

# **Evaluation of the Impacts of Reducing Truck Speeds on Interstate Highways in Idaho**

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**FINAL REPORT**

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**TABLE OF CONTENTS**

**EXECUTIVE SUMMARY ..... 1**

**BACKGROUND..... 3**

**METHODOLOGY ..... 4**

**RESEARCH QUESTIONS AND FINDINGS ..... 8**

**DISCUSSION ..... 19**

**List of Tables**

Table 1. Permanent count stations .....	5
Table 2. Crash data locations .....	7
Table 3. Passenger car mean speeds, before and after speed limit change (mi/h).....	8
Table 4. Truck mean speeds before and after speed limit change (mi/h) .....	9
Table 5. Average speed changes in mph before and after speed limit change (mi/h) .....	11
Table 6. t-test to determine statistical significance in changes in passenger car and truck speeds.....	11
Table 7. t-test to determine statistical significance in changes in passenger car and truck pace .....	12
Table 8. Mean speeds and standard deviations, I-84, Yale.....	13
Table 9. Mean speeds and standard deviations, I-84, Cottoral .....	14
Table 10. T-test for speed differential.....	15

**List of Figures**

Figure 1. Mean speeds from August 1997 to May 1999, ATR 30.....	6
Figure 2. Speed changes before and after speed limit change .....	10
Figure 3. Variation of mean speeds and standard deviations.....	14
Figure 4. Percentage of trucks exceeding speed limit.....	16
Figure 5. Collision data, all vehicles.....	17
Figure 6. Collision data for commercial vehicles .....	18

## **EXECUTIVE SUMMARY**

The 1998 Idaho Legislature passed legislation that lowered the speed limit for a certain class of trucks operating on interstate highways. The speed limit change results in a differential of ten miles per hour between passenger cars and trucks with five or more axles weighing more than 26,000 pounds. Since uniformity in traffic speeds is an important factor in highway safety, speed differentials may often reduce the safety of the highway.

This study examines speed measurements taken at 17 locations on interstate highways in Idaho, as well as crash statistics along these same highways, taken both before and after the change in truck speed limits. These measurements provide the information needed to make a preliminary assessment regarding the effect of the speed limit change.

The following is a summary of the key findings of this study:

- Passenger car speeds remain unchanged at 73.5 mph.
- Truck speeds declined slightly. Mean speeds dropped by 1.5 mph, while 85<sup>th</sup> percentile speeds declined by 2.9 mph. While these changes are small, they are statistically significant.
- Speed differentials between trucks and passenger cars increased from 5.5 mph to 7.1 mph. Again, while this change is small, it is statistically significant.
- The proportion of trucks violating the speed limit increased significantly from about 20 to 30 percent before the speed limit change to between 70 and 80 percent after the change.
- The standard deviation in vehicle speeds did not increase, indicating that the uniformity in speeds remained unchanged.
- Crash data did not increase as a result of the speed limit change.

While the potential for a decrease in safety exists because of the speed limit differential, data collected thus far show that a real change in the safety level has not occurred. The passenger car-truck speed differential increased slightly. But the standard deviation in vehicle speeds has not increased. And, while the crash data is limited, there is no evidence of an increase in crashes involving trucks.

The Idaho Transportation Department should continue to monitor the effects of the speed limit change, using both speed measurements and crash data.

## **BACKGROUND**

House Bill 623, passed by the 1998 Idaho Legislature, made several significant changes in the law governing the operation of trucks on Idaho highways. The legislation contained, among other things, amendments to Idaho Code 49-654 to allow the Idaho Transportation Board to set a maximum speed limit on interstate highways of 65 miles per hour for trucks with five or more axles weighing more than 26,000 pounds. The revised speed limit means that these trucks are restricted to speeds of ten miles per hour less than those of passenger cars.

It is generally believed that uniform vehicle speeds result in safer highways, while a higher deviation in vehicle speeds, particularly between different vehicle types, lowers the relative safety of the highway. If the change in the law increases the dispersion of vehicle speeds, particularly increasing the differential between passenger cars and trucks, the relative safety of Idaho's interstate system may decrease.

The purpose of this report is to provide preliminary answers to the following questions relative to the safety of interstate highways in Idaho:

- What are the speed characteristics of passenger cars and trucks on Idaho's interstate highways before and after July 1, 1998?
- Has there been a change in traffic safety on Idaho's interstate highways as a result of the change in the truck speed limit?

## **METHODOLOGY**

The Idaho Transportation Department (ITD) regularly collects vehicle speed and crash data. ITD's Planning Division has a number of permanent traffic count stations located throughout the state at which speed, vehicle classification, and volume data are gathered continuously. ITD's Office of Traffic Safety records crash statistics and compiles them periodically to assess the relative safety of different segments of the state's transportation system.

