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Supplemental Analysis for

Strategies to Reduce CMV-involved Crashes, Fatalities, and Injuries in Michigan

Driver Records and Crash Involvement

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Strategies to Reduce CMV-involved Crashes, Fatalities and Injuries in Michigan:

Analysis of Driver History Files

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16. Abstract

This research sought to identify differences in safety records of drivers who had undergone the training required to hold commercial drivers licenses, and to see if previous offenses and crashes in a CDL drivers record were reasonable indicators of future offenses and crashes. Crash and offense rates from the Michigan Driver Database from 2001-2005 of CDL drivers and non-CDL drivers were compared; crashes and offenses from 2006-2007 were compared across groups of CDL drivers based on their crash and offense records from 2001-2005; and driver records from the Michigan Driver Database were matched with CMV crash records from the Michigan Vehicle Crash data file from 2001-2005, to compare circumstances of CMV crashes of CDL drivers to those of drivers of CMVs that do not require a CDL. Previous offenses and crashes in CDL drivers' records were reasonable indicators of future offenses and crashes. CDL drivers who had no crashes or no crashes or offenses in the prior period also had the lowest crash involvement for crashes of all severities in the after period. Among crash-involved CMV drivers, non-CDL holders had significantly higher rates of coded hazardous actions than CDL holders. They also had poor prior driving records in terms of prior offenses, serious offenses, and alcohol-related crashes. CDL holders had slightly higher average numbers of prior crash involvements. The findings of this research can be useful to the CDL program to identify critical safety factors, and to the trucking industry to improve driver hiring, training, and retention policies.

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Supplemental Analysis for

Strategies to Reduce CMV–Involved Crashes, Fatalities and Injuries in Michigan:

Analysis of CMV Driver Records and Crash Involvement

1 Introduction

In light of its mission *to improve truck safety by providing Michigan's trucking industry and citizens of Michigan with effective educational programs, and by addressing significant truck safety issues*, the Michigan Truck Safety Commission (MTSC) asked the University of Michigan Transportation Research Institute (UMTRI) to identify key issues associated with Commercial Motor Vehicle (CMV)-involved crashes, injuries, and fatalities through the analysis of available data, and to propose practical and feasible strategies and solutions consistent with the four E's of traffic safety - *Enforcement, Education, Engineering, and Emergency Medical Services.*

UMTRI undertook this project in Fiscal Year (FY) 2007, and reported the results in UMTRI Technical Report UMTRI-2007-26, *Strategies to Reduce CMV-involved Crashes, Fatalities, and Injuries in Michigan* [1]. As part of the research project, UMTRI was to conduct analyses of truck driver records. Such records contain a wealth of information on drivers' license status and history, including offenses and crashes and allow exploration of the relationship between drivers' past and current offenses and crashes. These data support comparisons between drivers holding commercial driver licenses (CDL) and drivers without CDLs, (i.e., drivers of light vehicles-mostly passenger cars and CMVs under 26,000 lb GVWR that do not require CDLs). The data also support investigations of the associations between drivers' records in personal vehicles with their records in CMVs. The results of these analyses could be of value to the CDL program by identifying critical safety factors in a driver's record. Moreover, the trucking industry could use this information to improve driver hiring, training, and retention policies.

However, the driver history records from the Michigan Department of State did not become available to UMTRI in time to be included in work performed in FY 2007. The data were received later, and the project was extended into FY 2008. This report summarizes the analyses of CMV-driver records, and is a supplement to the earlier report for this project.

The objectives of this additional analysis are to address the following questions:

Do drivers who hold Commercial Driver's Licenses (CDL) have better driving records than other drivers? How do they compare on the number and rates of offenses and crashes?

Are previous offenses and crashes reasonable indicators of future offenses and crashes for drivers of CMVs?

What are the differences in CMV crashes for CMV drivers with and without CDLs?

2 Data and Methods

The sources of data for analyses reported here are the Michigan Driver Database and the Michigan Vehicle Crash Database. These are described below. The assumptions and methods used in the analyses are also described in this section.

2.1 Michigan Driver Database

The Michigan Driver Database contains records of all licensed drivers in the state of Michigan. The file also includes records for drivers in the graduated license program, unlicensed drivers who had been involved in a traffic offense or crash, and drivers of boats, snowmobiles, and off road vehicles involved in crashes or offenses. The database itself is a moving database, with new records added continuously, and old records deleted periodically. Records for most drivers contain information going back seven years. However, convictions for serious offenses are kept in the file indefinitely. An extraction of the Michigan Driver Database from December 2007 was used in the analyses reported here.

The database has a relational structure, and consists of separate files that can be linked together to join information as needed. The following files were used in this investigation:

- Client Data Set - This file contains identifying information about the person, and whether or not a driver record is present.
- Driver Data Set - This file contains the driver license type, driving restrictions, endorsements, issue data of most recent license, probation, suspension status, last conviction, date of last update to this record.
- CDL Data Set – This file contains records for persons with CDL. Included in the record are the CDL group type (A, B, C) and CDL endorsements (hazardous cargo, tank, passenger, double/triple tanker, school bus).
- Activity Data - Activity data contain records for convictions and crashes. There are four separate activity files: Conviction file, FAC/FCJ file, Accident file, and Action file.

- The *Conviction file* contains information about each offense, including the arrest/offense date, the plea, type of court, the convicted offense type, and the speed going/limit where appropriate.

- The *FAC/FCJ file* contains records for offenses in which the driver did not appear in court or did not comply with the court judgment.

- The *Accident file* contains a record of each crash including date of crash, police department reporting crash, vehicle type driven, violation/hazardous action, a flag if drugs or alcohol were involved, number of vehicles involved, number of persons injured and killed, and an identifier to link the crash to the Michigan Crash data file.

- The *Action* file contains information about actions taken on a license such as suspensions and restrictions, including action types, start and end dates of actions, and reasons for the action including information about related convictions and accidents.

- Locator Data Set - This file contains additional conviction, FAC/FCJ, accident, and action information for some cases, and includes information about the original offense charged.

2.2 Michigan Vehicle Crash Data

The Michigan Vehicle Crash file, covering all motor vehicle crashes from 2001-2007 was used in this research. These data are extracted from form UD-10 [2], which is completed by police officers on traffic crashes that result in a fatality, injury, or property damage over $400 (increased to $1,000 effective January 1, 2004).

The data were supplied in eight separate data files, covering different aspects of the crash. The files can be linked together to join information from the different files as needed.

- Crash file, with one record per crash. This file contains crash-level descriptive information, such as weather, time of day, road type, number of vehicles involved, as well as measure of severity in terms of number of fatalities, and numbers of injuries of different severities.

- Crash location, also one record per crash, identifying the location of the crash using latitude and longitude coordinates.

- Unit file, with one record per unit. Most units are motor vehicles, but a unit can also include a non-motorist such as a pedestrian or bicyclist, and non-road vehicle such as a

train engineer. The file includes variables with vehicle-specific information, such as make and model, but also counts of occupants by injury level.

- Party file, with one record per individual involved in the crash, including drivers, passengers, and non-motorists. The data in this file describes the individual and his injury level.

- Harmful event file, with one record per harmful event per unit involved in the crash. In other words, for each unit in the crash, this file contains records for each successive harm-inducing event in the crash.

- Driver license file, with one record per driver, providing the driver's license type.

- Driver condition file, with one record per condition for each driver. This file provides information about the driver's condition prior to the crash, and records fatigue, sleep, illness, medication use, and other factors. More than one condition may be recorded for a driver.

- Commercial vehicle file, with one record for each commercial vehicle involved in a crash, provided the crash meets a threshold severity level. These data are entered on a supplemental area of the UD-10, and are collected primarily in response to a US DOT mandate. Trucks and buses involved in a crash that results in a fatality, injury transported for immediate medical attention, or a vehicle towed due to disabling damage must be reported to the Motor Carrier Management Information System (MCMIS) Crash file, maintained by the Federal Motor Carrier Safety Administration in the US Department of Transportation. The data in the commercial vehicle file include some carrier identification information, vehicle description, and driver licensing information.

2.3 Methods

As noted above, the Michigan Driver Database is a moving database that covers about seven years of data for most drivers. A person's current license status, and most recent licensing activity are readily available, but the date when a driver first obtained a CDL is not necessarily in the record. In this investigation, a CDL driver was defined as a person who held a CDL anytime before and during 2005 and was age 21 to 69 years. The age criterion was included because a driver has to be 21 years of age to obtain a CDL and because CDL drivers usually retire from driving CMVs by age 70. A light vehicle driver was defined as a licensed driver who did not hold a CDL before or during 2005 and was also age 21-69 years. Offenses analyzed were the offenses as originally charged.

The first analysis involved a comparison of crashes and offenses for the period 2001-2005 between CDL and light vehicle drivers. Because the proportion of all licensed drivers who hold

CDLs is small, the comparisons were made between all CDL drivers and a random sample of light vehicle drivers.

