to the Michigan Manual of Uniform Traffic Control Devices (MMUTCD). All projects are selected from a priority listing developed in accordance with methodology outlined in the Federal Aid Highway Program Manual. At least 50 percent of authorized funds are available for the above project types.

During fiscal year 1981, $8,649,010 of 1978 HSA monies were obligated through this program. This figure also includes off-system (RRO) crossing improvements. Since inception of the railroad safety program, over $38 million have been obligated by the Michigan Department of Transportation for rail-highway crossing improvements. (See Part II of this section for a review of the impact of this program.)

Pavement Marking Demonstration

The purpose of the Pavement Marking Demonstration (PMS) Program is to improve vehicle and pedestrian safety through the application of standard pavement markings.

One hundred percent federal funding for surveying NO PASSING zones and marking any paved public highway, except for interstate routes, are available. All materials and labor costs, equipment rental or depreciation charges required to initially place and renew markings over a two-year period for evaluation purposes are funded. Higher type pavement markings such as hot applied thermoplastic materials are eligible, but require a complete cost-effectiveness analysis.

The department's Local Government Division has administrative responsibility for this program with the Traffic and Safety Division acting in an advisory capacity.

By June 30, 1981, a total of $14,480,665 in PMS funds had been obligated, $2,226,356 during fiscal year 1981.

For the first time our safety report includes an analysis of the impact of the Pavement Marking Program on accidents. The study analyzed 30 highway segments in six counties which were marked through this program. The study compared before-and-after accident data at the test locations with that in control (unmarked) locations in two other counties. The analysis indicated statistically significant benefits associated with pavement markings. See Part II for more detailed discussion of this study.

Hazard Elimination

Sections 152 and 153 of Title 23 offer funding to reduce hazards at locations on the federal aid system identified as "high-accident" and to eliminate or shield potentially hazardous roadside obstacles.

The types of projects eligible for Section 152 funding include, but are not limited to, intersection improvements, cross section modifications, skid resistance treatments, and alignment changes. It is intended that these projects be spot improvements, not major reconstruction of lengthy sections of roadway.

This department's Local Government Division has administrative responsibilty for program projects off the state trunkline system with the Traffic and Safety Division acting in an advisory capacity. Projects on the state trunkline system are administered and engineered by the Traffic and Safety Division. Many of the projects were identified and/or administered by the department's Community Assistance Program.

The selection of more cost effective projects on all roadway systems is improving because of the continued development of a highly sophisticated computerized accident data retrieval and analysis capability. As this sytem has evolved, we have become more selective in choosing improvement projects. Detailed evaluations of HES projects can also be found in Part II.

The success of this program can be attributed to a screening process which takes the following factors into consideration:

A. Number, severity, and statistical significance of accidents.
B. Presence of correctable and reoccurring patterns.
C. Potential for accident reduction.
D. Practicality - size of project, right-of-way and/or drainage problems, necessity of participation by other agencies.
E. Operational considerations such as increased capacity, roadside control, and emphasis on operational countermeasures such as improved signal operation, signs and pavement markings.
F. Other factors - potential growth, development of traffic generators, and uniformity of treatment or cross section.

A detailed outline of the department's safety improvement process can be found in Appendix I.

A total of ~~$6,117,863~~ 7,848,530 was obligated during Fiscal Year 1981 from the Hazard Elimination Program.

Safer Off-Systems

Sections 101(e) 219 and 315 of Title 23 United States Code offers funding to state and local agencies for constructing and improving off-system roads and bridges. Projects which significantly contribute to the safety of the traveling public are considered high priority.

The department's Local Government Division has administrative responsibilities for this subprogram. The Traffic and Safety Division provides traffic engineering consultation on an as needed basis.

During fiscal 1981, ~~$1,931,275~~ 2,700,000 of previously obligated SOS projects were either let to contract or accomplished through force account procedures. ~~Additionally, the Railroad Off-System Program (RRO) accounted for another $218,240 which has been included with the Rail-Highway Crossing Program.~~

Special Bridge Replacement

Section 144 of Title 23 of the United States Code provides financial assistance for replacing bridges over significant waterways or other topo-graphical barriers which are unsafe because of structural deficiencies, physical deterioration, or functional obsolescence. The program in Michigan is administered by the department's Local Government 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. From 1972 through June 30, 1980, ~~$28,905,040~~ in Federal Aid funds have been obligated. During fiscal 1981 a total of ~~$15,265,545~~ was obligated.

Transition Quarter Funds

Michigan extended the 1975-76 fiscal year from June 30, 1976, to September 30, 1976, to coincide with the federal fiscal year. As a result, we received a fifth quarter Transition Quarter (TQ) allotment of federal funds to be used as needed. During fiscal 1981 Michigan let to contract the last project using TQ funds, widening of 2 miles of DeQuindre Road to five lanes. The total project was $2,930,000, $2,255,000 being federal funds.

TABLE 4

PAVEMENT MARKING DEMONSTRATION PROGRAM

ANNUAL REPORT 1981

STATE MICHIGAN

FIPS CODE (Alpha): M I

TOTAL MARKINGS REMAINING TO BE PLACED

TYPE OF MARKINGS TO BE PLACED	QUANTITY BY SYSTEM: FEDERAL-AID SYSTEM				OFF THE FEDERAL-AID SYSTEM			GRAND TOTAL
	Urban	Primary	Secondary	Total	State Jurisdiction	Local Jurisdiction	Total	
Centerline Miles Only			17055	17055		11770	11770	28825
Edgeline Miles Only			10810	10810		4834	4834	15644
Miles of Both Center and Edge Lines			8494	8494		4118	4118	12612
TOTAL MILES			36359	36359		20722	20722	57081
Railroad-Highway Grade Crossings			835	835		803	803	1638
Pedestrian Crossings (Number of Intersections)								
Other (Describe) School Markings			129	129		85	85	214

STATE MICHIGAN | M | I |
FIPS CODE (Alpha)

TABLE 3

PAVEMENT MARKING DEMONSTRATION PROGRAM

ANNUAL REPORT 1981

QUANTITIES AND COST OF MARKINGS PLACED

TYPE OF MARKINGS PLACED	QUANTITIES AND COST ($1,000) OF MARKINGS PLACED, *JULY 1, 1980 TO JUNE 30, 1981										Total Quantities and Cost of Markings Placed July 1, 1980 To June 30, 1981		Cumulative Total Miles and Cost of Markings Placed to June 30, 1981	
	FEDERAL-AID SYSTEM						OFF THE FEDERAL-AID SYSTEM							
	Urban		Primary		Secondary		State Jurisdiction		Local Jurisdiction					
	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost
Centerlines Only					4794	591965			2163	272206	6957	864171	45783	6187686
Edgelines Only					3823	272325			1051	76049	4874	348374	37421	3482344
Both Centerlines and Edgelines					3223	552901			895	154401	4118	707302	17375	2852609
Sub-Total					11840	1417191			4909	502656	15949	1919847	100579	12522639
	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost		
Railroad-highway Grade Crossings					216	20370			144	13770	360	34140	3338	284464
Pedestrian Crossings 1/														
Other (Describe) School Markings					71	5768			13	1145	84	6913	1460	286835
													Total Oblig.	13093938
GRAND TOTAL						1,443,329				517,571		1,960,900		

*If reporting period is other than July 1, 1980 to June 30, 1981 indicate dates: ______

1/ Show number of intersections in "Quantity" column.

What percent of the total miles marked during the year ending June 30, 1981 was marked for the first time? 7 %

STATE MICHIGAN | M | I |
FIPS CODE (Alpha)

HIGHWAY SAFETY IMPROVEMENT PROGRAM
ANNUAL REPORT 1981
PROCEDURAL AND STATUS INFORMATION

Line	Highway System	HIGHWAY LOCATION REFERENCE SYSTEM: Miles Covered (Percent) (1)	HIGHWAY LOCATION REFERENCE SYSTEM: Expected Completion (Year) (2)	TRAFFIC RECORDS SYSTEM: Volume Data Correlation (Percent) (3)	TRAFFIC RECORDS SYSTEM: Highway Data Correlation (Percent) (4)	HAZARDOUS LOCATIONS: Location Criteria *(5)	HAZARDOUS LOCATIONS: Project Priority Selection *(6)
101	Interstate	100		100	100	AELRS	CEIPR
102	State - F.A.	100		100	100	AELRSY	CEIRPY
103	State - Non-F.A.	100		100	100	AELRSY	CEIRPY
104	Local - F.A.	100		100	0	AERS	CEIRP
105	Local - Non-F.A.	100		100	0	AERS	CEIRP

Y Accident Pattern - 5 Year Period See Page ___

Line	Highway System	ROADSIDE OBSTACLES Project Priority Selection *(7)	SKID IMPROVEMENT Project Selection *(8)	HAZARDOUS BRIDGES Project Selection *(9)	RAILROAD-GRADE CROSSINGS: Inventory Update *(10)	RAILROAD-GRADE CROSSINGS: Project Priority Selection *(11)	Compliance With MUTCD: Crossings Upgraded **7/1/73-6/30/81 (12)	Compliance With MUTCD: Not Complying Number (13)	Compliance With MUTCD: Not Complying % (14)	Compliance With MUTCD: Compliance Target Date (15)
201	Interstate	AEIRSV	AEGIPRSVW	NA						
202	State - F.A.	AEIRSV	AEGIPRSVW	ABDGRSVW	B	HIP	N/A	0	0	N/A
203	State - Non-F.A.	AEIRSV	AEGIPRSVW	ABDGRSVW	B	HIP	N/A	0	0	N/A
204	Local - F.A.	AEISV	AEPRSVW	ABDSVW	B	HIP	N/A	0	0	N/A
205	Local - Non-F.A.	AEISV	AEPRSVW	ABDSVW	B	HIP	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:
7/1/73-6/30/81 ___
7/1/80-6/30/81 ___

SECTION I

PART II

FEDERALLY FUNDED

SAFETY PROGRAM

EVALUATION DATA

Evaluation of High Hazard Safety Program

The Hazard Elimination Safety Program (HES), authorized by the Highway Safety Act of 1978, and its predecessor programs, High Hazard Safety (HHS) and Roadside Obstacle Safety (ROS) elements of the 1973 Highway Safety Act, are some of the most highly cost-effective and popular federally funded safety programs. Over $42 million have been obligated for these programs since passage of the Highway Safety Act of 1973. Over $6 million were obligated this past fiscal year.

Evaluation data for 31 projects funded by the High Hazard Safety Program is part of this year's report. Twenty of the locations include three years of before-and-after accident data.

Total accidents at the 20 locations decreased from 1,658 to 1,426. Injury accidents in the "before" period numbered 506. This was reduced to 366 in the "after" period. Fatal accidents increased from six to eight.

Calculation of a cost/benefit or time of return is difficult because the data does not reflect total casualties only casualty producing accidents. However, assuming the statewide average of 1.511 injuries per injury accident and 1.126 deaths per fatal accident and total project costs of $3.05 million, the time of return for the 20 projects is 6.7 years.

A more detailed analysis of 13 projects on the local (nonstate trunkline) system is also included in this year's report. This analysis does document total before-and-after casualties. The locations have been grouped into three project types; center left-turn lanes, flashing beacons, and traffic signal phasing/modernization. The remainder of the 31 locations were not included due to incomplete "after" accident data (11), failure to fall into one of the above project types (4), or the fact that they were not on the local road system (3).

The six locations where center left-turn lanes were installed experienced a total of 707 accidents in the three years preceding the projects. These accidents resulted in 285 injuries and three fatalities. During the 3-year "after" period, 555 accidents were reported including 178 injuries and three fatalities. The cumulative 3-year accident savings, using 1979 National Safety Council accident cost data, was $746,920 or $248,973 per year for the six projects. The total costs of the projects were $1,492,560. The time of return (T.O.R.) for these projects was 6.0 years.

Flashing beacons were installed at five locations. The total cost for these installations was $13,200. During the 3-year "before" period there were 106 accidents, 84 injuries, and no fatalities. In the "after" period there were 97 accidents, 44 injuries, and one death. Three-year accident savings were $73,210 ($24,303 per year). The T.O.R. for these projects was 0.55 years.

The last project type evaluated was left-turn phasing and signal modernization. Two such installations were accomplished at a cost of $26,052. During the 3-year before-and-after period total accidents were reduced from 178 to 149 and injuries from 94 to 41. There were no deaths in either period. Three-year accident savings were $171,300 ($57,100 annually). The T.O.R. for these projects was 0.46 years.

As might be expected, the center left-turn lane projects most positively affected left-turn and rear-end accidents. Left-turn phasing substantially reduced left-turn crashes and installation of flashing beacons had its greatest impact on right-angle accidents. Surprisingly however, rear-end crashes increased at the locations where flashing beacons were installed.

HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
ANNUAL REPORT 1981
EVALUATION DATA FOR COMPLETED IMPROVEMENTS

STATE MICHIGAN | M | I |
FIPS CODE (Alpha)

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)	Exposure Information Before ADT (17)	After ADT (18)	(19)	Rural or Urban (20)	Number of Lanes (21)	Divided or Undivided (22)
01	HH	10	448.8	1	X	36	0	11	49	60	36	0	13	62	75	F	18.6	18.7	V	U	4	U
02	HH	10	234.2	1	X	36	0	10	44	54	36	0	7	21	28	F	18.6	18.6	V	U	4	U
03	HH	10	183.2	1	X	36	0	41	99	140	36	0	36	83	119	F	40.8	42.7	V	U	4	U
04	HH	10	38.0	1	X	36	0	18.	34	52	36	0	13	37	50	F	12.9	13.1	V	U	4	U
05	HH	10	289.0	1	M	36	2	47	131	180	36	1	27	102	130	F	.87	.88	M	U	4	U
06	HH	10	144.7	1	X	36	1	39	87	127	36	2	35	107	144	F	22.9	25.5	V	U	2	U
07	HH	10	87.4	1	X	36	0	64	117	181	36	2	43	93	138	F	36.36	39.02	V	U	4	U
08	HH	11	2.6	1	X	36	0	5	6	11	36	0	7	12	19	F	.43	.44	V	R	4	U
09	HH	11	2.6	1	X	36	0	2	4	6	36	0	1	6	7	F	.65	.66	V	R	4	U
10	HH	11	2.6	1	X	36	0	4	11	15	36	0	7	14	21	F	15.3	15.4	V	R	2	U
11	HH	11	2.6	1	X	36	0	18	16	34	36	1	4	4	9	F	.54	.55	V	R	4	U
12	HH	11	2.6	1	X	36	0	16	24	40	36	0	10	32	42	F	.87	.88	V	R	4	U
13	HH	12	561.9	1	X	36	1	53	91	145	36	0	34	87	121	F	18.14	16.88	V	U	4	U
14	HH	12	347.9	1	X	36	0	42	109	151	36	0	36	115	151	F	26.53	31.72	V	U	4	U
15																						

* Threshold for reporting PDO accidents (i.e., minimum dollar value) $200.
Estimated percent of PDO accidents actually reported

STATE MICHIGAN

M	I

FIPS CODE (Alpha)

HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
ANNUAL REPORT 1981
EVALUATION DATA FOR COMPLETED IMPROVEMENTS

Line	Safety Improvement Program	Safety Classification Code	Total Cost of Evaluated Improvements ($1000)	Quantity of Improvements	Units	NUMBER OF ACCIDENTS Before Mos.	Before Fat.	Before Inj.	Before PDO*	Before Tot.	After Mos.	After Fat.	After Inj.	After PDO*	After Tot.	Evaluation Status	Exposure Information Before ADT	Exposure Information After ADT		Rural or Urban	Number of Lanes	Divided or Undivided
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
01	HH	11	12.9	1	X	36	1	40	64	104	36	0	11	42	53	F	29.5	29.9	V	U	4	U
02	HH	11	12.9	1	X	36	0	13	61	74	36	0	23	73	96	F	28.4	28.8	V	U	4	U
03	HH	12	24.1	1	X	36	0	11	34	45	36	0	9	47	56	F	30.6	31.0	V	U	4	U
04	HH	10	420.4	1	X	36	0	39	101	140	36	0	15	51	66	F	28.4	28.6	V	U	4	U
05	HH	10	178.9	1	X	36	0	18	48	66	36	0	18	50	68	F	38.3	38.4	V	U	4	U
06	HH	26	48.0	1	X	36	1	15	16	32	36	2	17	14	33	F	9.3	9.87	M	U	2	U
07																						
08	SUBTOTAL		3,045.3			720	6	506	1146	1658	720	8	366	1052	1426							
09																						
10																						
11																						
12																						
13																						
14																						
15																						

* Threshold for reporting PDO accidents (i.e., minimum dollar value) $200.
Estimated percent of PDO accidents actually reported

STATE MICHIGAN

M	I

FIPS CODE (Alpha)

HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
ANNUAL REPORT 1981
EVALUATION DATA FOR COMPLETED IMPROVEMENTS

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)	Exposure Information Before ADT (17)	After ADT (18)	(19)	Rural or Urban (20)	Number of Lanes (21)	Divided or Undivided (22)
01	HH	10	360.7	1	X	36	1	10	18	29	13	0	3	3	6	P	.33	.14	V	R	2	U
02	HH	10	37.6	1	X	29	0	2	1	3	15	0	0	1	1	P	.17	.11	V	R	2	U
03	HH	10	85.5	1	X	36	0	15	66	81	17	0	8	20	28	P	19.7	14.3	V	U	4	U
04	HH	11	47.6	1	X	36	0	91	187	278	24	0	55	160	215	P	91.9	66	V	U	5	U
05	HH	11	8.3	1	X	36	0	4	20	24	35	0	7	31	38	P	.79	.87	V	U	4	U
06	HH	10	304.4	1	X	36	0	8	15	23	28	0	6	5	11	P	16.4	12.1	V	U	2	U
07	HH	10	457.3	1	X	36	0	13	17	30	16	0	4	7	11	P	5.6	3.2	M	U	2	U
08	HH	10	458.1	1	X	36	0	38	119	157	29	1	25	82	108	P	33.9	26.7	M	U	4	U
09	HH	10	62.3	1	X	36	0	0	2	2	26	0	0	0	0	P	4.3	3.1	V	R	2	U
10	HH	10	262.4	1	X	36	1	0	1	2	28	0	0	1	1	P	1.9	1.7	V	R	2	U
11	HH	20		1	M	36	0	3	5	8	31	0	0	1	1	P	2.6	3.0	M	U	4	U
12	Subtotal		2,084.2			309	2	184	451	637	262	1	108	311	420							
13																						
14																						
15																						

* Threshold for reporting PDO accidents (i.e., minimum dollar value) $200.
Estimated percent of PDO accidents actually reported

PROJECT EVALUATION SHEET

FEDERAL PROJ. NO. / JOB NO. ______ / ______
CONTROL SECT. / SPOT NO. ______ / ______
S.I.I. NO. ______

LOCATION: Various

CITY/TWP. ______ CO. ______

COMPILER: A. H. Dewey DATE: 8-13-81

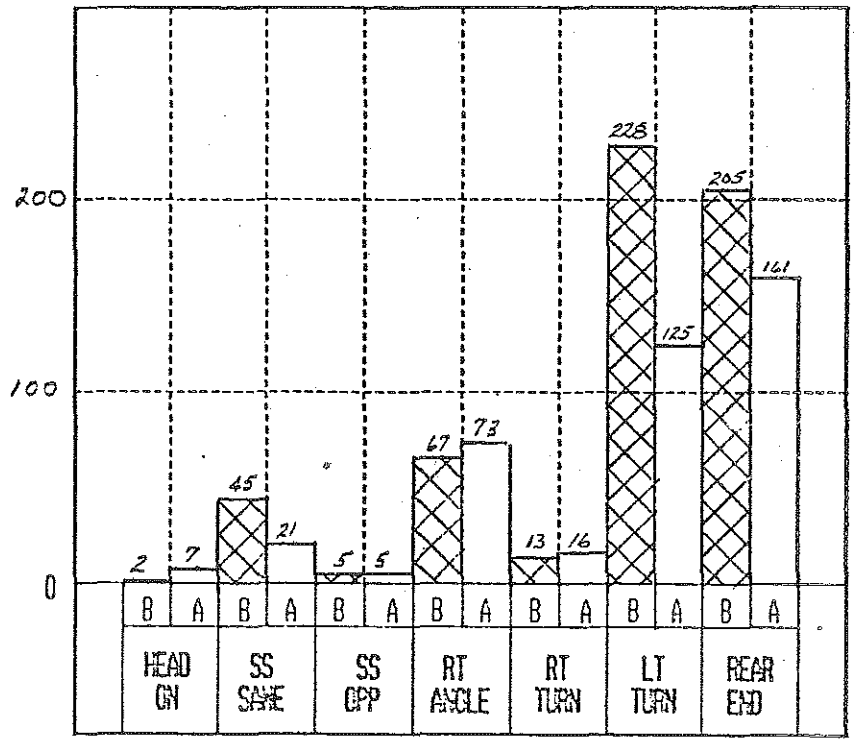
PROJECT DESCRIPTION:

Providing center lane for left turns - no phasing - at 6 locations

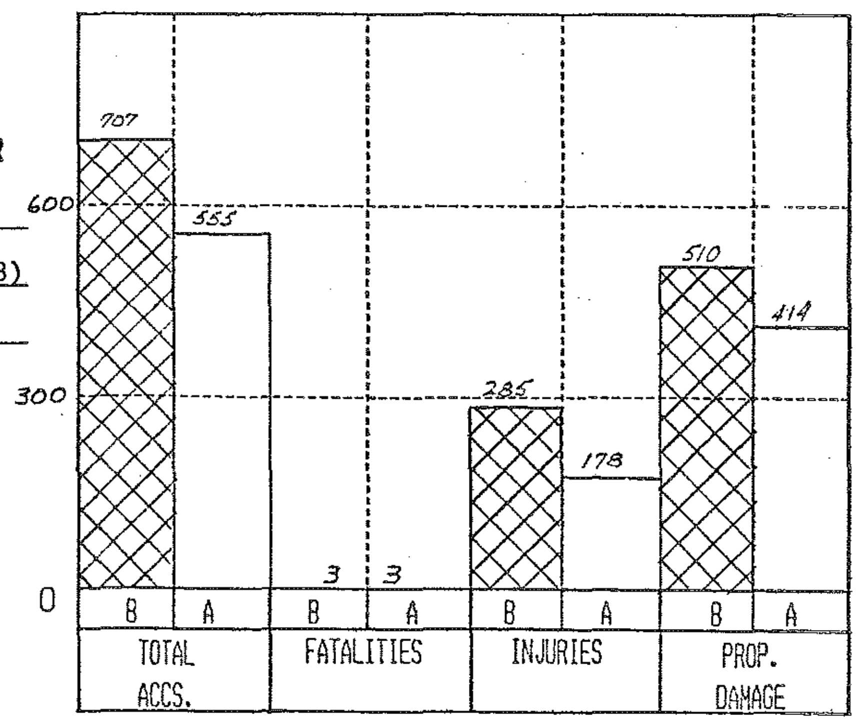
CONSTRUCTION PERIOD:
FROM - - TO - -

BEFORE PERIOD:
FROM - - TO - -

AFTER PERIOD:
FROM - - TO - -



TOTAL ACCS.	BEFORE	AFTER
FATAL ACCS. (KILLED)	3(3)	3(3)
INJURY (INJ'D)	194(285)	138(178)
PROP. DAMAGE	510	414



COMPUTED T.O.R. ______

PROJECT COST	1,492,560
BEFORE ACC. COST*	2,690,700
AFTER ACC. COST*	1,943,780
SAVINGS	746,920

*BEFORE ACC. COST
BASED ON ______ NATIONAL SAFETY COUNCIL:
FATALITY ______ INJURY ______ PROP. DAMAGE ______

* AFTER ACC. COST
BASED ON 1979 NATIONAL SAFETY COUNCIL:
FATALITY 160,000 INJURY 6,200 PROP. DAMAGE 870

PROJECT EVALUATION SHEET

LOCATION: 5 intersections

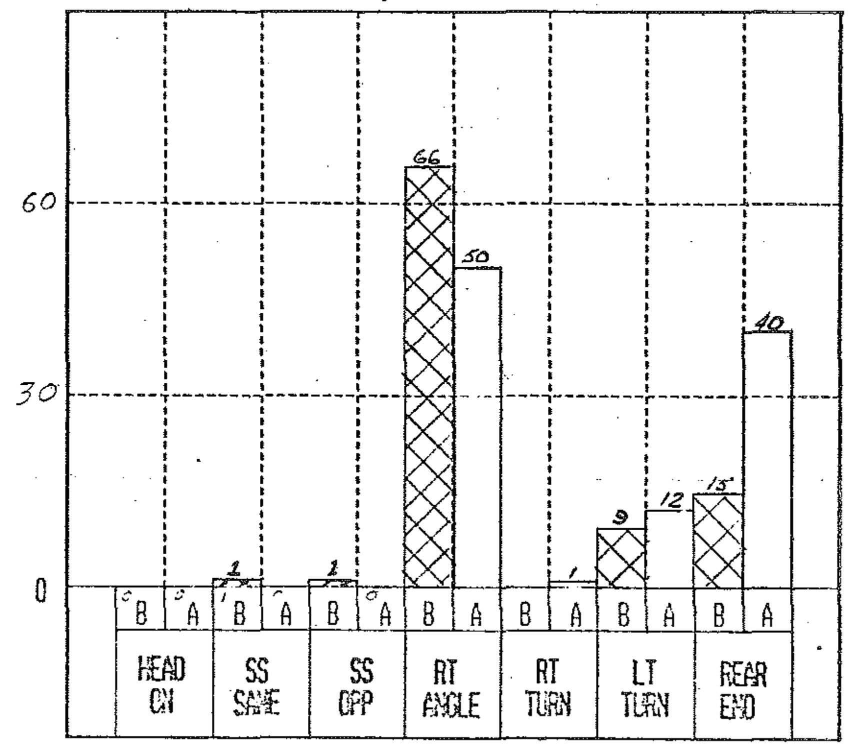
FEDERAL PROJ. NO. / JOB NO. 0005(002) / 08853
CONTROL SECT. / SPOT NO. HHS 11609 /
S.I.I. NO.