Speed data were assembled at 17 permanent count stations on Idaho's four interstate highways. These sites are listed in Table 1. Monthly mean speed, 85<sup>th</sup> percentile speed, and pace data were gathered for the following time periods:

- August 1997
- November 1997
- February 1998
- May 1998
- August 1998
- November 1998
- February 1999
- May 1999

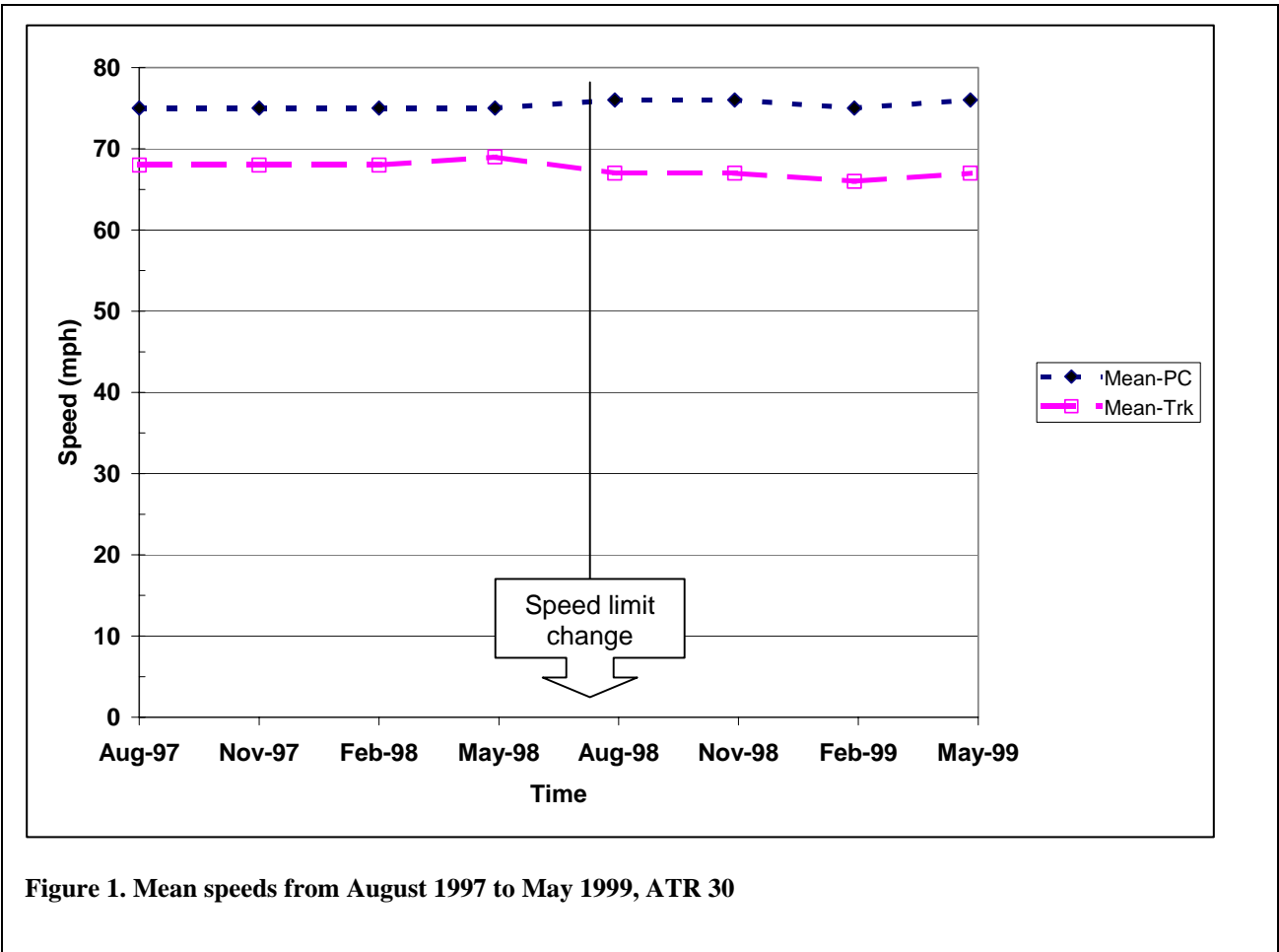
A time series analysis of the changes in passenger car and truck speed was conducted to provide the basis for assessing any speed changes resulting from the change in the law. The data were also grouped into before and after categories to enable a study of the effect of the speed limit changes.

**Table 1. Permanent count stations**

Site			Data Collection Period	
Interstate	Milepost	ATR Number	Begin Date	End Date
I-15	1.965	22	5/1/98	5/1/99
I-15	61.870	4	5/1/98	11/1/98
I-15	96.060	64	11/1/98	5/1/99
I-15	132.780	61	5/1/98	5/1/99
I-15	176.000	73	5/1/98	5/1/99
I-84	14.900	123	8/1/97	8/1/98
I-84	19.100	25	5/1/98	5/1/99
I-84	58.357	2	5/1/98	5/1/99
I-84	62.068	87	5/1/98	5/1/99
I-84	114.500	71	5/1/98	5/1/99
I-84	159.230	7	5/1/98	5/1/99
I-84	227.580	89	8/1/97	5/1/99
I-84	231.000	30	8/1/97	5/1/99
I-84	257.300	101	2/1/99	5/1/99
I-86	14.410	18	5/1/98	5/1/99
I-86	56.400	67	5/1/98	5/1/99
I-90	35.590	8	5/1/98	5/1/99



Figure 1 shows an example of a time plot of the passenger car and truck data measured between August 1997 and May 1999 for ATR site 30, on Interstate 84 at milepost 231.0. Four measurements are shown before the speed limit change, and four measurements are shown after the speed limit change. The plot shows that passenger car speeds increased slightly, while truck speeds declined somewhat.