Drivers whose job is driving CMVs tend to drive more miles in a year than other drivers, and comparisons of crashes and offenses should consider the difference in exposure. However, direct information about the number of miles driven by CDL drivers in Michigan is not available. This mileage was estimated by using the national average vehicle mileage for medium to large trucks (SU two axle, 6-tire, and combination vehicles) from the VIUS survey of 2002 [3], with the assumption that a CDL driver's annual mileage is the same as the annual vehicle mileage of a typical medium to large truck. Because a CDL driver most likely also drives a personal vehicle, a second estimate that included additional mileage in a personal vehicle was also used. Annual mileage for light vehicle drivers was obtained from data reported by the FHWA [4].

The second analysis explored the question of whether a driver's previous record can be used as an indicator of future driving behavior. CDL drivers were grouped by their crash and offense records from 2001-2005. The groups included CDL drivers with no crashes or offenses, and drivers with records of two or more crashes, serious offenses (i.e., offenses that resulted in three or more points on the driving record), speeding offenses, and alcohol offenses. Crash and offense rates for the period 2006-2007 were compared across these groups. Drivers who were not 21 years of age for the entire period 2001-2005 were not included in this comparison because they could not have held a CDL for the entire period. This eliminated CDL drivers identified for the first analysis, who were 25 age years or younger in 2006.

The third analysis was concerned with CMV crashes involving drivers with and without CDLs. CDLs are required for drivers of trucks with GVWR or GCWR over 26,000 lb; buses with 16 or more passengers; school buses, and hazmat transport. CDLs are not required for trucks with GVWR or GCWR from 10,000 to 26,000 lb and small buses, and drivers of these are not subject to the licensing requirements and monitoring that goes with along with a CDL. The circumstances of crashes with respect to the time, location, and environment of the truck crashes were compared for the two groups of drivers. Driver conditions and hazardous actions in the crashes were also compared.

Drivers of crash-involved trucks recorded in the Michigan Vehicle Crash file from 2001-2005 were matched with driver records in the Michigan Driver Database. As in the previous analyses, drivers were considered to have a CDL if they had one at any time from 2001-2005. It should be noted that because of the limitations in the structure of vehicle identification in the Michigan crash data, it is not possible to separate trucks with a GVWR over 10,000 pounds from buses. Based on the experience of other states and the General Estimates System [3, 6], national data file of police-reportable crashes, the percentage of buses in the category is estimated at about 10 to 12 percent. Therefore, it can be assumed that about 10 to 12 percent of the crashes examined in this analysis involve buses.

The time, location, and environmental conditions of the crash were obtained from the crash files of the Michigan Vehicle Data. The driver condition (fatigue, alcohol, drugs) was obtained from Driver Condition file.[1] The hazardous actions for the crash-involved drivers were obtained from the Party file.

3 Results

3.1 Comparison of Crash and Offense Rates for CDL and Light Vehicle Drivers

The average number of crashes and offenses per year for CDL drivers and light vehicle drivers were calculated for the period of time from 2001 through 2005. The CDL drivers are all licensed drivers that could be identified as holding a CDL at some point between 2001 and 2005, and were in the age range of 21-69 years. The light vehicle drivers were a random sample of drivers who did not hold a CDL at any time between 2001 and 2005, and who were in the age range of 21-69 years. There were 191,590 drivers with a CDL and 284,459 light vehicle drivers in the comparison. Table 1 shows the age distribution of the drivers in the two groups.

Table 1 Comparison of Age Distributions of CDL and Light Vehicle Drivers

Age Group	CDL Drivers	Light Vehicle Drivers
21-29	4%	22%
30-54	67%	57%
55-69	29%	21%

The age distributions of the two groups being compared were very different. Most of the CDL drivers are in the middle group and fewest in the youngest age group. While two-thirds of the CDL drivers are between 30 and 55 years of age, only 57 percent of the light vehicle drivers are of that age. Only four percent of the CDL drivers are below age 30. In the random sample of light vehicle drivers, 22 percent are between 21 and 30 years of age. The two groups also differ considerably by sex. The proportion of men among CDL drivers is 88 percent, while this proportion is 52 percent among the light vehicle drivers.

Table 2 shows the average number of crashes and offenses per year for CDL and light vehicle drivers.

[1] The structure of the Michigan Vehicle Crash data also includes variables on suspected drug and alcohol use, and there has been some concern by other users of the crash data about the use of the driver condition variables. In response to these concerns, we conducted consistency checks between the coding for driver condition and suspected use of alcohol and of drugs for truck crash records. We found the coding between the variables to be reasonably consistent, indicating that, at least for truck records, use of either set of variables gives similar results.

Table 2 Average Crashes and Offenses per Driver per Year for CDL and Light Vehicle Drivers, 2001-2005

Crash or Offense Type	CDL Drivers	Light Vehicle Drivers
All Crashes	0.133	0.056
Injury Crashes	0.026	0.013
Fatal Crashes	0.00062	0.00008
Alcohol Crashes	0.0019	0.0014
All Offenses	0.180	0.158
Serious Offenses	0.032	0.029
Alcohol offenses	0.009	0.011
Speeding Offenses	0.102	0.074

The annual number of all crashes and injury crashes per driver for CDL drivers are about two times that of light vehicle drivers. The annual number of fatal crashes per driver, while very small for both groups is almost eight times higher for CDL drivers than for light vehicle drivers. The annual number of alcohol crashes per driver is slightly lower for drivers with CDLs than for light vehicle drivers.

Offenses per driver per year for all offenses and for serious offenses (i.e., those that result in 3-points on the licenses) are just slightly higher for CDL drivers than for light vehicle drivers. The rate for alcohol offenses is slightly higher for light vehicle drivers, but the rate of speeding offenses is higher for drivers with CDLs.

Figure 1 shows the distribution of CDL and light vehicle drivers by the number of crashes they were involved in during the 5-years from 2001-2005.

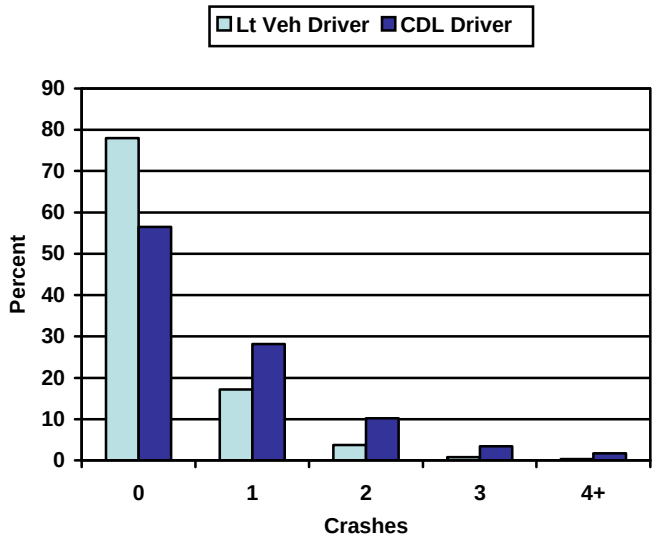

Figure 1 Distribution of Drivers by Number of Crashes, 2001-2005

Among CDL drivers, 57 percent did not have a crash in the five years between 2001 and 2005, 28 percent were involved in one crash, ten percent were in two crashes, three percent in three crashes and two percent in four or more crashes. The comparable distribution for light vehicle drivers is 78 percent with no crashes, 17 percent with one crash, four percent with two crashes, one percent with three crashes, and less than one percent with four or more crashes. Of crashes involving CDL drivers, 41 percent were in trucks and 59 percent were in light vehicles.

3.2 Crash and Offense Exposure Rates for CDL and Light Vehicle Drivers

CMV drivers drive more miles in a year than most other drivers and are therefore exposed to more chances of crashes and opportunities for offenses. To account for the differences in exposure, rates based on vehicle miles of travel were calculated. It was assumed that the miles driven in a year by an average light vehicle driver in Michigan could be estimated by the annual mileage of a passenger car and other 2-axle, 4-tire vehicles, which was reported by the FHWA to be 11,879 miles [4]. As described in the methods section, estimates of CDL drivers' annual mileage were based on two driving scenarios. In the first scenario, it was assumed that a Michigan CDL driver's annual mileage was equal to the annual vehicle mileage of a typical truck he/she would be driving. The national average vehicle mileage for medium to large trucks (SU two axle, 6-tire, and combination vehicles) obtained from the VIUS survey of 2002 [3] was 27,071 miles. In the second estimate, it was assumed that in addition to the 27,071 miles, an average Michigan driver holding a CDL also drives a personal car for another a 6,000 miles (about one-half that of the average mileage of a light vehicle). Table 3 shows the crash and offense rates for CDL and light vehicle drivers taking exposure into consideration.