CITY/TWP. CO. Berrien

COMPILER: A.H. Dewey DATE: 6-18-81

PROJECT DESCRIPTION:

Install flashing beacons

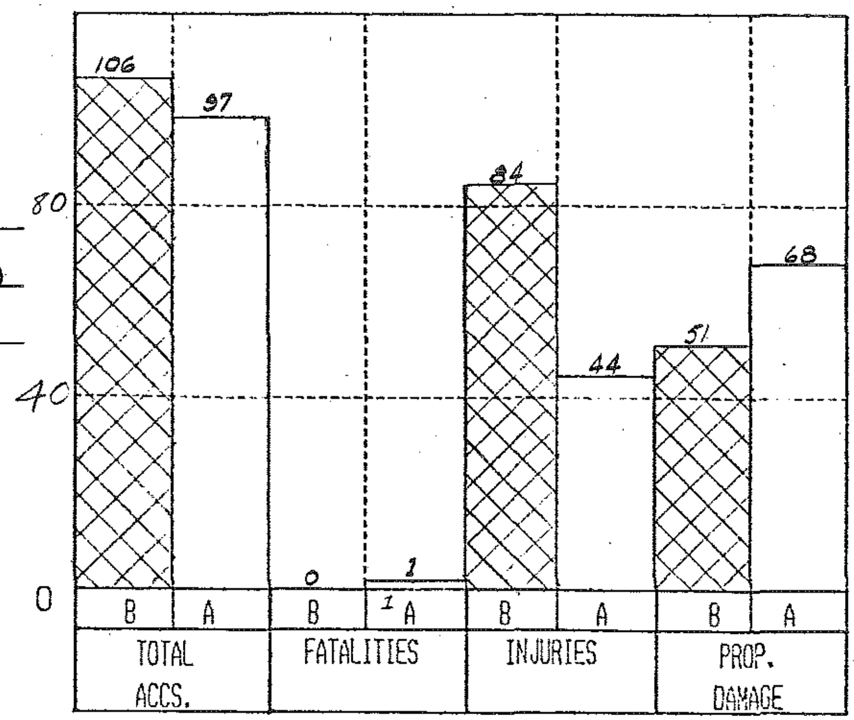


CONSTRUCTION PERIOD:
FROM 8 - 17 - 76 TO 10 - 18 - 76

BEFORE PERIOD:
FROM 8 - 17 - 73 TO 8 - 16 - 76

AFTER PERIOD:
FROM 10 - 19 - 76 TO 10 - 18 - 79

TOTAL ACCS.	BEFORE	AFTER
FATAL ACCS. (KILLED)	0(0)	1(1)
INJURY (INJ'D)	55(84)	28(44)
PROP. DAMAGE	51	68



COMPUTED T.O.R.	
PROJECT COST	13,200
BEFORE ACC. COST*	565,170
AFTER ACC. COST*	491,960
SAVINGS	73,210

*BEFORE ACC. COST
BASED ON ______ NATIONAL SAFETY COUNCIL:
FATALITY ______ INJURY ______ PROP. DAMAGE ______

* AFTER ACC. COST
BASED ON 1979 NATIONAL SAFETY COUNCIL:
FATALITY 160,000 INJURY 6,200 PROP. DAMAGE 870

PROEVLSHT 060481 61.4

PROJECT EVALUATION SHEET

LOCATION: Cedar/Aurelius and Waverly/Willow

CITY/TWP. ______ CO. Ingham

FEDERAL PROJ. NO. / JOB NO. 2003(001) / 10752

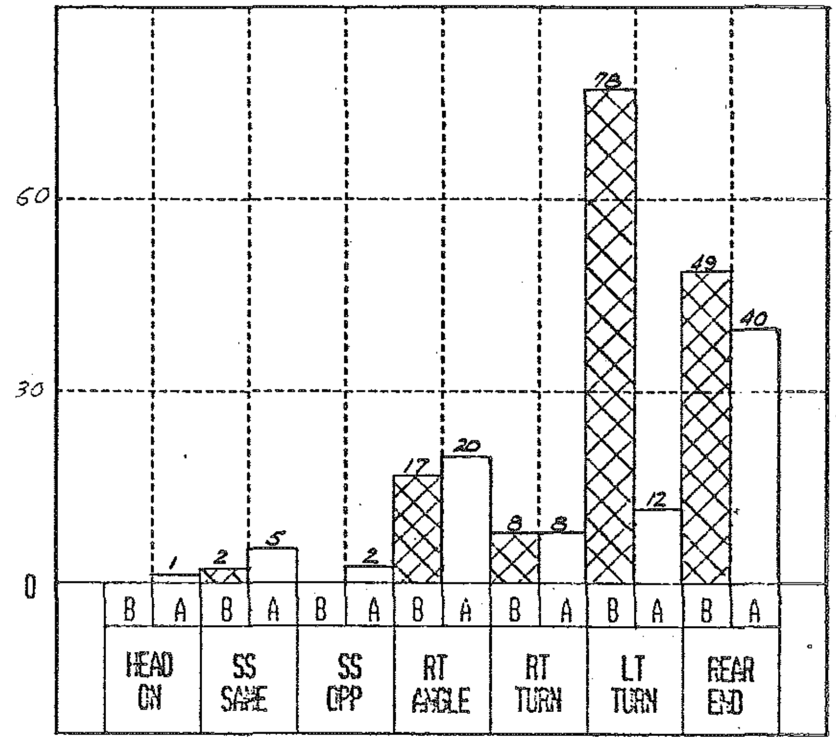
CONTROL SECT. / SPOT NO. HHS 336091 /

S.I.I. NO. ______

COMPILER: A.H. Dewey DATE: 6-18-81

PROJECT DESCRIPTION:

Signal modernization and mainline phasing for left turns

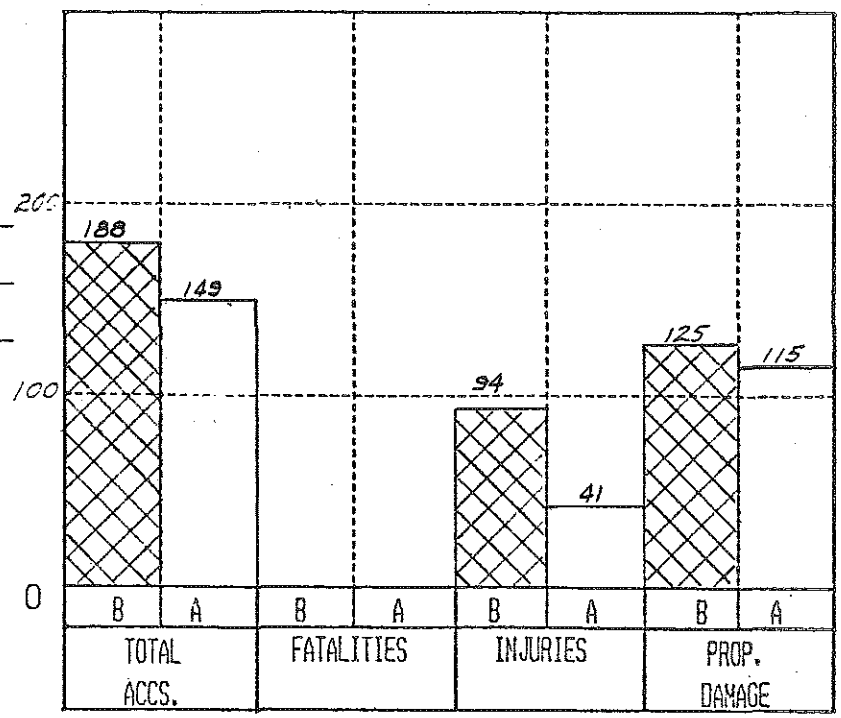


CONSTRUCTION PERIOD:
FROM 6 - 18 - 76 TO 7 - 26 - 76

BEFORE PERIOD:
FROM 6 - 17 - 73 TO 7 - 17 - 76

AFTER PERIOD:
FROM 7 - 27 - 76 TO 7 - 26 - 79

TOTAL ACCS.	BEFORE	AFTER
FATAL ACCS. (KILLED)	0 (0)	0 0
INJURY (INJ'D)	53 (94)	34 (41)
PROP. DAMAGE	125	115



COMPUTED T.O.R.	
PROJECT COST	26,052
BEFORE ACC. COST*	525,550
AFTER ACC. COST*	354,250
SAVINGS	171,300

*BEFORE ACC. COST
BASED ON ______ NATIONAL SAFETY COUNCIL:
FATALITY ______ INJURY ______ PROP. DAMAGE ______

* AFTER ACC. COST
BASED ON 1979 NATIONAL SAFETY COUNCIL:
FATALITY 160,000 INJURY 6,200 PROP. DAMAGE 870

PROEVLSHT 060481 61,4

Evaluation of Pavement Marking Demonstration Program

The Michigan Department of Transportation administers a federally funded program focusing on placement and maintainance of reflectorized highway pavement markings. However, assessment of the effectiveness of this program on traffic safety has proven difficult.

Nationwide, some studies have reported a decrease in the number of accidents after application of pavement markings. Other studies are inconclusive. A French study indicates that vehicle speeds increased after pavement markings were installed and the number of accidents remained nearly constant. However, a positive effect on safety was found during conditions of poor visibility. In general, none of the studies identified any negative effects of pavement markings and all studies conclude that positive effects on traffic safety may be expected.[1]

In an effort to assess the Pavement Marking program in Michigan, thirty roadway segments in six counties were selected as test locations and 12 roadway segments in two counties were selected as control locations. The test locations totaled 256.8 miles in length and the control locations 119.1 miles.

Test location road segments were painted with centerline and edgeline markings between August 1975 and October 1977. One year of "before" and one year of "after" accident data were collected for each test location. Accident data from 1975 and 1976 were used for the "before" period at the control locations and 1977 and 1978 were used for the "after" period.

Three groups of accidents were analyzed; total, (including combined fatal and injury and property damage (PDO)), day-night, and accidents involving centerline and edgeline encroachments. In all cases the method of analysis was the same: the change in accidents at the control locations (Table 1) was used to compute an "after-expected" number of accidents at the test locations. This was compared with the "after-observed" accidents at the test locations (Table 2). Using Chi-square tests, the changes in all three accident groupings were statistically significant at the 99 percent confidence level. Total, combined fatal and injury, and PDO accidents were all less than "expected" levels (actual injury and fatal accidents increased slightly but less than anticipated if pavement markings had not been applied). Accidents associated with centerline and edgeline violations were reduced with edgeline violation accidents showing the larger reduction. Although "day" accidents increased slightly, the increase was less than "expected" with no action. "Dark" accidents decreased absolutely. Both accident types contributed equally to the Chi-square test results.

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1 Organization for Economic Co-operation and Development, "Road Marking and Delineation," Road Research, February 1975, p. 16.

Table 1
Accident Frequencies

Control Locations

Accidents	Before	After	Percentage Change
Injury and Fatal	92 (1)	139 (1)	+51
Property Damage	144	183	+27
Total	236	322	+36

( ) denotes fatal accidents

Day	133	191	+44
Dark	103	131	+27

Centerline Violations	49	41	-16
Edgeline Violations	83	118	+42
Intersectional	78	117	+50
Other	26	46	+77
Total	236	322	+36

Table 2
Accident Frequencies

Test Locations

Accidents	Before	After Expected	After Observed	Percentage Change in Observed Accidents
Injury and Fatal	144 (5)	217 (5)	147 (6)	+ 2
Property Damage	228	290	199	-13
Total	372	506	346	- 6

( ) denotes fatal accidents

Day	199	287	205	+ 3
Dark	173	220	141	-18

Centerline Violations	56	47	40	-29
Edgeline Violations	154	219	144	- 5
Intersectional	101	152	112	+11
Other	61	108	50	-18
Total	372	506	346	- 6

To verify that the control locations were not experiencing an unusual accident frequency, percentage changes in accidents from 1975/76 to 1977/78 were calculated for the counties containing the control locations; the state; and the counties containing the test locations. These results are shown below:

Accidents	Control Locations	Control Counties	State	Test Locations	Test Counties
Injury and Fatal	+51	+21	+ 8	+ 2	+ 8
Property Damage	+27	+29	+10	-13	+12
Total	+36	+26	+ 9	- 6	+11

The control locations were among a very few unmarked paved roads in Michigan. This could account for the increase in accidents at the control locations being greater than the county-wide increases.

Table 3 outlines average accident rates at both control and test locations. Average rates increased at the control locations and decreased at the test locations. Grouping the locations by counties, all accident rates at the two control groups increased. Three of the six test groups reflected decreases in the injury and fatal accident rate, five in the property damage accident rate, and five in the total accident rate. Paired-T tests were done to assess the significance of the changes in accident rates. Combined injury and fatal accident rates, property damage accident rates, and total accident rates were analyzed at both control and test locations. Only total accident rates at the test locations evidenced a statistically significant change at the 95 percent confidence level.

Table 3
Accident Rates (Accidents/100 MVM)

Control Locations - Average Rates

Accidents	Before	After	Percentage Change
Injury and Fatal	23.3	33.7	+45
Property Damage	37.5	45.7	+22
Total	60.7	79.4	+31

Test Locations - Average Rates

Accidents	Before	After	Percentage Change
Injury and Fatal	40.2	36.3	-10
Property Damage	66.1	45.8	-31
Total	106.2	82.1	-23

It appears, that pavement markings are associated with a decrease in all types of accidents, especially those types involving edgeline and centerline violations. Since both day and dark accidents decreased approximately equally, no conclusions can be drawn concerning the visibility of the pavement markings. Unfortunately, for study purposes but fortunately for traffic safety, unmarked pavements are fast disappearing from Michigan. Thus, further studies of the effectiveness of these markings using control locations may not be possible.

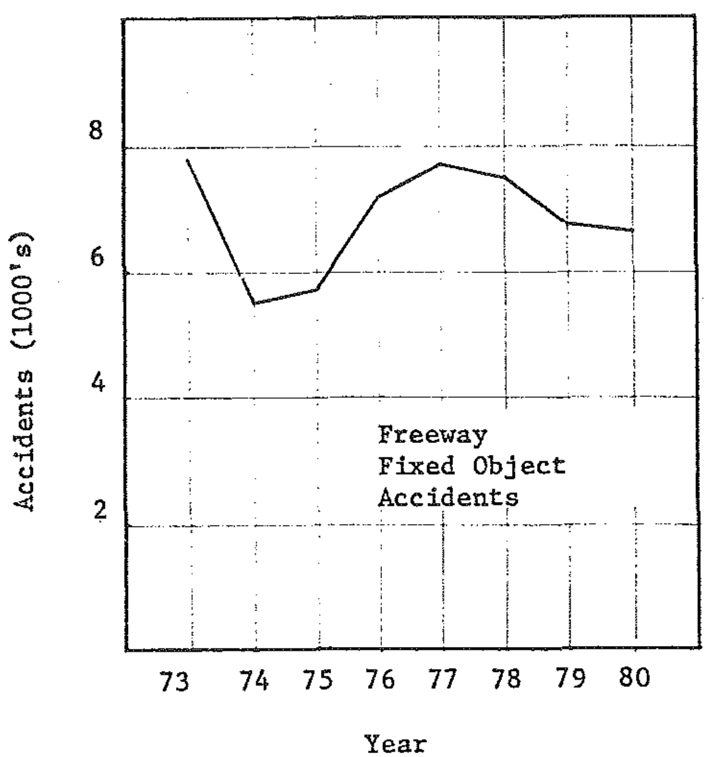
Evaluation of Freeway Yellow Book Program

As reported in previous safety reports, substantial progress toward the elimination, modification, or protection of roadside obstacles along freeways in Michigan began in about 1975. In our 1975 report we documented that 181 miles of interstate freeway were constructed or under contract to yellow book standards. 120 miles were partially complete or underway with further work required to bring them to then current standards.

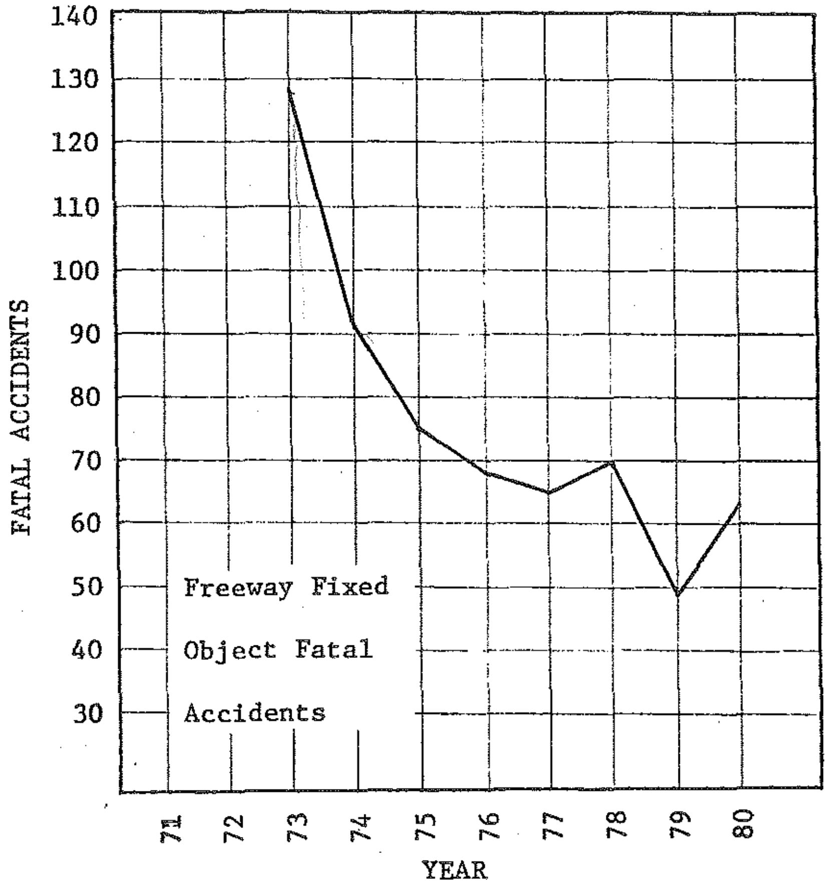
In this year's report we identify 735 miles of interstate freeway as complete or under contract with nearly all of the rest programmed for upgrading. Further, since 1975 we have initiated roadside improvements on the non-interstate freeway system and note that 255 miles (51 percent) is complete or under contract and 150 miles (30 percent) programmed or in design.

In an effort to assess the impact of our efforts, the department analyzed fixed-object accidents, particularly fatal accidents, on the freeway system. Particular attention was given to those accidents involving roadside appurtenances most commonly associated with the yellow book program - guardrails, signs, utility poles, abutments and piers, culverts and ditches.

As can be seen on the graphs below, total freeway fixed-object accidents have not changed appreciably. They have generally held in the 6,000 to 7,000 range annually, although in 1974 and 1975 total freeway fixed-object accidents dropped to less than 6,000. In 1973, 1974, 1975, the average was 5,985 fixed-object accidents. In 1978, 1979, 1980, the average was 6,745. Assuming the former three years as the "before" period and the latter as the "after" period, the average number of total fixed-object accidents has increased by 760 (12.7 percent). Volumes increased by about 2 percent from the before period to the after period.



Fixed-object fatalities, however, decreased dramatically in the face of the increase in the fixed-object accident totals. From a high of 128 in 1973, fixed-object fatalities dropped to 49 in 1979 and 63 in 1980. The average number of fixed-object fatalities in the 1973, 1974, 1975, "before" period was 98. In the 1978, 1979, 1980, "after" period the average was 61, a 37.8 percent decrease.



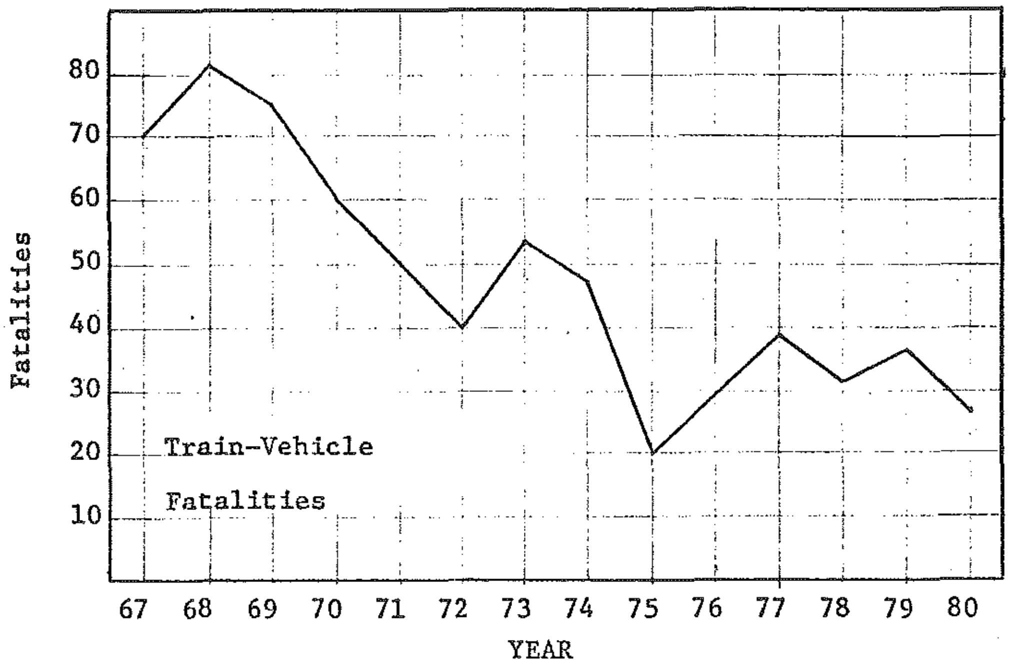
Much of this decrease is attributable to removal, modification, or protection of "hardware" and roadside features commonly addressed by the Yellow Book program. Following is a comparison of the 1973, 1974, 1975 average with the 1978, 1979, 1980 average for a number of the fixed-object accident categories.

Type	1973,74,75 Average	1978,79,80 Average	Decrease (Increase)
Guardrail	40	17	23
Sign	3	4	(1)
Utility Pole	13	4	9
Culvert	1	2	(1)
Ditch	3	3	-
Abutment/Pier	21	12	9
Bridge Pier	2	2	-
Concrete Barrier Wall	1	4	(3)

The reduction of fixed-object fatal accidents on Michigan's freeway system is substantially greater than corresponding changes in the fixed-object total freeway crashes, statewide fatalities and other normal measures of safety from the 73-75 to 78-80 periods. We believe that this accomplishment is a direct result of Michigan's freeway yellow book activities. Since 1975, Michigan has allocated $51,200,000 to the Yellow Book Program. The documented savings of lives justifies this effort.

Evaluation of Railroad Safety Program

Federal funds for railroad-highway grade crossing safety were first available following passage of the 1973 Highway Safety Act. In the late 1960's rail-crossing fatalities reached as high as 82 (1968). In the seven years preceding implementation of rail-crossing safety projects funded by the Highway Safety Act (1967-1973), the average number of deaths resulting from such accidents was 61 (see graph).



Since passage of the Highway Safety Act of 1973, over $38 million have been obligated by the Michigan Department of Transportation for rail-highway crossing improvements.

The impact of this continuing program and others focusing on railroad safety, such as Operation Lifesaver discussed in Section 4 of this report, has been impressive.

Last year (1980) fatalities resulting from accidents involving trains numbered only 26. The average number of fatalities over the last three years was 32 and the average annual number of fatalities since inception of the federally financed safety program (1974-1980) was 34.

The trend in fatalities involving trains is clearly decreasing. Much of the success in achieving this positive trend can be attributed to the rail-crossing protection programs. Further elimination and consolidation of railroad crossings, construction of grade separations and upgrading of signs, signals, markings, and other control devices at railroad crossings depends in large measure on continued provision of federal funds for implementation of these improvements.

SECTION 2

THE 1980-81

MICHIGAN SAFETY PROGRAM

1980-81
Michigan Safety Program

The Spot Safety Improvement Program, formerly known as the Michigan Safety (Ms) Program provides for the surveillance of the entire state trunkline system and implementation and evaluation of spot safety improvements at statistically high accident locations. The primary objective is to minimize accident frequency and personal injury to the motoring public through the identification of accident patterns for which known corrective treatments are available. Another objective is to minimize tort liability risk.

Identification of high accident locations continues to be accomplished through use of the Michigan Dimensional Accident Surveillance (MIDAS) model. The Michigan Accident Location Index (MALI) system, a computerized statewide accident location system, is the source of the accident data. The analyses of high accident locations are pursued through review of correctable accident patterns, determination of appropriate corrective treatments, development of either operational modifications and/or geometric safety improvement projects, request for programming either state or federal funds and the utilization of "before-and-after" evaluations to determine the effectiveness of the corrective measure(s) in terms of accident reduction and injury avoidance. The procedure used to conduct these engineering studies can be found in Appendix I, MDOT's Safety Improvement Process.

The annual review process also includes investigation of statewide trunkline accident listings to determine district wet surface accidents rates and isolate locations warranting further review. A more complete discussion of the High Accident Skid Test program can be found in Section 3, of this report.

The Safety Programs Unit located within the Traffic and Safety Division is responsible for the administration, development, implementation, and evaluation of this program. During fiscal 80-81, $656,000 was obligated through the Ms program for safety projects. This is substantially less than the previous year ($3,717,000) and reflects the severe funding restrictions now being experienced in Michigan.

However many projects identified through the Spot Safety Improvement program have been initially programmed and funded through other sources. The increased allocation of Federal aid primary funds for safety work, for example, reflects the priority Michigan assigns to safety. This year we have reported $44.3 million in safety related federal aid primary obligations compared to the previous year's $15.5 million. Another indication of the funding shift is $5.6 million of previously programmed Ms projects which were transferred to other funding sources last fiscal year.

Following is a 3-year before-and-after accident summary of 49 projects programmed through our Ms program. These projects were generally constructed during the 1976 and 1977 construction seasons. The projects reflect a total expenditure of $4.68 million. During the 3-year "after" period, total accidents were reduced from 4,868 to 4,331. Injury accidents decreased from 1,328 to 1,266. Actual numbers of injuries reduced are not included in this report; however, assuming the statewide average of 1.511

injuries per injury accident, it is estimated that total injuries in the 3-year "after" period decreased by 94. Fatal accidents numbered 20 in the before period and 15 in the after period.

Based on accepted National Safety Council accident cost data, the projects "saved" $627,000 annually resulting in an average time of return (T.O.R.) of 7.5 years.

The utilization of computer techniques and programs has been incorporated into the surveillance review process in order to improve the effectiveness of the Spot Safety Improvement Program. The Safety Programs Unit, in cooperation with the department's Computer Services Division, developed a computer program which allows statewide Traffic and Safety personnel to access a secured data file containing information on the status of current spot safety improvement studies and/or programmed projects. The forms display feature available on the computer terminal allows authorized personnel to add, delete, or change records and allow all division personnel fo find information and obtain hard copy reports if desired. This information allows division personnel to monitor and coordinate activities to better facilitate the analysis, design, and evaluation of candidate improvement locations.

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 intent is to enhance and promote efforts to meet the short-range transportation needs of urbanized areas by making efficient and coordinated use of existing transportation resources.

TOPICS-type actions are traffic engineering (operational/geometric) improvements designed to reduce traffic accidents, congestion, delay, fuel consumption and pollutants on existing facilities in the 11 identified urban areas in Michigan.

Activities include problem identification, data collection, identification of alternative operational/geometric treatments, definition of recommended solutions, identification of funding sources, and evaluation.

The Michigan Department of Transportation, Traffic and Safety Division has initiated TOPIC-type reviews in the cities of Muskegon and Jackson and is assisting in such a review in the city of Holland. Assistance in the preparation of TSM grant applications for project funding in seven urbanized areas was also undertaken. The TOPICS-type safety projects identified are intended to be coordinated with other division and department programs and planning processes.

HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
ANNUAL REPORT 1981
EVALUATION DATA FOR COMPLETED IMPROVEMENTS

STATE MICHIGAN | M | I | FIPS CODE (Alpha)

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)	Exposure Information: 1975 Before ADT (17)	1979 After ADT (18)	(19)	Rural or Urban (20)	Number of Lanes (21)	Divided or Undivided (22)
01	SL	25	11.2	0.3	M	36	0	9	36	45	36	0	14	36	50	F	21,000	22,000		U	4	U
02	SL	19	249.3	1	X	36	0	3	33	36	36	0	2	32	34	F	16,000	16,000		U	4	U
03	SL	25	31.7	0.7	M	36	0	44	135	179	36	0	34	139	173	F	17,000	18,000		U	4	U
04	SL	26	9.3	1	X	36	2	6	9	17	36	0	5	15	20	F	7,000	7,000		U	2	U
05	SL	26	10.0	1	X	36	0	3	35	38	36	0	4	23	27	F	12,000	10,300		U	2	U
06	SL	19	4.0	1	X	36	0	0	0	0	36	0	2	0	2	F	3,100	3,400		R	2	U
07	SL	19	26.7	1	X	36	0	10	5	15	36	0	4	2	6	F	800	1,500		R	2	U
08	SL	21	96.0	1	X	36	0	7	21	28	36	0	9	31	40	F	3,700	4,400		R	2	U
09	SL	19	1.4	1	X	36	0	0	2	2	36	0	0	0	0	F	7,600	6,000		R	2	U
10	SL	21	335.2	0.6	M	36	0	44	78	122	36	1	30	74	105	F	14,400	15,000		R	4	U
11	SL	26	53.2	1	X	36	1	12	31	44	36	0	17	30	47	F	17,000	20,000		U	4	U
12	SL	21	225.9	0.5	M	36	0	5	3	8	36	0	3	7	10	F	6,100	6,200		U	2	U
13	SL	29	69.5	0.1	M	36	0	22	41	63	36	0	23	35	58	F	22,400	27.400		U	4	D
14	SL	29	48.0	0.1	M	36	0	5	27	32	36	0	2	13	15	F	29,400	36,000		U	6	D
15	SL	19	80.6	1	X	36	0	0	3	3	36	0	1	7	8	F	14,000	10,700		R	4	U

* Threshold for reporting PDO accidents (i.e., minimum dollar value) $200.00
Estimated percent of PDO accidents actually reported 80-85%

STATE MICHIGAN | M | I |
FIPS CODE (Alpha)

HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
ANNUAL REPORT 1981
EVALUATION DATA FOR COMPLETED IMPROVEMENTS

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)	Exposure Information: 1975 Before ADT (17)	1979 After ADT (18)	(19)	Rural or Urban (20)	Number of Lanes (21)	Divided or Undivided (22)
01	SL	21	587.2	1.0	M	36	3	109	414	526	36	1	138	342	481	F	28,300	31,000		U	4	U
02	SL	21	9.0	.03	M	36	0	9	35	44	36	0	6	23	29	F	28,100	27,600		U	4	U
03	SL	21	61.8	0.1	M	36	0	24	22	46	36	1	21	31	53	F	12,500	13,000		U	4	U
04	SL	19	5.0	2	X	36	1	4	11	16	36	0	2	10	12	F	3,600	3,500		R	2	U
05	SL	19	31.4	0.4	M	36	0	8	28	36	36	0	5	14	19	F	6,750	8,900		U	2	U
06	SL	21	71.0	0.3	M	36	0	5	27	32	36	0	6	35	41	F	11,420	11,100		U	4	U
07	SL	26	22.6	2	X	36	0	33	154	187	36	0	21	111	132	F	17,000	17,600		U	4	U
08	SL	21	146.2	0.2	M	36	0	6	31	37	36	0	6	20	26	F	19,000	13,000		U	4	U
09	SL	19	35.7	3	X	36	0	19	17	36	36	0	13	28	41	F	5,000	7,700		R	2	U
10	SL	21	73.0	0.3	M	36	0	1	3	4	36	0	5	6	11	F	24,000	27,900		U	4	D
11	SL	21	71.1	1	X	36	0	42	123	165	36	0	39	114	153	F	29,000	23,100		U	4	D
12	SL	21	46.5	0.2	M	36	0	11	33	44	36	0	11	29	40	F	18,300	23,100		U	4	D
13	SL	26	49.6	0.7	M	36	0	72	395	467	36	0	72	281	353	F	27,000	25,900		U	6	D
14	SL	26	27.2	0.2	M	36	1	16	32	49	36	0	4	26	30	F	15,300	13,000		U	4	D
15	SL	19	17.1	2	X	36	1	5	7	13	36	2	5	12	19	F	1,900	2,200		R	2	U

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Estimated percent of PDO accidents actually reported 80-85%

STATE MICHIGAN — FIPS CODE (Alpha): M I

HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
ANNUAL REPORT 1981
EVALUATION DATA FOR COMPLETED IMPROVEMENTS

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)	Exposure Information 1975 Before ADT (17)	1979 After ADT (18)	(19)	Rural or Urban (20)	Number of Lanes (21)	Divided or Undivided (22)
01	SL	21	27.0	0.1	M	36	0	5	18	23	36	0	10	19	29	F	8,400	11,500		U	2	U
02	SL	21	302.9	0.1	M	36	0	22	35	57	36	1	6	11	18	F	22,000	24,000		U	4	U
03	SL	26	42.4	0.2	M	36	0	32	99	131	36	0	53	81	134	F	56,900	68,700		U	6	U
04	SL	21	48.8	0.1	M	36	0	74	101	175	36	1	49	70	120	F	55,300	63,900		U	6	D
05	SL	21	38.9	0.1	M	36	0	18	72	90	36	1	36	77	114	F	50,300	57,000		U	4	U
06	SL	25	21.2	0.1	M	36	1	28	87	116	36	0	36	122	158	F	48,000	56,300		U	4	U
07	SL	21	156.5	1	X	36	0	13	24	37	36	0	9	19	28	F	23,000	40,700		U	4	U
08	SL	25	25.0	1	X	36	3	148	346	497	36	1	135	311	447	F	62,300	49,600		U	4	U
09	SL	25	36.4	1	X	36	1	61	97	159	36	1	68	99	168	F	27,000	36,900		U	6	D
10	SL	26	148.2	1.2	M	36	3	175	379	557	36	2	165	332	499	F	26,300	34,700		U	6	U
11	SL	26	16.5	0.1	M	36	0	18	15	33	36	0	3	24	27	F	39,200	34,700		U	4	U
12	SL	21	161.5	0.02	M	36	0	2	10	12	36	0	4	6	10	F	34,000	38,500		U	4	U
13	SL	21	152.7	0.4	M	36	0	44	96	140	36	0	25	65	90	F	26,000	32,000		U	4	U
14	SL	21	85.8	0.02	M	36	1	18	30	49	36	1	16	16	33	F	21,100	29,000		U	2	U
15	SL	21	265.6	0.3	M	36	1	19	107	127	36	0	13	79	92	F	16,000	17,000		U	4	U

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Estimated percent of PDO accidents actually reported 80-85%

STATE MICHIGAN

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HIGHWAY SAFETY IMPROVEMENT PROGRAM AND
PAVEMENT MARKING DEMONSTRATION PROGRAM
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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)	Exposure Information: Before ADT (17)	After ADT (18)	(19)	Rural or Urban (20)	Number of Lanes (21)	Divided or Undivided (22)
01	SL	29	405.2	1.0	M	36	1	36	77	114	36	1	51	69	121	F	51,000	59,100		U	6	D
02	SL	29	140.3	0.8	M	24	0	72	114	186	24	1	72	109	182	F	51,300	53,000		U	6	D
03	SL	19	24.0	1	X	36	0	0	2	2	36	0	1	1	2	F	9,400	17,500		R	2	U
04	SL	21	77.6	0.1	M	36	0	9	20	29	36	0	10	14	24	F	30,500	30,600		U	4	U
05																						
06																						
07		TOTAL	4,682.9				20	1328	3520	4868		15	1266	3050	4331							
08																						
09																						
10																						
11																						
12																						
13																						
14																						
15																						

* Threshold for reporting PDO accidents (i.e., minimum dollar value) $200.00
Estimated percent of PDO accidents actually reported 80-85%

SECTION 3

OTHER SAFETY-RELATED PROJECTS

FISCAL YEAR 1980-81

The total Michigan safety effort includes several other types of projects that are safety related on the federal aid urban, primary, and secondary systems and federal aid off-system, as well as various 100 percent state and local funded efforts.

Safety-related work items accomplished through these projects include, intersection geometric improvements, signal modernizations, rail-highway crossing and signal improvements, roadside control, guardrail modernization, obstacle removal, skidproofing, median barrier construction, side slope, and shoulder improvements.

Federal Aid Urban System Program

This program focuses on improvement of roads in urbanized areas. Project selection is based on a predetermined planning process outlined in Title 23 Section 134.

Typical projects include widening and intersection flaring, traffic signal improvements, replacement of signs, removal of roadside obstacles, parking controls and some rail crossing improvements.

Recent emphasis has been toward TOPICS type spot improvements integrated into the overall Transportation Systems Management (TSM) process.

Projects such as intersection widening, elimination of unnecessary guardrail through slope grading, modification of crossovers, elimination of sight restrictions, guardrail or impact attenuator installations when obstacles could not be relocated, and resurfacing are considered as safety oriented in part or totally.

From July 1, 1980, to June 30, 1981, a total of ~~$44,600,000~~ was obligated ~~with $25,800,000 being safety related~~.

Federal Aid Primary Program

Projects within this program are on state trunklines and rural arterial routes extending into or through urban areas and considered to be part of a system of main connecting roads important to statewide and regional travel which service the interstate system.

Typical projects funded by this program include the entire range of safety improvement projects such as geometric modifications, skidproofing, improved traffic control devices, bridge railing replacement, etc.

During fiscal 1980 $44,323,786 was obligated that is safety-related ~~out of a total obligation of $65,787,358~~.

Federal Aid Secondary Program

This program offers state and local agencies funding assistance for improvement of federal secondary routes. It is a federal requirement that fifty percent or more of Michigan's apportionment be made available to the local road agencies for projects on secondary routes. Projects under local agency jurisdiction are selected by the local officials and department on a cooperative basis.

During fiscal 1980, ~~$14,363,724~~ was obligated for projects on routes under local agency jurisdiction. ~~$7,873,496 of this total was~~ attributed to safety.

Federal Aid Off System Program

This program provides federal funds for safety-oriented projects on local roads off the federal-aid system in cities and villages under 5,000 population and in rural areas.

Congress did not appropriate funds for fiscal 1980 for this program. As a result no expenditures were recorded in Michigan.

Michigan Funded Projects

In addition to the Safety (Ms) Program, several other state funded programs incorporate safety-related work.

The determination of which project types are safety-related is relatively complex. For instance, resurfacing projects through areas where skid coefficients are low are considered as safety expenditures. The same criteria were used in determining which bridge deck projects were identified as safety items.

Bridge railing replacement projects, improved traffic signals, guardrail improvements or removals, culvert extensions, etc., were evaluated similar to projects submitted for federal aid funding. If the project would have qualified for federal funds, 100 percent of the cost was considered safety. The percentage of safety items on other projects varied considerably.

Pedestrian and bicycle construction projects were considered 100 percent safety-related if total segregation from automobile traffic was provided. Shoulder improvements were also considered 100 percent safety-related because of the large percentage of right side, ran-off-roadway accidents and published research confirming the safety benefits of stabilized shoulders.

Mb Bituminous Resurfacing - This program primarily addresses the driving surface of highways. Resurfacing of highways that exhibit low coefficients of wet sliding friction, a high percentage of wet surface accidents, or have uneven surfaces are of primary concern. Correction of superelevation has also been accomplished through this program as has the stabilization of shoulders. Projects considered as safety-related in part or completely totaled ~~$127,767~~.

Mbr Bituminous Reconstruction - This program focuses on the surface and base of highways. Projects may include minor widening and roadside control with curb and gutter and enclosed drainage. During fiscal 1981 ~~$828,000~~ was identified as safety-related.

M - Miscellaneous Construction - During fiscal 1981, there were 113 miscellaneous projects let to contract. A total of 44 qualified as safety projects. Several incorporated resurfacing and shoulder upgrading. Two each were for guardrail upgradings and railroad crossing work. Two intersections were widened to five lanes or had other improvements completed. One project skidproofed a location with an identified slippery when wet pavement surface. The total outlay attributed to safety was $16,975,200.

Mbd - Bridge Deck - Projects in this program repair badly deteriorated bridge decks. In most cases the deck is waterproofed after completing any required deck repair and a latex modified mortar, concrete, or bituminous surface is applied. During fiscal 1980, $126,000 was considered as safety-related.

Mnm - Nonmotorized Vehicle Facility - This program funds facilities for exclusive pedestrian and bicycle usage. The conflict between vehicles, bicycles, and pedestrians has been the subject of concern for several years. Projects let to contract during fiscal 1980 totaled $68,000. The projects provided paved shoulders or separate pathways for nonmotorized vehicles.

Msh - Shoulder Edge Treatment - This program provides a minimum 3-foot bitminous edge strip along the right-hand side of state highways. It is aimed at preventing the formation of an edge drop between the pavement and adjacent shoulder material. An edgeline is provided to delineate the driving lanes and prevent regular usage of the added width. During fiscal 1980, $491,000 was expended in this program. A study is now underway to determine the impact of this program on safety.

Mtb - Turnback - This program rehabilitates trunkline routes scheduled for turnback to local jurisdictions. Projects considered as safety expenditures include center left-turn lane widening or other geometric revisions, shoulder upgrading, and resurfacing to improve friction coefficients. Expenditures attributed to safety were $305,000.

MCP - Minor Construction Program

This program is administered by the department's Maintenance Division. Projects within the program are generally low cost. This past year $442,000 was let to contract for guardrail upgradings on the state's trunkline system.

High Accident Skid Test Program

All locations experiencing 20 total accidents or more with a wet percentage exceeding the district average for that year are subjected to further review. Future projects are reviewed to determine if any of the identified areas will be included in a pavement resurfacing project. Available skid test results and more detailed accident data is reviewed for the remaining locations and new skid tests requested, if necessary. Ultimately, a cost/benefit analysis is developed for each location. Those evidencing a time of return (T.O.R.) of five years or less are segregated for possible project programming. Last year 832 locations were identified in the first step of this process. A flow chart of the wet accident review process follows.

STATE OF MICHIGAN	AUTH. NO.	DRAWN KEILEN, CLS	WET ACCIDENT PROGRAM FLOW CHART
DEPARTMENT OF TRANSPORTATION	CONT. SEC.	DATE 1-28-81	
•	REF.	SCALE 100	
TRAFFIC & SAFETY DIVISION	PLAN WETACCFLO	SHEET 43 OF	

In addition to review of locations experiencing disproportionate numbers of wet surface accidents, potential skidproofing projects are independently identified through the routine annual testing program conducted by the Testing and Research Division. All locations with skid numbers less than 35 are brought to the attention of the Traffic and Safety Division. Those locations are then subjected to the review and analysis process described above. Forty two such locations were brought to our attention last fiscal year.

During fiscal year 80-81 (81-82), 23 potential skidproofing projects were identified from the above described candidate lists. Limited funding, however, has not yet permitted programming of these projects. Nearly $1.5 million for six previously programmed skidproofing projects was let to contract last fiscal year.

Yellow Book Safety Program

The Michigan Department of Transportation continued its program of implementing safety improvements to reduce roadside obstacles. This program includes culvert extensions, modernization of guardrails, and bridge rail improvements, regrading, concrete median barrier and glare screen installations, impact attenuators, breakaway sign supports, and freeway lighting alterations.

Interstate safety projects may also include superelevation corrections, modification of interchange ramp termini to avert wrong-way maneuvers, widening lanes or structures to separate turning movements or provide for left-turns, freeway on- and off-ramp improvements, signalization, and other types of spot actions to improve safety.

Construction plan preparation for yellow book upgrading is based on current editions of the AASHTO publication "Highway Design and Operational Practices Related to Highway Safety" commonly referred to as the Yellow Book. More recently, AASHTO's "1977 Guide for Selecting, Locating, and Designing Traffic Barriers" has been used as a guide for designing roadside safety improvements. The Yellow Book program has proven effective in reducing fixed-object fatal accidents on freeways in Michigan. Section I Part II of this report includes an assessment of the Yellow Book program on safety.

Interstate Freeways - Yellow Book Status

Yellow book upgrading continues on the 1,100 miles of interstate routes open to traffic with 935 miles of upgrading approved by the FHWA. The remaining 165 miles are in accordance with present day standards with the exception of a limited number of buried end section guardrails and a few minor items which will ultimately be brought up to current standards.

Of the 935 miles:

1. 78 percent (733 miles) has been completed or is under contract.

2. 21 percent (194 miles) have been programmed or are in the design stage.

3. 1 percent (8 miles) are either unprogrammed or not in the design stage.

In 1980-81 Michigan obligated yellow book projects totaling $14,952,000. Fifty seven miles were let to contract at an estimated cost of $8,400,000.

Interstate safety projects are similar to those categorized as yellow book safety improvements and include installation and/or removal of traffic barriers and endings; installation of impact attenuators; lengthening culverts and modifying end sections; minor grading of slopes; installation, modification, and/or relocation of signs and markings; overpass screening; and glare screening. Generally, interstate safety projects are spot improvements.

Noninterstate Freeways - Yellow Book Status

Of the 560 miles of noninterstate freeways open to traffic, it will be necessary to perform yellow book safety upgrading on 500 miles. The remaining 60 miles are built to current safety standards.

Of the 500 miles:

1. 51 percent (255 miles) has been completed or is under contract.
2. 30 percent (150 miles) has been programmed or is in design.
3. The remaining 95 miles have been prioritized based upon accident rates but are currently not yet programmed due to lack of funds.

A total of 30 miles was let to contract at a cost of $1,100,000 since last year's report. In addition, there were other spot roadside safety projects obligated in the category of ROS, HHO, and HES. Those costs are outlined elsewhere in this report.

The estimated cost for completing the 150 miles of noninterstate freeways that are programmed or in design is $9,000,000. The remaining 95 miles is estimated to cost $4,000,000. The Michigan Department of Transportation continues to be concerned about funding to complete yellow book upgrading on the noninterstate freeway system.

Free Access State Trunklines - Yellow Book Status

As indicated in previous annual reports, yellow book upgrading on the free access state trunkline system will require several hundred million dollars to complete. Michigan, therefore, elected to complete this work in three stages.

Task 1, the installation of buffered guardrail end sections, is now complete.

Task 2 includes upgrading guardrails proximate to bridges and replacing or retrofitting guardrails to the existing railing system. This type of work is currently being included with road and bridge reconstruction or resurfacing projects as available manpower and funding allows. Most of this work is being financed with 100 percent state funds.

Task 3 includes improvement of the roadside to current yellow book standards. Due to lack of funds, specific Task 3 programs have not been initiated. However, guardrail modernization work is currently being included with road and bridge reconstruction or resurfacing projects as resources allow. A program to prioritize Task 3 improvements based on off-the-road accident frequency is being developed and will be used this year in identifying potential free access road yellow book projects.

Impact Attenuators

The Michigan Department of Transportation manages an active roadside obstacle removal program. The progress and future direction of this program is outlined in the discussion of the "Yellow Book" safety program.

Where removal or relocation of fixed-objects is not economically feasible, the installation of impact attenuators is authorized to minimize the consequences of a crash with the object.

As of June 30, 1981, approximately 200 impact attenuators exist on the state highway system. About 61 percent are "Hi-Dro cell units, 18 percent are Guardrail Energy Absorption Terminals (GREAT), 14 percent are sand barrel installations and 6 percent are cell cluster attenuators. One unit is a Hi-Dri cell unit. Nine attenuators (seven Hi-Dro cell and two GREAT units) were installed last fiscal year at a cost of $212,000.

In an effort to evaluate the effectiveness of our impact attenuator program, the Metro District office was contacted for crash data. The 3-county Metro District has 103 impact attenuators or crash cushions installed on the states trunkline system. Installation dates vary between 1971 and 1980 with a total of 655 impacts documented during that time. One attenuator, a Hi-dro Cell 10 Bay Narrow unit on westbound I-94 at the I-75 exit has been impacted 40 times since its November 1977 installation. During 1980 and 1981 through July 20, 138 and 71 impacts have been noted respectively. Not one fatality has resulted from any of the attenuator crashes.

As an alternate to utilization of impact attenuators to protect structure piers in narrow medians, the department has adopted use of a guardrail protection known as the "Minnesota Bull Nose." A typical "bull-nose" is believed to be an appropriate, cost-effective fixed object protective system. Approximately 50 bull-nose installations now exist on our state trunkline system.

Traffic Engineering Services

Our Community Assistance and Operational Inventories Programs assist agencies which lack the resources or expertise to develop and carry out highway safety improvements.

The Community Assistance Program assists in identifying, analyzing, and correcting problem accident locations. The Operational Inventories Program develops inventories of traffic control devices on local roads and recommends for erection, replacement, relocation, and removal of traffic control devices to conform with the Michigan Manual of Uniform Traffic Control

Devices. Department personnel conduct inventories for the smaller agencies and train local personnel to conduct their own inventories in larger agencies.

Requests for both services are initiated by the local agency to the department's Local Government or Traffic and Safety Division. Both programs are financed through a grant from the Office of Highway Safety Planning using Section 402 federal funds.

Community Assistance Program - In fiscal 1980-81, the Community Assistance Program analyzed 52 locations in 13 local jurisdictions. Recommendations included traffic signal installations and modernizations, intersection reconstructions, signing modifications, pavement resurfacing and marking, rural road realignments, and plans for urban parking. $4,221,368 in Federal Highway Safety funds was programmed to assist local agencies in implementing these recommendations. The bulk of the high hazard locations evaluated in Section I, Part II were identified and/or coordinated through the Community Assistance Program.

A consultant services contract was continued after the successful pilot project in 1979. During the past fiscal year the consultant completed an accident analysis in the city of Warren. Twenty locations were analyzed.

Work was begun on similar review in the city of Holland. A completed report is expected about October 1981. Authorization was also given to begin analysis of several high accident locations on the local system in Muskegon and as well as development of a signal optimization plan in Jackson as well as Muskegon.

Operational Inventories Program - As of June 30, 1981, traffic control device inventories have been finalized for:

19,701 miles of county primary roads in 58 counties
17,361 miles of county local roads in 22 counties
10,869 miles of major and local streets in 281 cities and villages

In addition, completed field inventories need to be reviewed for:

1,567 miles of roads and streets in 45 cities and villages,
5,024 miles of county local roads in seven counties,
729 miles of county primary roads in two counties need to be reviewed

An emphasis was placed on expediting the inventorying and finalizing of those inventories conducted or reviewed by the department. The department's computerized inventory program provides an agency with route-by-route inventory and quantity sheets and agencywide quantity sheets. The quantity sheets indicate the material needs ty type of road system (local, FAS, FAU, etc.). To date, 116 local agencies have been inventoried using this system of which 35 were inventoried by traffic engineering consultants. Thirty-nine traffic control devices inventories were conducted between July 1, 1980, and June 30, 1981.

Two traffic control devices inventories were completed by trained agencies, 25 by contracted traffic engineering consultants, nine by Michigan Department of Transportation personnel, and three by outside agency consultant contracts.

From July 1, 1980, to June 30, 1981, department personnel prepared engineer estimates for 31 local agency sign upgrading projects. Contracts were awarded for 19 off-trunkline agency sign upgrading projects. Funds from the Safer Off-System, Safer Roads Demonstration, Federal Aid Secondary, and Federal Aid Urban Programs were utilized involving $298,024 in federal monies.

SECTION 4

NEW DEVELOPMENTS IN HIGHWAY SAFETY AND SPECIAL STUDIES

Interchange Improvement Program

The interchange priority study reported on in previous annual reports, has evolved into an interchange improvement program emphasizing implementation of needed improvements.

During the past year, more time was spent on planning and design activities, such as evaluating and documenting alternative project designs for engineering reports and environmental documents. Computer analysis, including model simulation of possible corrective measures, has been performed.

Development of a revised priority ranking system incorporating interchange geometry and accident data on an element-by-element basis is underway. With the aid of the MARS survey vehicle, the MALI accident location system, and the MIDAS accident model an inventory is being developed which permits more detailed deficiency identification and comparative analyses of small segments of each interchange as well as prediction of the results of potential improvements.

Positive Guidance Demonstration Project

In October, 1977, the State of Michigan was selected by the Federal Highway Administration's (FHWA) office of Traffic Operations as one of three states to participate in a positive guidance demonstration project. Michigan received $75,000 in federal demonstration funds to finance the project.

Positive guidance is a procedure developed by the Federal Highway Administration which combines highway engineering and human factors technologies to produce an information system best suited to driver capabilities. It is designed to provide high payoff, short range solutions to safety and operational problems at a relatively low cost. The procedure is based on the premise that drivers are most likely to perform properly when given sufficient information in a usable form.

A positive guidance program was developed for a freeway location in the Grand Rapids area using a diagrammatic signing system. After the project was implemented, an evaluation report entitled "A Positive Guidance Evaluation of a Diagrammatic Signing System" was prepared and transmitted to the FHWA. This report outlines details of the signing modifications and the results of a before-and-after study which shows statistically significant reductions in erratic maneuvers and brake light applications. Reductions were greatest during the study period when drivers presumed to be less familiar with this site were passing through the area.

The limited amount of time since implementation of the signing changes precluded a statistically valid before-and-after accident study. However, the reductions in erratic maneuvers and brake light applications evidence a decrease in driver confusion which may support a corresponding decrease in related accidents. This data is now being collected for analysis at a later date.

The positive guidance principles and diagrammatic signs tested in this study appear promising. Further applications are being considered where driver confusion is identified, especially in situations where signs require replacement or maintenance and could therefore be economically converted to diagrammatic display.

Project BEAR Update

Project BEAR (Broad Emergency Assistance Radio) is a Citizens Band Radio Motorist Aid System initiated by joint efforts of the Michigan Departments of Transportation and State Police. The system, first operational on October 1, 1978, provided motorists on I-96 between Grand Rapids and Detroit a means of communication with the State Police for assistance in emergencies. The system was discontinued in October, 1980, when federal and state funds were depleted.

A project evaluation (available from this department) indicated that the system fulfilled intended objectives: it was a feasible and effective method of providing direct communication between state police and motorists; it evidenced a sizable increase in usage (approximately 400 percent) in terms of reported incidents; it supported the need for future development. This in conjunction with favorable public awareness and concern has prompted the department to put the system back into operation. Volunteers and federally funded personnel are now being used as radio operators to help run the system.

Expansion of the I-96 system through installation of additional towers is being considered to achieve 100 percent roadway coverage. In addition, the feasibility of including I-94 between New Buffalo and Detroit in the system is being investigated.

Variable Message Signs

The department has recently installed overhead variable message signs on a 1½-mile section of urban freeway (US-131 in Grand Rapids). The unusual reverse-curve geometric design, locally known as the S-curve, limits speeds to less than those prevailing adjacent to the curve. Despite lower speed limits through this area, a significant accident experience has continued as shown on the following table:

Year	Total Accidents	Fatal Accidents	Persons Killed	Injury Accidents	Persons Injured
1979	307	1	1	65	90
1978	275	0	0	49	63
1977	304	0	0	57	78
1976	314	1	1	59	77
1975	245	0	0	60	85

It is anticipated that the signing, in conjunction with installation of concrete median barrier and roadway resurfacing, will minimize accident frequency and severity. This combination of treatments was selected based on an in-depth analysis of accident patterns. Major reconstruction alternatives were considered cost prohibitive.

The signs are mounted on overhead trusses located at four sites through the curve area. They are externally illuminated and have a dot matrix to display messages of no more than three lines with a maximum of 18 characters per line. The signs, displaying one message at a time, such as "ACCIDENT AHEAD - LEFT LANE CLOSED," are easily readable and are in conformance with all accepted signing guidelines. Any traffic related message can be created and stored in a computer library (100 messages) for display when needed.

High-Production Pavement Marking

The Michigan Department of Transportation maintains approximately 38,000 line miles of pavement marking on Michigan's 9,400-mile state trunkline system. As part of continuing efforts to reduce production costs and increase operational safety, the department awarded a $154,000 contract (100 percent state funds) for the development of a high-production freeway pavement marking machine. It is capable of simultaneously applying center and edgeline markings at operating speeds of 25 mph, at least double current production capabilities. The equipment features a TV guidance system, high performance paint and bead loading, and a unique hydrostatically-driven kinetic energy heating system. The contract included development of compatible striping material with a 45-second maximum "no-track" dry time.

The vehicle was received in December, 1980, and has been undergoing performance testing prior to final system acceptance. The Traffic and Safety Division is assisting the Maintenance Division in testing and acceptance of the machine.

Mobile Automated Recording System (MARS)

MARS is a departmental program funded through a 70 percent Office of Highway Safety Planning grant to provide an automated mobile surveying system to further implement the MIDAS accident model. The system will be used on Michigan's trunkline system as well as a number of local roads and streets. The survey will be conducted in conjunction with the U.S. Geodetic Survey Monumentation project, using the monuments as reference points. The first vehicle, a mobile survey unit, uses a laser beam to establish the vehicle's position and record vertical and horizontal alignment, superelevations, locations of intersections, grades, LORAN-C coordinates, etc. at speeds up to 55 mph. For the first time the department will have accurate systemwide roadway geometry data. On August 4, a second vehicle equipped with an Inertial Surveying System began providing a 10X10 mile grid of NGS survey monuments. In September, as part of a different contract, a vehicle equipped with automated aviation hardware will begin the alignment survey of 22,000 miles of state and local roads.

Michigan Accident Location Index (MALI)
Michigan Dimensional Accident Surveillance Model (MIDAS)

MALI is a system designed to generate computerized descriptions of traffic crash locations directly from information reported by the police officer. The computer system generates and maintains crash location information on the MALI street index for later retrieval and analysis. MALI enables users to identify hazardous locations, establish priorities for safety improvement projects, and identify areas for selective police enforcement. MALI is currently operational on the state trunkline system and the local road system in all 83 counties.

The MALI system is currently being enhanced by the addition of all public railroad crossings to each county index. Railroad crossings were treated as intersections using the federal railroad identification number and railroad name. Currently, railroad crossings have been added to all 83 county indexes. Crashes are now being coded directly to specific railroad crossings and not to the nearest intersecting street as done in the past.

Development of the Michigan Dimensional Accident Surveillance Model continues. MIDAS II discussed in last year's report is now operational. Utilization of MIDAS II printouts has greatly reduced the need for collision diagrams. The large amount of concisely presented data has been of significant help to our engineers as they search out accident patterns and their causes.

Use of Strobe Lights at Rail-Highway Crossings

Standard signals at rail-highway crossings are not always easily perceived by motorists due to sun, fog, advertising signs, and nearby traffic signals.

There are several measures available to improve crossing protection. Half-roadway gates can be added, but installation and maintenance costs are high. Larger lenses and/or higher voltage bulbs have been installed at some locations to increase driver awareness. Several states and railroads have experimented with supplementing standard flashing lights with a variety of strobe light designs.

The Michigan Department of Transportation, at the request of the C&O railroad, identified a study site for addition of supplemental strobe lights to the existing flashing light signals. The location on US-27BR in the city of Clare, was selected on the basis of accident experience and reported motorist visibility problems in observing the standard flashing light signals. The installation was completed July 21, 1978, and consists of three individual strobe lights mounted around each standard red flashing warning light on the nearside overhead crossing signal.

Evaluation data during the two-year after-period disclosed only one car-train accident, and that occurred during a period when the strobe lights were not in operation. During the 6-year before-period, there were ten car-train accidents.