Crash data were assembled for each of Idaho’s four interstate highways. The data were gathered for three years, two years before the speed limit change and one year after the speed limit change. A comparison in the number of crashes was made for these two periods. Conclusions are only preliminary because of the limited amount of data. Table 2 lists the locations for which the crash data were collected.

**Table 2. Crash data locations**

<b>Interstate highway</b>	<b>Site designation</b>	<b>Milepost range</b>
I-15	I15a	0 – 66.78
	I15b	73.1 – 196.0
I-84	I84a	0 - 25.5
	I84b	25.501 – 48.660
	I84c	55.0 - 275.65
I-86	I86	0 – 61.268
I-90	I90	33.380 – 59.0

## RESEARCH QUESTIONS AND FINDINGS

The two basic questions that must be answered here are:

- What are the speed characteristics of passenger cars and trucks on Idaho’s interstate highways before and after July 1, 1998?
- Has there been a change in traffic safety on Idaho’s interstate highways as a result of the change in the truck speed limit?

This section of the report provides answers to each question, supported by seven findings.

### What are the speed characteristics of passenger cars and trucks on Idaho’s interstate highways before and after July 1, 1998?

Finding #1: The speed of passenger cars on Idaho’s interstate highways was virtually the same before and after July 1, 1998.

Table 3 lists the mean speed, the 85<sup>th</sup> percentile speed, and lower bound of the pace for all sites, and for each interstate separately, for measurements taken both before and after July 1, 1998.

**Table 3. Passenger car mean speeds, before and after speed limit change (mi/h)**

	All		I-15		I-84		I-86		I-90	
Summary	Before	After	Before	After	Before	After	Before	After	Before	After
Mean speed	73.5	73.5	73.0	73.8	73.7	73.8	73.5	73.6	71.0	70.0
85 <sup>th</sup> percentile speed	79.6	79.8	79.5	80.3	79.8	80.0	79.0	79.5	78.0	77.0
Pace lower bound	70.5	70.8	68.8	70.9	71.1	71.4	71.0	70.5	67.0	66.5

**Notes:**

- *Before* data include all speed measurements taken before July 1, 1998.
- *After* data include all speed measurements taken after July 1, 1998.

The mean passenger car speed averaged over all sites remained at 73.5 mph both before and after July 1, 1998. Before the truck speed limit change, the mean speed of passenger cars ranged from 71.0 mph on I-90 in North Idaho to 73.5 to 73.8 mph on the other three Idaho interstates. After the change, the mean speed changes ranged from a 0.8 mph increase to a 1.0 mph decrease, essentially no change.

The 85<sup>th</sup> percentile speed and pace for passenger cars also changed very little.

**Finding #2:** The speed of trucks on Idaho's interstate highways decreased slightly when the speed limit was reduced on July 1, 1998.

Table 4 lists the mean speed, the 85<sup>th</sup> percentile speed, and lower bound of the pace for all sites, and for each interstate separately, for measurement taken both before and after July 1, 1998.

**Table 4. Truck mean speeds before and after speed limit change (mi/h)**

Summary	All		I-15		I-84		I-86		I-90	
	Before	After	Before	After	Before	After	Before	After	Before	After
Mean speed	67.9	66.4	68.5	67.4	67.5	65.7	70.5	67.8	67.0	65.3
85 <sup>th</sup> percentile speed	74.6	71.7	74.8	72.6	74.5	71.0	76.0	72.5	74.0	71.5
Pace lower bound	63.7	62.7	63.3	63.4	63.6	62.4	66.5	63.5	62.0	60.8

**Notes:**

- *Before* data include all speed measurements taken before July 1, 1998.
- *After* data include all speed measurements taken after July 1, 1998

Before July 1, 1998, the mean truck speed ranged from 67.5 mph to 70.5 mph on Idaho's four interstate highways. After July 1, the speed decreased an average of 1.5 mph, with a decrease ranging from 1.1 mph on I-15 to 2.8 mph on I-86.

The 85<sup>th</sup> percentile truck speed decreased an average of 2.9 mph, while the lower bound of the pace decreased 1 mph.

