IDENTIFICATION OF LOCATIONS SUITABLE FOR RAISING THE SPEED LIMIT ON FULL ACCESS ROADS IN MICHIGAN

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16. Abstract: In 1999 a bill was introduced in the Michigan Legislature that would require the Michigan Department of Transportation (MDOT) in consultation with the Michigan State Police (MSP), to designate up to 1500 miles of non-freeway Trunk Line Highways on which a test would be conducted to determine the impact of raising the speed limit. The maximum speed limit on this class of roads is currently 55 MPH, and the bill would permit an increase in the speed limit up to 65 MPH.

In meetings with the MDOT advisory committees it was decided that three criteria would be used to define eligible sections for the demonstration program:

1) The prevailing speed (85th percentile) exceeds 60 MPH; and
2) The crash rate is lower than the statewide average crash rate on those sections meeting criterion number one; and
3) These two criteria exist for a minimum length of 25 miles (excluding any urban areas where the speed limit was reduced below 55 MPH).

The prevailing speed on the rural trunklines in Michigan exceeds 60 MPH on most of the sections where speed data is available, including 17 of 21 PTR locations. The crash data and ADT data can be used to identify sections of the Trunk Line systems that have a relatively low crash rate combined with a prevailing speed of 60 MPH or higher. Thus, if the legislature passes a bill allowing a test of the impact of raising the speed limit on a sample of rural non-freeway trunkline highways, test sections can be easily identified that meet the criteria established in this study.

Since there are a large number of sections of the Michigan Trunk Line system where the prevailing speed is currently greater than 60 MPH and the crash rate is below the state average the sites selected could vary by geometry. The cost of modifying the signs and pavement marking to conduct this experiment would be between $500,000 and $1,000,000, depending on which road sections were selected.

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DISCLAIMER

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INTRODUCTION

In 1999 a bill was introduced in the Michigan Legislature that would require the Michigan Department of Transportation (MDOT) in consultation with the Michigan State Police (MSP), to designate up to 1500 miles of non-freeway Trunk Line Highways on which a test would be conducted to determine the impact of raising the speed limit. The maximum speed limit on this class of roads is currently 55 MPH, and the bill would permit an increase in the speed limit up to 65 MPH.

A separate section of this bill directed the MDOT, in conjunction with the MSP, to designate up to 500 miles of rural freeway where a test of the impact of raising the speed limit for commercial vehicles from 55 MPH up to 65 MPH would be conducted. The maximum speed limit on rural freeways in Michigan is 70 MPH for automobiles and 55 MPH for commercial vehicles.

A research project was initiated to obtain information that could be used to establish guidelines for the selection of the test sections and to obtain baseline data for the proposed experiment. The tasks to be completed in the study were:

Task 1 – Conduct a state-of-the-art review of the impact of raising speeds above 55 MPH on non-freeway sections of highways.

Task 2 – Select a sample of roads to be used for the field test in Michigan.

Task 3 – Analyze the impact of raising truck speeds on the freeway system.

Task 4 – Prepare a final report on the findings.

Task 5- Review the geometry of each of the test sections to determine the changes required in the number or location of traffic control devices.

Task 6 – Select a sample of roads to be used as a control group.

Task 7 – Establish baseline crash data for the two samples.

Task 8 – Obtain and/or collect speed data before the speed limit is raised.

Task 9 – Obtain and/or collect speed data after the speed limit is raised.

Task 10 – Analyze the speed and crash data.

Phase one (which included tasks 1 through 4) was funded by MDOT, with phase two to be funded if the proposed legislation was enacted. Subsequently, task 5 was added to the work plan and part of task 3 was deleted since the task could only be conducted if the truck speed limit was changed.

This bill was not enacted in the 1999 or 2000 legislative sessions, but may be re-introduced in the 2001 session. This report contains the results of the activity on those tasks that could be completed.

<u>Task 1 State-of-the Art Review</u>

The first two objectives of the state-of-the-art survey were:

1) To determine which states had raised the speed limit on non-freeway rural highways and/or raised the speed limit for commercial vehicles on rural freeways.
2) To determine which of these states had data on vehicle speeds, vehicle crashes and vehicle exposure (VMT) which could be used to determine the impact of speed limit changes in their state.

Telephone contact was made with a representative of the Department of Transportation in each state, and the data on the current speed limits was compiled on a spread sheet (Tables 1 and 2). Table 1 lists the state, the automobile and commercial vehicle speed limits on rural freeways, and the data this speed limit was established. Ten states had raised their speed limits for automobiles to 75 MPH, eighteen had raised their speed limit for automobiles to 70 MPH

TABLE 1 - Speed Limits on Rural Freeways for Cars and Trucks as of May 2000

STATE	CARS	DATE ESTABLISHED	TRUCKS	DATE ESTABLISHED
ALABAMA	70	May-96	70	May-96
ALASKA	65	January-88	65	January-88
ARIZONA	75	December-95	75	December-95
ARKANSAS	70	August-96	65	August-96
CALIFORNIA	70	January-96	55	January-96
COLORADO	75	June-96	75	June-96
CONNECTICUT	65	October-98	65	October-98
DELAWARE	65	January-96	65	January-96
FLORIDA	70	May-96	70	May-96
GEORGIA	70	July-96	70	July-96
HAWAII	55	-	55	-
IDAHO	75	May-96	65	May-98
ILLINOIS	65	April-87	55	April-87
INDIANA	65	June-87	60	June-87
IOWA	65	May-87	65	May-87
KANSAS	70	March-96	70	March-96
KENTUCKY	65	June-87	65	June-87
LOUISIANA	70	August-97	70	August-97
MAINE	65	June-87	65	June-87
MARYLAND	65	July-95	65	July-95
MASSACHUSETTS	65	January-92	65	January-92
MINNESOTA	70	July-97	70	July-97
MISSISSIPPI	70	February-96	70	February-96
MISSOURI	70	March-96	70	March-96
MONTANA	75	May-99	65	April-87
NEBRASKA	75	July-96	75	July-96
NEVADA	75	December-95	75	December-95
NEW HAMPSHIRE	65	April-87	65	April-87
NEW JERSEY	65	January-98	65	January-98
NEW MEXICO	75	May-96	75	May-96
NEW YORK	65	August-95	65	August-95
NORTH CAROLINA	70	August-96	70	August-96
NORTH DAKOTA	70	July-96	70	July-96
OHIO	65	July-87	55	-
OKLAHOMA	70	December-95	70	December-95
OREGON	65	September-87	55	-
PENNSYLVANIA	65	July-95	65	July-95
RHODE ISLAND	65	May-96	65	May-96
SOUTH CAROLINA	65	August-87	65	August-87
SOUTH DAKOTA	75	April-96	75	April-96
TENNESSEE	70	April-98	70	April-98
TEXAS	70 (65 night	December-95	60 (55 night)	April-87
UTAH	75	June-96	75	June-96
VERMONT	65	April-87	65	April-87
VIRGINIA	65	July-88	65	July-94
WASHINGTON	70	March-96	60	March-96
WEST VIRGINIA	70	August-97	70	August-97
WISCONSIN	65	June-87	65	June-87
WYOMING	75	December-95	75	December-95

(including Michigan), twenty-one had a speed limit of 65 MPH, and Hawaii had retained the 55-MPH speed limit.