Three strobe light colors, red, blue, and clear, were evaluated during the two-year period. Public acceptance of the blue lenses was most favorable. The Clare Chief of Police indicated the only time he received a complaint about the signals was when they were not working.

As a result of this initial installation it was recommended that several other sites be selected in Michigan for the addition of strobe lights to existing signals. MDOT is currently evaluating several crossings for this purpose.

Because of the success experienced at this location five additional sites have been selected for placement of the supplemental strobe lights.

Operation Lifesaver Public Information Program

Operation Lifesaver is a public information program developed to reduce both the number and severity of railroad grade crossing accidents in Michigan. The program utilizes principles long recognized as effective in improving highway safety-Education, Engineering, and Enforcement. Railroad and highway officials survey crossings and then initiate the engineering changes necessary to make them as safe as possible. Law enforcement agencies continue to enforce the laws relating to grade crossings, and, through a public awareness program, the public is educated to the potential hazards that exist at grade crossings.

Although the law requires motorists to yield the right-of-way to trains at railroad crossings, impatience or carelessness causes some drivers to speed across in front of passing trains. By emphasizing the consequences, through the Operation Lifesaver public awareness program, it is hoped that motorists will heed the warning devices that exist at grade crossings.

Michigan's Operation Lifesaver campaign, which began April 21, 1980, is being sponsored by the Michigan Traffic Safety Information Council and the Michigan Railroads Association in cooperation with the Michigan Department of Transportation. The safety message for Michigan's program is "Trains Can't Stop, You Can". During the first year television and radio public service announcements were used to promote this message to the public. Posters and brochures have also been produced with this message. In addition, filmstrips entitled "No Place to Play" were sent to 650 elementary schools statewide. The filmstrip describes the dangers associated with children playing near railroad tracks. The response to the filmstrip from teachers has been excellent.

Before Michigan's Operation Lifesaver program went into effect, 30 to 40 car/train fatalities occurred every year. For instance, in 1979, there were 36 people killed and 322 people injured in 465 car/train collisions. In 1980, however, there were 26 people killed and 204 people injured in 391 accidents, a 28 percent reduction in fatalities and a 37 percent reduction in injuries. During the first five months of 1981, the reduction was even more impressive with only four fatalities.

Operation Lifesaver has been continued for 1981, sponsored again through the Michigan Traffic Safety Information Council. Funding for the second year activities again came from the Michigan Office of Highway Safety Planning, the Michigan Railroad Association, and the Michigan Department of Transportation. This year's activities include distribution of brochures and posters that explain the programs theme "Trains Can't Stop, You Can". In addition, the filmstrip "No Place to Play" was sent to an additional 1,500 elementary schools bringing the two year total to 2,150 schools.

We were also fortunate this year to participate in the appearance of the "Chessie Safety Train" in Michigan. The Chessie System Railroad operates a steam-powered train known as the Chessie Safety Express. The train, which is powered by a rebuilt 1948 steam locomotive, is used to promote railroad safety and specifically a nation-wide Operation Lifesaver program.

Evaluation of the train-vehicle accident experience will be made after the second year of the program to determine if the impact of Operation Lifesaver remains positive. Continuation of Operation Lifesaver will be dependent on the second year accident evaluation and availability of funds.

Evaluation of 4-Way Stop Sign Control

Michigan Department of Transportation Engineers have long recognized that accident problems are occasionally experienced at high-speed, low-volume, rural intersections on the state highway system. Many of the techniques normally used to correct these accident problems have not been proven effective at this type of intersection. The 4-way stop, previously considered as an intersection control applicable only in moderate volume, low speed, urban-suburban environments, was utilized at many of these locations.

To determine how effective these installations have been a "before-and-after" study was conducted at ten locations where 4-way stop control had been used. Accident experience, vehicle operating cost, travel time, fuel consumption, and vehicle emissions were compared for these intersections. Nine of the intersections experienced low to moderate traffic volumes (daily approach volume less than 13,000 vehicles) while one intersection experienced higher volume.

Three years of before-and-after accident data were available for eight of the intersections. A total of 230 accidents, with 219 injuries and 15 fatalities occurred in the before-period. There were 89 accidents, 45 injuries and one fatality in the after-period. All accident types (that is, angle, rear-end, etc.) were reduced and the overall reduction was statistically significant at the 97.5 percent confidence level.

Two years of before-and-after accident data were available for the two remaining intersections. A total of 47 accidents, including nine injuries and one fatality occurred in the before-period. There were 19 accidents, with one injury and no fatalities in the after-period.

The overall reductions in accidents and injuries were statistically significant but the reduction in deaths was not significant due to the low numbers involved except for the property damage accident rates at two intersections, all other accident rates were reduced. The annual savings resulting from reduced accidents at the ten intersections was $760,200 (1979 price levels).

The study also evaluated additional motor vehicle operating costs (fuel, tires, engine oil, maintenance, and depreciation) which totaled $913,700 per year. There was also additional travel time at these locations of $208,800 per year and additional fuel consumption of 440,300 gallons per year. The excess annual vehicle emmissions totaled 1,287,500 pounds of carbon monoxide, 79,200 pounds of hydrocarbons, and 83,000 pounds of nitrogen oxides.

An isolated examination of the single higher volume intersection shows that 30 percent of the total vehicle operating costs, travel time, fuel consumption, and vehicle emissions occurred at this location. At intersections with greater daily approach volumes, these additional costs appear to exceed accident reduction savings. For intersections with low to moderate volumes (that is, daily approach volumes less than 13,000 vehicles), the savings due to accident reductions generally equal or exceed the above-mentioned cost. Thus, the study concludes that at moderate or low volumes, where operating costs are less and where a traffic study indicates that a 4-way stop will substantially reduce the number and severity of accidents, the 4-way stop can be a cost-effective method of intersection control.

Surveillance, Control, and Driver Information (SCANDI)

The Michigan Department of Transportation has undertaken a major effort to improve the freeway system in southeast Michigan. The project, called the Surveillance, Control, and Driver Information (SCANDI) system, involves 32.5 miles of trunkline freeway in the Detroit metropolitan area.

SCANDI will monitor freeway traffic conditions by means of computers, traffic detectors, and closed circuit television cameras and will be able to initiate corrective action when an incident interferes with traffic flow. Also, motorist-aid call boxes are being installed which will provide voice communication between freeway motorists and the Department of State Police.

Response to incidents is coordinated through the Michigan State Police Freeway Patrol, assisted by the Detroit Fire Department, the Emergency Medical Service, the Wayne County Road Commission, and other service agencies. An incident Management Task Force, consisting of these and other agencies, has been formed and is developing operating plans to further enhance response to incidents that affect traffic.

Currently, the Changeable Message Sign System (CMSS), Motorist Aid System (MAS) and four Closed Circuit Television (CCTV) cameras are in operation. The CMSS employs nine tri-color signs installed at various locations on the freeway system. They are used any time SCANDI control has information about interferences with traffic on the freeway. Motorists are alerted as to the problem and advised of proposed corrective action. The MAS provides a direct line to the State Police post. Several hundred calls are handled each month ranging from notifying a family member or service station that assistance is needed, to sending a car to give assistance at an accident scene. The CCTV monitors allow the SCANDI operators to visually monitor the area of the I-94 Freeway from Linwood to Dubois. This area includes the US-10 and I-75 interchanges and is one of the most heavily traveled sections of highway in the state.

The computerized traffic control system is not yet complete. The contractor has indicated that he will be ready to begin acceptance testing this month. However, a large percentage of the system is still not operational and so the contractor's proposal appears overly optimistic. In addition, the expansion of the CCTV system from four to ten cameras is progressing well. Unfortunately, it appears that the manufacturer will experience delays in furnishing equipment cabinets. These delays may delay the overall expansion until spring.

APPENDIX I

MICHIGAN DEPARTMENT OF TRANSPORTATION

SAFETY IMPROVEMENT PROCESS

SAFETY IMPROVEMENT PROCESS

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Safety Improvement Processes
State Trunkline System

I. Planning

A. Process for Collecting

1. Accident Data

Michigan Accident Location Index (MALI)

The Michigan Department of Transportation and the Michigan Department of State Police, in cooperation with the Michigan Office of Highway Safety Planning, have developed a computerized crash location reference and analysis system referred to as the Michigan Accident Location Index (MALI). The MALI system is designed to generate a computerized description of traffic crash locations directly from the information reported by the police officer. The computer system generates and maintains the crash location information on the MALI street index for later retrieval and analysis. The MALI street index is a map of the street network stored in the computer. The street index is composed of distances between intersections, alternate street names, and accurate city and township boundaries.

The primary functions of the MALI system are to expand the state's crash locating capability to all roads and streets, eliminate the manual locating of crashes, and provide crash analysis information to state and local users. The MALI system will enable the user to identify hazardous locations on all roads and streets, forming the basis for establishing priorities for safety improvement projects, selected enforcement areas, and other activities that have an impact on the state's accident experience.

The MALI project is currently operational on the state trunkline system and the local road system in all 83 counties. Thus, the MALI system is locating crash data beginning with 1979 data on all roads and streets in the state.

The MALI system is currently being enhanced by the addition of all public railroad crossings to each county index. Railroad crossings were treated as intersections using the federal railroad identification number and railroad name. Currently, railroad crossings have been added to all 83 county indexes. Crashes are now being coded directly to specific railroad crossings and not to the nearest intersecting street as done in the past.

2. Traffic Data

The department utilizes Permament (automatic) Traffic Recorders (PTR), portable traffic recorders, and manual recording techniques to collect traffic data on the entire trunkline system. The counting network consists of 103 ATR's, 400 portable traffic recorder "A" stations, and 2,812 portable traffic recorder "C" stations. ATR 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 determine 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.

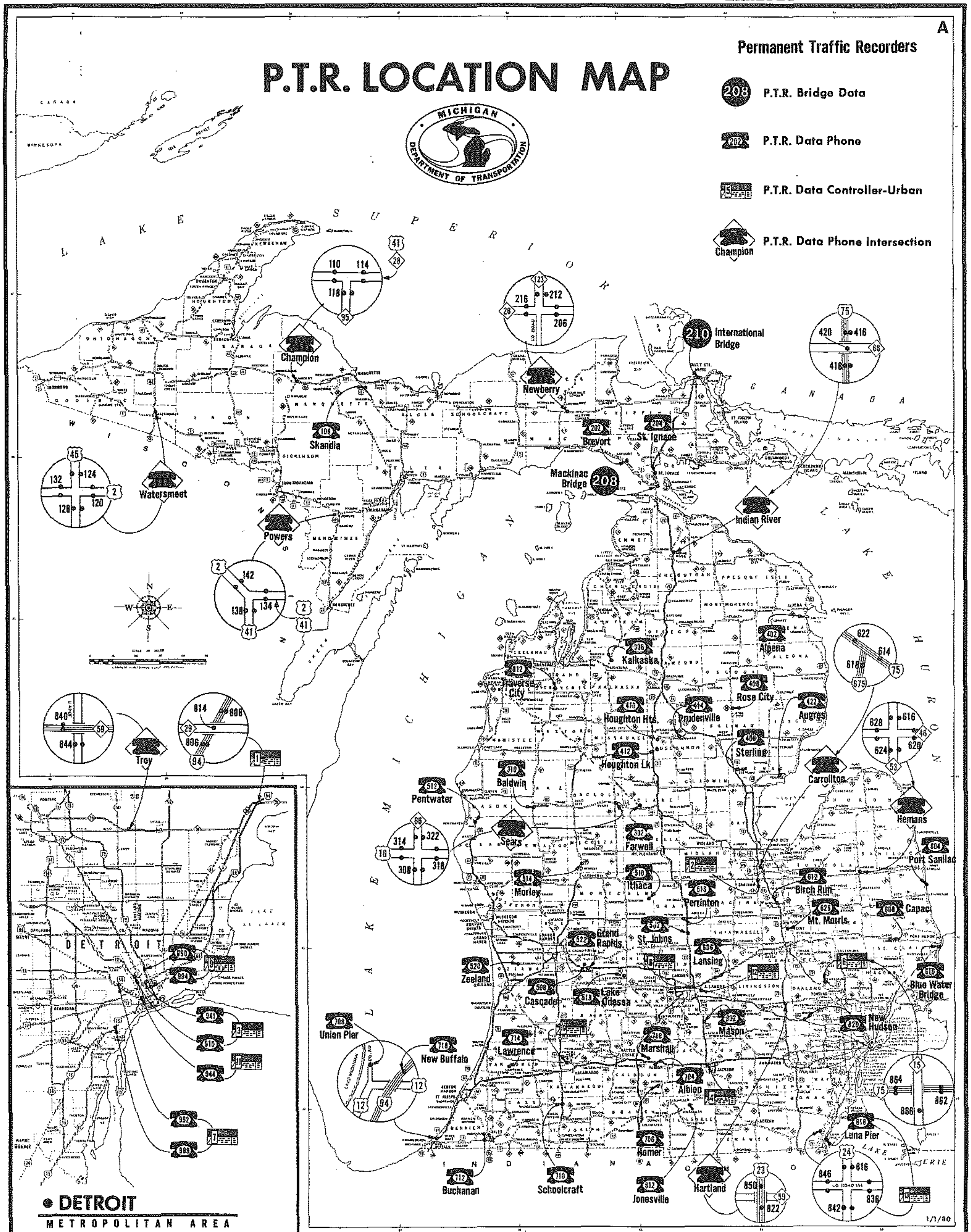
Special intersection operational traffic surveys are conducted on a request basis which are primarily used for traffic engineering analyses. These surveys may include 8-hour manual turning movement counts and 24-hour machine counts. Vehicle gap-and-delay studies, and pedestrian movement counts are included 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 for the state trunkline system as well as develop traffic flow maps, develop link maps, 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, Washington D.C., in order to develop national traffic trends.

As a result of the Surface Transportation Act, vehicle speed data is also collected on various highway categories. This speed monitoring information is collected through automatic techniques from 37 stations (see Exhibit II) and is reported on a quarterly and annual basis (MDOT #66). This 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 done in conjunction with the Department of State Police and the Office of Highway Safety Planning.

Exhibit I

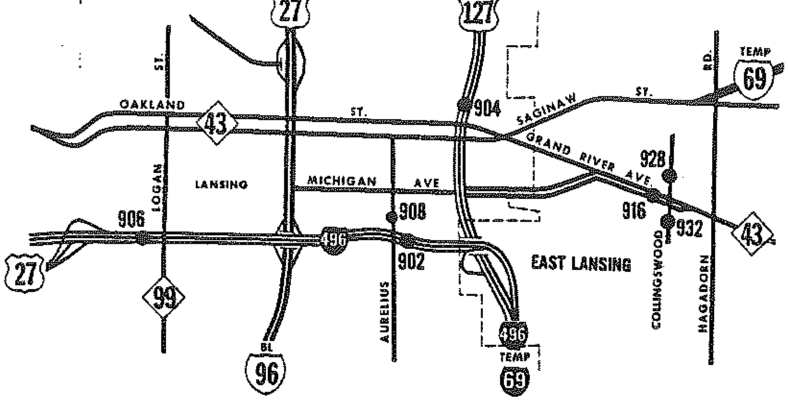


A
P.T.R. LOCATION MAP
MICHIGAN DEPARTMENT OF TRANSPORTATION
Permanent Traffic Recorders
208 P.T.R. Bridge Data
202 P.T.R. Data Phone
P.T.R. Data Controller-Urban
Champion P.T.R. Data Phone Intersection
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
CANADA
WISCONSIN
INDIANA
OHIO
International Bridge
Mackinac Bridge
Champion
Newberry
Skandia
Brevort
St. Ignace
Watersmeet
Powers
Indian River
Kalkaska
Alpena
Traverse City
Rose City
Houghton Hts.
Prudenville
Augres
Sterling
Houghton Lk.
Baldwin
Carrollton
Pentwater
Hemans
Sears
Farwell
Port Sanilac
Morley
Ithaca
Birch Run
Perrinton
Mt. Morris
Capac
Grand Rapids
St. Johns
Lansing
Zeeland
Blue Water Bridge
Cascade
Lake Odessa
Mason
New Hudson
Union Pier
New Buffalo
Lawrence
Marshall
Albion
Luna Pier
Homer
Buchanan
Schoolcraft
Jonesville
Hartland
Troy
DETROIT
METROPOLITAN AREA
1/1/80

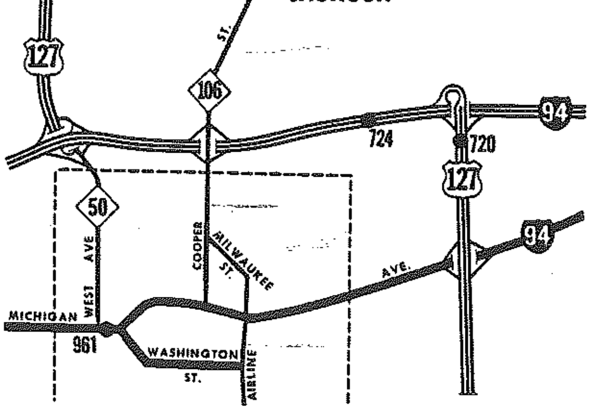
B

P.T.R. URBAN LOCATION MAP

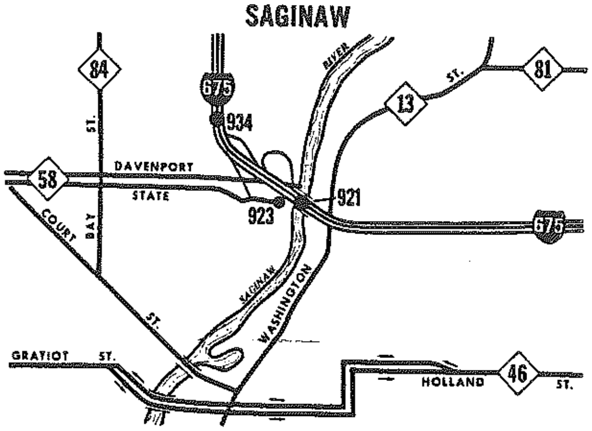
LANSING



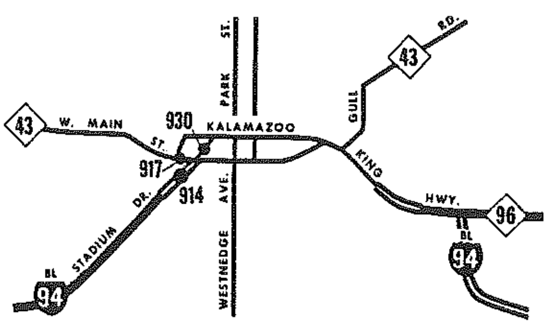
JACKSON



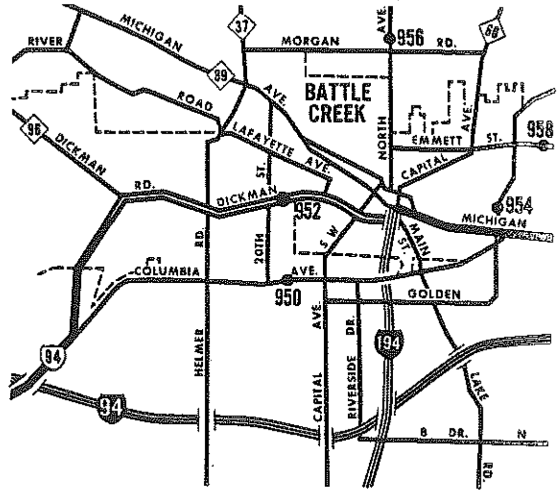
SAGINAW



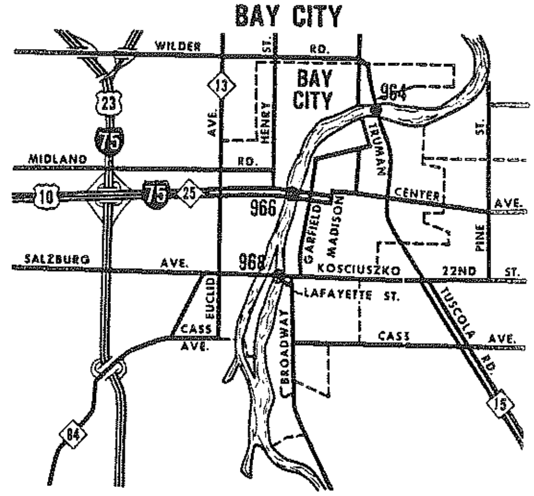
KALAMAZOO



BATTLE CREEK

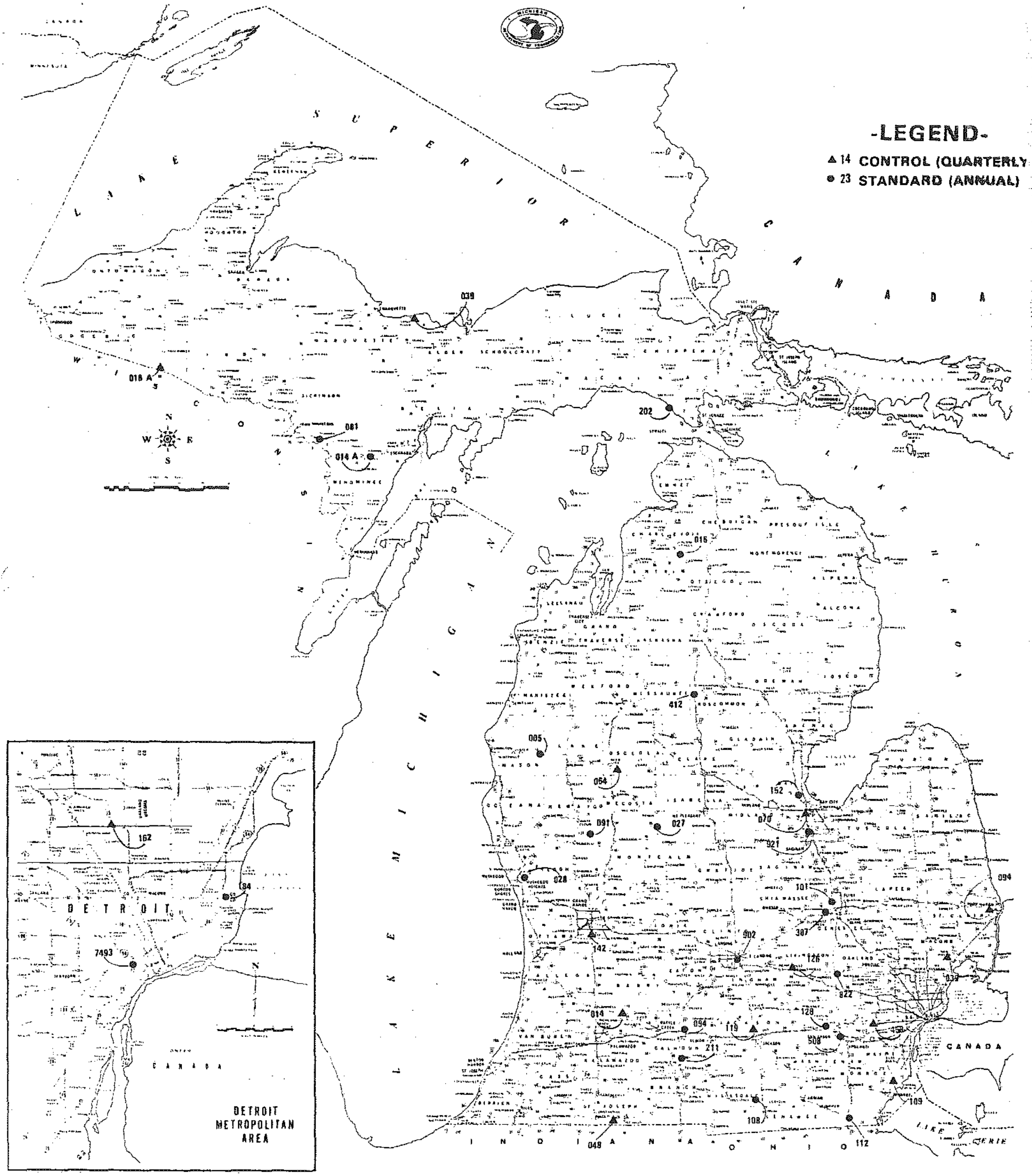


BAY CITY



55 M.P.H. SPEED MONITORING PROGRAM

Station Location Map



6/1/81

3. Highway Data

Mobile Automated Recording System (MARS)

MARS is a departmental program funded through a grant (70 percent) by the Office of Highway Safety Planning to provide an automated mobile surveying system needed to further implement the MIDAS model. The system will be used on Michigan's trunkline system as well as a number of local county, city, and village roads and streets. The road survey will be conducted in conjunction with the U.S. Geodetic Survey Monumentation project, using the monuments as reference points. The mobile survey vehicle (van) will use a laser to reference to the monuments from the vehicle, establsih the vehicles X, Y, and Z position and as the vehicle traverses the roadway it will record vertical alignment, horizontal alignment, superelevations, locations of intersections, grades, LORAN-C coordinates, etc. at speeds up to 55 mph. For the first time the department will have accurate systemwide data on roadway geometry. We shall also have the framework of a nonlinear line-node network tied to NGS survey coordinates for referencing all future data. The future expectations of this system is to make the survey information compatible with the department's computer graphics system, photolog system, and other referencing systems used by the department.

The expected timetable of events are as follows:

1. Expected arrival in Michigan - August, 1981.
2. Shakedown and presentation to public - August, 1981.
3. Conduct initial roadway survey - September, 1981 (The initial survey will include city, county, and state trunklines in Oakland and Washtenaw counties).
4. Contractor expected to complete the survey of 22,000 one-way miles - January, 1982.
5. Department expected to complete continuation survey of 18,000 miles - October 1982.

Photolog System

In 1972, the department initiated 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 Michigan Accident Location Index (MALI) System.

The system is located in the department's Traffic and Safety Division which includes three motion analyzer units for reviewing film. The sequential mode used in filming provides ready access to any given roadway area. The versatility of the photolog has proven effective in such areas as traffic investigations, roadway rehabilitation and redesign, environmental planning reviews, and litigation. For example, the need and extent to repair local roads used for trunkline detours can be estimated by filming before-and-after sequences. In litigation, enlargements of specific frames or the use of the motion analyzer in court provides readily available evidence as to the condition of a specific highway segment.

The department has realized a savings in manhours and dollars due to the availability of the system which can be used in lieu of on-site field investigations for certain activities. These savings are estimated at an average of 10,000 manhours and $100,000 per year.

Michigan Highways - Sufficiency Rating

In the past two decades, the Michigan Department of Transportation has conducted extensive research in such areas as highway classification, priority ratings, capacity ratings, and sufficiency ratings in an effort to develop an impartial and scientific method of scheduling highway improvements that will accomplish two things:

First, it should be able to measure the existing and future adequacy of all road sections on the state highway systems and rate each section according to measurable standards in order to determine which sections will require attention within a given time period.

Secondly, each individual road section should be given a rating index denoting its relative urgency which can be simply explained to the public, in general concept at least, in order to gain their understanding and support.

The method used by the Michigan Department of Transportation, at the present time, is a Sufficiency Rating.

Purpose of a Sufficiency Rating Study

One of the best methods available in measuring the adequacy of road sections is a Sufficiency Rating System. A completely adequate section of a highway rates 100. All road sections that have any deficiencies of any kind in their structural condition, effectiveness in serving traffic, or their safety are marked down from 100 according to specified formulae and procedures.

When the entire trunkline system has been rated, it is immediately evident which road sections should be given first priority for improvement. There is an indication, also, through the magnitude of the rating, of the degree of inadequacy on the specific road sections.

The Highway Sufficiency Rating Report is published biennially. This report graphically portrays the routes, indicates federal aid systems, the control sections, and the critical deficiencies. Interested groups and individuals, even though they have no familiarity with engineering, find that sufficiency ratings provide a readily understandable picture of the highway system. The information in the Sufficiency Rating Report provides management with a number of effective administrative tools to implement sound engineering decisions, justify logical programs, and expedite long-range planning.

Listed are some of the results that can be obtained from the Sufficiency Report:

- Statewide "Rating Sections" for comparative purposes by control sections, counties, districts, and systems.
- Strip maps of each individual route showing all pertinent data including type and location of deficiencies and sufficiency ratings.
- Tabulation of critically deficient "Rating Sections" by counties, districts, routes, or systems.
- Immediate comparative data for priority listings.
- Biennial comparison data for progress reports on elimination of deficiencies.
- Five-Year Program perpetuation on a biennial basis.
- Understandable justification of priorities and programming for public consumption.
- Measurable biennial trunkline status reports.