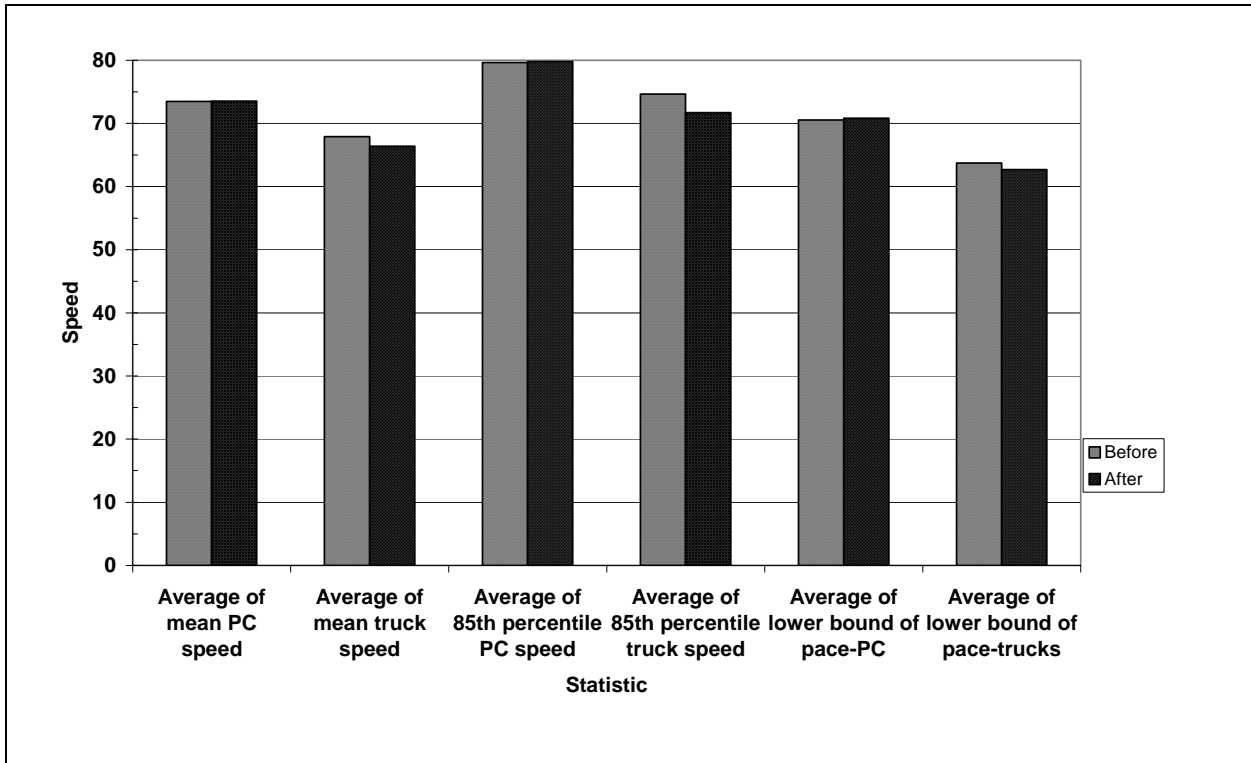


Figure 2. Speed changes before and after speed limit change

Finding #3: The decline in truck speeds was statistically significant.

Table 5 shows the before and after speed changes for both passenger cars and trucks for each interstate. Mean speed, 85<sup>th</sup> percentile speed, and the lower bound of the pace are shown in the table. While the truck speed changes appear to be greater than the passenger car changes, statistical tests are required to confirm this observation.

Figure 2 shows a plot of the before and after measurements for all sites for the mean speeds, 85<sup>th</sup> percentile speed data, and lower bound of pace for passenger cars and trucks.

**Table 5. Average speed changes in mph before and after speed limit change (mi/h)**

Speed data category	All Sites	I-15	I-84	I-86	I-90
Average of mean passenger car speed	0.1	0.8	0.1	0.1	-1.0
Average of mean truck speed	-1.5	-1.1	-1.9	-2.8	-1.8
Average of 85 <sup>th</sup> percentile passenger car speed	0.2	0.8	0.2	0.5	-1.0
Average of 85 <sup>th</sup> percentile truck speed	-2.9	-2.2	-3.4	-3.5	-2.5
Average of minimum pace for passenger cars	0.3	2.2	0.3	-0.5	-0.5
Average of minimum pace for trucks	-1.0	0.1	-1.2	-3.0	-1.3

A t-test was used to determine if the difference in the mean speed data was significant when comparing the mean speeds at each site during each measurement period before and after July 1, 1998. The test determines whether the apparent differences in the mean speeds are due to chance or because there is a real difference in the mean values.

Table 6 shows that the passenger car speeds remain statistically unchanged, while there is a 1.5 mile per hour reduction in truck speeds that is statistically significant.

**Table 6. t-test to determine statistical significance in changes in passenger car and truck speeds**

	Passenger Car Mean Speeds (mi/h)		Truck Mean Speeds (mi/h)	
	Before	After	Before	After
Mean	73.5	73.5	67.9	66.4
Variance	3.3	4.7	3.6	5.3
Number of observations	24	60	24	60
Alpha	.05		.05	
t-statistic	-0.15		2.86	
t-critical	1.99		1.99	

Note: Alpha is the significance level, an estimation of the probability that the speed differences are due to chance alone. The t-critical value is the theoretical test statistic. The t-statistic value is the computed value for the given data. If the absolute value of the t-statistic value is greater than the t-critical value, the apparent difference in the mean values of the speeds is likely a real difference, not due to chance.

Pace is the ten-mile per hour speed range that encompasses the greatest number of vehicles. The greater the number of vehicles traveling in the ten mile per hour range, the higher the stability in the traffic stream. Table 7 shows the proportion of vehicles traveling in pace both before and after the speed limit change. The proportion of passenger cars in pace remained unchanged. However, the proportion of trucks in pace increased, indicating that the speed limit change helped to bring more order to the commercial traffic stream. The issue of speed variation is discussed further below.