Eight states had raised the commercial vehicle speed limits to 75 MPH, thirteen states had raised the limit to 70 MPH, twenty had raised the limit to 65 MPH, three had a current speed limit of 60 MPH, and the remaining six (including Michigan) had retained the 55 MPH limit. Texas was the only state that had a different speed at night than during the day.

Table 2 contains similar data for non-freeway roads in each state, including the data when the change was made. This table is categorized by roadway geometry since some states had different speed limits based on the geometry. More than half the states (29) had raised the speed limit on some non-freeway roads by 1999, with the most common change being to raise the speed limit to 65 MPH.*

A total of 40 states were then contacted to determine whether the state had data available that would assist in this study. This contact was made by telephone or email, depending on the response to the initial inquiry. The specific questions asked in this survey were:

a) Is speed data before and after the speed limit was changed? If so, what is the source of the data (permanent counters or spot speeds)

b) Is crash data available before and after the speed limit was changed? If so, does the crash data differentiate between automobiles and commercial vehicles.

c) Is the data available in electronic format, and is it accessible to the research team.

This results of the survey were then used to identify states that could be included in a summary of the impact of raising speed limits as proposed in the bill introduced in Michigan.

*The U.S. Department of Transportation later published a document titled "Summary of State Speed hours – Fourth Edition" in January, 2000 (DOT HS809007)

TABLE 2 - Non-Freeway Speed Limits as of May 2000

STATE	4 LN DIVIDEND	DATE ESTABLISHED	4 LN UNDIVIDED	DATE ESTABLISHED	2 LN	DATE ESTABLISHED
ALABAMA	65	May-96	65	May-96	55	-
ALASKA	55	-	55	-	55	-
ARIZONA	65	1998	65	1998	65	1998
ARKANSAS	70,60,55	May-97	55	-	55	-
CALIFORNIA	65 (55 trucks)	January-96	65 (55 trucks)	January-96	55	-
COLORADO	65 (some 55)	June-96	Do not exist	-	65 (some 55)	June-96
CONNECTICUT	55	-	55	-	55	-
DELAWARE	55	-	55	-	50	-
FLORIDA	65	May-96	60	May-96	60	May-96
GEORGIA	65		55	-	55	-
HAWAII	55	-	55	-	55	-
IDAHO	65	May 96-Mar 97	65	May 96-Mar 97	65	May 96 - Mar 97
ILLINOIS	65 (trucks 55)	Dec-95	55	-	55	-
INDIANA	55	-	55	-	55	-
IOWA	65 (some 55)	1996	55	-	55	-
KANSAS	70		65		65	
KENTUCKY	55	-	55	-	55	-
LOUISIANA	65	July-97	55	-	55	-
MAINE	55	-	55	-	55	-
MARYLAND	55	-	55	-	50	-
MASSACHUSETTS	55	-	55	-	55	-
MINNESOTA	65	Jul-97	Do not exist	-	55	-
MISSISSIPPI	65	late 1996	55	-	55	-
MISSOURI	65 (some 70)	March-96	60	March-96	60, 55	March-96
MONTANA	70 (60 trucks)	May-99	70 (60 trucks)	May-99	70 (60 trucks)	May-99
NEBRASKA	65	September-96	Do not exist	-	65,60,55	varies (most Sept 96)
NEVADA	70 (55 trucks)	Dec-95	70 (55 trucks)	Dec-95	70 (55 trucks)	Dec-95
NEW HAMPSHIRE	55	-	55	-	55	-
NEW JERSEY	55	-	55	-	55	-
NEW MEXICO	70	May-96	70	May-96	65 with shldr, 60 w/o	May-96
NEW YORK	55	-	55	-	55	-
NORTH CAROLINA	55	-	55	-	55	-
NORTH DAKOTA	65 (55night)	Jul-96	65 (55 night)	Jul-96	65 (55 night)	Jul-96
OHIO	65		55	-	55	-
OKLAHOMA	70	Dec-95	65	Dec-95	65	Dec-95

TABLE 2 (continued)

OREGON	55	-	55	-	55	-
PENNSYLVANIA	55	-	55	-	55	-
RHODE ISLAND	55	-	55	-	50	-
SOUTH CAROLINA	55	-	55	-	55	-
SOUTH DAKOTA	65	1996	65	1996	65	1996
TENNESSEE	55 (some 65 or 60)	1996?	55 (some 65 or 60)	1996?	55	-
TEXAS	70 (65 night, 60/55 tr)	Dec-95	70 (65 night, 60/55 tr)	Dec-95	70 (65 night, 60/55 tr)	Dec-95
UTAH	65	Jun-96	55	-	55	-
VERMONT	55	-	Do not exist		50	-
VIRGINIA	55	-	55	-	55	-
WASHINGTON	70/65/55*	7/96, 3/97	65/55*	7/96, 3/97	65/55*	7/96, 3/97
WEST VIRGINIA	65 (some 55)	Aug-97	55	-	55	-
WISCONSIN	65/55	Jun-96	55	-	55	-
WYOMING	65	Dec-95	65	Dec-95	65	Dec-95

An additional criterion used to identify candidate states were that the speed limit for either commercial vehicles or rural freeways or all vehicles on non-freeways had been raised prior to January 1, 1997. This date was selected because sufficient data to measure the impact would not be available for changes made after that date.

Five states met these requirements for the study of the impact of raising the speed limit for commercial vehicles on rural freeways. These states were Idaho, Oklahoma, Texas, Washington and Wyoming. However, each of these states had at least one factor that might limit the applicability of their data to the study in Michigan.

In Idaho, the commercial vehicle speed limit was raised to 75 MPH in May 1996, but then lowered to 65 MPH in May of 1998. Thus, only two years of data would be available for comparison with the prior speed limit of 55 MPH.

In Oklahoma, the speed data was all from spot speed studies (as opposed to permanent monitoring stations), and thus it would not be possible to match speed data at the same location for the before and after period. In Texas, the 55-MPH speed limit for commercial vehicles was retained at night. In Washington, only one year of after crash data was available at the time they were contacted. Finally, the speed data from Wyoming was obtained from portable weigh-in-motion devices, and was only available for 5 days each year.

Before obtaining the data from these states, we retrieved the commercial vehicle exposure data the states submit to the US Department of Transportation. Table 3 presents the volume data reported for these states.

TABLE 3 – Commercial Vehicle Miles of Travel on Rural Freeways (in millions)

YEAR	IDAHO	OKLAHOMA	TEXAS	WASHINGTON	WYOMING
1991	299	Not Reported	1916	438	230
1992	336	"	1979	405	408
1993	348	"	1960	393	529
1994	338	"	2235	390	425
1995	368	"	2446	414	621

Table 4 presents the fatal crashes in which a commercial vehicle was involved for each year.