Table 3 Average Crash and Offense Rates per Million Miles of Driving for CDL and Light Vehicle Drivers in Michigan, 2001-2005

Crash or Offense Type	Light Vehicle Drivers	CDL Drivers Exposure Scenario 1	CDL Drivers Exposure Scenario 2
All Crashes	4.74	4.92	4.02
Injury Crashes	1.12	0.96	0.79
Fatal Crashes	0.007	0.023	0.019
Alcohol Crashes	0.116	0.072	0.059
All Offenses	13.31	6.66	5.46
Serious Offenses	2.45	1.18	0.97
Alcohol offenses	0.089	0.035	0.029
Speeding Offenses	6.27	3.75	3.07

When exposure is considered, the overall crash rates for CDL and light vehicle drivers are similar. However, light vehicle drivers have higher rates of injury crashes, and CDL drivers have higher rates of fatal crashes. This is most likely due to the higher probability of fatalities in crashes between vehicles of unequal mass, such as large trucks and light vehicles, than in crashes between vehicles of more equal mass. The rate of alcohol crashes per million miles driven for

CDL drivers is about one-half that for light vehicle drivers. Offense rates for CDL drivers are approximately one-half that of light vehicle drivers for overall offenses, serious offenses, and speeding offenses. Alcohol offense rates for CDL drivers are about one-third that of light vehicle drivers.

It should be noted that the estimates for annual miles of driving for CDL drivers used here are most likely conservative. More precise estimates would most likely show even lower crash and offense rates for CDL drivers.

3.3 Offense and Crash Rates of CDL Drivers in Prior and After Periods

The question of whether a CDL driver's record of crashes and offenses in the past can give some indication of problems in the future was addressed in this section. Driving records of CDL drivers from 2001-2006 were examined, and drivers were grouped by crash and conviction patterns. These groups can be interpreted as conveying a level of risk taking behavior, and are not mutually exclusive. For example, a driver with no crashes and no offenses will be included also in the group with no crashes but with offenses. However, a driver with no crashes and no offenses probably takes fewer risks than the driver with no crashes but with offenses in his/her record. The demographic descriptors of the groups defined by their crash and offense patterns from 2001-2005 were first examined. Then the crash and offense rates of these groups from 2006-2007 were compared. In the rest of this report, the five-year period from 2001 to 2005 is referred to as the prior period, and the two-year interval from 2006 to 2007 is referred to as the after period.

The CDL driver groups and their distribution by age and sex are shown in Table 4.

Table 4 Age and Sex Distribution of CDL Groups in Prior/After Analysis

CDL Driver Groups	Number	Age Categories			% Female
		21-29	30-54	55-69	
All	190,081 (100%)	3.1%	68.0%	28.9%	12.1%
No Crashes	107,687 (56.7%)	2.4	66.0	31.6	12.2
No Crashes and No Offenses	69,818 (36.7%)	1.4	61.7	36.9	14.3
2+ Crashes	28,949 (15.2%)	5.1	72.8	22.1	11.9
2+Speeding Offenses	21,882 (11.5%)	7.1	76.6	16.3	5.9
1+Alcohol Offense	7,330 (3.9%)	5.8	80.9	13.4	4.4
2+Serious offenses	4,334 (2.3%)	8.7	77.6	13.6	5.0

Several observations can be made by comparing the age and sex distributions of each group against the overall distributions of CDL drivers in the analysis. Women with CDLs constitute 12

percent of all CDL drivers examined here, but make up 14 percent of the group that did not have a crash or offense in 2001-2005. Furthermore, women constitute only six percent of those with speeding offenses, four percent of those with alcohol offenses, and five percent of those with serious offenses. Thus, overall, female CDL drivers have better driving records than male CDL drivers.

Table 4 also shows that the more mature CDL drivers (i.e., age 55-69) have better driving records than younger CDL drivers. While the oldest group accounts for 29 percent of all CDL drivers, it makes up 32 percent of CDL drivers with no crashes, and 37 percent of CDL drivers with no crashes or offenses. The oldest CDL drivers constitute 22 percent of CDL drivers with two or more crashes, 16 percent of those with two or more speeding offenses, 14 percent of those with a serious offense, and only 13 percent of those with an alcohol offense during 2001-2005. The youngest drivers, who are three percent of the CDL population, are overrepresented in crashes and offenses. They make up five percent of the CDL drivers with two or more crashes, seven percent of those with speeding offenses, nine percent of those with serious offenses, and six percent of those with alcohol offenses. The middle age group (30-54) is highly overrepresented in speeding and alcohol offenses. This age group is 68 percent of all CDL drivers, but accounts for 81 percent of those with alcohol offenses, 77 percent of those with speeding offenses and 78 percent of those with serious offenses.

Table 5 and Figure 2 show the crashes per driver in the after period for all the CDL drivers, and for the groups based on their crash/offense record in the prior period. Overall, the average number of crashes involving CDL drivers in the after period is 0.15 crashes per driver. Drivers with the lowest crash involvement in the after period are those who had no crashes or no crashes or offenses in the prior period. Their after period crash involvement is approximately 0.1 crash per driver. Drivers who had been involved in two or more crashes in the prior period had the highest rate of crash involvement in the after period. Their rate in the after period was about two times that of the overall average crash-involvement for all CDL drivers, and 2.5 times as much as the CDL drivers who were not involved in a crash in the prior period. Drivers with two or more speeding offenses or two or more serious offenses were involved in about 0.2 crashes per driver in the after period, a rate that is approximately 1.4 times that of the average crash involvement of all CDL drivers. For all groups, about one-third of the crashes in were in trucks and two-thirds were in light vehicles.

Table 5 Crashes per Driver in 2006-2007 by CDL Group

CDL Driver Groups	Crashes per Driver in 2006-2007		
	In Truck and Light Vehicle	In Truck	In Light Vehicle
All	0.1452	0.0483	0.0969
No Crashes	0.1038	0.0263	0.0775
No Crashes and No Offenses	0.0949	0.0218	0.0731
2+ Crashes	0.2642	0.1145	0.1497
2+ Speeding Offenses	0.2005	0.0730	0.1265
1+ Alcohol Offense	0.1195	0.0302	0.0894
2+ Serious Offenses	0.1910	0.0695	0.1216

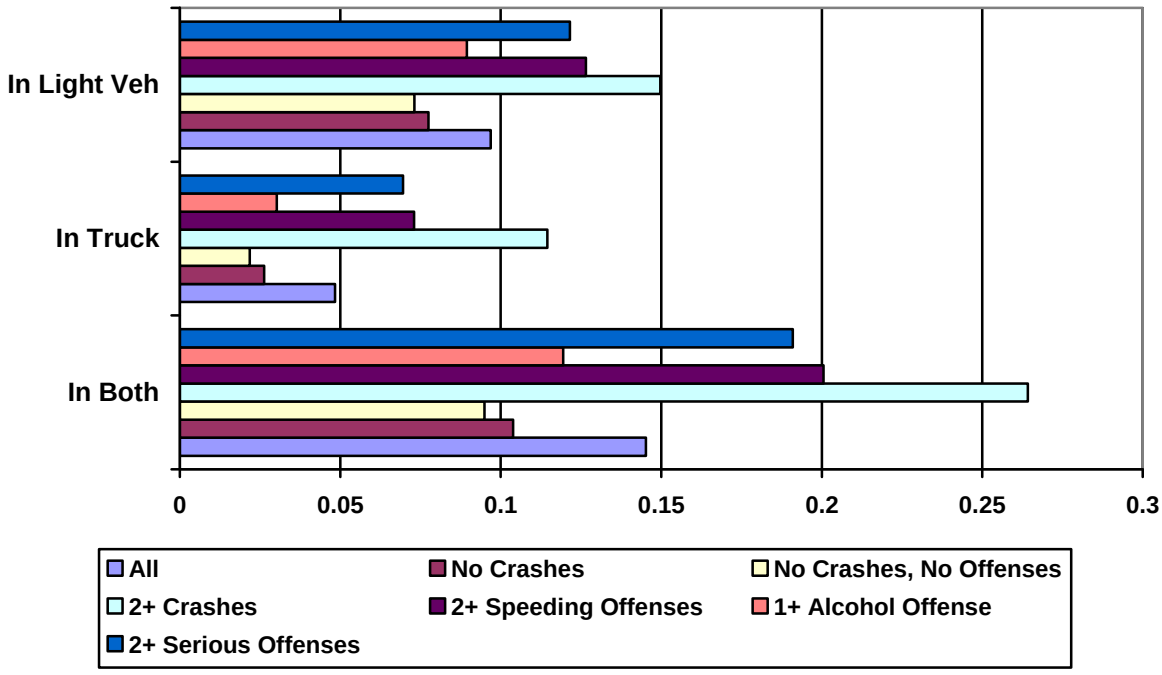

Figure 2 Crashes/Driver in 2006-2007 by CDL Group

Examining the crash involvement in the after period by the severity (Table 6 and Figure 3) shows that the number of injury crashes per driver in the after period is 0.03 injury crashes per driver, which indicates that about 20 percent of the crashes involving CDL drivers result in an injury. The pattern of highest and lowest injury-crash involvement among the CDL driver groups parallels that of their crash-involvement. Drivers with no crashes and convictions in the prior period had the lowest rate of injury crashes at 0.02 per driver, and the drivers who had two or more crashes in the prior period had the highest rate of 0.05 injury crashes per driver. Drivers with two or more serious offenses in the prior period also had a rate of 0.05 injury crashes per driver, and drivers with two or more speeding offenses had a rate of 0.04 injury crashes per

driver. For all driver groups, the rate of injury crash-involvement was higher in light vehicles than in trucks.