**Table 7. t-test to determine statistical significance in changes in passenger car and truck pace**

	Proportion of Passenger Cars in Pace		Proportion of Trucks in Pace	
	Before	After	Before	After
Mean	0.620	0.618	0.5958	0.7048
Variance	0.001	0.004	0.0013	0.0087
Number of observations	23	60	23	60
Alpha	0.05		0.05	
t-statistic	0.18		5.55	
t-critical	1.99		1.99	

Note: Alpha is the significance level, an estimation of the probability that the speed differences are due to chance alone. The t-critical value is the theoretical test statistic. The t-statistic value is the computed value for the given data. If the absolute value of the t-statistic value is greater than the t-critical value, the apparent difference in the mean values of the speeds is likely a real difference, not due to chance.

### **Has there been a change in traffic safety on Idaho’s interstate highways as a result of the change in the truck speed limit?**

There are a variety of ways in which we can assert whether there has been an increase or decrease in safety as a result of the speed limit change. This analysis considers the following indicators of potential or real change in highway safety:

- Change in the standard deviation of speed, indicating a greater potential for vehicle conflicts.

- Change in the differential between passenger car and truck speeds, again indicating a greater potential for vehicle conflicts.
- The proportion of trucks exceeding the speed limit, showing a need for increased enforcement or public information.
- Change in the truck crash rate, indicating an actual decrease in highway safety.

Finding #4: The standard deviation in vehicle speed did not change as a result of the change in the truck speed limit.

The dispersion of speeds is an indication of the relative safety of the traffic stream. The standard deviation of passenger car and truck speeds was computed for two sites on I-84, Yale and Cotteral (see Table 8 and Table 9). Figure 3 shows the before and after data for the Yale site. The data indicate that there was no identifiable change in the standard deviation of the vehicle speeds, either for passenger car or truck speeds, when comparing the before and after data.

**Table 8. Mean speeds and standard deviations, I-84, Yale**

Date	Mean Speeds (mi/h)			Standard Deviation of Speeds		
	Passenger Cars	Trucks	All Vehicles	Passenger Cars	Trucks	All Vehicles
8/2/97	75.0	68.3	72.9	6.60	5.95	7.12
11/2/97	75.2	68.4	72.3	6.55	6.01	7.16
2/2/98	74.6	68.2	71.4	7.44	6.31	7.62
5/2/98	75.3	68.8	72.8	6.55	5.84	7.03
8/2/98	75.6	67.3	72.9	6.52	4.91	7.19
11/2/98	75.8	67.1	72.1	6.59	4.86	7.29
2/2/99	74.6	66.2	70.3	7.89	5.78	8.06
5/2/99	75.7	67.2	72.3	6.61	4.82	7.28



Table 9. Mean speeds and standard deviations, I-84, Cottoral

Date	Mean speeds (mi/h)			Standard deviation of speeds		
	Passenger Cars	Trucks	All Vehicles	Passenger Cars	Trucks	All Vehicles
8/1/97	73.6	65.7	71.2	7.36	6.82	8.06
11/1/97	73.7	65.3	70.1	7.39	7.75	8.62
2/1/98	72.0	65.0	68.7	9.31	7.65	9.24
5/1/98	73.5	65.9	70.6	7.41	6.68	8.02
8/2/98	65.6	60.8	64.3	15.21	10.59	14.26
11/2/98	73.8	64.6	69.9	7.53	6.00	8.30
2/2/99	71.9	62.1	66.8	9.81	8.72	10.48
5/2/99	73.9	64.6	70.4	7.53	6.08	8.35