Procedure

Sufficiency Rating for sections of Michigan's highways are determined as follows:

- The length of each rating section of each highway is limited by one or more of the following:

  a. County lines
  b. Urban area limits of cities
  c. Limits of cities and incorporated villages
  d. Junctions with other state trunklines
  e. Changes in state or federal highway system or changes in control section designations
  f. Sections already scheduled or under construction

The length is further limited by marked changes in:

g. Physical factors such as:

   (1) Geometrics of design
   (2) Remaining surface life
   (3) Base
   (4) Safety factors
   (5) Surface deficiency
   (6) Drainage deficiency

h. Traffic volumes and types.
i. Overall homogeneity resulting from smaller uncompensating changes in combinations of the above.

- The length of each rating section is determined from maps, construction plans, control section log records, and from field measurements.

- One code sheet is made for each rating section. The code sheet contains:

  a. Terminal point identification and other information from maps, construction plans, and/or control section log records.
  b. An inventory of the section and check on office information from field observations.

- The code sheet is used to:

  a. Store office and field information about the section.
  b. Compute the sufficiency rating for the section from the stored information.
  c. Make detailed analyses of the deficiencies in the section.

- The sufficiency ratings are computed by the use of:

  a. Information on the code sheet.
  b. Tables derived from State and Federal Highway Standards.

4. RR-Xing Data

The Michigan Department of Transportation, Office of Transportation Safety and Tariffs 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 report. The inventory data is computerized to provide flexibility in use, analysis, and updating.

B. Process for Analyzing

1. Accident Experience

2. Accident Potential

Michigan Dimensional Accident Surveillance Model (MIDAS)

The department is continuing to develop the crash surveillance and analysis system known as the Michigan Dimensional Accident Surveillance model (MIDAS). The system being designed will ultimately provide a statistical analysis of abnormal crash patterns and an analysis of all feasible corrective treatments.

The goal of the department is to further develop and implement the MIDAS model which, in conjunction with the MALI index, will provide Michigan with a coordinated traffic record and analytic system.

The model is composed of three stages. The first stage involves a computerized data bank containing information such as laneage, alignment, lane and shoulder widths, auxiliary lanes, traffic controls, and land usage. It is possible to classify the information into discreet units, with each unit containing accident data for sites with nearly identical characteristics. The numerous variables are explained by four basic dimensions; geometry, environment, cross section, and accident characteristics. At the present time this stage of the model is operational within the constraints of existing accident data and program limitations.

The second stage of the computer model will calculate the cost-effectiveness of each potential accident countermeasure.

The third stage will involve objective optimization using mathematical optimizing processes.

During the development of the model, deficiencies have been discovered, for the most part involving a lack of needed data, insufficient precision of existing data, and/or file incompatibilities. Thus we requested and have received two Highway Safety Grants ($900,000 each over three years) for model improvements and advancement. A major component of the proposed projects consists of the integration of parallel data sources, such as the Secretary of State's driver and vehicle records, Weather Bureau information, and environmental data, with the existing data base for the MIDAS model. These types of data will allow the MIDAS model to relate the driver, the vehicle, and the roadway to available crash characteristics.

Because the modeling techniques are continuously being improved as we gain greater insight, MIDAS will be developed in a series of generations. MIDAS-I provides a histogram output which is a graphical representation of the accident frequency distribution. Exhibit III is a sample histogram output of the MIDAS-I model. The accident codes used in this sample include total accidents, right-angle, rear-end, left-turn, and wet surface accident rankings at 139 2-lane two-way signalized trunkline intersections. These histograms determine families based on like geometrics, traffic control, and ADT. Those intersections that are within a family norm are indicated by X's (inliers) to the right of the number of accidents that occurred. Intersections having more accidents than what has been determined as the upper confidence limit are indicated by 0's to the right of the number of accidents that occurred. These intersections are called outliers which are identified in English and reviewed for possible corrective treatment. These outliers are five standard deviations or more from their family means.

The need for reliable accident predictive algorithms necessitated the development of MIDAS-II. Roadway lengths were established with variable lengths while intersections were treated as dimensionless points and did not affect the definition of a segment or a point. A segment was created whenever there was a change in an independent variable and may encompass none to several intersections. Accidents coded as "intersection related" are assigned to the nearest intersection. All other accidents are assigned to the appropriate roadway segments.

The independent variables and their rank order for roadway segments are laneage, posted speed limit, lane width, and shoulder width. The independent variables and their rank order for intersections are laneage, signalization, posted speed limit, and number of auxiliary left-turn lanes.

Each cell was analyzed statistically and its mean, variance, and standard deviation of the sample determined. Cell outliers were determined by establishing a threshold value for each accident type. The threshold is the mean number of accidents plus five standard deviations as with MIDAS-I.

In building the accident predictive algorithms, the initial analysis of the data was by Automatic Interaction Detection (AID). AID is a multivariate procedure for determining the value of the dependent variable as a combination of independent variables. The program makes dichotomous splits in the independent variables on the basis of least squares, emphasizing the reduction in variance. The accident predictive algorithms for each accident type are being reviewed and placed in operation. All algorithms should be accessible by the end of July, 1981. Also with MIDAS-II a great deal of effort went into the making all software "user friendly."

STATEWIDE URBAN SIGNALIZED 1980 TOTAL ACCIDENTS

TOTAL ACCIDENTS

```
                  NUMBER OF LOCATIONS
             1         2         3         4         5         6
ACC*123456789012345678901234567890123456789012345678901234567890123
  0*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX  205
  1*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX   75
  2*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  3*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  4*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  5*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  6*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  7*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  8*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  9*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 10*XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 11*XXXXXXXXXXXXXXXXXXXXXXX
 12*000000000000000000000000000
 13*0000000000000000
 14*00000000000000000000000
 15*0000000000000000000
 16*0000000000000
 17*000000000000
 18*000000
 19*000000000000
 20*00000
 21*000000000
 22*0000000000
 23*000000000
 24*00000
 25*00000000
 26*00000000000000
 27*00000
 28*000000000
 29*000
 30*0000
 31*0000
 32*0000
 33*00000
 34*000
 35*0000
 36*00
 37*000
 38*0000
 39*00
 40*00
 41*000
 42*0000
 43*
 44*0
 45*0
 46*00
 47*
 48*0
 49*
 50*0
 51*
 52*0
 53*
 54*0
 55*
 56
```


Exhibit III

57*
58*
59*
60*
61*
62*
63*
64*
65*
66*0

ACCIDENT TYPE = 1
LOCATIONS = 938
AVE 24HR VOLUME= 45520
AVE ACCIDENTS = 8.762
UPPER LIMIT =11.722

HIGH HAZZARD LOCATIONS-- 259

CSECT	MP	ACC	ROUTE	XROAD/MIDBLOCK	LOCAL GOV'T	COUNTY
4032	0.16	18	US 23	AT THIRD AVE	ALPENA CITY	ALPENA
4032	0.69	16	US 23	AT NINTH AVE	ALPENA CITY	ALPENA
4032	0.86	12	US 23	AT ELEVENTH AVE	ALPENA CITY	ALPENA
8012	0.37	23	M37,M43	AT THORN STREET	HASTINGS CIT	BARRY CO.
9031	4.06	12	M-13	AT LAFAYETTE AVE	PORTSMOUTH	BAY COUNT
9042	82.11	17	M-15,I-75	URBAN MIDBLOCK IN	HAMPTON TWP	BAY COUNT
9042	82.97	22	M-84	URBAN MIDBLOCK IN	BAY CITY	BAY COUNT
9042	83.04	13	M-84	URBAN MIDBLOCK IN	BAY CITY	BAY COUNT
11011	3.75	13	US-12	AT WHITTAKER STREET	NEW BUFFALO	BERRIEN C
12021	17.70	15	US-12	AT HANCHETT STREET	COLDWATER CI	BRANCH CO
18031	0.34	16	US27BR/US10B	AT JCT US10BR/FIFTH S	CLARE CITY	CLARE
23091	6.42	15	M-99,M-50	AT KNIGHT/MILL	EATON RAPIDS	EATON
25101	9.89	23	M-57	AT MILL STREET	CLIO CITY	GENESEE C
27011	0.52	12	US-2 BR	AT LOWELL ST	IRONWOOD	GOGEBIC
27011	0.61	14	US-2 BR	AT SUFFOLK ST	IRONWOOD	GOGEBIC
30032	0.21	15	M-99	AT WEST ST	HILLSDALE	HILLSDALE
33062	1.16	12	M-143	AT CLEMENS	LANSING	INGHAM
33062	1.73	21	M-143	AT HOWARD	LANSING	INGHAM
34032	7.20	33	M-66	AT MAIN ST	IONIA CITY	IONIA CO.
37011	3.06	21	US-27BR	AT PRESTON RD	UNION TWP	ISABELLA
37012	1.01	21	US-27BR	AT PICKARD RD	MT PLEASANT	ISABELLA
38051	60.43	20	M-106	URBAN MIDBLOCK IN	JACKSON CTY	JACKSON C
38083	0.79	24	I-94BL	AT ALLEY	JACKSON CTY	JACKSON C
38083	1.03	25	I-94BL	AT ALLEY	JACKSON CTY	JACKSON C
38083	1.74	16	I-94BL	AT EAST AVE	JACKSON CTY	JACKSON C
39042	0.12	22	BL94,M96,M43	AT N.BD.US131BR	KLMZOO CITY	KLMZOO CO
39042	0.93	13	BL94,M96,M43	AT KING HIGHWAY	KLMZOO CITY	KLMZOO CO
39042	80.13	25	BL94,M96,M43	AT PARK STREET	KALAMAZOO CY	KLMZOO CO
39042	80.25	27	BL94,M96,M43	AT ROSE STREET	KALAMAZOO CY	KLMZOO CO
41013	0.57	20	I96-M44 CONN	URBAN MIDBLOCK IN	PLAINFIELD T	KENT CO
41014	0.45	13	US-131 BR	AT WESTON ST	GRAND RAPIDS	KENT CO
41014	0.74	13	US-131 BR	AT PEARL ST	GRAND RAPIDS	KENT CO
41062	0.18	22	M-11	AT IVANREST AVE	WALKER TWP	KENT CO
41062	1.16	31	M-11	AT BRYON CENTER AVE	WYOMING CITY	KENT CO
41062	2.15	42	M-11	AT BURLINGAME AVE	WYOMING CITY	KENT CO
41062	2.65	33	M-11	AT MICHAEL AVE	WYOMING CITY	KENT CO
41062	3.15	32	M-11	AT CLYDE PARKE AVE	WYOMING CITY	KENT CO
41062	3.89	38	M-11	AT BUCHANAN AVE	WYOMING CITY	KENT CO
41063	0.46	19	M-11	AT MADISON AVE	GRAND RAPIDS	KENT CO
41063	0.96	44	M-11	AT EASTERN AVE	GRAND RAPIDS	KENT CO
41063	1.93	35	M-11	AT KALAMAZOO AVE	GRAND RAPIDS	KENT CO
41063	2.93	38	M-11	AT BRETON AVE	GRAND RAPIDS	KENT CO
41063	3.75	34	M-11	AT WOODLAND DR	KENTWOOD CIT	KENT CO
41063	4.18	28	M-11	AT JCT M37/M44 BROADM	KENTWOOD CIT	KENT CO
41081	0.43	27	M-45	AT JCT M-11, WILSON A	WALKER TWP	KENT CO

41081	3.41	14	M-45	AT BRIDGE ST	GRAND RAPIDSKENT CO
47061	2.69	21	M-106	AT JCT M-155	HOWELL TWP LIVINGSTO
47121	0.06	19	M-155	AT SIBLEY ST	HOWELL LIVINGSTO
50011	3.02	17	M-53	AT ELEVEN MILE ROAD	WARREN CITY MACOMB CO
50011	3.56	26	M-53	AT FRANCINE STREET	WARREN CITY MACOMB CO
50011	4.62	46	M-53	URBAN MIDBLOCK IN	WARREN CITY MACOMB CO
50051	0.57	22	M-3	AT TOEPFER STREET	E. DETROIT CMACOMB CO
50051	1.12	27	M-3	AT ETHYLYN STREET	E. DETROIT CMACOMB CO
50051	1.70	24	M-3	AT OWEN STREET	E. DETROIT CMACOMB CO
50051	2.85	31	M-3	AT FRAZHO ROAD	ROSEVILLE C MACOMB CO
50051	3.11	13	M-3	URBAN MIDBLOCK IN	ROSEVILLE C MACOMB CO
50051	3.37	28	M-3	AT E.BD.M-6/11MILE RD	ROSEVILLE C MACOMB CO
50051	3.43	22	M-3	AT W.BD.M-6/11MILE RD	ROSEVILLE C MACOMB CO
50051	4.11	26	M-3	AT ELIZABETH STREET	ROSEVILLE C MACOMB CO
50051	4.58	31	M-3	AT TWELVE MILE ROAD	ROSEVILLE C MACOMB CO
50051	5.14	15	M-3	AT GLENN STREET	ROSEVILLE C MACOMB CO
50051	5.71	18	M-3	AT THIRTEEN MILE RD.	ROSEVILLE C MACOMB CO
50051	6.29	66	M-3	AT MASONIC STREET	ROSEVILLE C MACOMB CO
50051	6.85	16	M-3	AT FOURTEEN MILE RD.	CLINTON TWP.MACOMB CO
50051	11.12	19	M-3	URBAN MIDBLOCK IN	MT.CLEMENS CMACOMB CO
50051	11.47	15	M-3	URBAN MIDBLOCK IN	MT.CLEMENS CMACOMB CO
50051	60.36	26	M-3	AT HARRINGTON BLVD.	MT.CLEMENS CMACOMB CO
50051	60.95	12	M-3	AT ROBERTSON STREET	MT.CLEMENS CMACOMB CO
50051	61.21	17	M-3	AT CHURCH STREET	MT.CLEMENS CMACOMB CO
50051	61.44	37	M-3	AT CASS/CROCKER/STS.	MT.CLEMENS CMACOMB CO
50051	61.65	19	M-3	AT MARKET STREET	MT.CLEMENS CMACOMB CO
52044	1.55	34	US-41BR	URBAN MIDBLOCK IN	MARQUETTE CIMARQUETTE
54012	0.25	19	US-131 M-20	AT PERRY AVE	BIG RAPIDS CMECOSTA C
54012	0.99	18	US-131 M-20	AT MILL ST	BIG RAPIDS CMECOSTA C
54012	1.71	14	US-131 M-20	AT PERE MARQUETTE/BAL	BIG RAPIDS CMECOSTA C
54022	0.10	16	M-20	AT MICHIGAN ST	BIG RAPIDS CMECOSTA C
59021	2.96	13	M-57	AT LAFAYETTE ST	GREENVILLE CMONTCALM
59032	0.08	15	M-91	AT CASS ST	GREENVILLE CMONTCALM
61022	1.23	28	M-46	URBAN MIDBLOCK IN	MUSKEGON CITMUSKEGON
61022	1.98	14	M-46	URBAN MIDBLOCK IN	MUSKEGON CITMUSKEGON
61023	0.08	35	M-46	AT SHONAT ST	MUSKEGON TWPMUSKEGON
61023	0.46	25	M-46	AT QUARTERLINE RD	MUSKEGON TWPMUSKEGON
61073	1.77	12	US-31BR	AT MEARS ST	WHITEHALL CIMUSKEGON
61153	0.57	19	US-31BR,M-46	AT TERRACE ST	MUSKEGON CITMUSKEGON
61153	0.76	12	US-31BR,M-46	AT SPRING ST	MUSKEGON CITMUSKEGON
61153	60.57	26	US-31BR,M-46	AT TERRACE ST	MUSKEGON CITMUSKEGON
63041	19.34	38	M-59	AT US-10/TELEGRAPH RD	PONTIAC CITYOAKLAND C
63041	20.75	25	M-59	AT STATE/WILLIAMS STS	PONTIAC CITYOAKLAND C
63041	20.83	30	M-59	AT I-75BL/CASS AVENUE	PONTIAC CITYOAKLAND C
63043	0.34	22	M-59	AT PADDOCK STREET	PONTIAC CITYOAKLAND C
63043	80.33	17	M-59	URBAN MIDBLOCK IN	PONTIAC CITYOAKLAND C
63051	5.96	30	M-1/WOODWARD	AT SHEFFIELD DRIVE	BIRMINGHAM COAKLAND C
63051	6.54	23	M-1/WOODWARD	AT NORMANDY/HUNT ROAD	ROYAL OAK CYOAKLAND C
63051	7.13	50	M-1/WOODWARD	AT THIRTEEN MILE RD.	ROYAL OAK CYOAKLAND C
63051	7.24	17	M-1/WOODWARD	AT COOLIDGE HIGHWAY	ROYAL OAK CYOAKLAND C
63051	7.76	12	M-1/WOODWARD	AT BURNHAM ROAD	ROYAL OAK CYOAKLAND C
63051	8.34	42	M-1/WOODWARD	AT NORTHWOOD BLVD.	BERKLEY/R.O.OAKLAND C
63051	9.61	29	M-1/WOODWARD	AT ELEVEN MILE ROAD	HUNT.W/R.O. OAKLAND C
63051	10.45	14	M-1/WOODWARD	AT HUNTINGTON AVE.	ROYAL OAK C OAKLAND C
63091	0.32	14	I-75 BL	AT HOWARD STREET	PONTIAC CITYOAKLAND C
63112	6.64	15	M-24/I-75 BL	AT GLANWORTH STREET	ORION TWP. OAKLAND C
63131	0.24	46	M-150	AT BIG BEAVER/16 MILE	PONTIAC CITYOAKLAND C
63132	2.97	19	M-150	AT THIRD STREET	ROCHESTER CYOAKLAND C
63132	3.15	24	M-150	AT 5 TH/UNIVERSITY ST	ROCHESTER CYOAKLAND C
63151	1.60	14	I-75 BL/US-1	AT WILSON STREET	PONTIAC CITYOAKLAND C
63151	1.96	12	I-75 BL/US-1	AT RAPID STREET W.	PONTIAC CITYOAKLAND C
63201	0.38	14	US-10BR/M-59	AT EBD. AUBURN STREET	PONTIAC CITYOAKLAND C
63201	0.59	14	US-10BR/M-59	AT PIKE STREET	PONTIAC CITYOAKLAND C
63201	1.12	35	US-10BR/M-59	AT N. SAGINAW STREET	PONTIAC CITYOAKLAND C
63201	1.22	13	US-10BR/M-59	AT OAKLAND AVENUE	PONTIAC CITYOAKLAND C
[illegible]201	1[illegible]	[illegible]	[illegible]10B[illegible]9	A[illegible]INTO [illegible]REET	PON[illegible] CIT[illegible]LAND

Exhibit IV is a sample output of MIDAS-II which provides an analysis of nonfreeway trunkline intersections and/or variable length highway segments. Accident data from 1974 thru 1979 is presently available. The intent of the outputs is to serve as a stand alone report which includes a summary of accidents by intersection approach; a one line printout of each specific accident; accident distribution by hour of the day (with volume distribution), by day of week, by month, and by year (using multiyear analysis). The reports in some cases can be used in lieu of a collision diagram. This information is useful for in-depth accident investigations, responses to public inquiries, and task group type investigations. The model also provides before-and-after accident information which is helpful in the evaluation of safety improvements (see Exhibit V).

MIDAS-I was built totally with the resources of the Michigan Department of Transportation, with a total investment of approximately 5,000 manhours. MIDAS-II was built by using Michigan Department of Transportation personnel funded by an Office of Highway Safety Planning safety grant, total cost of approximately $100,000.

MIDAS-III will be our first attempts at integrating and modeling data on the driver and vehicle and is already far along in its development. The initial step in this process is the establishment of a monument grid system which is being contracted where the use of a Spanmark inertial surveying system will provide the horizontal control. The next step is alignment and roadway feature survey for over 49,000 miles of roadway (every hardsurfaced road in the state). A mobile survey vehicle is being constructed and implemented by contractor to perform this task. (See the discussion on MARS, Area I, Paragraph A of the safety improvement process). It is expected that a meaningful relationship between highway accident and geometry can be developed. With the additional information on driver characteristics and vehicular properties that is presently being obtained from existing sources, it is believed that MIDAS-III can be a very comprehensive and powerful analytical tool. Refer to Exhibit VI for an organization chart of the agencies involved in this endeavor.

MIDAS-IV is scheduled for completion in 1982 and will have more precise data on highway geometry and more advanced mathematical algorithms for alternative analysis and optimization of objectives.

C. Process for Conducting Engineering Studies

1. Traffic Operations Program to Increase Capacity and Safety (TOPICS)

TOPICS - type actions are traffic engineering and operational improvements which are designed to reduce accidents, traffic

INTERSECTION PROFILE

DIST 9 CS 82053 MP 7.93 (MALI), 7.93 (PHOTOLOG) US-24 AT MCNICHOLS/6 MILE DETROIT CITY WAYNE 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 PHLG MP	INFLUENCE ZONE LENGTH	
NORTH BOUND	45	31,050				NO	NONE	9	82053	7.89- 7.93	0.04MI	210FT
SOUTH BOUND	45	31,050				NO	NONE	9	82053	7.93- 7.97	0.04MI	210FT
EAST BOUND						NO	NONE	9	82053			
WEST BOUND						NO	NONE	9	82053			

INTERSECTION ACCIDENTS: 1- 1-77 THRU 12-31-79 (3.00 YEARS)

APPROACH DIRECTION	INJ ACC	FAT. ACC	TOTL ACC	HEAD ON	SS PASS	SS MEET	ANGL	LEFT TURN	RIGHT TURN	REAR END	BACK UP	PARK	OTHER	PERCENT WET	PERCENT ICY	PERCENT DARK	ACC PER MILLION VEHICLES
				NUMBER OF ACCIDENTS BY TYPE													
NORTH BOUND	41	0	79	0	6	0	18	4	1	43	0	2	5	35.4	5.1	45.6	2.32
SOUTH BOUND	11	0	55	0	6	0	8	2	0	27	0	1	11	30.9	10.9	60.0	1.62
EAST BOUND	8	0	24	1	1	1	5	1	1	6	0	1	7	20.8	12.5	58.3	0.00
WEST BOUND	6	0	23	0	1	0	13	0	0	7	0	0	2	26.1	4.3	65.2	0.00
OTHER	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.00
3.00 YEAR TOTAL	66	0	181	1	14	1	44	7	2	83	0	4	25	30.9	7.7	54.1	
AVERAGE PER YEAR	22.0	0.0	60.3	0.3	4.7	0.3	14.7	2.3	0.7	27.7	0.0	1.3	8.3				
PERCENT OF TOTAL	36.5	0.0	100.0	0.6	7.7	0.6	24.3	3.9	1.1	45.9	0.0	2.2	13.8				
EXPECTED ACC.	5.9						5.1			9.4		0.8					
DIFF IN ACCIDNT	16.1						9.6			18.3		0.5					

Exhibit IV

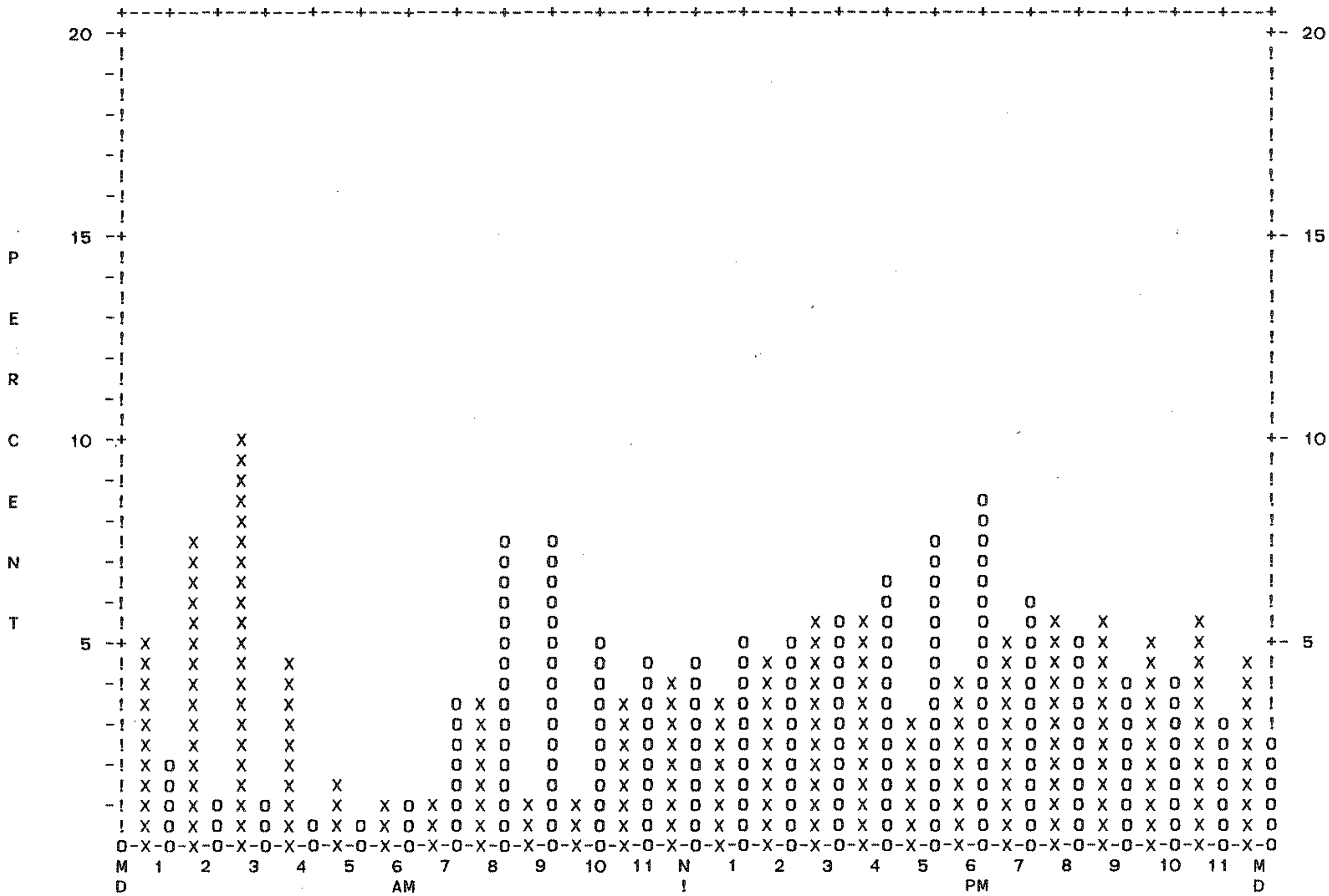
?????

MICHIGAN DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION

INTERSECTION PROFILE-HISTOGRAM

DIST CS 82053 MP 7.93 (MALI) 7.93 (PHOTOLOG) US-24 AT MCNICHOLS/6 MILE DETROIT CITY WAYNE COUNTY

DISTRIBUTION BY HOUR OF DAY



X = ACCIDENT DISTRIBUTION (JANUARY 1, 1977 THRU DECEMBER 31, 1979)
O = VOLUME DISTRIBUTION

?????

INTERSECTION PROFILE-HISTOGRAM

DIST CS 82053 MP 7.93 (MALI) 7.93 (PHOTOLOG) US-24 AT MCNICHOLS/6 MILE DETROIT CITY WAYNE COUNTY

DISTRIBUTION BY DAY OF WEEK

```
        +----------------------------------------------------------------------+
    20 -+ *XXX                                                                   +- 20
        ! 1XXX                                                                   !
       -!  XXX                                                               XXX !
        !  XXX                                                               XXX !
       -!  XXX                                                               XXX !
        !  XXX                                                               XXX !
       -!  XXX                                                               XXX !
        !  XXX                                                               XXX !
       -!  XXX                                                               XXX !
        !  XXX                                                               XXX !
    15 -+  XXX                                                               XXX +- 15
P       !  XXX                                                               XXX !
       -!  XXX                 XXX                                XXX        XXX !
        !  XXX                 XXX                                XXX        XXX !
E      -!  XXX                 XXX                                XXX        XXX !
        !  XXX                 XXX                                XXX        XXX !
       -!  XXX                 XXX                     XXX        XXX        XXX !
        !  XXX                 XXX                     XXX        XXX        XXX !
R      -!  XXX       XXX       XXX                     XXX        XXX        XXX !
        !  XXX       XXX       XXX                     XXX        XXX        XXX !
C   10 -+  XXX       XXX       XXX         XXX         XXX        XXX        XXX +- 10
        !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
       -!  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
E       !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
       -!  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
        !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
N      -!  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
        !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
       -!  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
T       !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
     5 -+  XXX       XXX       XXX         XXX         XXX        XXX        XXX +- 5
        !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
       -!  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
        !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
       -!  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
        !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
       -!  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
        !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
       -!  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
        !  XXX       XXX       XXX         XXX         XXX        XXX        XXX !
        +--XXX-------XXX-------XXX---------XXX---------XXX--------XXX--------XXX-+
          SUNDAY    MONDAY    TUESDAY   WEDNESDAY    THURSDAY    FRIDAY    SATURDAY
```

X = ACCIDENT DISTRIBUTION (JANUARY 1, 1977 THRU DECEMBER 31, 1979)

*1 : ACTUAL PERCENT IS 20

?????