Table 6 Injury Crashes per Driver in 2006-2007 by CDL Group

CDL Driver Groups	Injury Crashes per Driver in 2006-2007		
	In Truck and Light Vehicle	In Truck	In Light Vehicle
All	0.0280	0.0091	0.0190
No Crashes	0.0202	0.0041	0.0153
No Crashes and No Offenses	0.0178	0.0041	0.0136
2+ Crashes	0.0510	0.0217	0.0283
2+ Speeding Offenses	0.0417	0.0137	0.0280
1+ Alcohol Offense	0.0255	0.0053	0.0202
2+ Serious Offenses	0.0452	0.0138	0.0314

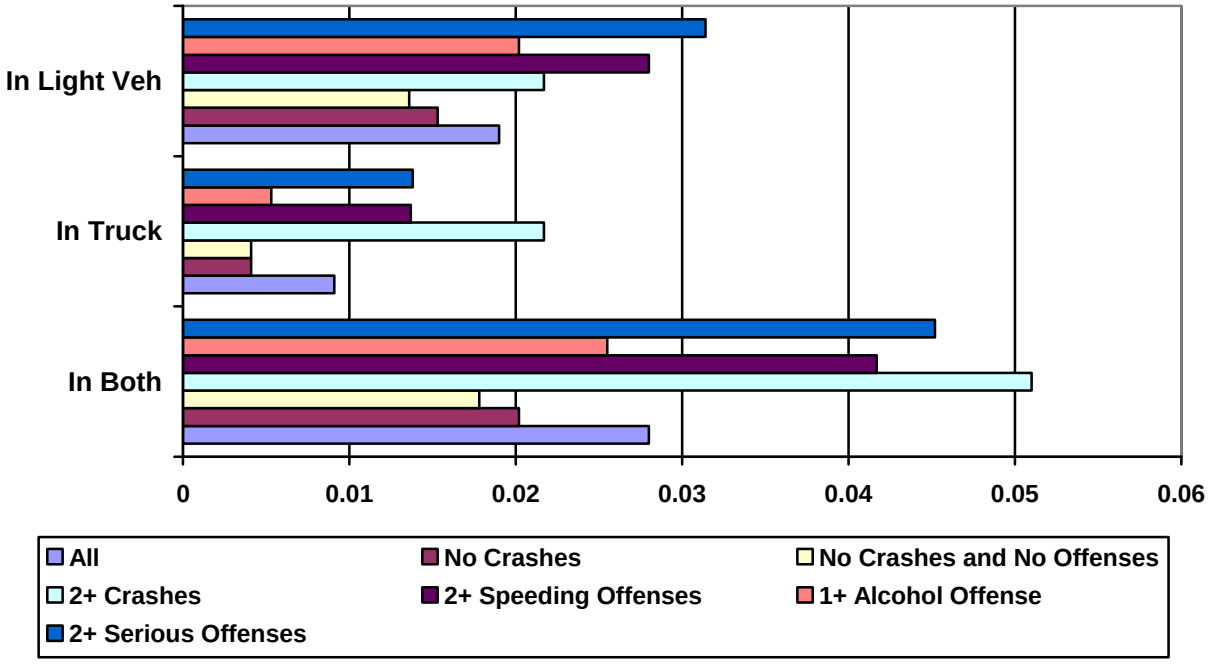

Figure 3 Injury Crashes/ Driver in 2006-2007 by CDL Group

Fatal crashes are examined in Table 7 and Figure 4. The overall rate of fatal crashes per CDL driver in the after period is 0.0009 per driver or about one fatal crash per 1,111 drivers. Drivers with no crashes or offenses in the prior period had the lowest rate of 0.0004 fatal crashes per driver or one fatal crash per 2,500 drivers. Drivers who had at least two speeding tickets in the prior period had the highest rate of 0.0017 fatal crashes per driver or one fatal crash per 588 drivers.

Table 7 Fatal Crashes per Driver in 2006-2007 by CDL Group

CDL Driver Groups	Fatal Crashes per Driver in 2006-2007		
	In Truck and Light Vehicle	In Truck	In Light Vehicle
All	0.00085	0.00050	0.00035
No Crashes	0.00057	0.00031	0.00026
No Crashes and No Offenses	0.00039	0.00020	0.00019
2+ Crashes	0.00062	0.00097	0.00055
2+ Speeding Offenses	0.00174	0.00087	0.00087
1+ Alcohol Offense	0.00068	0.00000	0.00068
2+ Serious Offenses	0.00092	0.00023	0.00069

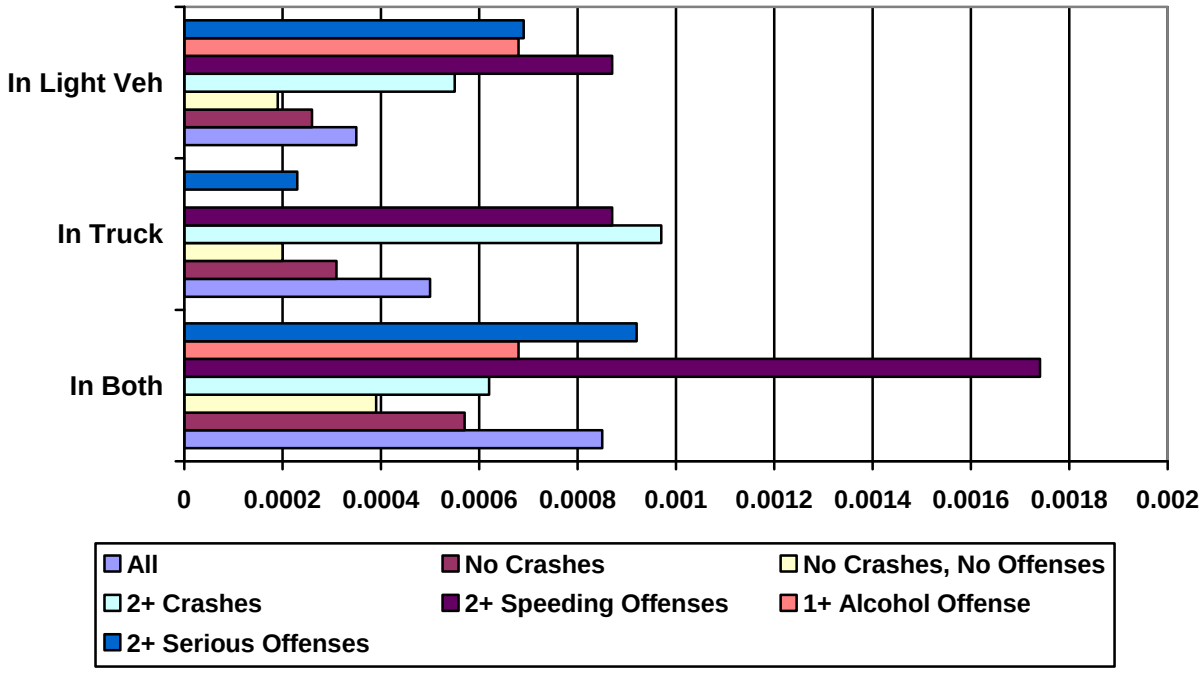

Figure 4 Fatal Crashes/Driver in 2006-2007 by CDL Group

Alcohol-crash involvement in the after period is shown in Table 8 and Figure 5. The overall involvement is 0.002 alcohol crashes per driver with most of the crashes occurring in light vehicles. The lowest rate of involvement is for drivers with no crashes or offenses in the prior period (0.001 alcohol crashes per driver). However, with the exception of those CDL drivers who had at least one alcohol offense in the prior period, the rate of alcohol crashes per driver is very low (0.001 - 0.005 alcohol crashes per driver). However, drivers who had at least one alcohol offense in the prior period had a very high rate of 0.12 alcohol crashes per driver in the

after period. This rate 52 is times that of the overall average alcohol crash involvement for all CDL drivers.

Table 8 Alcohol Crashes per Driver in 2006-2007 by CDL Group

CDL Driver Groups	Alcohol Crashes per Driver in 2006-2007		
	In Truck and Light Vehicle	In Truck	In Light Vehicle
All	0.00231	0.00005	0.00227
No Crashes	0.00182	0.00003	0.00178
No Crashes and No Offenses	0.00123	0.00003	0.00120
2+ Crashes	0.00363	0.00003	0.00359
2+ Speeding Offenses	0.00425	0.00009	0.00416
1+ Alcohol Offense	0.11951	0.03015	0.08936
2+ Serious Offenses	0.00485	0.00000	0.00485

The rate of alcohol crashes for all CDL driver groups was much lower while driving trucks than while driving light vehicles. This was also true for the CDL drivers who had at least one alcohol offense in the prior period. Their rate of alcohol crashes in light vehicles was three times that of their alcohol crash rate for trucks.