TABLE 4 – Fatal Crashes Involving a Commercial Vehicle on Rural Freeways

YEAR	IDAHO	OKLAHOMA	TEXAS	WASHINGTON	WYOMING
1991	3	Not Reported	35	5	7
1992	5	"	29	7	5
1993	1	"	34	3	2
1994	3	"	33	2	8
1995	3	"	36	7	6

The fatal crash data from all the states except Texas are considered too small to be used to draw conclusions on the impact of raising the speed limit for commercial vehicles. The VMT data also appears to be questionable, especially in Wyoming (which reported a 20% decrease in 1994 followed by a 46% increase in 1995, and Washington (which reported a lower VMT in 1995 than in 1991). For these reasons, a decision was made to not collect and analyze data from these states in an attempt to assess the impact of raising commercial vehicle speeds on rural freeways. Instead, the data from the U.S. DOT was used to determine if there was a different rate of fatal crashes involving commercial vehicles between states that had a different commercial vehicle speed limit and those that did not.

For this study, the commercial vehicle involved fatal crash rate was used to compare the states.

A 1994 study by Harkey and Mera titled "Safety Impacts of Different Speed Limits on Cars and Trucks" was conducted to determine whether differential or uniform (non-differential) speed limits are more beneficial to transportation safety and traffic operations on Interstate highways. The authors concluded that:

- The 65/65 and 65/60 speed limits had very few differences in mean speed, speed variance and compliance.
- The 65/55 speed limit affects the travel speed of trucks by reducing the number of trucks in excess of 70 mph, and consequently reducing the speed variance for trucks.
- The 65/55-speed limit results in larger speed variance for all vehicles and a greater number of car/truck interactions when compared to 65/60 and 65/65.
- The accident analysis showed very little difference in overall accidents or accident severity between states with respect to the type of speed limit.
- The accident analysis suggests that the type of collision and role of the vehicles involved may be impacted by the type of speed limit:
    a) For differential speed limit states, car-truck rear-end crashes were more likely to involve a car striking the truck.
    b) For uniform speed states, all car-truck accidents were more likely to involve trucks striking cars.

Summary of Task 1

The majority of states had raised the speed limits for commercial vehicles on rural freeways by 1999. However, in each case the entire freeway system was changed at the same time. No state conducted a study as proposed in Michigan, to raise the speed limit on a limited number of miles and monitor the change in speeds and traffic crashes on these segments compared to other segments where the speed limit remained at 55 MPH.

Likewise, more than half the states had increased the speed limit for all vehicles on non-freeway roads. In some states the speed limit was raised on only certain types of road – typically four lane divided with access – but in other states the speed limit on all roads was raised. Once again, no state chose to review the prevailing speed and crash history as a basis for selecting road segments where the speed limit would be raised.

Thus, there is not much information on what criteria should be used to select the experimental sections in Michigan, or what the impact on safety a travel speed will be for those selected highway segments.

Each state that reported that crash data and speed data were available were contacted again to determine the form and availability of these data. None of these states had more than spot data on traffic volumes, and none of the states had selected the road sections where the speed would be increased based on prevailing speed or the crash history.

Five states reported that they had conducted a study of the impact of raising speed limits on non-freeway roads in their state. Copies of the reports of these studies were obtained, and the results summarized below.

a) Texas – Texas has 20 locations with volume data on approximately 5400 miles on the rural U.S. and State Highway system. They reported that when the speed limit on these roads was increased from 55 mph to 70 mph, the average speed at these 20 locations increased by 4-5 mph in the first year. The fatal and injury crashes on multilane divided highways increased by 25.5%, multilane undivided highways by 8.7% and on two-lane highways by 32.6% in the first year after the changes.

b) Iowa – Iowa raised the speed limit on 248 miles of rural expressways. They reported an increase of 6-7 mph in the 85th percentile speed in the year after the speed limit was increased from 55 to 65 mph. The fatal and injury crash rate increased by 40.2% on a portion of these miles selected for the crash study.

c) Minnesota – Minnesota reported an increased of 2.1 mph in the 85th percentile speed on divided highways when the speed limit was increased from 55 to 65 mph. They did not report the crash results for this roadway type.

d) Wisconsin – Wisconsin reported a 4.3 mph increase in the 85th percentile speed and a 43.7 percent increase in fatal and injury crashes after raising the speed limit on rural expressways from 55 to 65 mph.

e) Arkansas – Arkansas reported one fatal crash on rural expressways in the first year after raising the speed limit to 60 MPH from 55 MPH. There were no fatal crashes in the previous year.

Task 2 – Select a Sample of Roads to be used for the Field Test

In meetings with the MDOT advisory committees it was decided that three criteria would be used to define eligible sections for the demonstration program:

1) The prevailing speed (85th percentile) exceeds 60 MPH; and
2) The crash rate is lower than the statewide average crash rate on those sections meeting criterion number one; and
3) These two criteria exist for a minimum length of 25 miles (excluding any urban areas where the speed limit was reduced below 55 MPH).

Two sources of data were used to identify locations on the rural state trunkline system with a prevailing speed exceeding 60 MPH. First, the data from the Permanent Traffic Recorders (PTR) locations were retrieved from the files for the years 1995 and 1997. There was no data file available for 1996.

The data for June, July and August for each of the 34 PTR stations was analyzed and it was determined that 13 stations had no data in the file, 17 stations had a prevailing speed of more than 60 MPH and 4 stations had a prevailing speed of 60 MPH or lower.

Second, the data files from all spot speed studies available at MDOT were reviewed, and locations with a prevailing speed exceeding 60 MPH were identified. In most cases, this data consisted of sample taken on one day, and often for only a sample large enough for the intended use, which was most often a speed zone analysis. However, the coverage of the Trunkline System from this source was much more extensive than that provided by the PTR data.

Using both sources, 166 locations were identified as meeting the first criterion. The control section that contained each of these spot locations was identified, and used for determining the second and third criterion.

The route number, county name and the length of the control section were obtained from the control section files maintained by MDOT. The traffic volume on the control section was taken from the 1998 ADT maps obtained from the Transportation Planning Bureau, and the number of crashes that occurred in 1998 were taken from the Michigan State Police crash file.

The accident rate (based on the weighted average ADT) was then determined for each control section. These data are shown in Table 5. The average crash rate for these control sections was then calculated. There were 124 sections used in the calculation after combining continuous control sections into a single analysis section. Figure 1 is a plot of the crash rate distribution over the 124 sections. The mean crash rate is 3.9, and the median crash rate is in the interval between 3 and 3.5 crashes per million vehicle miles. Those sections with a crash rate of less than 3.0 were considered as having met criterion 2.

Criterion 3 can also be assessed using Table 5 after combining contiguous sections into a single analysis zone. This was done and the sections that meet all three criteria were plotted on a map as shown in Figure 2.