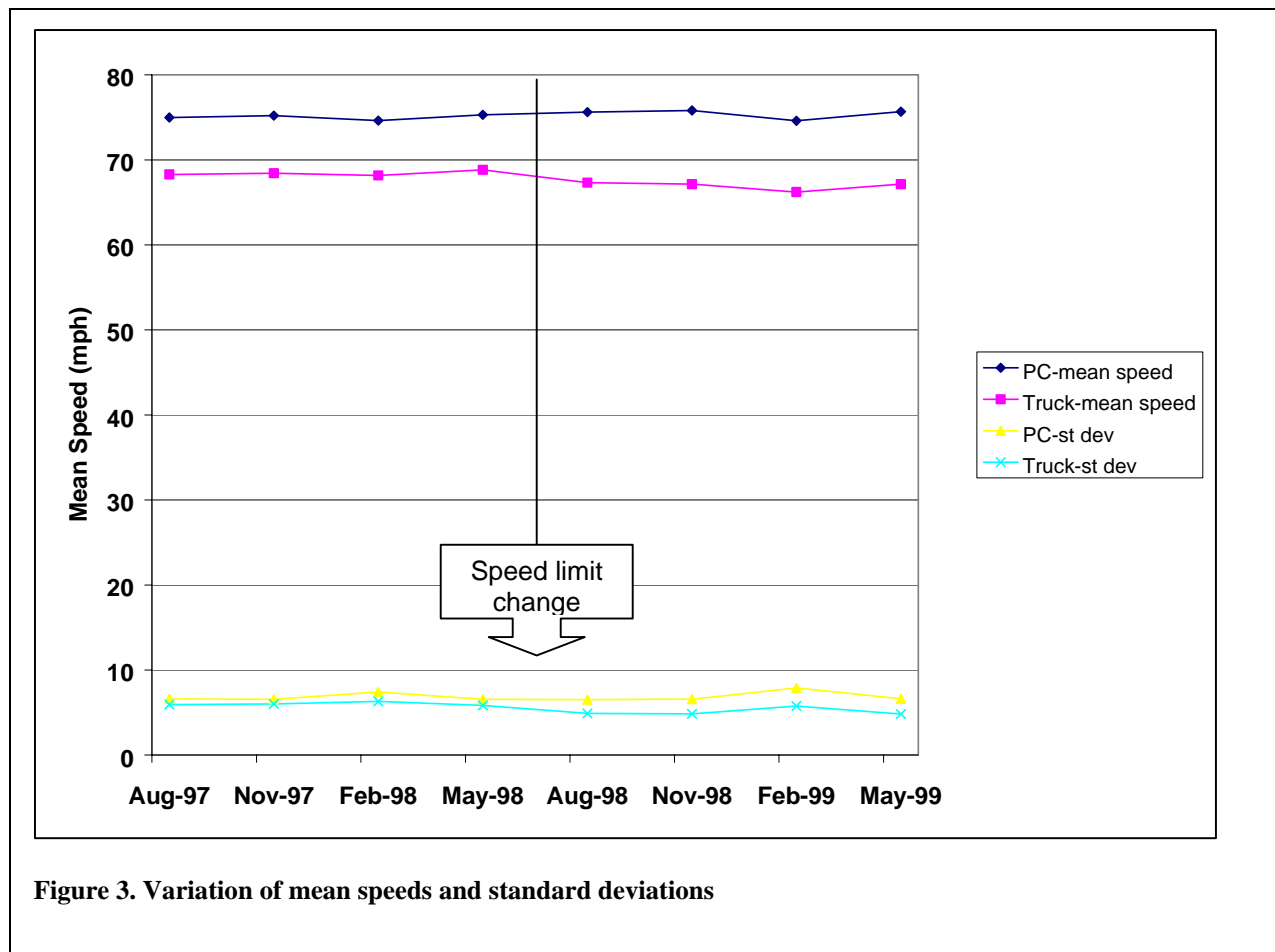


Figure 3. Variation of mean speeds and standard deviations

Finding #5: The differential between passenger car and truck speeds increased as a result of the change in the truck speed limit.

Speed differential between vehicle types is often an indicator of the potential for decreased safety. Table 10 shows that the mean differential between passenger cars and trucks was 5.5 mph before the speed limit change; this differential increased to 7.1 mph after the change. This change is statistically significant at the 0.05 significance level.

**Table 10. T-test for speed differential**

	<b>Before</b>	<b>After</b>
Mean speed differential (mi/h)	5.54	7.13
Variance of speed differential	3.39	3.44
Number of observations	24	60
Pooled Variance	3.43	
Hypothesized Mean Difference	0	
Degrees of freedom	82	
t Statistic	-3.561	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.664	
P(T<=t) two-tail	0.001	
t Critical two-tail	1.989	

Finding #6: The proportion of trucks violating the speed limit increased when the speed limit was changed.

Conformance to the speed limit may be an indicator of the relative safety of the highway. The percentage of heavy trucks exceeding the speed limit increased dramatically when the speed limit was reduced. This resulted from the large decrease in the speed limit (10 mph) and the small decrease in the speed of heavy trucks.

Figure 4 shows the percentage of trucks traveling at greater than 75 mph before July 1998 and greater than 65 mph after July 1998 at two sites, Massacre Rocks and Downey.

Before July 1998, only 20 to 30 percent of the trucks at the Downey site traveled above 75 mph. After July 1998, between 70 and 80 percent of the trucks at this site traveled above 65 mph. The same conclusion can be drawn about the Massacre Rocks site.

This increase in speed violations may indicate the need for increased enforcement or a more effective public information campaign.