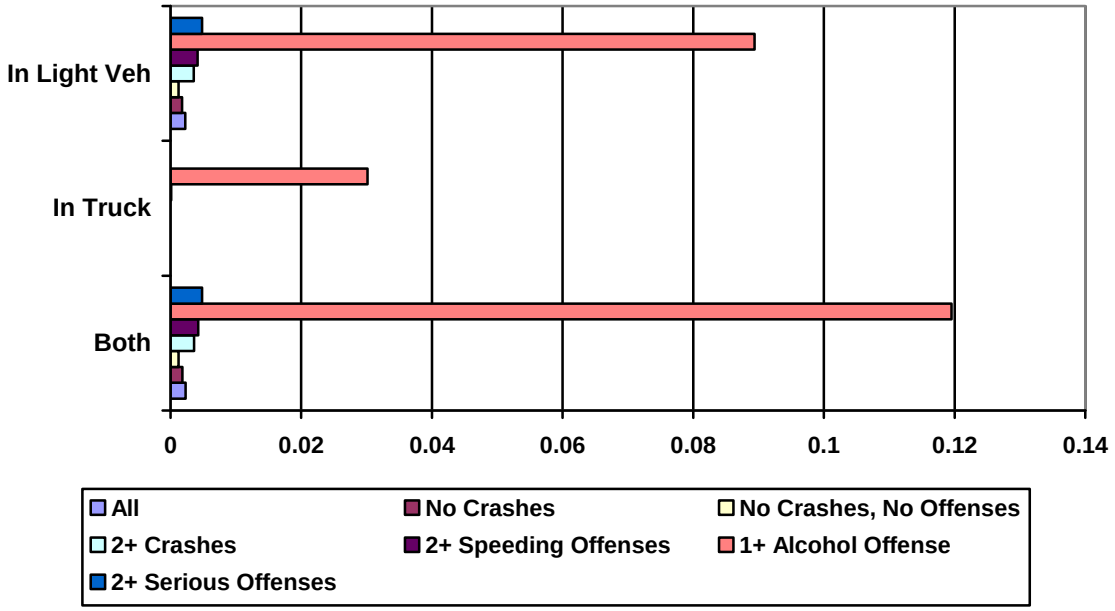

Figure 5 Alcohol Crashes/Driver in 2006-2007 by CDL Group

Table 9 and Figure 6 show the rate of offenses that CDL drivers were charged with in the after period. The overall rate was 0.2 offenses per driver. The lowest offense rate was for CDL drivers who had no crashes or offenses in the prior period (0.09 offenses per driver). The rate for drivers

who had no crashes, but may have had offenses in the prior period was 0.17 offenses per driver. The highest offense rate was among those drivers with two or more serious offenses in the prior period (0.68 offense per driver), followed by those with two or more speeding offenses (0.56 offense per driver). Overall, and for each group of CDL drivers, about two-thirds of the offenses were recorded for light vehicles and one-third were recorded in trucks.

Table 9 Offenses per Driver in 2006-2007 by CDL Group

CDL Driver Groups	Offenses per Driver in 2006-2007		
	In Truck and Light Vehicle	In Truck	In Light Vehicle
All	0.2104	0.0456	0.1466
No Crashes	0.1662	0.0323	0.1185
No Crashes and No Offenses	0.0900	0.0152	0.0668
2+ Crashes	0.3332	0.0805	0.2280
2+ Speeding Offenses	0.5580	0.1451	0.3643
1+ Alcohol Offense	0.3876	0.03656	0.2905
2+ Serious Offenses	0.6801	0.1714	0.4449

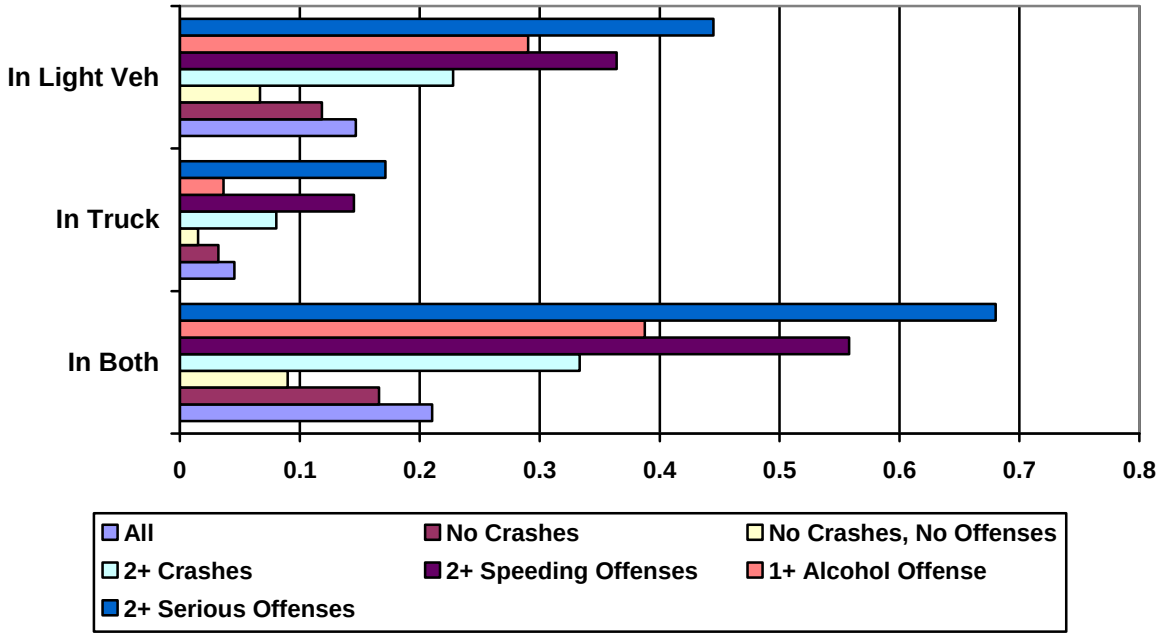

Figure 6 Offenses/Driver in 2006-2007 by CDL Group

Table 10 and Figure 7 show the rate of serious offenses for CDL drivers in the after period. Serious offenses are those offenses that result in three or more points on the driver license, and

are used here as an indication of risky driving behaviors. The overall rate was 0.04 serious offenses per driver. The lowest rate was for CDL drivers who had no crashes or offenses in the prior period (0.02 serious offenses per driver). The rate for drivers who had no crashes, but may have had offenses in the prior period was 0.03 serious offenses per driver. The highest rate was among those drivers with two or more serious offenses in the prior period (0.12 offense per driver), followed by those with two or more speeding offenses (0.10 serious offenses per driver). Overall, and for each group of CDL drivers, about two-thirds of the serious offenses were recorded for light vehicles and one-third were recorded for trucks. Many (but not all) of the speeding offenses are also serious offenses, so drivers with two or more speeding offenses may also be included in the group of drivers with two or more serious offenses.

Table 10 Serious Offenses per Driver in 2006-2007 by CDL Group

CDL Driver Groups	Serious Offenses per Driver in 2006-2007		
	In Truck and Light Vehicle	In Truck	In Light Vehicle
All	0.0370	0.0073	0.0248
No Crashes	0.0295	0.0054	0.0198
No Crashes and No Offenses	0.0163	0.0024	0.0115
2+ Crashes	0.0580	0.0123	0.0400
2+ Speeding Offenses	0.0957	0.0220	0.0614
1+ Alcohol Offense	0.0517	0.0064	0.0394
2+ Serious Offenses	0.1244	0.0270	0.0838