The conclusions from task 3 is that the prevailing speed on the rural trunklines in Michigan exceeds 60 MPH on most of the sections where speed data is available, including 17 of 21 PTR locations. The crash data and ADT data can be used to identify sections of the Trunkline systems that have a relatively low crash rate combined with a prevailing speed of 60 MPH or higher. Thus, if the legislature passes a bill allowing a test of the impact of raising the speed limit on a sample of rural non-freeway trunkline highways, test sections can be identified that

TABLE 5

Locations in Michigan with 85% speed greater than 60 mph

S.No	Control Section	Route	County	Number of lanes	AADT (Max)	AADT (Average)	Length of Section	No. of Signilized intersections	No of Accidents (Year 1998)	Accident Rate (Year 1998)
Superior Region										
1	2021	M-94	Alger	2	1800	1728	25.79	0	30	1.84
2	2041	M-28	Alger	4	7700	4663	26.74	0	53	1.16
3	2042	M-28	Alger	2	7200	5458	15.67	0	37	1.19
4	7023	US-41/ M-28	Barga	2	3300	3300	14.01	0	33	1.96
5	17011	M-123	Chippewa	2	1500	1420	21.89	0	6	0.53
6	17022	M-134	Chippewa	2	1500	952	11.58	0	16	3.98
7	17043	M-48	Chippewa	2	890	700	24.05	0	36	5.86
8	17062	M-28	Chippewa	2	2400	2150	22.30	0	31	1.77
9	21011	M-69	Delta	2	5400	5400	5.23	0	30	2.91
10	21022	US-2/US-41	Delta	2,4	25000	17750	8.41	5	166	3.05
11	21024	US-2/US-41	Delta	2,4	8800	6225	25.42	0	121	2.09
12	21031	M-35	Delta	2,4	18000	8400	17.69	2	172	3.17
13	21032	M-35	Delta	2,4	8100	4516	25.72	0	134	3.16
14	22012	M-95	Dickinson	2	3400	3200	16.23	0	120	6.33
15	22022	US-2	Dickinson	2,4	11000	1456	5.61	1	102	34.21
16	22042	M-69	Dickinson	2	1700	1147	23.24	0	64	6.58
17	22051	US-8	Dickinson	2	3000	2233	2.34	0	27	14.16
18	27021	US-2	Gogebic	2,4	14000	9217	12.56	5	82	1.94
19	27023	US-2	Gogebic	2	1100	935	25.65	0	33	3.77
20	27031	M-64	Gogebic	2	360	305	9.60	0	3	2.81
21	27051	US-45	Gogebic	2	3000	2123	12.42	0	35	3.64
22	31012	M-26	Houghton	2	19000	11237	8.36	0	87	2.54
23	31021	M-28	Houghton	2	2000	1967	15.26	0	15	1.37
24	31031	M-203	Houghton	2	5600	2708	18.01	0	54	1.91
25	31041	M-38	Houghton	2	540	540	12.30	0	30	12.37
26	36021	US-2	Iron	2,4	7600	3787	16.60	1	69	3.01
27	36051	US-2	Iron	2	3000	2833	10.00	0	60	5.80
28	42011	M-26/US-41	Keweenaw	2	4800	3050	10.17	0	12	1.06
29	48041	M-28	Luce	2	3500	2560	15.38	0	37	2.57
30	49022	US-2	Mackinac	2,4	5000	4600	21.28	0	60	1.68
31	49031	M-117	Mackinac	2	2100	1950	9.97	0	19	2.68
32	49071	M-129	Mackinac	2	2800	2550	4.99	0	23	4.95
33	52041	US-31/M-28	Marquette	2,4	18000	10720	26.03	3	162	1.59
34	52042	US-41	Marquette	2,4	26000	13588	15.76	8	343	4.39
35	52061	M-28	Marquette	2	7800	5850	11.23	2	26	1.08
36	55011	US-41	Marquette	2,4	23000	14040	21.41	5	322	2.93
37	55012	US-41	Marquette	2,4	6200	3570	20.89	0	115	4.22
38	55031	M-35	Menominee	2,4	8800	4867	34.51	1	85	1.39
39	66021	M-28/ M-64	Ontonagon	2	2100	2100	8.56	0	13	1.98
40	66022	M-28	Ontonagon	2	2500	2250	19.57	0	77	4.79
41	66031	US-45	Ontonagon	2	2000	1656.7	14.24	0	30	3.48
42	66042	M-38	Ontonagon	2	5200	2760	13.27	0	38	2.84
43	66051	M-26	Ontonagon	2	2400	1393	15.49	0	21	2.67
44	75022	US-2	Schoolcraft	2	7100	5050	25.91	0	124	2.60
45	75051	M-77	Schoolcraft	2	1800	1298	17.33	0	17	2.07
North Region										
46	1051	US-23	Alcona	2	3900	3667	10.43	0	53	3.80
47	4012	M-65	Alpena	2	3200	2350	10.05	0	23	2.67
48	15091	US-131	Charlevoix	2	6900	5020	13.27	0	78	3.21
49	20022	M-72	Crawford	2,4	7600	4550	17.60	1	52	1.78
50	28052	M-37	Grand Traverse	2	9800	4850	18.03	2	36	1.13

TABLE 5 (Continued)