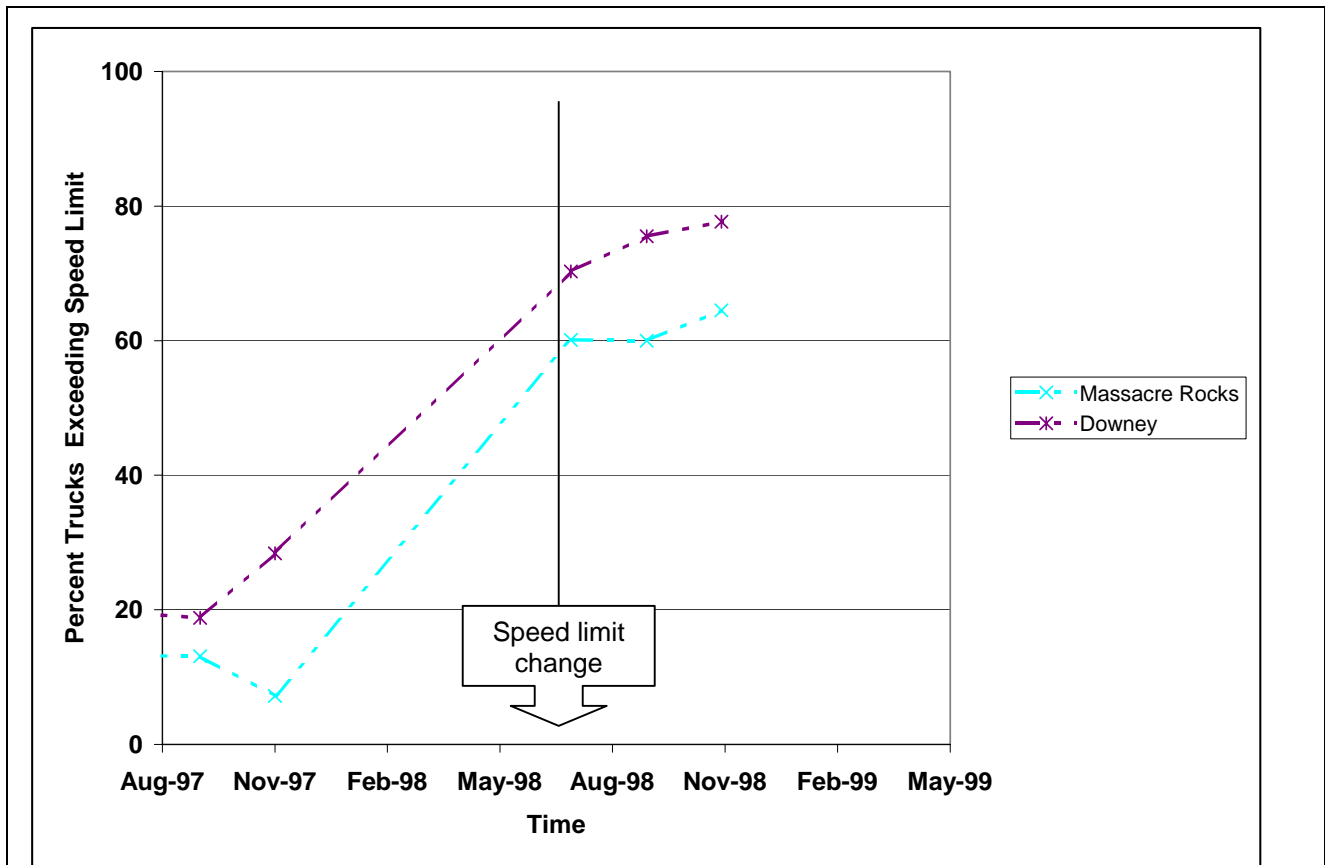


Figure 4. Percentage of trucks exceeding speed limit

Finding 7: The crash rates for all vehicles and for those crashes involving commercial vehicles did not change as a result of the speed limit change.

Figure 5 and Figure 6 show the collision data for all vehicles and for crashes involving commercial vehicles for two years<sup>1</sup> preceding the speed limit change and for the year after the speed limit change. The sites shown, noted by the interstate designation, are various locations on Idaho’s four interstate highways. Table 2 lists the site designations. While the number of data points is admittedly small, there is no discernable effect of the speed limit change on the number of observed collisions.

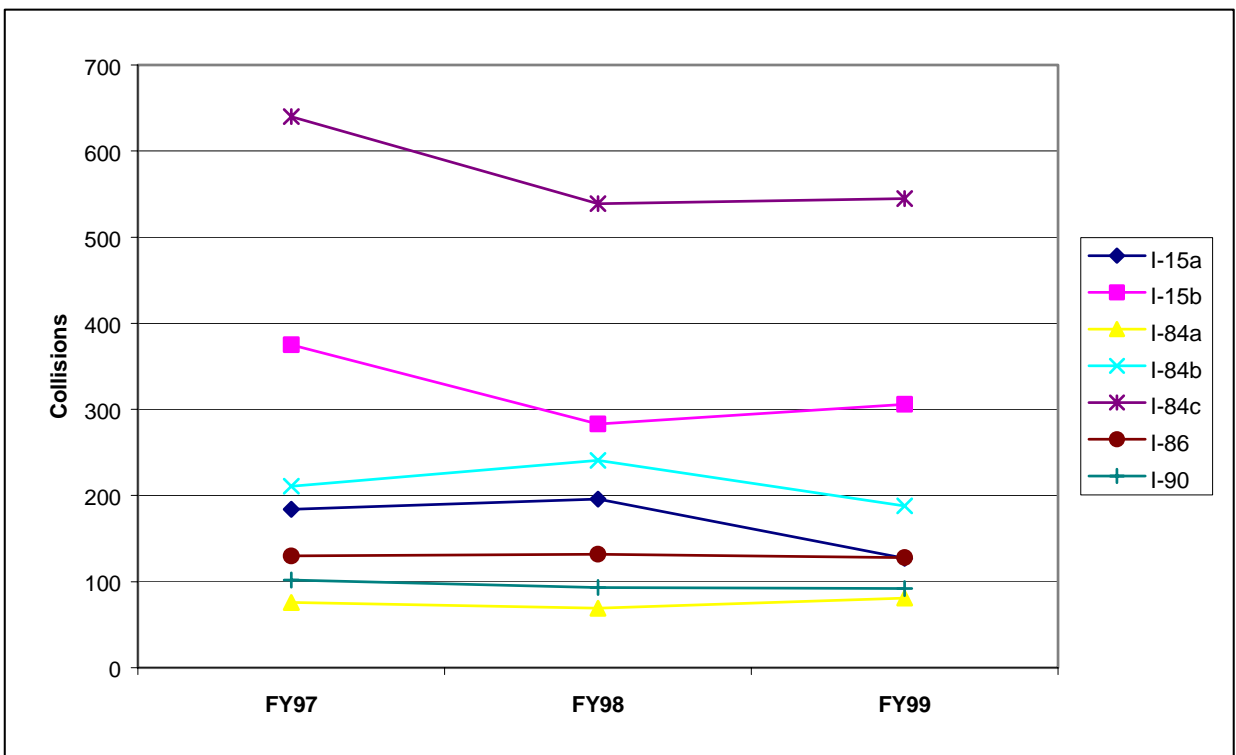


Figure 5. Collision data, all vehicles

<sup>1</sup> Yearly data are shown for fiscal years, beginning July 1<sup>st</sup> and ending June 30<sup>th</sup>.