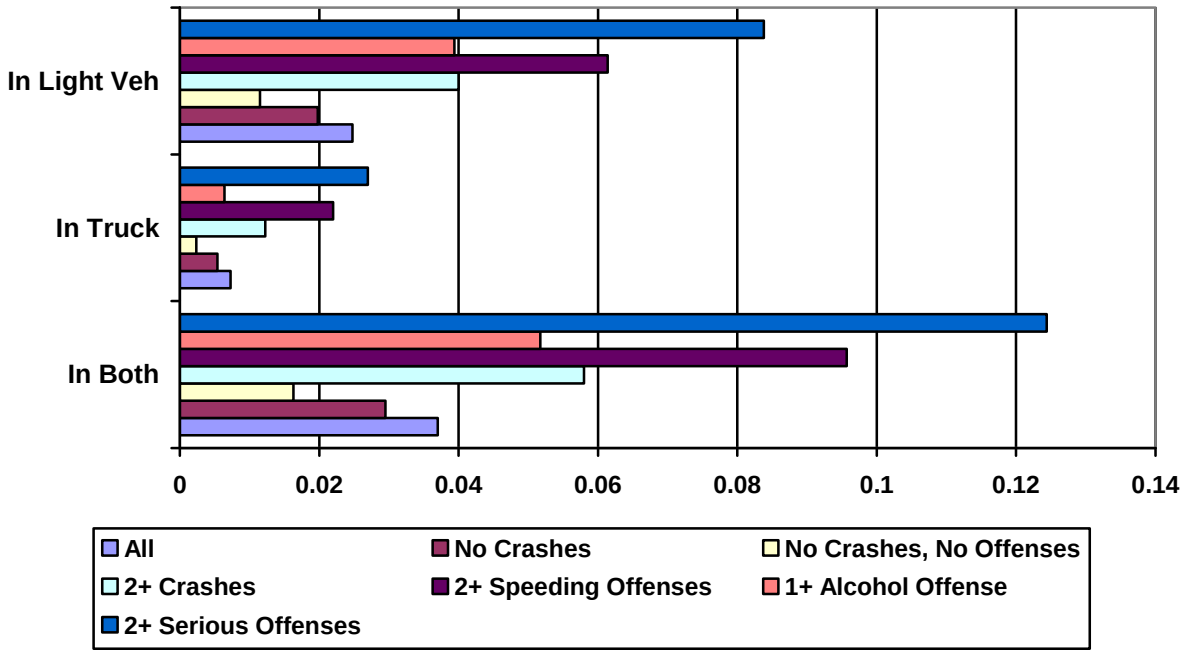

Figure 7 Crashes/Driver in 2006-2007 by CDL Group

Speeding offense rates in the after period are shown in Table 11 and Figure 8. The overall rate was 0.12 speeding offenses per driver. The lowest rate was for CDL drivers who had no crashes or offenses in the prior period (0.05 speeding offenses per driver). The rate for drivers who had no crashes, but may have had offenses in the prior period was 0.09 serious offenses per driver. Drivers who had at least two speeding offenses and also drivers who had two or more serious offenses in the prior period had the highest rate of 0.33 speeding crashes in the after period. Overall, about two-thirds of the speeding offenses of CDL drivers were in passenger cars. A similar distribution by vehicle type was found for each group with 60 to 80 percent of speeding offenses recorded in a light vehicle.

Table 11 Speeding Offenses per Driver in 2006-2007 by CDL Group

CDL Driver Groups	Speeding Offenses per Driver in 2006-2007		
	In Truck and Light Vehicle	In Truck	In Light Vehicle
All	0.1183	0.0271	0.0816
No Crashes	0.0941	0.0189	0.0667
No Crashes and No Offenses	0.0529	0.0083	0.0398
2+ Crashes	0.1822	0.0484	0.1215
2+ Speeding Offenses	0.3348	0.0935	0.2142
1+ Alcohol Offense	0.1231	0.0202	0.0937
2+ Serious Offenses	0.3343	0.1045	0.2035

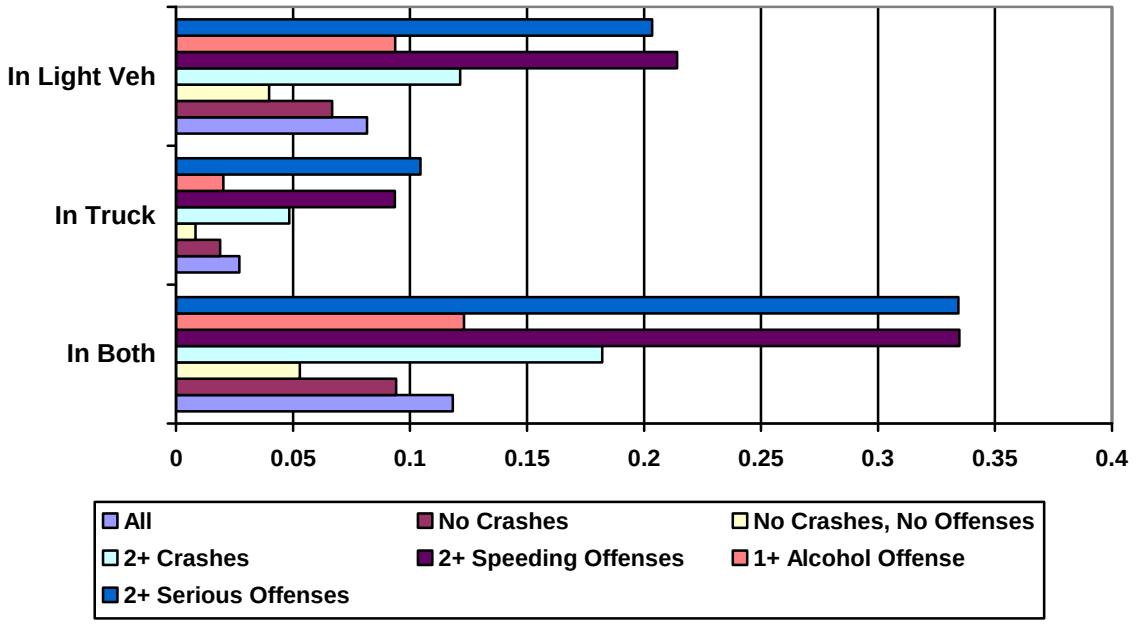

Figure 8 Speeding Offenses/Driver in 2006-2007 by CDL Group

Alcohol offenses in the after period are shown in Table 12 and Figure 9. The rate of alcohol offenses for CDL drivers was quite low. The average number of alcohol offenses per CDL driver in the after period is 0.007 per driver, with most of the offenses charged while driving a light vehicle. The only group that showed a noticeably higher rate of alcohol offenses in the after period consisted of drivers who had at least one alcohol offense in the prior period. The overall rate of these drivers was 0.047 alcohol offenses per driver, which was seven times more than the average rate for all CDL drivers. The alcohol offense rate while driving a truck for these drivers was 0.008, which is four times greater than the average rate of all CDL drivers while driving a truck.

Table 12 Alcohol Offenses per Driver in 2006-2007 by CDL Group

CDL Driver Groups	Alcohol Offenses per Driver in 2006-2007		
	In Truck and Light Vehicle	In Truck	In Light Vehicle
All	0.0070	0.0002	0.0068
No Crashes	0.0056	0.0002	0.0054
No Crashes and No Offenses	0.0029	0.0001	0.0028
2+ Crashes	0.0109	0.0001	0.0109
2+ Speeding Offenses	0.0135	0.0005	0.0130
1+ Alcohol Offense	0.0473	0.0008	0.0447
2+ Serious Offenses	0.0178	0.0007	0.0171

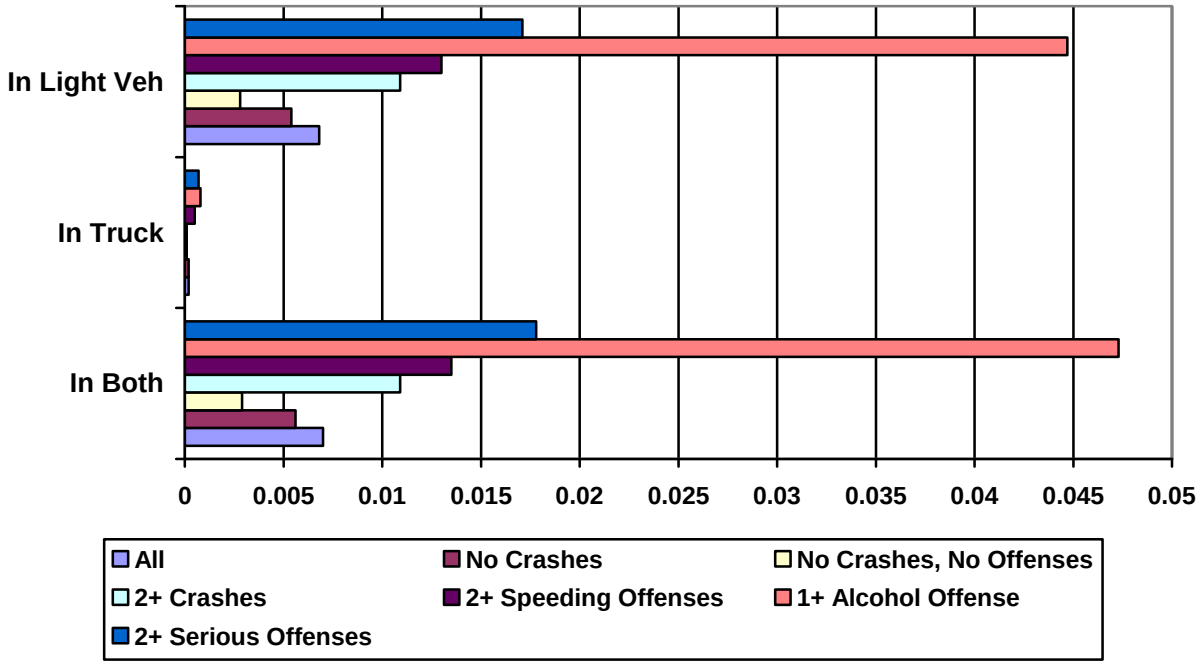

Figure 9 Alcohol Offenses/Driver in 2006-2007 by CDL Group

3.4 Crash Experience of CMV Drivers with and without CDLs

In this section, we discuss the crash experience of CMV drivers with and without a commercial drivers license, or CDL. (All the drivers discussed in this section are in a CMV at the time of the crash, meaning either a bus or a truck with a gross vehicle weight rating over 10,000 pounds.) The purpose is to identify and explore any differences between the two populations. CDLs are required for a truck with a gross vehicle weight rating or gross combination weight rating over 26,000 pounds; a bus with seating for sixteen or more passengers; for a school bus; or for any vehicle transporting hazardous materials requiring a placard. A CDL is not required for smaller CMVs, primarily trucks with a gross vehicle weight rating between 10,001 pounds and 26,000 pounds. Because these drivers are not required to have a CDL, they are not subject to the licensing requirements and monitoring that goes along with a CDL.