51	35011	M-65	Iosco	2	4100	3950	7.97	0	47	4.09
52	43022	US-10	Lake	2	5700	4633	17.34	0	86	2.93
53	51011	US-31	Manistee	2,4	15000	10964	7.17	2	149	5.19
54	51021	M-55	Manistee	2	4500	2860	25.10	0	67	2.56
55	51041	M-115	Manistee	2	2300	2267	9.57	0	24	3.03
56	53022	US-10	Mason	2	7300	5800	12.13	1	131	5.10
57	57012	M-66/ M-55	Missaukee	2	11000	9980	4.91	0	42	2.35
58	67022	US-10	Osceola	2	11000	6281	23.49	1	118	2.19
59	68012	M-72/ M-33	Oscoda	2	8900	6125	18.32	0	57	1.39
60	69022	M-32	Otsego	2	3800	3800	11.67	0	32	1.98
61	69023	M-32	Otsego	2,4	28000	12900	6.96	1	89	2.72
62	83022	M-55	Wexford	2,4	30000	13300	6.58	1	31	0.97
63	83032	US-131	Wexford	2,4	32000	15856	18.66	3	370	3.43
Grand Region										
64	34033	M-66	Ionia	2	12000	9375	5.70	1	84	4.31
65	34061	M-21	Ionia	2	18000	8085	13.40	2	113	2.86
66	34062	M-21	Ionia	2	9800	5637	12.69	0	108	4.14
67	41033	M-37	Kent	2,4	47000	14671	17.12	2	652	7.11
68	41043	M-21	Kent	2,4	26000	13718	15.10	2	276	3.65
69	41061	M-11	Kent	2,4	35000	19228	8.30	2	337	5.79
70	41081	M-45	Kent	2,4	20000	16537	5.79	3	320	9.16
71	54011	Old US-131	Mecosta	2,4	16000	5657	15.83	2	116	3.55
72	54022	M-20	Mecosta	2,4	16000	8125	26.30	3	209	2.68
73	54031	M-66	Mecosta	2	3200	3200	8.97	1	81	7.73
74	54032	M-66	Mecosta	2	4500	3440	14.99	1	99	5.26
75	59022	M-57	Montcalm	2	11000	9100	9.42	1	75	2.40
76	59032	M-91	Montcalm	2,4	15000	11685	18.14	3	272	3.52
77	59041	M-46	Montcalm	2	5200	5200	2.76	0	19	3.63
78	59051	M-66	Montcalm	2	9700	7388	20.47	0	198	3.59
79	59052	M-66	Montcalm	2	4100	4100	2.84	0	9	2.12
80	61012	M-120	Muskegon	2	22000	14050	19.60	2	212	2.11
81	62032	M-37	Newaygo	2	6600	4616	20.60	0	57	1.64
82	64011	US-31	Oceana	2	5100	4600	10.11	0	ND	ND
83	70014	US-31	Ottawa	2	30000	17000	7.63	3	384	8.11
Bay Region										
84	6072	US-23	Arenac	2,4	17000	11280	9.51	1	89	2.27
85	6073	US-23	Arenac	2,4	10000	8750	17.83	0	92	1.62
86	9011	M-84	Bay	2	14000	11250	5.26	1	51	2.36
87	9021	M-138	Bay	2	2100	1767	5.42	0	13	3.72
88	9033	M-13	Bay	4	16000	11428	20.53	4	212	2.48
89	9042	M-251-75BS	Bay	2,3,4	23000	12437	12.85	12	381	6.53
90	18041	M-61	Clare	2,4	10000	6444	17.43	1	67	1.63
91	25074	M-54	Genesee	4	10000	10000	2.93	0	80	7.48
92	25092	M-15	Genesee	2,4	20000	10325	13.22	1	132	2.65
93	26011	M-18	Gladwin	2,4	15000	8062	12.67	1	103	2.76
94	29012	M-46	Gratiot	2,4	13000	11725	2.68	1	78	6.80
95	32012	M-25	Huron	2	6800	3167	29.13	1	98	2.91
96	37012	US-27BR	Isabella	2,4	25000	16237	2.13	3	24	1.90
97	44012	M-24	Lapeer	2,4	23000	13742	19.05	1	272	2.85
98	44031	M-53	Lapeer	2,4	21000	17333	10.08	1	144	2.26
99	73021	M-57	Saginaw	2,4	10000	7930	22.96	2	132	1.99
100	73031	M-52	Saginaw	2	13000	8085	20.42	0	168	2.79
101	73051	M-13	Saginaw	2,4	17000	10145	18.39	2	161	2.36
102	73062	M-46	Saginaw	2,3,4	30000	17561	8.96	11	299	5.21
103	73073	M-47	Saginaw	4	19000	15600	13.64	4	526	6.77
104	74012	M-53	Sanilac	2	5800	5000	18.05	0	87	2.64

TABLE 5 (Continued)

105	74032	M-19	Sanilac	2	2200	2200	18.05	0	45	3.10
106	74072	M-25	Sanilac	2	8400	4900	11.36	1	43	2.12
107	74073	M-25	Sanilac	2	4800	2440	18.41	0	67	4.09
108	79032	M-15	Tuscola	2,4	15000	10960	6.85	2	26	0.95
109	79041	M-46	Tuscola	2	7000	5666	15.84	0	65	1.98
110	79051	M-24	Tuscola	2	8300	5750	14.39	0	106	3.51
111	79061	M-81	Tuscola	2,4	20000	10077	16.90	1	176	2.83
South West Region										
112	3023	M-89	Allegan	2,4	27300	17130	13.19	3	311	3.77
113	3041	M-222	Allegan	2	10000	7300	10.12	1	62	2.30
114	8012	M-43	Barry	2,4	14000	6671	15.36	1	170	4.55
115	8032	M-37	Barry	2,4	11100	10016	13.85	1	147	2.90
116	11081	BL-94	Berrien	2,4	5300	4100	2.42	2	10	2.76
117	12021	US-12	Branch	2,4	15000	10109	17.87	2	181	2.75
118	12061	M-60	Branch	2	4200	3600	8.00	0	19	1.81
119	13021	M-60	Calhoun	2	6100	4625	8.98	0	48	3.17
120	13032	M-66	Calhoun	2,4	18000	11800	7.21	3	218	7.02
121	14011	M-51	Cass	2	13000	8487	15.91	1	142	2.88
122	141031	M-62	Cass	2	8600	6740	11.19	0	85	3.09
123	14032	M-62	Cass	2	12000	6725	8.37	2	70	3.41
124	14033	M-62	Cass	2,4	4500	4450	5.14	0	20	2.40
125	14041	US-12	Cass	2	12000	9083	16.01	0	89	1.68
126	14042	US-12	Cass	2	7200	5200	10.55	0	60	3.00
127	14062	M-60	Cass	2	9600	6900	13.21	2	57	1.71
128	39014	US-131	Kalamazoo	2,4	20000	12833	5.04	1	67	2.84
129	39051	US-131 BR	Kalamazoo	2	9800	4490	5.98	4	133	13.57
130	39081	M-43	Kalamazoo	2,4	29000	20300	9.18	4	449	6.60
131	78011	M-103	St. Joseph	2	3900	3900	3.10	0	14	3.17
132	78012	US-131	St. Joseph	2,4	19000	10312	10.46	3	101	2.57
133	78021	US-12	St. Joseph	2	5100	4800	5.14	0	17	1.89
134	78042	M-60	St. Joseph	2,4	13000	4900	22.43	2	157	3.91
135	80041	M-43	Van Buren	2,4	10000	6590	12.47	1	107	3.57
Metro Region										
136	50012	M-53	Macomb	2,4	19000	15267	11.20	4	46	0.74
137	63022	M-53	Oak Land	3,4	76000	49714	11.29	0	1030	5.03
138	63041	M-59	Oak Land	2,3,4	46000	28000	21.21	13	1372	6.33
139	63043	M-59	Oak Land	2,3,4	37500	27611	10.67	1	420	3.91
140	63071	M-15	Oak Land	2,4	26000	19500	11.57	2	304	3.69
141	77011	M-19	St. Clair	2	7700	5950	7.16	1	34	2.19
142	77012	M-19	St. Clair	2	6800	5478	12.44	2	70	2.81
143	77033	US-25	St. Clair	2	17000	11533	8.16	0	101	2.94
University Region										
144	19031	US-27	Clinton	2,4	34000	20912	16.14	4	323	2.62
145	19061	M-21	Clinton	2,4	7700	5175	14.52	2	87	3.17
146	23011	Old M-78	Charlotte	2	6100	4725	7.18	2	34	2.75
147	23012	Old US-27	Eaton	2	6500	6167	12.29	2	91	3.29
148	23021	M-79	Eaton	2,4	13000	9600	12.26	0	100	2.33
149	23041	M-43	Eaton	2	11000	6014	16.13	0	119	3.36
150	23042	M-43	Eaton	2,4,6	40000	26153	6.99	7	429	6.43
151	23051	M-50	Eaton	2	7500	5920	9.87	1	84	3.94
152	23052	M-50	Eaton	2	6600	4740	19.22	0	100	3.01
153	30062	US-12	Hillsdale	2	12000	8500	17.00	1	84	1.59
154	33021	M-36	Ingham	2,4	18000	6054	20.64	5	115	2.52
155	33051	M-52	Ingham	2	7200	5300	8.95	0	53	3.06