I N T E R S E C T I O N   P R O F I L E - H I S T O G R A M

DIST CS 82053 MP 7.93 (MALI) 7.93 (PHOTOLOG) US-24 AT MCNICHOLS/6 MILE DETROIT CITY WAYNE COUNTY

DISTRIBUTION BY MONTH OF ALL YEARS

```
       +---------------------------------------------------------------------------+
   40 -+                                                                           +- 40
       !                                                                           !
      -!                                                                           !
       !                                                                           !
      -!                                                                           !
       !                                                                           !
      -!                                                                           !
       !                                                                           !
A     -!                                                                           !
       !                                                                           !
   30 -+                                                                           +- 30
C      !                                                                           !
      -!                                                                           !
       !                                                                           !
C     -!                                                                           !
       !                                                                           !
      -!                                                                           !
I      !                                                                           !
      -!                                                                           !
       !                                                                           !
D  20 -+                     XXX                                            XXX    +- 20
       !                     XXX                                            XXX    !
      -!   XXX               XXX   XXX                           XXX        XXX    !
E      !   XXX               XXX   XXX                     XXX   XXX        XXX    !
      -!   XXX   XXX         XXX   XXX               XXX   XXX   XXX        XXX    !
       !   XXX   XXX         XXX   XXX               XXX   XXX   XXX        XXX    !
N     -!   XXX   XXX         XXX   XXX               XXX   XXX   XXX        XXX    !
       !   XXX   XXX         XXX   XXX               XXX   XXX   XXX   XXX  XXX    !
      -!   XXX   XXX         XXX   XXX               XXX   XXX   XXX   XXX  XXX    !
T      !   XXX   XXX         XXX   XXX               XXX   XXX   XXX   XXX  XXX    !
   10 -+   XXX   XXX         XXX   XXX               XXX   XXX   XXX   XXX  XXX    +- 10
       !   XXX   XXX         XXX   XXX   XXX         XXX   XXX   XXX   XXX  XXX    !
S     -!   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX  XXX    !
       !   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX  XXX    !
      -!   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX  XXX    !
       !   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX  XXX    !
      -!   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX  XXX    !
       !   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX  XXX    !
      -!   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX  XXX    !
       !   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX   XXX  XXX    !
       +---XXX---XXX---XXX---XXX---XXX---XXX---XXX---XXX---XXX---XXX---XXX--XXX----+
       !   JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV  DEC    !
```

X = ACCIDENT DISTRIBUTION (JANUARY 1, 1977 THRU DECEMBER 31, 1979)

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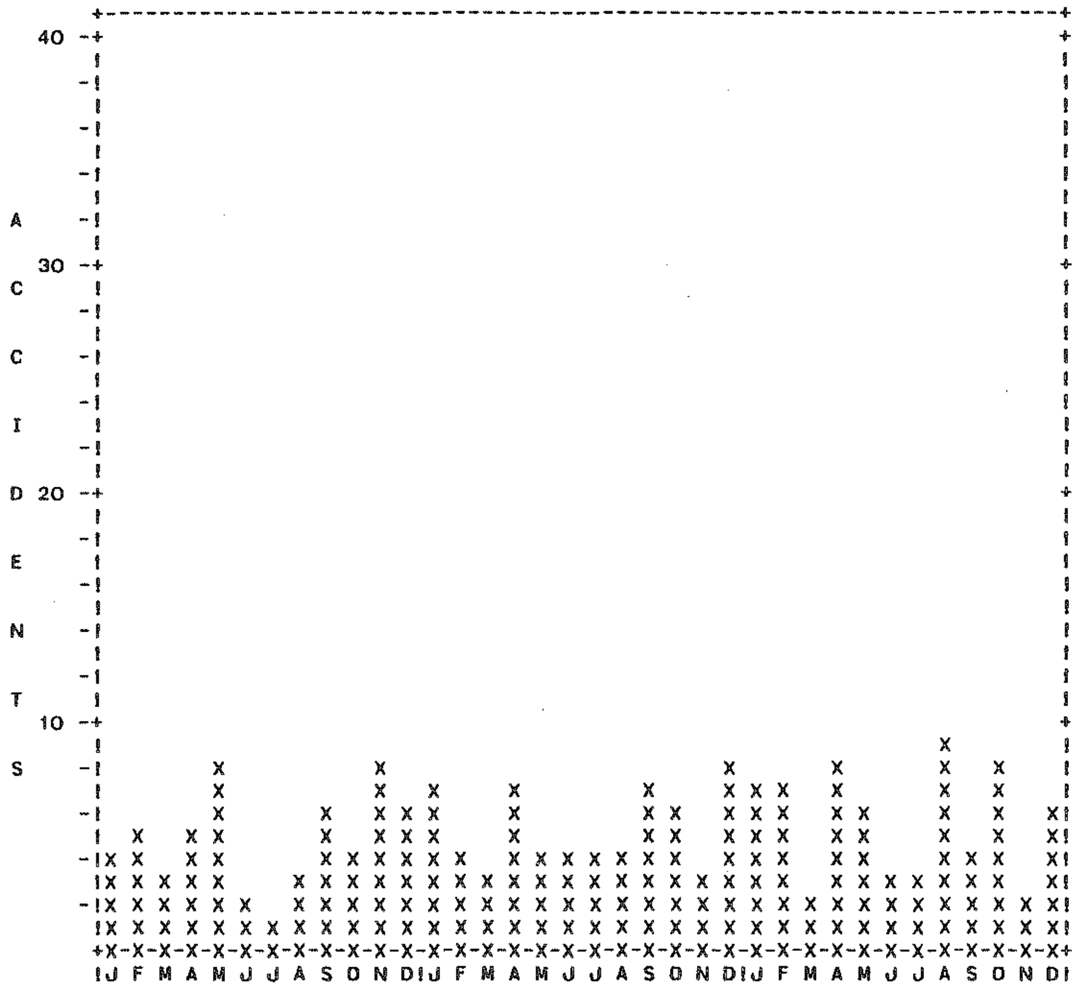
MICHIGAN DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION

08/18/81 MICHIGAN DIMENSIONALIZED ACCIDENT SURVEILANCE SYSTEM (MIDAS)

INTERSECTION PROFILE-HISTOGRAM

DIST . CS 82053 MP 7.93 (MALI) 7.93 (PHOTOLOG) US-24 AT MCNICHOLS/6 MILE DETROIT CITY WAYNE COUNTY

DISTRIBUTION BY MONTH



X = ACCIDENT DISTRIBUTION (JANUARY 1, 1977 THRU DECEMBER 31, 1979)

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INTERSECTION PROFILE-HISTOGRAM

DIST CS 82053 MP 7.93 (MALI) 7.93 (PHOTOLOG) US-24 AT MCNICHOLS/6 MILE DETROIT CITY WAYNE COUNTY

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              DISTRIBUTION BY YEAR
          +----------------------+
     80 -+                      +- 80
          !                      !
         -!                      !
          !                      !
         -!                      !
          !                      !
         -!                      !
          !               XX     !
 A       -!               XX     !
          !        XX     XX     !
     60 -+        XX     XX     +- 60
 C        !        XX     XX     !
         -!  XX    XX     XX     !
          !  XX    XX     XX     !
 C       -!  XX    XX     XX     !
          !  XX    XX     XX     !
         -!  XX    XX     XX     !
 I        !  XX    XX     XX     !
         -!  XX    XX     XX     !
          !  XX    XX     XX     !
 D   40 -+  XX    XX     XX     +- 40
          !  XX    XX     XX     !
         -!  XX    XX     XX     !
 E        !  XX    XX     XX     !
         -!  XX    XX     XX     !
          !  XX    XX     XX     !
 N       -!  XX    XX     XX     !
          !  XX    XX     XX     !
         -!  XX    XX     XX     !
 T        !  XX    XX     XX     !
     20 -+  XX    XX     XX     +- 20
          !  XX    XX     XX     !
 S       -!  XX    XX     XX     !
          !  XX    XX     XX     !
         -!  XX    XX     XX     !
          !  XX    XX     XX     !
         -!  XX    XX     XX     !
          !  XX    XX     XX     !
         -!  XX    XX     XX     !
          !  XX    XX     XX     !
          *--XX--**--XX--**--XX--*
          * 1977 ** 1978 ** 1979 *
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X = ACCIDENT DISTRIBUTION (JANUARY 1, 1977 THRU DECEMBER 31, 1979)

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 : SIGNALIZED

LOCATION : US-24 AT MCNICHOLS/6 MILE DETROIT CITY , WAYNE COUNTY

DISTRICT 9 CONTROL SECTION 82053 MILEPOINT 7.93

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 INJURY CLASS F	A	B	C	O	PRP DMG	DATE OF ACCIDENT	ACCDNT REPORT NUMBER
													NORTHBOUND APPROACH								
100	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	GO STR	REAR	NONE	RAIN	WET	DK-SL		0	0	1	1	1		FRI 5/12/78 MIDN	805112
75	2-VEH ANGLE	E	L-TURN	FRNT-R	F YLD	N	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	MON 8/20/79 2PM	918793
100	2-VEH SSW-P	N	CHNG L	FRNT-R	WR LN	N	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	TUE 10/18/77 4PM	924422
100	2-VEH SSW-P	S	GO STR	FRNT-L	WR LN	S	GO STR	FRNT-R	NONE	RAIN	WET	DK-SL		0	0	0	0	2	X	MON 1/ 1/79 10PM	900027
100	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	GO STR	REAR	NONE	SNOW	ICY	DAY	1/SKID	0	0	0	0	2	X	TUE 1/24/78 3PM	903407
100	2-VEH R-END	S	GO STR	FRONT	NONE	S	STOPPD	REAR	NONE	CLEAR	WET	DARK		0	0	0	0	3	X	TUE 1/23/79 NOON	902686
90	2-VEH R-END	N	GO STR	FRONT	FAST	N	GO STR	REAR	NONE	CLEAR	WET	DAY		0	0	0	0	9	X	SUN 1/30/77 10AM	903132
90	1-VEH FX OB	S	GO STR	FRONT	CLOSE		P POLE			CLEAR	DRY	DAY	1/RECK	0	0	1	0	0		WED 8/29/79 2PM	810345
70	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	CHNG L	REAR	NONE	SNOW	ICY	DK-SL		0	0	0	0	9	X	FRI 1/13/78 10PM	902081
100	2-VEH R-END	S	AV VEH	FRNT-R	FAST	S	GO STR	FRONT	NONE	CLEAR	ICY	DAY		0	0	0	1	1		TUE 2/13/79 3PM	801809
100	3-VEH R-END	N	GO STR	REAR	CLOSE	N	STOPPD	FRONT	NONE	RAIN	WET	DAY		0	0	0	3	3		FRI 5/ 5/78 2PM	804892
75	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	GO STR	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	1	1		SUN 12/30/79 2AM	502219
100	3-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE	RAIN	WET	DAY		0	0	1	1	2		TUE 4/ 4/78 4PM	803707
85	3-VEH OTHER	S	STRTNG	SIDE-L	CLOSE	S	GO STR	FRNT-R	NONE	CLEAR	WET	DAY	1/RECK	0	0	0	0	5	X	SUN 12/23/79 NOON	927445
100	2-VEH ANGLE	E	L-TURN	REAR-R	F YLD	N	GO STR	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	6	X	MON 2/ 7/77 8AM	904095
100	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	GO STR	REAR	NONE	CLEAR	DRY	DAY		0	0	0	1	2		FRI 8/25/78 7PM	810171
70	3-VEH R-END	N	GO STR	FRONT	FAST	N	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	TUE 10/ 4/77 3PM	922887
100	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	1	0	1		SAT 10/21/78 2AM	812601
100	2-VEH PRKNG	S	R-TURN	REAR	TURN	S	GO STR	FRNT-R	NONE	RAIN	WET	DAY	1/OB V	0	0	0	1	5		SUN 8/21/77 6PM	811146
100	2-VEH L-TRN	S	CHNG L	FRNT-L	CLOSE	S	L-TURN	REAR-R	UNKN	CLEAR	DRY	DAY		0	0	0	1	1		THU 4/20/78 MIDN	804220
100	2-VEH R-END	N	GO STR	FRONT	FAST	N	STOPPD	REAR	NONE	RAIN	WET	DARK		0	0	0	3	0		SUN 8/21/77 9PM	811142
100	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	GO STR	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	SAT 7/22/78 NOON	918388
20	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE	CLEAR	WET	DAY		0	0	0	1	1		MON 1/15/79 1PM	800801
30	2-VEH R-END	N	GO STR	FRONT	FAST	N	STOPPD	REAR	NONE	CLEAR	WET	DAY		0	0	0	1	1		MON 5/ 2/77 8AM	805734
30	2-VEH SSW-P	N	CHNG L	FRNT-R	WR LN	N	GO STR	FRNT-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	2	X	SUN 10/14/79 9PM	603300
15	2-VEH R-END	N	CHNG L	FRONT	CLOSE	N	STOPPD	REAR-L	NONE	CLEAR	DRY	DK-SL		0	0	0	2	1		TUE 2/28/78 8PM	802269
50	2-VEH R-END	N	GO STR	SIDE-L	CLOSE	N	GO STR	REAR-R	NONE	CLEAR	DRY	DARK		0	0	1	0	2		FRI 8/24/79 8PM	810107
55	2-VEH R-END	S	GO STR	FRONT	FAST	S	GO STR	REAR	F YLD	CLEAR	WET	DK-SL		0	0	0	1	1		SAT 3/24/79 10PM	803300
50	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE	CLEAR	DRY	DAY	1/OB V	0	0	0	1	3		FRI 12/15/78 11AM	815154
15	2-VEH ANGLE	N	GO STR	FRONT	F YLD	E	GO STR	SIDE-R	NONE	CLEAR	DRY	DARK		0	0	0	2	3		SUN 4/15/79 8PM	804275
25	2-VEH R-END	N	GO STR	FRONT	FAST	N	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	1	0	1		SAT 9/ 3/77 4AM	811753
10	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	1	0	2		SAT 5/19/79 2AM	805831
20	2-VEH R-END	N	GO STR	FRONT	UNKN	N	STOPPD	REAR	NONE	RAIN	WET	DK-SL		0	0	0	0	5	X	MON 1/ 1/79 1AM	900041
20	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	0	3	1		FRI 5/20/77 3PM	806549
50	2-VEH R-END	N	AV VEH	FRNT-R	CLOSE	N	STOPPD	SIDE-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	2	X	THU 9/27/79 9PM	920757
20	3-VEH R-END	N	GO STR	FRNT-R	NONE	N	AV VEH	REAR	NONE	RAIN	WET	DAY	1/SKID	0	0	1	3	2		THU 9/21/78 7PM	501498
0	2-VEH ANGLE	N	GO STR	FRNT-R	F YLD	W	GO STR	FRNT-L	NONE	CLEAR	WET	DK-SL		0	0	0	0	4	X	MON 12/25/78 MIDN	930431
0	2-VEH R-END	N	R-TURN	FRNT-R	NONE	N	STOPPD	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	SUN 8/12/79 NOON	919372
0	2-VEH L-TRN	N	L-TURN	REAR-L	NONE	N	L-TURN	FRNT-R	NONE	CLEAR	DRY	DARK		0	0	0	0	4	X	WED 8/ 1/79 2AM	917022
0	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	GO STR	REAR	NONE	RAIN	WET	DAY		0	0	1	0	2		WED 4/25/79 5PM	804735

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 : SIGNALIZED

LOCATION : US-24 AT MCNICHOLS/6 MILE DETROIT CITY , WAYNE COUNTY

DISTRICT 9 CONTROL SECTION 82053 MILEPOINT 7.93

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 INJURY CLASS F	A	B	C	O	PRP DMG	DATE OF ACCIDENT			ACCDNT REPORT NUMBER
0	2-VEH R-END	N	CHNG L	FRNT-L	WR LN	N	GO STR	SIDE-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	4	X	SUN	8/ 5/79	9PM	917345
0	2-VEH ANGLE	N	GO STR	REAR-L	F YLD	E	GO STR	FRONT	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	SAT	9/ 2/78	7AM	921276
0	2-VEH SSW-P	N	AV VEH	FRNT-R	CLOSE	N	GO STR	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	1	1	1		TUE	11/20/79	3PM	813643
0	2-VEH SSW-P	N	AV VEH	FRNT-R	WR LN	N	GO STR	FRNT-L	NONE	SNOW	WET	DK-SL		0	0	0	0	2	X	FRI	2/10/78	7AM	916246
0	2-VEH ANGLE	N	GO STR	FRNT-L	F YLD	E	GO STR	SIDE-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	2	X	THU	6/ 2/77	1AM	912988
0	4-VEH R-END	N	AV VEH	SIDE-R	CLOSE	N	GO STR	SIDE-R	NONE	CLEAR	DRY	DAY	1/SKID	0	1	2	6	5		SAT	2/10/79	9AM	801723
0	2-VEH SSW-P	N	GO STR	REAR-R	WR LN	N	GO STR	SIDE-L	NONE	RAIN	WET	DK-SL		0	0	0	0	3	X	FRI	7/21/78	10PM	918358
0	2-VEH R-END	N	GO STR	FRONT	NONE	N	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	2	1		WED	4/11/79	7PM	804105
0	2-VEH ANGLE	N	GO STR	FRONT	WR LN	E	GO STR	SIDE-R	NONE	RAIN	WET	DK-SL		0	0	0	4	1		MON	1/ 1/79	1AM	800027
0	2-VEH ANGLE	N	GO STR	FRONT	F YLD	W	GO STR	FRONT	NONE	CLEAR	WET	DARK		0	0	0	0	2	X	TUE	4/19/77	8PM	601435
0	2-VEH L-TRN	N	L-TURN	FRONT	WR LN	N	GO STR	REAR	NONE	CLEAR	DRY	DUSK		0	0	0	1	2		SAT	8/20/77	8PM	811238
0	2-VEH R-END	N	PASSNG	FRNT-R	WR LN	N	STOPPD	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	SUN	6/17/79	2PM	602034
0	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	2	1	0		WED	12/27/78	1PM	815662
0	2-VEH ANGLE	N	GO STR	FRONT	F YLD	W	GO STR	SIDE-L	NONE	CLEAR	WET	DK-SL		0	0	0	1	1		SUN	6/17/79	11PM	500976
0	2-VEH R-END	N	GO STR	FRONT	FAST	N	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL	1/DUIL	0	0	0	1	2		SUN	9/ 4/77	5AM	811949
0	2-VEH ANGLE	N	GO STR	REAR-R	F YLD	W	GO STR	FRNT-R	NONE	CLEAR	DRY	DK-SL	1/DF E	0	0	0	0	5	X	WED	5/ 9/79	MIDN	911046
0	2-VEH ANGLE	N	GO STR	FRNT-L	F YLD	E	GO STR	FRNT-R	NONE	CLEAR	DRY	DAY		0	0	1	0	1		MON	3/ 7/77	10AM	803041
0	1-VEH FX OB	N	GO STR	REAR	FAST		SIGN			RAIN	WET	DAY		0	0	0	0	1	X	WED	4/11/79	3PM	909012
0	2-VEH ANGLE	N	GO STR	FRNT-R	F YLD	W	GO STR	FRNT-L	NONE	CLEAR	WET	DAY		0	0	1	0	1		THU	12/ 1/77	9AM	816140
0	3-VEH ANGLE	N	GO STR	FRONT	WR LN	E	GO STR	SIDE-R	NONE	CLEAR	WET	DK-SL		0	0	1	1	3		TUE	10/16/79	6PM	812340
0	2-VEH R-TRN	N	R-TURN	SIDE-R	TURN	N	GO STR	FRNT-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	WED	2/16/77	MIDN	904801
0	2-VEH R-END	N	GO STR	FRONT	FAST	N	R-TURN	REAR	NONE	CLEAR	DRY	DAY		0	0	0	1	2		THU	2/10/77	1PM	801981
0	3-VEH R-END	N	STOPPD	REAR	NONE	N	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	0	1	2		THU	2/24/77	3PM	802520
0	2-VEH L-TRN	N	GO STR	FRONT	FAST	N	L-TURN	REAR-L	NONE	SNOW	ICY	DAY		0	0	0	1	2		SUN	11/27/77	2PM	816092
0	2-VEH OTHER	N	L-TURN	FRNT-R	F YLD	W	GO STR	FRNT-L	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	TUE	3/14/78	2PM	908219
0	2-VEH R-END	N	GO STR	REAR-L	WR LN	N	CHNG L	FRNT-R	NONE	FOG	DRY	DARK		0	0	0	0	2	X	SUN	1/ 9/77	3AM	900822
0	2-VEH PRKNG	N	STRTNG	FRNT-R	F YLD	E	GO STR	REAR-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	2	X	SUN	11/20/77	10PM	603641
0	2-VEH ANGLE	N	R-TURN	FRNT-L	TURN	W	STOPPD	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	TUE	9/ 5/78	6PM	921522
0	2-VEH ANGLE	N	R-TURN	FRNT-L	F YLD	E	GO STR	FRNT-R	NONE	CLEAR		DAY		0	0	0	0	2	X	SUN	6/ 5/77	11AM	913201
0	2-VEH R-END	N	GO STR	FRNT-L	CLOSE	W	STOPPD	REAR-R	NONE	CLEAR	WET	DAY		0	0	0	0	4	X	THU	2/ 9/78	11AM	905458
0	2-VEH R-END	N	GO STR	FRONT	BCKNG	N	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	THU	8/17/78	7AM	602621
0	2-VEH ANGLE	N	GO STR	FRONT	CLOSE	E	GO STR	SIDE-R	NONE	CLEAR	DRY	DK-SL		0	0	0	2	1		SAT	9/30/78	7PM	811621
0	1-VEH BIKE	E	STOPPD	REAR-R	NONE					CLEAR	DRY	DK-SL		0	0	0	0	5	X	TUE	2/15/77	7PM	904742
0	3-VEH R-END	N	STOPPD	SIDE-R	NONE	E	STOPPD	FRONT	NONE	FOG	WET	DK-SL		0	0	1	0	4		TUE	5/31/77	9PM	807124
0	5-VEH R-END	N	GO STR	FRONT	F YLD	N	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	1	1	6		FRI	4/ 7/78	9PM	805038
0	2-VEH ANGLE	N	GO STR	REAR-R	F YLD	S	GO STR	FRONT	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	THU	6/22/78	2PM	916954
0	2-VEH ANGLE	N	GO STR	SIDE-L	F YLD	E	GO STR	FRONT	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	TUE	5/ 9/78	3PM	912583
0	3-VEH R-END	N	GO STR	FRONT	FAST	N	STOPPD	REAR	NONE	RAIN	WET	DK-SL		0	0	1	0	3		THU	11/17/77	10PM	815441
0	2-VEH R-END	N	GO STR	FRONT	BCKNG	N	STOPPD	REAR	NONE	RAIN	WET	DAY		0	0	0	0	2	X	SAT	10/ 8/77	10AM	923148

SOUTHBOUND APPROACH

DIST FROM ISCN	ACCIDENT TYPE	DR	INTENT	IMPACT	HAZRD ACT'N	DR	INTENT	IMPACT	HAZRD ACT'N	WEATH	SRF CND	LIGHT	VEH/ CIRCUM	F	A	B	C	O	PRP DMG		DATE		REPORT NUMBER
50	1-VEH FX OB	S	GO STR	FRNT-R	FAST		SIGN			CLEAR	ICY	DK-SL	1/SKID	0	0	0	0	2	X	SAT	1/ 1/77	1AM	900011

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

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 : SIGNALIZED

LOCATION : US-24 AT MCNICHOLS/6 MILE DETROIT CITY , WAYNE COUNTY

DISTRICT 9 CONTROL SECTION 82053 MILEPOINT 7.93

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 INJURY CLASS F	A	B	C	O	PRP DMG	DATE OF ACCIDENT	ACCDNT REPORT NUMBER
25	1-VEH FX OB	S	AV VEH	FRNT-R	NONE		P POLE			RAIN	WET	DK-SL		0	0	0	0	1	X	WED 10/11/78 10PM	924558
10	2-VEH OTHER	S	GO STR	FRNT-R	CLOSE	S	R-TURN	REAR-L	NONE	CLEAR	WET	DK-SL		0	0	0	0	7	X	SAT 5/12/79 11PM	911243
50	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	GO STR	REAR	NONE	SNOW	WET	DK-SL		0	0	0	0	2	X	SUN 12/ 3/78 1AM	928900
0	2-VEH R-END	S	GO STR	FRNT-R	BCKNG	S	GO STR	REAR-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	2	X	THU 8/17/78 11PM	602594
0	2-VEH R-END	S	GO STR	FRONT	NONE	S	SLOWNG	REAR	NONE	RAIN	WET	DAY		0	0	0	0	2	X	FRI 4/22/77 4PM	601402
0	3-VEH ANGLE	S	GO STR	FRONT	CLOSE	W	GO STR	REAR-R	NONE	CLEAR	DRY	DAY		0	0	0	0	6	X	SAT 10/20/79 2PM	922416
0	2-VEH R-END	S	GO STR	FRONT	FAST	S	STOPPD	REAR	NONE	SNOW	WET	DK-SL		0	0	0	1	2		SAT 11/ 5/77 2AM	814765
0	2-VEH R-END	S	SLOWNG	REAR	CLOSE	S	STOPPD	REAR-L	NONE	RAIN	WET	DK-SL	1/SKID	0	0	0	0	3	X	SAT 11/ 5/77 1AM	925457
0	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	0	1	1		FRI 4/ 6/79 1PM	803980
100	1-VEH PARKD	W	GO STR	FRONT	WR LN					CLEAR	DRY	DAY		0	0	0	0	1	X	SAT 7/21/79 7PM	916386
0	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	0	2	X	SAT 12/16/78 3AM	930059
0	2-VEH ANGLE	S	GO STR	FRONT	F YLD	W	GO STR	FRNT-R	NONE	CLEAR	DRY	DARK		0	0	0	0	2	X	TUE 11/29/77 5PM	927803
0	1-VEH PARKD	S	GO STR	FRNT-R	FAST					CLEAR	DRY	DAY		0	0	0	1	5		FRI 9/16/77 6PM	812450
0	2-VEH OTHER	S	STRTNG	FRNT-R	CLOSE	W	GO STR	SIDE-R	NONE	CLEAR	DRY	DAY	1/RECK	0	0	0	0	2	X	SAT 8/11/79 3PM	917791
0	2-VEH ANGLE	S	GO STR	SIDE-L	CLOSE	W	GO STR	FRONT	NONE	CLEAR	DRY	DAY		0	0	2	0	1		FRI 6/22/79 1PM	807385
0	2-VEH R-END	S	CHNG L	FRNT-R	WR LN	S	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	4	X	TUE 10/31/78 NOON	925999
0	2-VEH SSW-P	S	AV VEH	FRNT-L	CLOSE	S	GO STR	SIDE-R	NONE	CLEAR	WET	DAY		0	0	0	0	2	X	WED 1/17/79 3PM	902004
0	2-VEH L-TRN	S	L-TURN	FRNT-L	TURN	S	GO STR	SIDE-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	SUN 11/27/77 4AM	603772
0	2-VEH SSW-P	S	CHNG L	SIDE-R	WR LN	S	GO STR	SIDE-L	NONE	RAIN	WET	DARK		0	0	0	0	2	X	SAT 5/26/79 MIDN	912382
0	2-VEH R-END	S	GO STR	FRNT-R	CLOSE	S	STOPPD	REAR-L	UNKN	CLEAR	DRY	DAY		0	0	0	0	2	X	TUE 6/27/78 5PM	916669
0	1-VEH FX OB	S	GO STR	FRNT-R	WR LN		FENCE			CLEAR	ICY	DARK		0	0	0	0	1	X	THU 1/13/77 6PM	400147
0	2-VEH R-END	S	CHNG L	FRNT-L	WR LN	S	GO STR	OTHER	NONE	CLEAR	WET	DK-SL		0	0	1	2	2		SAT 2/17/79 1AM	801959
100	4-VEH R-END	W	GO STR	FRONT	CLOSE	W	STOPPD	REAR	NONE	CLEAR	DRY	DUSK	1/RECK	0	0	0	2	3		TUE 12/19/78 5PM	930070
100	1-VEH FX OB	W	GO STR	FRNT-R	FAST		P POLE			CLEAR	WET	DK-SL	1/DUIL	0	0	0	1	0		MON 12/26/77 7PM	817312
0	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	GO STR	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	THU 12/20/79 1PM	927261
0	1-VEH FX OB	S	GO STR	FRONT	FAST		P POLE			CLEAR	DRY	DK-SL		0	0	0	1	0		SUN 3/ 6/77 3AM	802987
0	2-VEH SSW-P	S	CHNG L	FRNT-R	NONE	S	GO STR	FRNT-L	NONE	CLEAR	WET	DK-SL		0	0	0	0	3	X	THU 2/22/79 2AM	905320
0	2-VEH OTHER	S	R-TURN	REAR-R	F YLD	E	GO STR	FRNT-R	NONE	RAIN	WET	DK-SL		0	0	0	0	3	X	WED 4/19/78 2AM	911135
100	2-VEH SSW-P	E	GO STR	FRONT	BCKNG	E	GO STR	REAR-L	NONE	RAIN	WET	DAY		0	0	0	0	4	X	THU 4/20/78 11AM	601440
0	2-VEH R-END	S	SLOWNG	FRNT-L	CLOSE	S	STOPPD	REAR-L	NONE	CLEAR	ICY	DAY	1/SKID	0	0	0	0	2	X	MON 1/ 2/78 2PM	900172
0	2-VEH ANGLE	S	GO STR	SIDE-L	F YLD	W	GO STR	FRNT-R	NONE	CLEAR	DRY	DK-SL		0	0	1	1	2		SAT 6/10/78 2AM	806514
0	1-VEH FX OB	S	AV VEH	FRONT	NONE		SIGN			RAIN	WET	DARK		0	0	0	0	1	X	THU 4/21/77 MIDN	910052
0	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	8	X	SAT 7/16/77 6PM	916451
0	2-VEH R-END	S	GO STR	FRONT	FAST	S	STOPPD	REAR	NONE	CLEAR	WET	DARK		0	0	0	0	2	X	SUN 10/ 2/77 6AM	603062
0	2-VEH ANGLE	S	GO STR	FRNT-L	F YLD	W	GO STR	FRNT-R	NONE	SNOW	ICY	DK-SL	1/SKID	0	0	0	0	2	X	MON 12/ 5/77 7PM	928390
0	2-VEH ANGLE	S	GO STR	FRNT-L	F YLD	E	GO STR	FRONT	NONE	CLEAR	WET	DK-SL		0	0	0	4	2		SAT 5/13/78 8PM	912866
0	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE	CLEAR	DRY	DARK		0	0	0	0	2	X	SUN 6/11/78 4AM	806543
100	2-VEH L-TRN	W	L-TURN	FRNT-L	F YLD	W	L-TURN	FRNT-R	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	SAT 7/ 8/78 10AM	917261
100	3-VEH R-END	S	GO STR	FRONT	CLOSE	S	STOPPD	FRONT	NONE	CLEAR	DRY	DARK		0	0	1	3	4		SAT 11/17/79 2AM	813491
60	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	SAT 9/23/78 5AM	923084
100	2-VEH OTHER	W	STRTNG	FRNT-R	NONE	S	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	6	X	FRI 5/ 4/79 1PM	910668
100	2-VEH ANGLE	W	L-TURN	REAR-R	F YLD	S	GO STR	REAR-L	NONE	CLEAR	DRY	DK-SL	1/SKID	0	0	0	0	2	X	SAT 5/ 7/77 2AM	601466
100	3-VEH SSW-P	N	AV VEH	REAR-L	NONE	N	GO STR	REAR-R	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	TUE 9/25/79 NOON	920664