Whether a CMV driver possessed a CDL was determined by matching records of CMV crashes with the driver history file. The crash records cover the period from 2001 to 2005. There were 59,215 total relevant crash involvements in the period. Of these involvements, 54,301 drivers or 91.7 percent held a CDL and 4,914 CMV drivers (8.3 percent) did not. Information from the driver history file was used to determine if the driver had held a CDL at any point from 2005 and prior. Drivers who had a CDL were classified as CDL holders, and those that did not were non-CDL holders. All drivers used in the comparison were found in the driver history file, so all are Michigan-licensed drivers.

Classifying drivers by whether they possessed a CDL while driving a CMV does not directly reflect whether the vehicle they were driving at the time of the crash required a CDL, just that it was a CMV. This method of classifying drivers does not reflect the vehicles actually operated by the drivers. As explained in the prior report [1], the vehicle information available in the Michigan crash file does not support, in a reliable and exhaustive fashion, classifying vehicles by whether they require a CDL. It is of course possible that some of the drivers without a CDL were driving a vehicle requiring a CDL. Similarly, drivers with a CDL may have been driving a CMV that did not require a CDL at the point of the crash. The comparison made is between drivers with and without a CDL; without regard to the vehicle they were actually operating in the crash, beyond the fact that all were driving a CMV.

It is likely, however, that most of the CDL drivers were truck drivers operating a heavy truck, mainly tractor-semitrailers, and that most of the non-CDL drivers were operating smaller, medium duty trucks, falling into the gross vehicle weight rating classes class 3 through 6. Most of the trucks requiring a CDL are tractor-semitrailers, which are used in long distance hauling, primarily on relatively high speed roads. Trucks that do not require that the driver have a CDL include medium-duty vehicles, such panel and delivery vans, two-axle dump trucks, and medium duty van straight trucks. Many of these smaller vehicles do not operate across state lines. They

are operated more often as part of a business, such as construction, retail, or landscaping, while a higher proportion of the trucks requiring a CDL are used in the freight-hauling business.

The line in terms of vehicle operations dividing these two types of vehicles is not by any means well-marked. Instead, the differences are more a matter of tendencies and averages. On average, trucks requiring a CDL are more likely to be tractor-semitrailers used in long-distance freight hauling, while the trucks that do not require a CDL are more likely to be straight trucks operated as part of a business such as landscaping and construction. However, it should be noted that many package delivery vehicles are operated by a large, interstate package delivery service, and that there are plenty of heavy duty concrete mixer and construction dumps included among the trucks requiring a CDL. The point is a matter of emphasis and averages.

Comparisons of environmental circumstances of CMV crashes for drivers with and without a CDL are consistent with the general outline of the differences between the two groups discussed above (Table 13.) The crashes of CMV drivers without a CDL were more likely to occur on weekends, on local roads, and during the daylight hours, and the drivers themselves were heavily male. In contrast, CMV drivers possessing a CDL were also primarily male, but in lower proportion than non-CDL, and their crashes were more likely during a weekday, more often on Interstate roads, and somewhat more likely in non-daylight conditions. Large trucks are typically used for long distance freight hauling, and operate on high-speed roads such as Interstates, and more often at night. In contrast, trucks used as part of a business such as construction or other trade, are more likely to operate on local roads, during daylight hours, with work extending into the weekend.

Table 13 Some Comparisons of Crash Environment for CMV Drivers with and without CDL, Michigan 2001-2005

	CDL	No CDL
Week period		
Weekend	7.1	11.9
Weekday	92.9	88.1
Driver sex		
Male	87.0	92.7
Female	13.0	7.3
Road type		
Interstate	17.6	12.6
US/M route	30.7	27.9
Local Roads	48.7	56.9
Light condition		
Daylight	80.3	84.2
Dark/lighted	6.3	5.9
Dark/unlighted	7.4	4.4
Other	5.9	5.4

Two comparisons are explored. In the first, we compare the role in crashes of CMV drivers who have a CDL with CMV drivers who do not have a CDL. In this comparison, we will compare the two groups in terms of the types of crashes in which they are involved; the extent to which the driver contributed to the crash, as indicated by the assignment of a hazardous action by the reporting police officer; and their driving records prior to the crash. The second comparison focuses on all CMV drivers, without regard to possession of a CDL. Drivers assigned a hazardous action by the reporting police officer are compared with those who apparently did not contribute to the crash. The primary point of comparison is the driver's prior record in terms of crashes and violations, to determine if the driver's prior record is associated with hazardous actions in the current crash. In other words, do CMV drivers coded with hazardous actions in crashes have poorer prior driving records? Does a poor driving record predict actions that contribute to crashes?

Current crash involvement

Overall, there was no significant difference in the crashes of CMV drivers with a CDL and those who did not possess a CDL. Figure 10 shows the distribution of crash severity, measured by the most severe injury in the crash, for involvements in which the CMV driver held a CDL and for involvements in which the CMV driver did not hold a CDL. All the involvements are for CMV drivers while driving a truck. There is some slight tendency for the crashes of non-CDL CMV drivers to be somewhat less likely to include a fatal injury and somewhat more likely to include an injury, but the differences are not statistically significant, nor are they practically significant. The slight increased tendency for the crashes of CDL drivers to result in a fatal may be because CMVs requiring a CDL are larger, and more likely to travel on high speed roads.

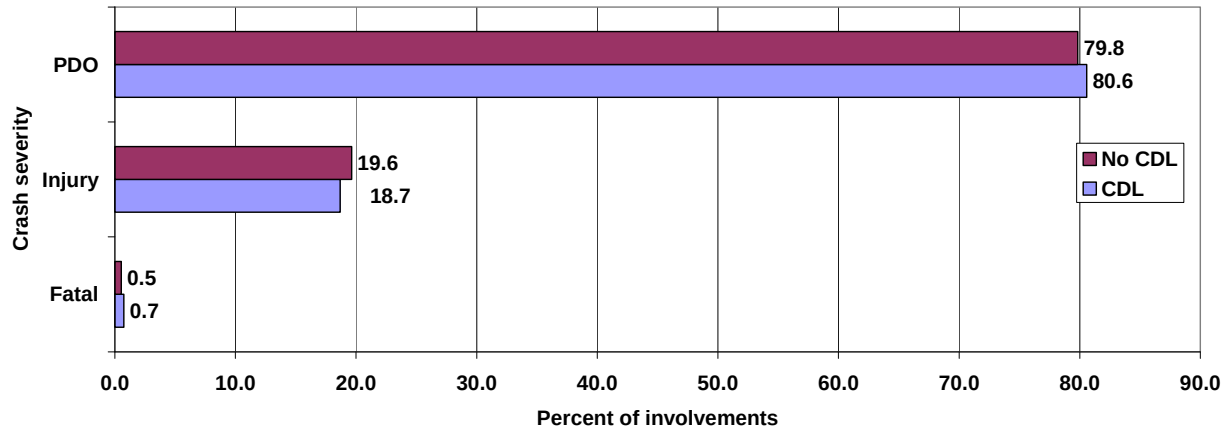

Figure 10 Severity of Crash for CMV Drivers with and without CDL Michigan 2001-2005

The distributions of the types of crashes involved differed somewhat between the two groups of CMV drivers. Non-CDL holders were somewhat more likely to be involved in rear-end and backing crashes than CDL holders (Figure 11). About 27.1 percent of the crashes of non-CDL

holders were rear-end crashes, compared with 22.8 percent of the crashes of drivers with CDLs. Non-CDL holders also had a higher proportion of backing crashes, 10.7 percent to 8.2 percent, and angle crashes, 18.6 percent to 16.7 percent. In contrast, the proportions of head-on and single-vehicle crashes are about the same between the two groups.