TABLE 5 (Continued)

156	38072	M50/ BR127	Jackson	2,4	20000	16500	1.73	4	224	21.50
157	46032	M-156	Lenawee	2	3100	2216	10.66	2	19	2.20
158	46062	US-223	Lenawee	2,4	19000	.14952	18.56	6	178	1.76
159	46071	M-52	Lenawee	2	7000	4800	10.95	0	46	2.40
160	47062	I-96 BL	Livingston	2,4	32000	26000	4.05	1	243	6.32
161	47082	M-59	Livingston	2	14500	18184	16.36	2	336	3.09
162	58042	M-50	Monroe	2,3,4	14000	8587	8.50	4	131	4.92
163	58051	US-24	Monroe	2,4	14000	10760	6.10	0	42	1.75
164	58071	M-125	Monroe	2,4	25000	12431	19.46	12	321	3.64
165	76011	M-52	Shiawassee	2,4	11000	9030	16.28	5	184	3.43
166	81063	US-12	Washtenaw	2,3,4	12500	10700	6.05	0	205	8.68

FIGURE 1 - Crash rate on Michigan Trunkline highways with prevailing speeds greater than 60 MPH

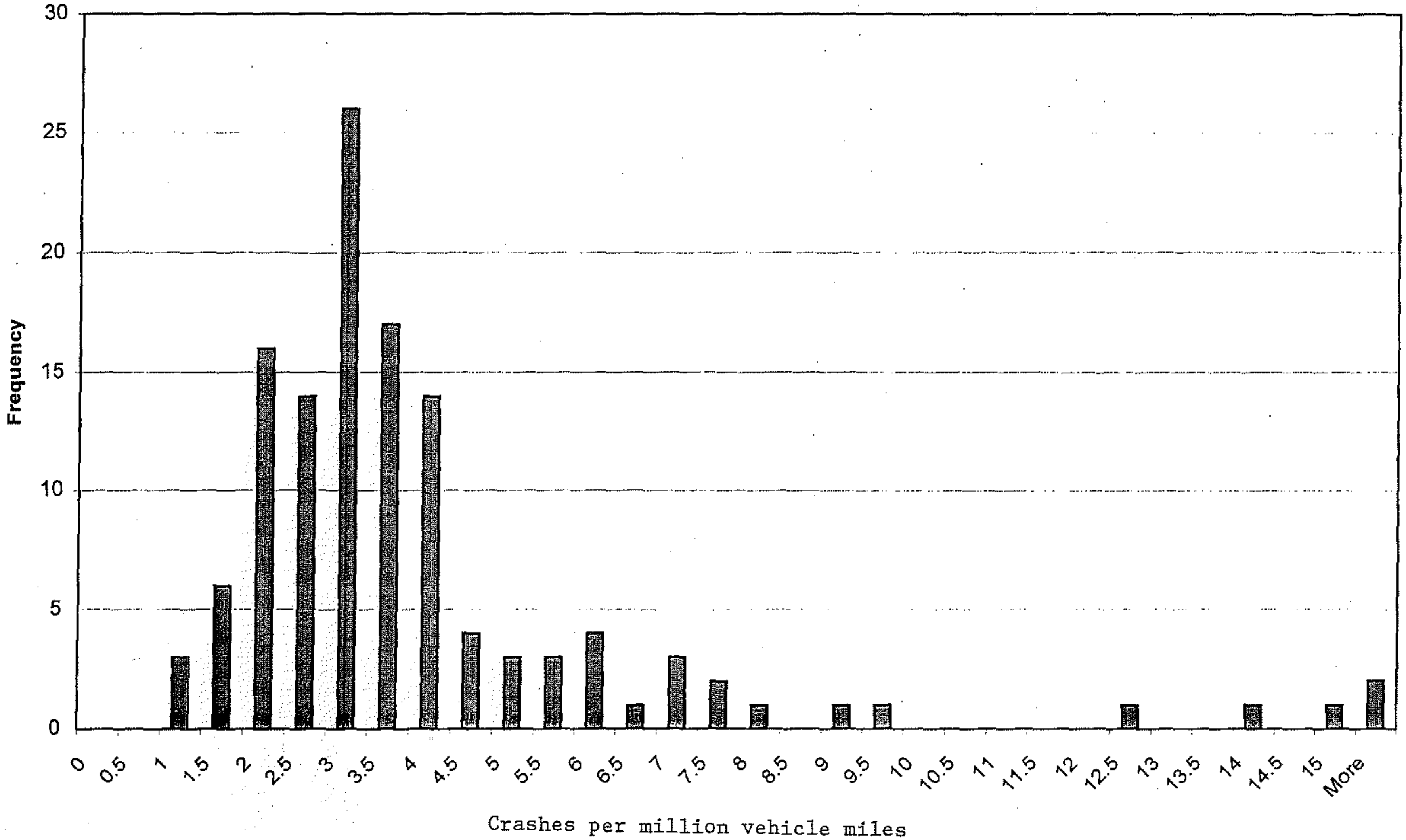
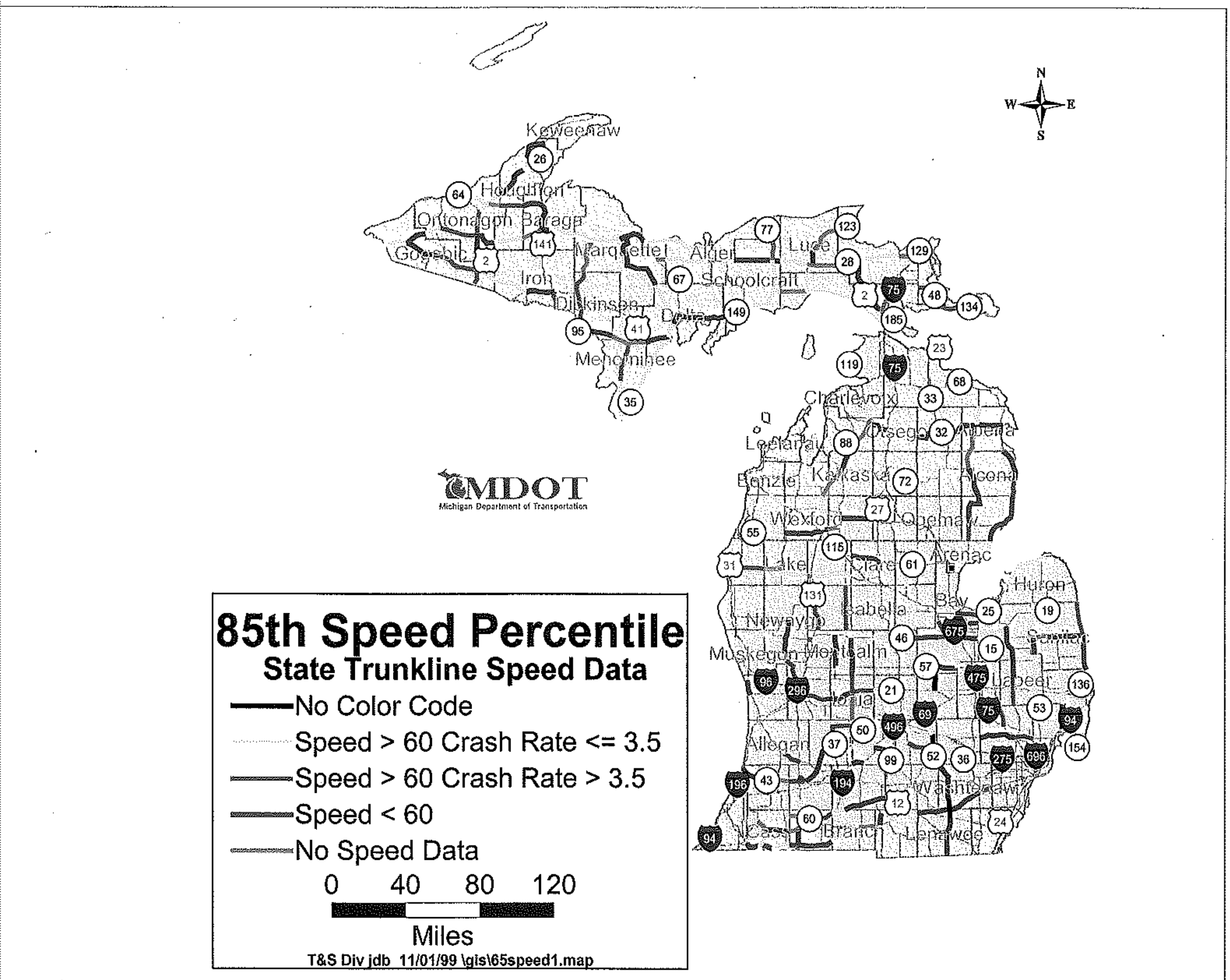