INTERSECTION ACCIDENT PROFILE

INTERSECTION TYPE : SIGNALIZED

LOCATION : US-24 AT MCNICHOLS/6 MILE DETROIT CITY , WAYNE COUNTY

DISTRICT 9 CONTROL SECTION 82053 MILEPOINT 7.93

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 INJURY CLASS F	A	B	C	O	PRP DMG	DATE OF ACCIDENT			ACCDNT REPORT NUMBER
85	3-VEH SSW-P	S	CHNG L	FRNT-R	CLOSE	S	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	5	X	TUE	8/ 1/78	1PM	919121
100	2-VEH R-END	S	SLOWNG	FRONT	CLOSE	S	SLOWNG	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	THU	10/18/79	5PM	922399
100	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	4	X	SUN	12/18/77	MIDN	604059
100	2-VEH R-END	N	GO STR	REAR-L	WR LN	N	GO STR	FRNT-R	WR LN	CLEAR	DRY	DK-SL		0	0	0	0	2	X	SUN	9/ 9/79	3AM	919511
100	2-VEH R-END	N	GO STR	FRONT	CLOSE	N	STOPPD	REAR	NONE	SNOW	ICY	DAY		0	0	0	0	2	X	MON	11/27/78	7AM	928140
50	2-VEH R-END	S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	SAT	10/20/79	3AM	603730
65	4-VEH R-END	S	GO STR	FRONT	CLOSE	S	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	0	9	X	SUN	10/22/78	1AM	924994
50	2-VEH R-END	S	GO STR	FRONT	FAST	S	GO STR	REAR	NONE	CLEAR	DRY	DARK		0	0	0	0	4	X	FRI	4/27/79	10PM	910270
60	2-VEH R-END	S	GO STR	FRONT	FAST	S	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	0	4	X	SAT	4/ 1/78	10PM	909606
100	2-VEH ANGLE	W	L-TURN	FRONT	CLOSE	S	STOPPD	REAR	NONE	CLEAR	WET	DAY		0	0	0	0	3	X	THU	12/ 8/77	11AM	928427
60	2-VEH R-END	S	AV VEH	FRNT-L	CLOSE	S	GO STR	SIDE-R	NONE	SNOW	ICY	DK-SL		0	0	0	0	8	X	SUN	1/ 8/78	8PM	900961

EASTBOUND APPROACH

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	F	A	B	C	O	PRP DMG	DATE OF ACCIDENT			ACCDNT REPORT NUMBER
20	1-VEH FX OB	E	AV VEH	FRNT-R	CLOSE		P POLE			RAIN		DK-SL		0	0	0	0	1	X	MON	3/20/78	8PM	908941
0	1-VEH FX OB	E	R-TURN	FRONT	NONE		P POLE			CLEAR	DRY	DK-SL		0	0	0	0	2	X	SUN	10/28/79	2AM	922958
0	2-VEH L-TRN	E	L-TURN	FRNT-L	F YLD	W	GO STR	FRONT	NONE	CLEAR	DRY	DARK		0	0	0	0	3	X	SUN	12/16/79	2AM	926928
0	1-VEH FX OB	E	R-TURN	SIDE-R	CLOSE		P POLE			CLEAR	DRY	DAY		0	0	0	0	1	X	FRI	4/27/79	6PM	910268
0	2-VEH PRKNG	E	STOPPD	FRNT-R	NONE	E	UNKN	REAR-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	SAT	4/ 2/77	1AM	908034
0	2-VEH ANGLE	E	GO STR	FRNT-R	F YLD	S	GO STR	SIDE-R	NONE	RAIN	WET	DAY		0	0	0	1	3		SUN	7/ 1/79	10AM	807835
0	2-VEH OTHER	E	STRTNG	FRNT-R	UNKN	S	GO STR	SIDE-R	UNKN	CLEAR	DRY	DK-SL		0	0	0	0	4	X	SUN	4/22/79	11PM	909869
0	2-VEH R-END	E	GO STR	FRONT	CLOSE	E	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	2	1		TUE	2/28/78	11PM	500309
0	2-VEH ANGLE	E	GO STR	FRONT	UNKN	N	GO STR	SIDE-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	WED	2/28/79	3AM	600774
0	3-VEH ANGLE	E	GO STR	FRONT	F YLD	W	STOPPD	FRONT	NONE	CLEAR	DRY	DK-SL		0	0	1	0	3		SUN	9/18/77	1AM	812549
0	2-VEH ANGLE	E	GO STR	FRNT-R	F YLD	N	GO STR	FRNT-L	NONE	CLEAR		DAY		0	0	0	0	4	X	FRI	7/21/78	2PM	602362
0	2-VEH SSW-M	E	GO STR	FRNT-L	F YLD	W	STOPPD	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	5	X	WED	8/29/79	8PM	602938
0	2-VEH SSW-P	E	GO STR	FRNT-R	CLOSE	E	GO STR	SIDE-L	NONE	FOG	WET	DK-SL		0	0	0	0	2	X	SAT	1/20/79	2AM	600267
0	2-VEH R-END	E	GO STR	FRONT	CLOSE	E	STOPPD	REAR	NONE	SNOW	ICY	DAWN		0	0	0	1	1		MON	2/12/79	7AM	801786
0	3-VEH R-END	E	GO STR	FRONT	FAST	E	STOPPD	REAR	NONE	RAIN	WET	DAWN		0	0	3	0	2		WED	5/ 4/77	6AM	805773
0	2-VEH R-TRN	E	GO STR	FRONT	CLOSE	E	R-TURN	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	MON	5/ 7/79	7PM	910836
0	2-VEH R-END	E	GO STR	FRNT-R	WR LN	E	SLOWNG	FRNT-L	NONE	CLEAR	WET	DK-SL		0	0	0	0	3	X	SUN	12/23/79	11PM	604194
0	1-VEH PEDES	E	GO STR	FRONT	F YLD					RAIN	ICY	DK-SL		0	0	0	1	1		SAT	3/12/77	2AM	500555
0	2-VEH R-END	E	GO STR	FRONT	FAST	E	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	3	X	SUN	9/25/77	1AM	602884
0	2-VEH OTHER	E	STRTNG	FRONT	F YLD	S	GO STR	REAR-R	NONE	CLEAR	DRY	DARK		0	0	0	0	3	X	SAT	9/ 9/78	1AM	602916
0	1-VEH PARKD	E	GO STR	FRONT	CLOSE		P POLE			CLEAR	WET	DK-SL		0	0	0	1	0		SUN	1/22/78	10PM	801093
0	2-VEH R-END	E	GO STR	OTHER	NONE	E	GO STR	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	FRI	11/ 3/78	MIDN	603442
0	2-VEH ANGLE	E	GO STR	FRONT	F YLD	N	GO STR	SIDE-L	F YLD	CLEAR	DRY	DAY		0	0	0	6	0		SUN	12/10/78	4PM	814769
50	2-VEH HD-ON	E	L-TURN	SIDE-R	TURN	W	GO STR	FRNT-R	NONE	CLEAR	ICY	DAY		0	0	0	0	2	X	FRI	2/16/79	10AM	904812

WESTBOUND APPROACH

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	F	A	B	C	O	PRP DMG	DATE OF ACCIDENT			ACCDNT REPORT NUMBER
0	3-VEH R-END	W	GO STR	FRNT-L	CLOSE	W	STOPPD	REAR-R	NONE	RAIN	WET	DK-SL		0	0	0	0	3	X	MON	10/ 8/79	9PM	921547
0	2-VEH ANGLE	W	GO STR	FRONT	F YLD	N	GO STR	REAR-R	F YLD	CLEAR	DRY	DK-SL		0	0	0	0	4	X	WED	10/10/79	9PM	921678

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

INTERSECTION ACCIDENT PROFILE

INTERSECTION TYPE : SIGNALIZED

LOCATION : US-24 AT MCNICHOLS/6 MILE DETROIT CITY , WAYNE COUNTY

DISTRICT 9 CONTROL SECTION 82053 MILEPOINT 7.93

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 INJURY CLASS F	A	B	C	O	PRP DMG	DATE OF ACCIDENT			ACCDNT REPORT NUMBER
0	2-VEH OTHER	W	CHNG L	SIDE-L	WR LN	W	GO STR	FRNT-R	NONE	RAIN	WET	DK-SL		0	0	0	0	7	X	SUN	12/31/78	11PM	931009
0	2-VEH ANGLE	W	GO STR	FRNT-R	F YLD	S	GO STR	FRNT-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	WED	11/23/77	1AM	927975
0	2-VEH R-END	W	GO STR	FRONT	CLOSE	W	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	WED	11/22/78	11PM	927672
0	2-VEH SSW-P	W	CHNG L	FRNT-L	WR LN	W	GO STR	FRNT-R	NONE	CLEAR	WET	DAY		0	0	0	0	2	X	MON	10/23/78	11AM	925385
0	3-VEH ANGLE	W	GO STR	FRONT	NONE	S	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	2	1	7		MON	9/ 3/79	7AM	810446
0	2-VEH ANGLE	W	GO STR	SIDE-R	F YLD	S	GO STR	FRONT	NONE	RAIN	WET	DK-SL		0	0	0	0	3	X	MON	10/16/78	2AM	924828
0	2-VEH ANGLE	W	GO STR	SIDE-L	F YLD	N	GO STR	FRONT	NONE	RAIN	WET	DARK		0	0	0	0	2	X	SUN	12/23/79	3AM	927367
0	2-VEH ANGLE	W	GO STR	FRNT-R	UNKN	S	R-TURN	FRNT-L	UNKN					0	0	0	0	3	X	THU	8/30/79	2AM	918949
0	2-VEH ANGLE	W	GO STR	FRONT	F YLD	N	GO STR	FRNT-R	NONE	CLEAR	DRY	DAY		0	0	0	1	5		FRI	9/16/77	5PM	812449
0	2-VEH ANGLE	W	GO STR	SIDE-R	F YLD	S	GO STR	FRONT	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	FRI	3/ 9/79	11AM	906473
0	2-VEH R-END	W	GO STR	FRNT-L	FAST	W	STOPPD	REAR-R	NONE	CLEAR	DRY	DK-SL		0	0	0	0	3	X	TUE	5/31/77	2AM	912794
0	2-VEH R-END	W	GO STR	OTHER	F YLD	W	GO STR	SIDE-L	NONE	CLEAR	DRY	DK-SL		0	0	0	0	2	X	FRI	7/27/79	1AM	602464
0	2-VEH R-END	W	GO STR	FRONT	CLOSE	W	GO STR	REAR	NONE	SNOW	ICY	DARK	1/SKID	0	0	0	0	5	X	TUE	1/24/78	7PM	903411
0	2-VEH OTHER	W	GO STR	FRONT	F YLD	S	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	SAT	3/ 4/78	4PM	907583
0	2-VEH ANGLE	W	GO STR	FRNT-L	F YLD	N	GO STR	FRNT-R	NONE	CLEAR	DRY	DARK		0	0	0	0	2	X	THU	4/28/77	3AM	910258
0	2-VEH ANGLE	W	GO STR	FRNT-R	F YLD	S	GO STR	SIDE-L	NONE	CLEAR	DRY	DAY		0	0	1	0	3		SUN	5/ 1/77	6PM	805728
0	2-VEH ANGLE	W	GO STR	REAR-R	F YLD	S	GO STR	FRNT-R	NONE	CLEAR	WET	DK-SL		0	0	0	0	6	X	TUE	4/11/78	9PM	910844
0	3-VEH ANGLE	W	GO STR	FRNT-R	F YLD	S	GO STR	FRONT	NONE	CLEAR	DRY	DK-SL		0	0	0	2	2		FRI	12/ 2/77	8PM	816188
0	3-VEH R-END	W	GO STR	FRONT	CLOSE	W	STOPPD	REAR	NONE	CLEAR	DRY	DK-SL		0	3	0	2	2		THU	1/19/78	6PM	800992
0	2-VEH R-END	W	GO STR	FRONT	CLOSE	W	STOPPD	REAR	NONE	CLEAR	DRY	DAY		0	0	0	0	2	X	WED	5/11/77	5PM	911480
0	2-VEH ANGLE	W	GO STR	REAR-R	F YLD	S	GO STR	FRONT	NONE	CLEAR	DRY	DK-SL		0	0	1	1	0		FRI	9/15/78	2AM	810846

MICHIGAN DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION

08/18/81 MICHIGAN DIMENSIONALIZED ACCIDENT SURVEILLANCE SYSTEM (MIDAS) PAGE 1

NAME:
REASON: EXAMPLE RUN FOR 1981 ANNUAL REPORT

KIND OF RUN: SEGM-INTRS SUMMARY

-LOCATION DATA REQUESTED-

DISTRICT NUMBER: 9 CONTROL SECTION: 82053 DATA BASE SYSTEM: M FOR MALI
BEGINNING MILE POINT: 7.90 ENDING MILE POINT: 7.96
STARTING DATE: 1/ 1/77 ENDING DATE: 12/31/79

--TYPES OF ACCIDENT DATA REQUESTED--

ALL ACCIDENTS

---REPORT OPTIONS REQUESTED---

INTERSECTION OPTION(S):
ALL INTERSEC OPTS
SEGMENT OPTION(S):

SEGMENT PROFILE

LOCATION: US-24 COUNTY: WAYNE COUNTY

DISTRICT	CONTROL SECTION	MALI MILEPOINT BEGINNING	ENDING
9	82053	7.90	7.96

DATE REQUESTED: JANUARY 1, 1977 THRU DECEMBER 31, 1979 (3 YEARS, 0 MONTHS, 0 DAYS)

REPORT RUN BY:

REASON FOR RUN: EXAMPLE RUN FOR 1981 ANNUAL REPORT

AUGUST 18, 1981

MICHIGAN DEPARTMENT OF TRANSPORTATION
TRAFFIC AND SAFETY DIVISION

S E G M E N T   P R O F I L E

DIST 9 CS 82053 MALI MP 7.90 TO 7.96

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

DIST	CNTRL SECTN	MILEPOINT	LENGTH (MILE)	GEOMTC TYPE	WIDTH LN	WIDTH SH	DELTA DEG:MN	CURVE DEG:MN	BEARING DEG:MN	ACTVTY	PASSNG ZONE	TRUCK LANE	SPD LMT	DIRECTION APP	DIRECTION DEP	ADT
9	82053	7.45- 8.40	0.96	OTHER	12	0	0: 0	0: 0	N 0:50W	URBAN			45	N	S	62,100