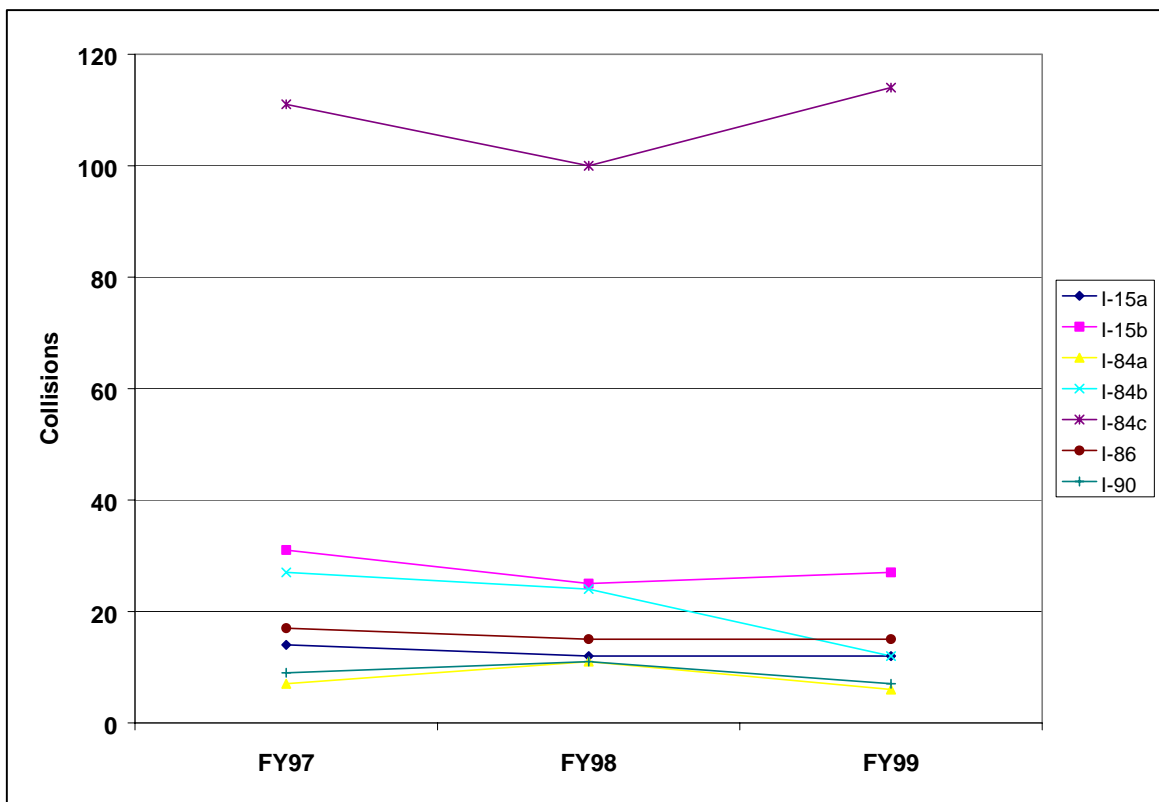


Figure 6. Collision data for commercial vehicles

## **DISCUSSION**

The change in the truck speed limit has only been in effect for a little more than a year. The trends that have been presented in this report show the initial results of this change. Further changes may occur as time goes on.

This report summarizes the conclusions that can be drawn based on the speed and crash data that have been collected thus far.

- Passenger car speeds remain unchanged at 73.5 mph.
- Truck speeds declined slightly. Mean speeds dropped by 1.5 mph, while 85<sup>th</sup> percentile speeds declined by 2.9 mph. While these changes are small, they are statistically significant.
- Speed differentials between trucks and passenger cars increased from 5.5 mph to 7.1 mph. Again, while this change is small, it is statistically significant.
- The proportion of trucks violating the speed limit increased significantly from about 20 to 30 percent before the speed limit change to between 70 and 80 percent after the change.
- The standard deviation in vehicle speeds did not increase, indicating that the uniformity in speeds remained unchanged.
- Crash data did not increase as a result of the speed limit change.

While the potential for a decrease in safety exists because of the speed limit differential, data collected thus far show that a real change in the safety level has not occurred. The passenger car-truck speed differential increased slightly. But the standard deviation in vehicle speeds has not increased. And, while the crash data is limited, there is no evidence of an increase in crashes involving trucks.

The Idaho Transportation Department should continue to monitor the effects of the speed limit change, using both speed measurements and crash data. More definitive trends may appear as additional data are collected.