FIGURE 2 - Speed and Crash Data for Michigan Trunkline Highways



meet the criteria established in this study. However, before making the final selections, the following analyses should be conducted:

1) There are many miles of rural trunkline where there is no speed data available. The crash rate on these highways should be determined, and for those sections where the crash rate is lower than 3 crashes/mvm, speed studies should be conducted to determine if these sections would qualify to be included in the test sections.
2) Additional speed data should be collected in any section tentatively identified as a candidate location for the test, since in most control sections only one speed study has been conducted.
3) The crash rate should be determined for the latest year that crash data is available to verify that the low crash rate still exists.

Task 3 – Analyze the Impact of Raising Truck Speeds on the Freeway System

Since crash data is not uniform among states the crash data used in this analysis was obtained from the FARS report. The date was reduced to only fatal crashes involving one-trailer trucks or two (+) trailer trucks. There were five years of data available for use, 1991 to 1995. The FARS data is categorized by area, urban or rural, and only the rural data were used to calculate the crash rate.

As noted above, the vehicle miles of travel data reported by the US DOT was inconsistent. Therefore, the data was edited to eliminate entire states (or specific years in states that were not eliminated) where the data appeared to be incorrect. The crash data and the VMT data were then combined to calculate the crash rates for differential and non-differential speed states, respectively.

Table 6 and Table 7 show the fatal crash rate for these two categories.

TABLE 6 – States with Different Speed Limits for Commercial Vehicles (fatal crashes per 100 million vehicle miles)

Rural	Arkansas	California	Michigan	Illinois	Indiana	Texas
1991		0.011902664	0.007260728			0.018266
1992		0.012621267	0.008941369	0.008437		0.014652
1993	0.014471571	0.016044935	0.005548109	0.008869	0.008825	0.017345
1994	0.008300741				0.00756	0.014763
1995	0.01148555	0.016195614		0.006137	0.011165	0.014713

TABLE 7 – States with the Same Speed Limit for Cars and Commercial Vehicle (fatal crashes per 100 million vehicle miles)

Rural	Alabama	Arizona	Louisiana	Missouri	Ohio	Pennsylvania
1991	0.008756518	0.017955134	0.02000669	0.013178172	0.010577879	0.018336383
1992			0.02066636			0.013513048
1993	0.011917653		0.017342085	0.012887751		
1994		0.012122784		0.009904052	0.00604119	
1995		0.00988753	0.013637217			0.011537326

Rural	Tennessee	Florida	Kansas	Kentucky	Nevada	Wisconsin
1991	0.018051			0.015435		
1992			0.007112			0.004723
1993		0.017377	0.007008	0.016138	0.012091	
1994	0.013218	0.013716	0.012417	0.01236	0.011783	
1995		0.01156		0.01122	0.014685	

The weighted average fatal crash rate for each of these two categories is shown in Figure 3 for the years 1991 through 1995. The conclusion from the analysis is that there are no significant differences between states that had adopted a uniform speed for automobiles and commercial vehicles, and those that adopted a different speed limit for commercial vehicles.