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9   82053 * 7.61 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT FLORANCE STREET   DETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
9   82053 * 7.68 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT VERNE STREET      DETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
9   82053 * 7.75 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT DEHNER STREET     DETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
9   82053 * 7.79 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT GROVE AVENUE      DETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
9   82053 * 7.84 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT DIRECTIONAL X-OVERDETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
+++++++++++++++++++ THE INTERSECTION BELOW IS THE FIRST INTERSECTION FOUND IN THE MILE POINT RANGE SPECIFIED +++++++++++++++++++
9   82053 * 7.93 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT MCNICHOLS/6 MILE  DETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
+++++++++++++++++++ THE INTERSECTION ABOVE IS THE LAST INTERSECTION FOUND IN THE MILE POINT RANGE SPECIFIED ++++++++++++++++++++
9   82053 * 7.99 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT DIRECTIONAL X-OVERDETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
9   82053 * 8.11 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT SANTA MARIA AVE.  DETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
9   82053 * 8.22 <<<<<<<<<<<<< INTERSECTION OF  US-24       AT BENNETT STREET    DETROIT CITY,  WAYNE        >>>>>>>>>>>>>>62,100
```

SEGMENT ACCIDENTS: 1- 1-77 THRU 12-31-79 (3.00 YEARS)

YEAR	INJ ACC	FAT. ACC	TOTL ACC	NUMBER OF ACCIDENTS BY TYPE: OVER TURN	FIX OBJT	PARK	PED/ BIKE	HEAD ON	SS PASS	SS MEET	REAR END	OTHER S-VH	OTHER MT-V	PERCENT: WET	ICY	DARK
1977	1	0	7	0	0	0	0	0	0	0	1	0	6	42.9	14.3	42.9
1978	0	0	1	0	0	1	0	0	0	0	0	0	0	0.0	0.0	0.0
1979	2	0	5	0	0	0	0	0	0	0	4	0	1	60.0	20.0	40.0
3.00 YEAR TOTAL	3	0	13	0	0	1	0	0	0	0	5	0	7	46.2	15.4	38.5
AVERAGE PER YEAR	1.0	0.0	4.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	1.7	0.0	2.3			
PERCENT OF TOTAL	23.1	0.0	100.0	0.0	0.0	7.7	0.0	0.0	0.0	0.0	38.5	0.0	53.8			

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

NAME:
REASON: EXAMPLE RUN FOR 1981 ANNUAL REPORT

KIND OF RUN: BEFORE & AFTER REP

-LOCATION DATA REQUESTED-

DISTRICT NUMBER: 5 CONTROL SECTION: 19031 DATA BASE SYSTEM: M FOR MALI
BEGINNING MILE POINT: 16.06 ENDING MILE POINT: 16.11
STARTING DATE: 1/ 1/74 ENDING DATE: 1/ 1/79

--TYPES OF ACCIDENT DATA REQUESTED--

ALL ACCIDENTS

---REPORT OPTIONS REQUESTED---

INTERSECTION OPTION(S):
ALL INTERSEC OPTS
SEGMENT OPTION(S):

Exhibit V

S E G M E N T   P R O F I L E

LOCATION: US-27   COUNTY: CLINTON COUNTY

AVERAGE DAILY TRAFFIC (ADT): 16320

DISTRICT	CONTROL SECTION	MALI MILEPOINT BEGINNING	MALI MILEPOINT ENDING
5	19031	16.06	16.11

DATE REQUESTED: JANUARY 1, 1974 THRU JANUARY 1, 1979 (5 YEARS, 0 MONTHS, 1 DAYS)

REPORT RUN BY:

REASON FOR RUN: EXAMPLE RUN FOR 1981 ANNUAL REPORT

AUGUST 18, 1981

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

B E F O R E A N D A F T E R S T U D Y

DISTRICT 5 CONTROL SECTION 19031 MALI MILEPOINT 16.06 - 16.11

ACCIDENT TYPE	B E F O R E P E R I O D 1- 1-74 THRU 1- 1-76 (2.00 YEARS)					A F T E R P E R I O D 1- 1-77 THRU 1- 1-79 (2.00 YEARS)							
	YEARS 1ST	2ND	TTL	MEAN	STD DEV	YEARS 1ST	2ND	TTL	MEAN	STD DEV	DIFF IN MEAN	T VALUE	DEG OF FREDOM
INJURY ACC	0	0	0	0.00	0.000	1	0	1	0.50	0.707	0.50	1.00	2.
FATAL ACC	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
TOTAL ACC	0	0	0	0.00	0.000	2	1	3	1.50	0.707	1.50	3.00	2.
OVERTURNED	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
FIXED OBJT	0	0	0	0.00	0.000	1	0	1	0.50	0.707	0.50	1.00	2.
PARK	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
PED/BIKE	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
HEAD-ON	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
SS-PASS	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
SS-MEET	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
REAR-END	0	0	0	0.00	0.000	1	1	2	1.00	0.000	1.00	0.00	0.
OTHER S-VH	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
OTHER MT-VH	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
WET	0	0	0	0.00	0.000	0	1	1	0.50	0.707	0.50	1.00	2.
ICY	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
DARK	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.

BEFORE AND AFTER STUDY

DISTRICT 5 CONTROL SECTION 19031 MALI MILEPOINT 16.06 - 16.11

ACCIDENT TYPE	BEFORE PERIOD 1- 1-74 THRU 1- 1-76 (2.00 YEARS) APPROACH DIRECTION				AFTER PERIOD 1- 1-77 THRU 1- 1-79 (2.00 YEARS) APPROACH DIRECTION			
	NB	SB	OTH	TTL	NB	SB	OTH	TTL
INJURY ACC	0	0	0	0	1	0	0	1
FATAL ACC	0	0	0	0	0	0	0	0
TOTAL ACC	0	0	0	0	2	1	0	3
OVERTURNED	0	0	0	0	0	0	0	0
FIXED OBJT	0	0	0	0	1	0	0	1
PARK	0	0	0	0	0	0	0	0
PED/BIKE	0	0	0	0	0	0	0	0
HEAD-ON	0	0	0	0	0	0	0	0
SS-PASS	0	0	0	0	0	0	0	0
SS-MEET	0	0	0	0	0	0	0	0
REAR-END	0	0	0	0	1	1	0	2
OTHER S-VH	0	0	0	0	0	0	0	0
OTHER MT-VH	0	0	0	0	0	0	0	0
WET	0	0	0	0	0	1	0	1
ICY	0	0	0	0	0	0	0	0
DARK	0	0	0	0	0	0	0	0

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

INTERSECTION PROFILE

LOCATION: US-27 AT JCT M21/STATE ST

CITY/VILLAGE/TOWNSHIP: ST JOHNS CTY

COUNTY: CLINTON COUNTY

INTERSECTION TYPE: 4 LEGS - CROSS - SIGNAL

DISTRICT	CONTROL SECTION	MILEPOINT MALI	MILEPOINT PHOTOLOG
5	19031	16.11	16.04

DATE REQUESTED: JANUARY 1, 1974 THRU JANUARY 1, 1979 (5 YEARS, 0 MONTHS, 1 DAYS)

REPORT RUN BY:

REASON FOR RUN: EXAMPLE RUN FOR 1981 ANNUAL REPORT

AUGUST 18, 1981

B E F O R E   A N D   A F T E R   S T U D Y

DIST 5 CS 19031 MP 16.11 (MALI), 16.04 (PHOTOLOG) US-27 AT JCT M21/STATE ST ST JOHNS CTY

ACCIDENT TYPE	BEFORE PERIOD 1- 1-74 THRU 1- 1-76 (2.00 YEARS) YEARS 1ST	2ND	TTL	MEAN	STD DEV	AFTER PERIOD 1- 1-77 THRU 1- 1-79 (2.00 YEARS) YEARS 1ST	2ND	TTL	MEAN	STD DEV	DIFF IN MEAN	T VALUE	DEG OF FREDOM
INJURY ACC	11	15	26	13.00	2.828	3	6	9	4.50	2.121	-8.50	-3.40	2.
FATAL ACC	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
TOTAL ACC	47	49	96	48.00	1.414	15	19	34	17.00	2.828	-31.00	-13.86	2.
HEAD-ON	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
SS-MEET	1	0	1	0.50	0.707	1	0	1	0.50	0.707	0.00	0.00	2.
SS-PASS	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
ANGLE	6	11	17	8.50	3.536	1	4	5	2.50	2.121	-6.00	-2.06	2.
LEFT-TURN	29	23	52	26.00	4.243	0	0	0	0.00	0.000	-26.00	-8.67	2.
RIGHT-TURN	0	0	0	0.00	0.000	0	0	0	0.00	0.000	0.00	0.00	0.
REAR-END	9	6	15	7.50	2.121	8	7	15	7.50	0.707	0.00	0.00	2.
BACKUP	1	2	3	1.50	0.707	0	2	2	1.00	1.414	-0.50	-0.45	2.
PARK	1	4	5	2.50	2.121	5	0	5	2.50	3.536	0.00	0.00	2.
OTHER	0	3	3	1.50	2.121	0	6	6	3.00	4.243	1.50	0.45	2.
WET	12	16	28	14.00	2.828	5	3	8	4.00	1.414	-10.00	-4.47	2.
ICY	3	2	5	2.50	0.707	3	1	4	2.00	1.414	-0.50	-0.45	2.
DARK	6	5	11	5.50	0.707	4	1	5	2.50	2.121	-3.00	-1.90	2.

BEFORE AND AFTER STUDY

DIST 5 CS 19031 MP 16.11 (MALI), 16.04 (PHOTOLOG) US-27 AT JCT M21/STATE ST ST JOHNS CTY

ACCIDENT TYPE	BEFORE PERIOD 1- 1-74 THRU 1- 1-76 (2.00 YEARS) APPROACH DIRECTION						AFTER PERIOD 1- 1-77 THRU 1- 1-79 (2.00 YEARS) APPROACH DIRECTION					
	NB	SB	EB	WB	OTH	TTL	NB	SB	EB	WB	OTH	TTL
INJURY ACC	10	12	3	1	0	26	3	3	0	2	1	9
FATAL ACC	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL ACC	36	46	7	7	0	96	11	14	2	6	1	34
HEAD-ON	0	0	0	0	0	0	0	0	0	0	0	0
SS-MEET	0	1	0	0	0	1	1	0	0	0	0	1
SS-PASS	0	0	0	0	0	0	0	0	0	0	0	0
ANGLE	9	5	1	2	0	17	1	1	1	2	0	5
LEFT-TURN	17	32	3	0	0	52	0	0	0	0	0	0
RIGHT-TURN	0	0	0	0	0	0	0	0	0	0	0	0
REAR-END	7	5	1	2	0	15	6	9	0	0	0	15
BACKUP	1	0	1	1	0	3	0	1	1	0	0	2
PARK	1	1	1	2	0	5	1	1	0	3	0	5
OTHER	1	2	0	0	0	3	2	2	0	1	1	6
WET	11	12	4	1	0	28	2	4	0	2	0	8
ICY	1	3	0	1	0	5	2	1	0	1	0	4
DARK	4	5	2	0	0	11	1	2	0	2	0	5

MICHIGAN DIMENSIONAL ACCIDENT SURVEILLANCE SYSTEM

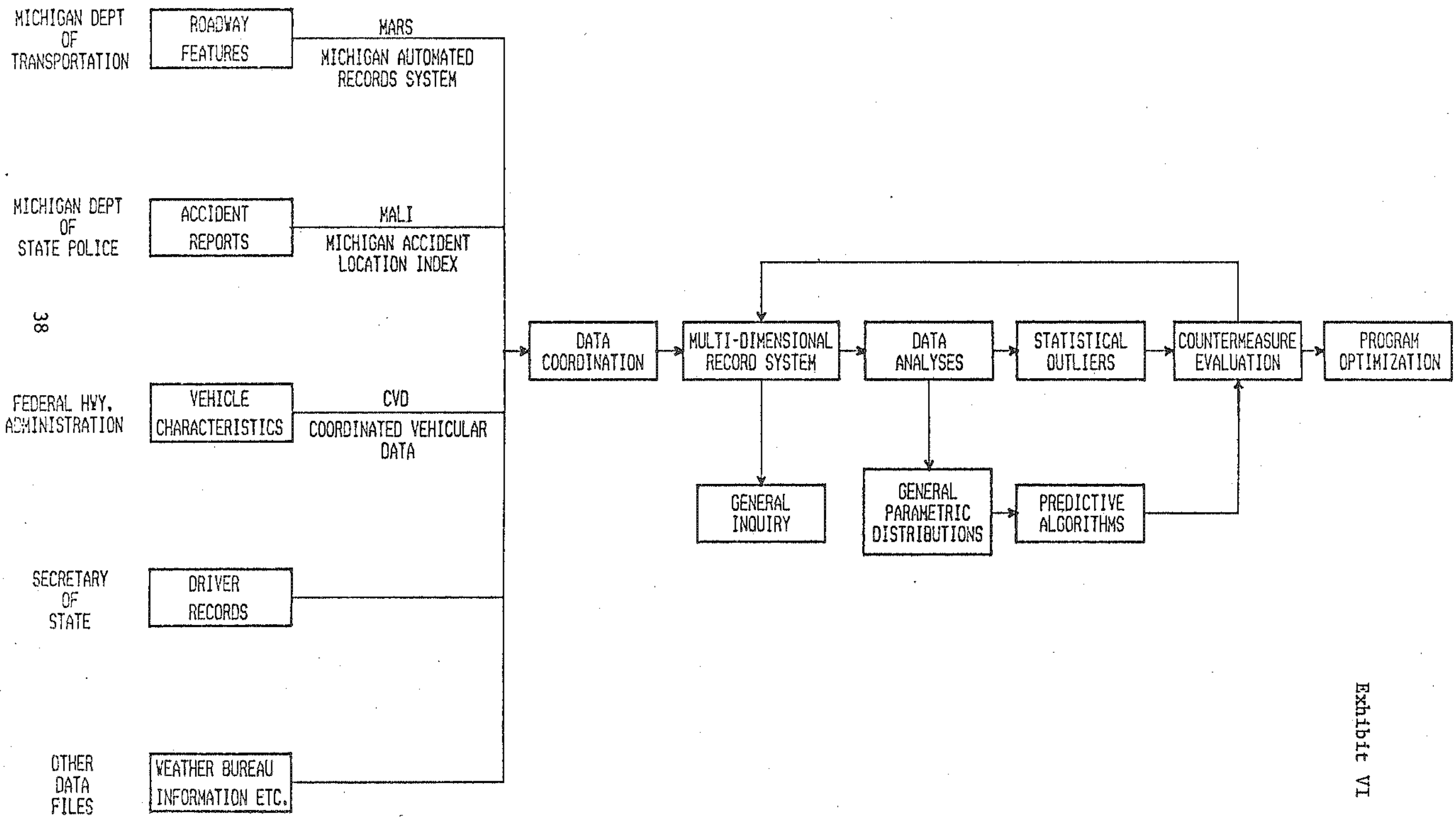

Exhibit VI

congestion, and facilitate the flow of traffic on existing facilities. In Michigan, the TOPICS program is focused in 11 urban areas and is the traffic engineering element of the department's Transportation System Management (TSM) process.

Specific Actions of the TOPICS program include:

a. Data Collection including traffic volumes, levels of service, accidents, parking and speed controls, geometrics and traffic control devices.

b. Problem identification such as locations or areas of congestion, high accident spots or segments, inefficient traffic control devices, and inadequate parking or speed controls.

c. Identification and cost-effectiveness analysis of geometric and operational alternative strategies which address identified problems.

d. Definition of recommended solutions to defined problems and assistance in indentifying funding sources, design, and construction engineering and project assessment.

The TOPICS-type safety projects identified are intended to be coordinated with the departments spot safety improvement program relative to the identification and improvement of high accident locations, especially in the nine identified urbanized areas.

2. <u>Spot Safety Improvement Program</u> - Study/Project Analysis Procedures on the State Trunkline System

    a. Source of study and/or project may be from:

    - Computer listings of high accident locations (MIDAS)
    - Citizen complaints
    - District request
    - Surveillance observations

    b. After initial review, the list of study locations or candidate projects is reduced because of recent or impending construction, operational changes, or ongoing studies to those warranting more in-depth study.

    c. A work file is prepared for each location which may include location maps, accident data, traffic surveys, and pertinent correspondence.

    d. A field review is conducted, with appropriate members of the Geometrics, Electronic Systems, and Safety Programs Units as well as the district traffic engineer in attendance. Alternative solutions are proposed.

e. The Geometrics Coordination Unit develops proposed alternate geometric schemes with cost estimates and transmits recommended plan to Safety Programs. (Solutions are developed with district input, local input, and private developer's input if required.)

f. Funding is approved or disapproved from Safety Programs based on cost-effectiveness. The method used is a time of return on the safety dollar. The National Safety Council (NSC) values are used for estimating the cost of motor vehicle accidents. Candidate projects are considered desirable when the expected return in safety benefits is realized in approximately five to eight years. If approved, Safety Programs Unit will program and request job number for programming.

g. Process Intent to Study form which provides documentation of alternatives considered in developing safety improvement projects in order to fulfill state and federal environmental requirements.

h. Transmit approved functional layout to the district for their review and for the district traffic and safety engineer to discuss with local officials. District traffic and safety engineer will obtain unofficial written concurrence from local agencies that are required to participate in the project.

i. Make necessary changes resulting from district review, if required, transmit to Design Division.

j. Maintain contact with various divisions to establish and readjust letting dates.

k. Conduct "before-and-after" project evaluations.

D. Process for Establishing Priorities

1. Potential Accident Reduction Factors (Number, Severity, and/or Pattern of Accidents).

a. Current Practice - Analysis of Anticipated Benefits for Safety Projects.

The analysis technique used by the Traffic and Safety Division of the Michigan Department of Transportation at the present time is to determine the cost-benefit of short-term safety improvement projects and subsequently the time-of-return (TOR) or the number of years to amortization.

While many agencies may work from accident data tabulations, we prefer the use of collision diagrams which, in our case, are mostly computer generated. The anticipated probable reduction in accidents due to a particular treatment at a given location is then estimated. We use data collected from previous before-and-after accident studies to determine expected reductions. For example, injury reductions of 50 percent are expected when widening a signalized intersection from four to five lanes and in strip commercial areas, a reduction in rear-end accidents of approximately 60 percent is used when considering a 4- to 5-lane widening project. Studies have also revealed an approximate 80 percent reduction in rear-end and improper turn related accidents in the construction of exclusive right-turn lanes. In some cases, the reduction of total reported accidents was minimal, however, there was a change in accident types and a significant reduction in accident severity. The expected reduction in accident types are now updated periodically but will be done annually with the development of Stage III of the MIDAS model.

Other agencies have utilized published tables to forecast accident reductions as illustrated by the attached copies of various tables included in the "Manual on Identification, Analysis, and Correction of High Accident Locations" by the U.S. Department of Transportation, Federal Highway Administration, April 1976. Attached is a copy of a worksheet (Exhibit VII) used by the Michigan DOT to evaluate accident costs, determine expected accident reductions, and anticipated benefits.

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: 1979 values

Death - $160,000

Nonfatal Injury - $6,200

Property Damage Accident - $870

$$B = \frac{ADT_a}{ADT_b} \times (Q\ R_1 + 870\ R_2)$$

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 = 6,200 if no fatal accidents occurred, and

$$Q = \frac{160{,}000 + (I/F \times 6{,}200)}{1 + I/F} = 7{,}935$$ if at least 1 fatality occurred.

where

I/F = Ratio of injuries to fatalities that occurred statewide during the year 1979

$$= \frac{162{,}822}{1{,}859} = 87.6$$

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

_____ yrs. B = _____[6200 or 7935) _____ + (870) _____]

_____ yrs. B = _____ [(_____) + (_____)] = _____

Annual B = _______________ dollars

C = Total cost of project

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

Prepared by________________________ Date________________________

Location____

City/Twp.______________________ County______________

Control Section_________________ SII#______________

Type of Improvement________________________________

PERIOD	ACCIDENT TYPES									
		pd / Injd		pd / Injd		pd / Injd		pd / Injd		pd / Injd
TOTALS										

Estimated Accident Reduction	___% Red.		___% Red.		___% Red.		___% Red.		___% Red.	

Remarks

Estimated Project Cost______________

Anticipated Annual Benefit______________

Project Amortization (T.O.R.)______________

The estimated cost of each improvement can then be compared to the anticipated yearly benefit. To accomplish this, a modified Time of Return (TOR) approach is used which can be computed by merely dividing the estimated initial cost by the anticipated yearly benefit neglecting interest, maintenance, and salvage factors. This system provides a reasonable comparative index since most typical safety projects have a similar design life. Presently, most safety related projects programmed yield a return in safety benefits in approximately five to eight years.

b. Future Methodology

MIDAS - Stage III; MIDAS IV
(Refer to Area I, Paragraph B of the Spot Safety improvement process)

2. Cost and Resources

MIDAS - Stage III; MIDAS IV
(Refer to Area I, Paragraph B of the Spot Safety improvement process)

3. Grade Crossings (RR Xings) Improvement Program

The Grade Crossing Improvement Program now being implemented 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 form (Exhibit VIII). 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

<u>Hazard Index Rating</u> (H.I.R.) = 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

Exhibit VIII

1704 (N9/79)

GRADE CROSSING INSPECTION REPORT

File No. ______ N.I. No. ______ Inspector ______ Date ______

Railroad(s) ______ Road Authority ______

Location ______

Intersecting Roadway(s) Nearby ______

Direction of Roadway ______ Direction of Tracks ______ Angle ______

No. of Traffic Lanes ______ Roadway Width ______ Shoulder Width ______ Surface of Roadway ______

______ Approaches ______ Electricity Nearby ______

No. of Tracks ______ Materials in Crossing ______ Crossing Length ______

Site Distances (Approx.)	NE Quadrant	NW Quadrant	SE Quadrant	SW Quadrant
100 Feet				
200 Feet				
300 Feet				

PHYSICAL CROSSING	CONDITION	RECOMMENDATIONS	QUANDRANTS	LOCATION	RECOMMENDATIONS
1. Existing Crossing			8. Vegetation		
2. Proposed Crossing			9. Structures		
3. Trackage			10. Embankments		
4. Road Approaches			11. Vehicle Parking		
5. Devil Strip			12. RR Car Storage		
6. Drainage			13. Other		
7. Other					

STATIC SIGNING	REMARKS	RECOMMENDATIONS	AUTO. PROTECTION	REMARKS	RECOMMENDATIONS
14. Crossbucks			21. Flashing Lights		
15. Adv. Warning Signs			22. Side Lights		
16. Pavement Markings			23. Signals on Cants		
17. Overhead Lighting			24. Gates		
18. Stop Signs			25. Other		
19. Stop Ahead Signs					
20. Other					

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

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: Thru ______ Switching ______

Speed ______ Main Tracks ______ Sidings/Spurs ______ Simultaneous Occupancy ______

Exposure Factor ______ Priority ______ Other ______

REMARKS ______

A. Existing situation adequate.

B. More information required.

C. Will draft supplemental report and mail to the involved parties at a later date.

D. Items ______ are considered seasonal and/or normal maintenance and should be accomplished within ____ days from this inspection and written confirmation provided to the Railroad Safety Section.

E. Items ______ are considered construction improvements, and a Commission Order will be issued. Objections to the recommendations must be received within 45 days from this inspection and must be based upon specific safety concerns.

REPORT PREPARED BY: ______

REPORT RECEIVED BY: Railroad Representative ______

Road Authority Representative ______

______ Representative ______

Signature Title

0.27 - Flashing Light Signals with Cantilever Arms
0.24 - Flashing Light Signals with Cantilever Arms with Traffic Signal Interconnection
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

Note - Railroad Safety does not account for interconnected traffic lights in their inventory data.

We have now scheduled 103 inspections based on the new rail-highway crossing process. The annual target is to complete 200 inspections.

b. Diagnostic Team Inspection
   Grade Crossing Inspection Report
   People Factor
   Hazardous Materials Factor

II. Implementation

A. Process for Scheduling and Implementing

<u>Michigan's Overall Prioritized Safety Program</u>

1. Interstate Freeway System

a. Continue the "Yellow Book" program on the interstate system.

To date, 78 percent of the 935 miles requiring upgrading by this program has been completed, while 21 percent has been programmed and is in the design stage and 1 percent is unprogrammed or inactive. However, since safety guidelines change periodically, it is often necessary to make safety improvements to some of the earlier Yellow Book projects. This work consists mainly of bridge rail replacements, ramp and crossroad safety improvements and replacement of Type A (12' 6" post spacing) guardrail.

b. Develop and implement an improved Interstate Safety (Is) spot improvement program based upon accident data to provide cost-beneficial expenditures (priority ranking of interchanges).

Phase 2 of the Interchange Prioritization Study outlines the procedures to be followed in the analyzation/prioritization process. This phase addresses five steps: alternate solutions, estimated costs and benefits, cost-effectiveness of the alternate solutions, implementation, and project evaluation. Currently we are in step 4 of this process with two interchange studies.

The Michigan Accident Location Index (MALI) program is now totally operational on the state's total trunkline system and the local road system in all 83 counties. Through this program we can identify high accident locations on all roadways.

c. Develop and implement a program sensitive to run-off-roadway accidents to allow cost-beneficial expenditures using interstate funding.

We have developed a prioritization program using a five-year accident history for the total freeway system in Michigan. Attention is focused on accident severity for segments of roadways. We can analyze any type of accident pattern that occurs over that five-year period which includes run-off-roadway type accidents. However, we cannot determine what side (left or right) the run-off-roadway accidents occur.

2. Noninterstate Freeway System

a. Develop and implement an improved spot safety improvement (Ms) program based upon accident data.

Now that the Michigan Accident Location Index (MALI) program is completed on all road systems within the state and Stages I and II of the MIDAS model are operational, the department can improve the effectiveness of the spot safety improvement program. For instance, we now have the capability to rank trunkline locations by geometric feature, by frequency, and by accident types. Our efforts can therefore be focused on concentrations of correctable accident patterns occurring over a 6-year or greater period.

b. Develop and implement a program sensitive to run-off-roadway accident data using available funding. See response to 1C.

c. Complete "Yellow Book" work with available funds other than Ms.

To date, 255 miles or 51 percent of the total 500 miles of noninterstate freeway system that requires upgrading has either been completed or let to contract.

3. Free Access Trunkline System

a. Develop and implement an improved Spot Safety Improvement (Ms) Program based upon accident data. See response to objective 2A.

b. Insert greater safety awareness into MCP (Minor Construction Program).

This is a continuous activity and has been implemented as a result of coordinating efforts of a departmentwide highway safety steering committee.

c. "Yellow Book" work (Roadside Safety Improvement Program).

(1) Perform Task 1 on the free access trunkline system. Task 1 includes the installation of buffered-end sections to eliminate straight guardrail endings.

Work authorizations have been issued and completed on all noninterstate trunklines to install buffered-end sections. The work was accomplished by state forces and local contract agencies.

(2) Perform Task 2 on the free access state trunkline system. Task 2 includes upgrading guardrails proximate to structures, replacement of inadequate bridge railings, or retrofitting guardrails to the existing railing system.

A separate 10-year program had originally been developed for Task 2 work. This program is now being accelerated by including this work within other program projects such as resurfacing, shoulder reconstruction, and bridge overlays and is usually funded with 100 percent state funds. It is estimated that the total cost of this program will be $15,000,000.

(3) Perform Task 3 on the free access state trunkline system. Task 3 includes improvement of the roadside to current "Yellow Book" standards. This work is to be completed with available funds other than Ms.

Due to lack of funds, few specific Task 3 projects have been initiated. However, guardrail modernization work is currently being included with road resurfacing projects as resources permit. The costs for Task 3 are included in the category of Other State Funded Projects on page .

4. Nontrunkline

a. The MALI project is currently totally operational on the state trunkline system and the local road system in all 83 counties. The MALI project has added at-grade railroad crossings to the county indexes. This addition was completed in June 1980. Additional data such as bridges/ structures may be required in the future.

b. Develop and implement a spot safety improvement program utilizing available funds.

The Traffic and Safety Division's Community Assistance Program provides traffic engineering services in order to identify, analyze, and correct problem accident locations on the local road system. During fiscal 1979, 89 spot locations in 33 different local jurisdictions were reviewed, analyzed, and recommendations issued. Hazard Elimination Program funds are used to construct these various corrective treatments. The completion of the MALI project on the local system has had a positive effect on this program.

c. Develop and implement run-off-roadway accident program utilizing available federal funds.

A specific program aimed at the run-off-roadway problem has been initiated with the completion of the MALI project on the local road system. We currently have several realignment type projects being processed that directly relate to the run-off-roadway problem.

d. Encourage the development of local awareness and expertise in highway safety activities.

Traffic safety seminars are continually being offered at the beginning and advanced levels by both Wayne State and Michigan State University to local officials responsible for highway safety in their community. In addition, new courses are being developed to serve the needs of graduate engineers embarking on a career in traffic engineering.

As another means of creating local awareness, Regional Safety Committees have been established in each of the department's nine districts. Membership consists of representatives from the same state departments that are represented on the State Safety Commission plus an engineer from the affected district traffic office.

The purpose of these committees is to establish a two-way communication system between the Regional Safety Committee and the local officials within their respective district. Each committee operates independently with meetings scheduled generally on a bimonthly basis.

III. Evaluation

A. Process for Determining Effectiveness

1. Cost-Benefit

2. Before-and-After Accidents

   (See Area I, Paragraph D, Item 1 - Process for Establishing Priorities in the Safety Improvement Process)

3. Compare to "No-Build"

   The department is currently developing a process where spot safety improvement projects on the state trunkline system will be evaluated on a routine basis. It is intended to include "before-and-after" accident studies of the project sites as well as control site locations. Statistical analysis techniques will be incorporated into the process in order to determine significant changes in accident frequency, severity, and pattern.

   It is expected that this process will provide a "no-build" comparison through the evaluation of the control sites which represents a sample of the population or the "do nothing" alternative.

4. The evaluation of past spot safety improvement projects on the state trunkline system has been utilized to monitor the effectiveness of individual projects and improvements. These data served as the basis for the development of accident reduction factors which are used to forecast expected safety benefits in terms of accident and severity reductions for candidate locations. Through this process, it is possible to determine the contribution of various improvement types and aid in the selection and implementation of effective countermeasures. This utlimately facilitates the decision to continue, modify, or delete various types of highway safety programs. Stage Three of the MIDAS model will provide computerized techniques for alternative analysis and objective optimization.

APPENDIX II

HIGHWAY SAFETY IMPROVEMENT PROGRAM PROCEDURAL INFORMATION CODES

Table 1 Instructions and Codes

Procedural and Status Information
Highway Safety Improvement Program
Annual Report 1981

Highway Location Reference System

Column (1) - Percent of miles covered by location reference system.

Column (2) - If column (1) is less than 100 percent, show date it is expected 100 percent of highway mileage will be covered by reference method. (Year)

Traffic Records System

Column (3) - Percent of reported accidents for which accident data is linked with traffic volume data.

Column (4) - Percent of reported accidents for which accident data is linked with highway inventory data through automated processing (Change -- last year it was only asked if such linkage was possible).

Hazardous Locations

Column (5) - Criteria used to identify high hazard locations for further study.

Codes (more than one may apply)

- A Number of accidents
- E Economic loss/accident cost
- L A specific number of locations (e.g. top 100)
- R Accident rate, including rate-quality control
- S Accident severity
- Y Other (Describe on separate sheet)
- Z Under development

Column (6) - Factors taken into account in establishing hazardous location project priorities.

<u>CODES</u> (more than one may apply)

- C Criteria indicated in column (5)
- E Cost-benefit analysis
- I Onsite inspection
- P Project cost
- R Accident number and/or severity reduction expected from project
- Y Other (describe on separate sheet)
- Z Under development

<u>Elimination of Roadside Obstacles</u>

Column (7) - Factors analyzed in establishing project priorities for correction of roadside obstacle hazards.

<u>CODES</u> (more than one may apply)

- A Accident data
- E Cost-benefit analysis
- H Highway system or type
- I Type of obstacle/type of improvement
- O Obstacle survey data
- R Accident number and/or severity reduction expected from project
- S Traffic speed or speed limit
- V ADT
- Y Other (describe on separate sheet)
- Z Under development

Skid Improvement Projects

Column (8) - Factors analyzed in determining priorities for correcting hazardous skid prone location.

CODES (more than one may apply)

- A Total accidents
- E Cost-benefit analysis
- G Roadway geometrics
- I Onsite inspection other than skid testing
- P Pavement texture or other pavement characteristic besides skid number
- R Accident number and/or severity reduction expectd from project
- S Skid number
- V ADT
- W Wet pavement accidents
- Y Other (describe on separate sheet)
- Z Under development

Hazardous Bridges

Column (9) - Factors analyzed to determine priorities for correcting operationally hazardous conditions associated with bridges.

CODES (more than one may apply)

- A Accident history
- B Bridge width
- D Approach geometry
- E Cost-benefit analysis
- G Condition of approach guardrail and transition
- R Accident number and/or severity reduction expected from project
- S Posted speed limit

V ADT

W Bridge width in relation to approach width

Y Other (describe on separate sheet)

Z Under development

Railroad-Highway Grade Crossings

Column (10) - Method used to update crossing inventory

CODES

B State inventory separate but National Railroad-Highway Crossing Inventory also being effectively maintained

N National Railroad-Highway Crossing Inventory Update Manual (used as State inventory)

S State inventory - National Railroad-Highway Crossing Inventory not being maintained

Y Other (describe on separate sheet)

Column (11) - Factors taken into account in establishing project priorities

CODES

A Potential for reducing the number and/or severity of accidents

E Cost-benefit analysis

H Hazard index formula (show formula on separate sheet and define all terms)

I Onsite inspection

M Hazardous materials factor

P People factor (buses, passenger trains, pedestrians, bicyclists)

T Characteristics of train traffic (volume, speed, etc.)

V Characteristics of highway traffic (volume, speed, etc.)

W Existing warning devices

Y Other (describe on separate sheet)

Column (12) - Number of crossings upgraded to full MUTCD standards thru installation of crossbucks, advance warning signs, and/or pavement markings during the period July 1, 1973 to June 30, 1981, without regard to funding source. If this information was reported last year for the period July 1, 1973 to June 30, 1980, report only for the period July 1, 1980 to June 30, 1981. Check the appropriate item at the bottom of column (12) to indicate which period is being reported.

Column (13) - Number of public crossings that do not comply with minimum MUTCD standards as of June 30, 1981.

Column (14) - Percentage of public crossings that do not comply with minimum MUTCD standards as of June 30, 1981.

Column (15) - Target date for full compliance with MUTCD (Year).

APPENDIX III

INSTRUCTIONS AND CODES FOR EVALUATION DATA

Table 2 Instructions

Evaluation Data for Completed Improvements
Highway Safety Improvement Program
and
Pavement Marking Demonstration Program
Annual Report 1981

General

- o Provide information only for improvements with at least 1 year "before" and 1 year "after" accident data.
- o Information for columns (1) through (16) is required.
- o Information for columns (17) through (22) is optional.
- o Supplemental information is requested relative to the property damage only (PDO) information to be reported in columns (9) and (14). The threshold for reporting PDO accidents varies among the States and may be changed within an individual State at any time. Therefore, information relative to the reporting threshold and to the estimated percentage of PDO accidents actually reported would be very helpful. (Change -- this supplemental information was not requested last year).
- o If optional information (i.e., columns 17 thru 22) is provided, data for each individual project should be reported on a separate line. If optional information is not provided, data for more than one project may be combined as long as the source of funds (column 1), safety classification code (column 2), before and after periods (columns 6 and 11), and evaluation status (column 16) are the same. (Change -- last year exposure data, involving calculations from given formulas, was requested).

Column (1) - Indicate source of funds for the safety improvement.

Code:

HH - High Hazard Location Projects

RO - Elimination of Roadside Obstacles

HR - High Hazard/Roadside Obstacle

HE - Hazard Elimination Program

SR - Safer Roads Demonstration

PM - Pavement Marking Demonstration Program

RR - Rail-Highway Crossings

SO - Safer Off-System Roads Program

IS - Interstate Safety Improvements

FA - Other safety improvements made with Federal-aid funds

SL - Safety improvements funded with State and local funds only

Column (2) - Indicate the type of safety improvement as classified by Safety Classification Codes in FHWA Administrative Manual, Volume 22, Chapter V, Paragraph 23.

Column (3) - For the improvement(s) included on each line enter the total cost(s) in thousands of dollars to one decimal place.

Column (4) - Based on the classification code used in column (2), enter the total quantity of improvements included on each line according to the codes below:

Safety Codes	Quantity of Improvements	Unit Codes
10-19	Number of Intersections	X
20-24, 27, 29, 67	Number of miles (0.1)	M
25, 26	Either of the above as appropriate	X or M
30-39, 66	Number of structures	S
50-59	Number of crossings	R
64	Highway miles of centerline marked	C
	Highway miles of edgeline marked	E
	Highway miles of both center and edgelines marked	B
	Number of intersections marked (crosswalks, stop bars, etc.)	X
	Number of railroad grade crossings marked	R
	Other markings	As appropriat
68	Number of locations	L
All others	Any of the above as appropriate	As appropriat
Any	Unknown	N

Column (5) - Indicate the appropriate units code for quantity shown in Column (4). If quantity of improvements is not available, use "N" in column (5).

Columns (6) and (11) - Indicate the number of months included in the "before" and "after" periods, repectively.

Columns (7) and (12) - Enter the number of fatal acidents that occured in the "before" and "after" periods, respectively.

Columns (8) and (13) - Nonfatal injury accidents.

Columns (9) and (14) - Property damage only accidents. At the bottom of Table 2, please enter (a) the threshold for reporting PDO accidents, that is, the minimum dollar value required before a non-injury accident must be reported, and (b) a rough estimate of the number of PDO accidents that actually are reported. (Change -- the threshold and PDO percentage information were not requested last year).

Columns (10) and (15) - Total accidents.

Column (16) - For each line of data in the table:

- o Enter "P" if this is preliminary data and more evaluation data will be submitted on the project(s)
- o Enter "F" if this is the final evaluation data that will be submitted on the project(s).

Columns (17) and (18) - For each line entry, based on the classification codes used in column (2), enter the appropriate "before" and "after" ADT. (Change -- last year this same information was utilized in formulas which provided exposure information relative to million-vehicles or million-vehicle miles. This year the computer will be used to make the calculations). Although optional, this information will be of great value. Please note that each individual project should be shown on a separate line.

Column (19) - Leave blank. (Change -- last year unit codes for the exposure data were shown here).

Column (20) - Enter "R" if projects are in a rural area, enter "U" if projects are in an urban area, and enter "B" if projects are in both rural and urban areas. (Change -- last year the "B" code was not included).

Column (21) - Enter number of lanes. For divided highways indicate the total number of lanes in both directions. For intersection projects enter the number of lanes on the major street.

Column (22) - Enter "U" if roadway is undivided, enter "D" if roadway is divided, and enter "B" if roadway, within the project limits, contains both undivided and divided sections. For intersection projects indicate if the major street is divided or undivided. (Change -- last year the "B" code was not included).