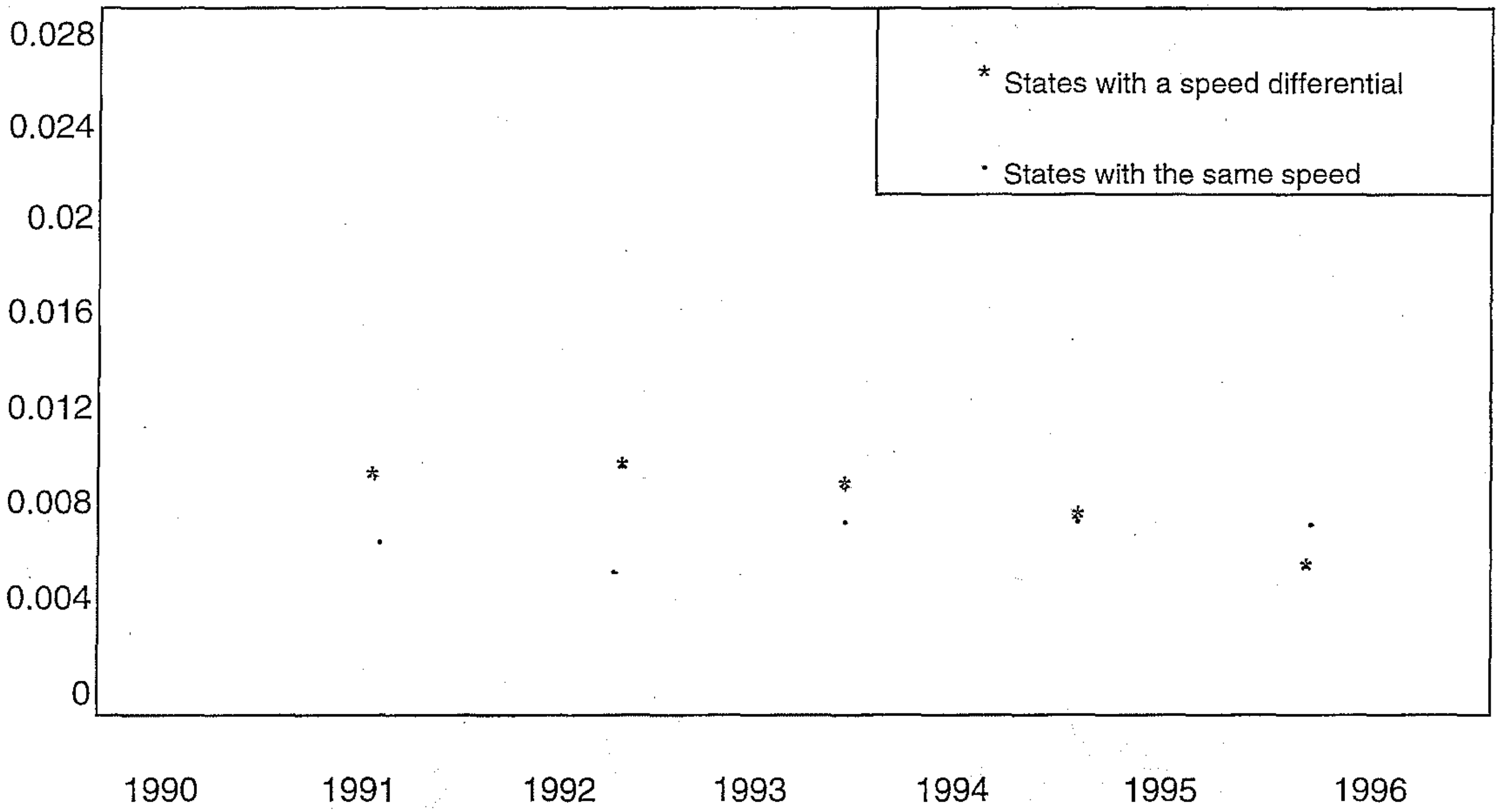


Figure 3 - Crashes per 100 million vehicle miles for states with the same speed limit for trucks and automobiles, and for states with a speed limit differential

Task 5 – Review the Geometry in a Sample of the Eligible Sections to Estimate the Cost of Implementing a Change in the Speed Limit.

This task was moved from phase two to phase one after the bill proposing a change in the speed limit was not reported out of the House committee. Since the intent of the test is to include various geometric designs and to include sections from various parts of the State, the sample was selected accordingly.

The sections of highway selected for the analysis were M-52 from M-36 to the Saginaw County line; US-12 from Coldwater to Niles; US-2 from St. Ignace to the Schoolcraft County line; US-131 from Cadillac to Petoskey; and M-62 from the Indiana state line to M-140. M-52 is a two-lane road with a straight alignment; US-12 is a combination of 2-lane and 4-lane alignment with a more curved alignment, US-2 is a 2-lane road with passing lanes in the Upper Peninsula; US-131 is a two-lane road with a straight alignment in northern lower Michigan, and M-62 is a 2-lane road with a curved alignment.

The traffic control devices, and the geometric features that could affect the need for traffic control devices, that were recorded in the field inspection were;

a) The beginning and ending of "no passing zones" due to horizontal or vertical curves

b) Horizontal curve signs

c) Horizontal curves where passing is allowed, but where the passing sight distance would need to be checked for 60 MPH.

d) Intersections where the cross sight distance would need to be checked to see if the clear distances exceed 600 feet.

Table 8 presents a summary of the results of the field study.

Table 8 – Average Number Of Observations Per Mile For Various Traffic Control Devices

Route	Miles	No Passing Zones	Curve Signs	Curves where passing is allowed	Intersections to be tested
M-52	42	0.8	0.2	0.2	0.4
US-12	82	1.6	0.2	0.2	0.3
US-2	63	0.3	0.2	0.9	0.3
US-131	78	0.5	0.3	0.6	0.4
M-62	38	1.6	0.6	0.2	0.2
Total	303	0.9	0.3	0.4	0.3

There is a significant variation in the number of signs that would need to be replaced if the speed limit were increased from 55 MPH to 60 MPH on the different sample sections. The curvature of the road is certainly the most significant variable, because of the many no-passing zones on roads with a large number of horizontal and vertical curves, US-12 and M-62 each average more than one no-passing zone per mile, while US-2 averages only one such zone every three miles. Each zone would require a passing sight distance study and the repositioning of three signs (a no passing regulatory sign, a no passing warning sign and a pass with care sign) as well as repainting the no passing marking on the pavement. This will be the highest cost item if the speed limit is changed.

The location of the curve warning signs would also need to be moved to conform to the minimum distances specified in the MMUTCD. Obviously the speed limit signs would also need to be replaced. These average spacing of speed limit signs is about three miles.

Each 0.4 miles, on the average, there is a horizontal curve that is not marked as a no-passing zone. Many of these would need to be reviewed to determine if no-passing restrictions would be required with an increased speed limit. Most intersections have clear sight lines adequate for an increase in the speed limit from 55 MPH to 60 MPH but there is an average of one intersection every three miles that would require a study to determine if the sight distance is adequate.

A rough estimate of the cost of conducting an experiment on 1500 miles of trunkline, based on the sample routes studied, is shown in Table 9.

Table 9 – Cost of Changing the Speed Limit on 1500 miles of Michigan Trunkline Highways

ACTIVITY	PERSON HOURS	COST
• No Passing Zone Study – 0.9 zones per mile times 1500 miles times a crew of 3 times one hour at $30.00 per hour	4050	$121,500
• Moving no-passing zone signs at a unit cost of $100		$405,000
• Moving Curve Warning Sign and replacing speed limit signs at a unit cost of $100.00		$185,000
• Checking intersection sight distance 0.3 intersections per mile times 1500 miles times a crew of 2 times one hour at $30.00 per hour.	900	$27,000
• Checking horizontal and vertical curves that are currently not marked as no-passing zones. 0.4 curves per mile times 1500 miles times a crew of 3 times one-hour at $30.00 per hour.	1800	$54,000
TOTAL		$792,500

Adding the cost of vehicles used in the studies and travel time to the test sections and moving other warning signs that might be impacted by the change in the speed limit would increase the cost. However, if the test sections are selected from roads that have few horizontal and vertical curves, the cost could be considerably lower than estimated since the major cost item is moving the no-passing zone signs.

SUMMARY AND CONCLUSIONS

The state-of-the-art review did not provide much information useful to this study. No state has selected a sample of roads having a high prevailing speed and a low accident rate as a basis for raising the speed limit. Instead, they raised the speed on all rural highways or all rural highways with a specific geometry (such as all 4-lane highways). No state carried out an adequate analysis of the change in the speed parameters following the change in the speed limit, thus it is not possible to relate any change in crashes to a change in these parameters.

There are an adequate number of sections of the Michigan Trunkline system where the prevailing speed is currently greater than 60 MPH and the crash rate is below the state average to conduct the study proposed in the 1999 bill introduced by Representative Vear and others. The cost of modifying the signs and pavement marking to conduct this experiment would be between $500,000 and $1,000,000, depending on which road sections were selected.