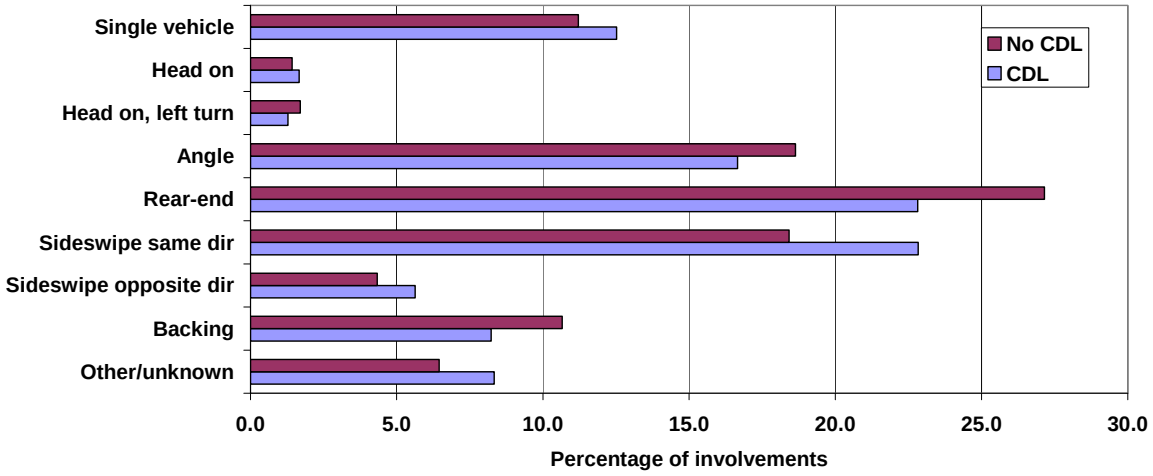

Figure 11 Crash type for CMV Drivers with and without a CDL Michigan 2001-2005

By themselves, these comparisons are merely suggestive, since driver contribution to the crash cannot be inferred from crash type, especially since the crash type does not indicate the role of the driver in the crash, e.g., whether the CMV was the striking or struck vehicle in a rear-end crash. However, the reporting police officer records actions that contributed to the crash, as "hazardous actions." These codes reflect the officer's judgment of whether a driver's actions contributed to the crash, and are recorded whether or not a citation is issued or an arrest made. [2] Since police officers exercise discretion in issuing citations, this variable gives the most direct insight into the officer's evaluation of responsibility for the crash.

Overall, CMV drivers who did not have a CDL were significantly more likely to be coded with a hazardous action than CMV drivers who did have a CDL. Almost 55 percent of non-CDL CMV drivers were coded with a hazardous action, compared with only 44.5 percent of CDL holders. This difference is both practically and statistically significant. It appears that CMV drivers who do not have a CDL are much more likely to have contributed to a crash than CMV drivers who go through the training, testing, and licensing required for a CDL.

Table 14 Hazardous Action Coded for CMV Drivers with and without a CDL
Michigan 2001-2005

Hazardous action?	CDL	No CDL	Total
None	26,258	1,844	28,102
Coded	24,179	2,690	26,869
Unknown	3,864	380	4,244
Total	54,301	4,914	59,215
	Column percentages		
None	48.4	37.5	47.5
Coded	44.5	54.7	45.4
Unknown	7.1	7.7	7.2
Total	100.0	100.0	100.0

Table 15 shows the specific hazardous actions coded for CDL holders and CMV drivers who did not have a CDL. The table shows the percentage of CMV drivers coded with specific hazardous actions, along with the total number of CMV crash involvements. The hazardous actions are sorted in order of decreasing frequency. Note that 13.5 percent of the hazardous actions of non-CDL drivers are "unable to stop," and that this percentage is significantly higher than for CDL holders, 9.6 percent. This overrepresentation is consistent with the higher rate of rear-end crashes for non-CDL drivers, observed in Figure 11 above. That figure illustrated the overrepresentation of rear-end crashes, which is consistent with the result here. Improper backing and failure to yield are also overrepresented for non-CDL holders, in comparison with CDL holders. Again, this is consistent with the higher percentage of angle and backing crashes involving CMV drivers who did not have a CDL.

Table 15 Percent Distribution of Specific Hazardous Action Coded, CMV Drivers
Michigan 2001-2005

Hazardous action	CDL	No CDL	All
None	48.4	37.5	47.5
Unable to stop	9.6	13.5	9.9
Other	9.4	9.5	9.4
Improper backing	5.2	7.7	5.4
Failed to yield	5.2	7.6	5.4
Improper lane use	4.3	4.2	4.3
Speed too fast	2.8	3.0	2.8
Improper turn	3.7	2.7	3.7
Careless/negligent	1.6	2.3	1.7
Disregard traffic control	1.1	2.0	1.2
Improper passing	0.6	0.9	0.6
Drive left of center	0.6	0.5	0.6
Speed too slow	0.1	0.3	0.1

Hazardous action	CDL	No CDL	All
Improper/no signal	0.2	0.2	0.2
Reckless driving	0.1	0.2	0.1
Drove wrong way	0.1	0.1	0.1
Unknown	7.1	7.7	7.2
Total	100.0	100.0	100.0
N =	54,301	4,914	59,215

Non-CDL holders were also significantly more likely to be issued a hazardous citation after the crash than CDL holders. Almost 24 percent of crash-involved CMV drivers who did not have a CDL were issued a hazardous citation, compared with only 16.0 percent of CMV drivers with a CDL. Thus, non-CDL holders in a CMV were about 50 percent more likely to be charged with a moving violation than were CMV drivers who did have a CDL. It is important to note that these are citations for hazardous actions, not for failure to have a CDL when required. Indeed, there is no evidence that any significant fraction of the CMV drivers who did not have a CDL were driving a vehicle that required one at the time of the crash.

Non-CDL holder' rates were similar to those of CDL holders for illegal drug use and coded fatigue or asleep, but they had significantly higher rates of coded alcohol use (Figure 12.) The rates of detected illegal drug use are very low for both CMV driver groups, with illegal drug use identified for only about 0.04 percent of crash involvements. The rates at which the two groups were coded as fatigued or asleep were also similar, with about a quarter of a percent of each group. (Note that, as discussed in the prior report [1], driver fatigue is probably underestimated.) However, the non-CDL group had a much higher rate of coded alcohol involvement. Only 0.25 percent of CDL drivers were coded as using alcohol at the time of crash, compared with 0.75 percent, or three times as high, of non-CDL holders.

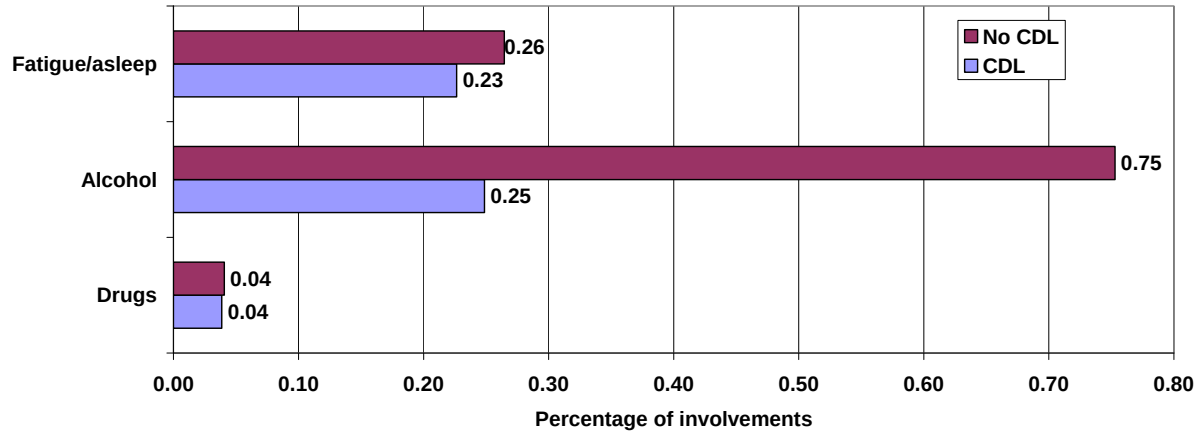

Figure 12 Selected Driver Conditions, CMV Drivers with and without CDL, Michigan 2001-2005

It probably should be noted that each of these rates is lower than the comparable rate in the whole population of drivers in crashes. Overall, as calculated from *2007 Michigan Traffic Crash Facts* [7], 0.17 percent of all drivers were coded as using illegal drugs, which is about four times higher than the rate for CMV drivers. The rate of fatigued or asleep for all drivers in crashes in 2007 was 0.39 percent, about 1.5 times higher than the rate for CMV drivers. And 2.45 percent of all drivers in crashes in 2007 were coded as drinking, which is significantly higher than the alcohol use rate for either CMV drivers with CDLs or CMV drivers with no CDL.[7] CMV drivers, whether possessing a CDL or not, are at work when driving and less likely to be drinking or using illegal drugs. While rates of fatigue are likely underestimated, on the evidence of the crash record, CMV drivers are also less likely to be fatigued.

Prior Driving Record and Crash Involvement

By linking crash-involved CMV drivers with the driver history records, it is possible to determine rates of prior offenses and crashes for the drivers and to compare the prior records of CMV drivers with a CDL and CMV drivers who do not have a CDL. CMV drivers who did not have a CDL have higher rates of prior serious offenses (defined as those that result in three points on the license), any offenses, and alcohol-related crashes, but somewhat lower rates of prior crashes (Figure 13.) Crash-involved CMV drivers holding a CDL actually had more prior crashes, on average, than CMV drivers that did not hold a CDL. The difference was not large but still significant.

The higher average number of prior crashes may be related to higher mileage for CDL holders. Data on average miles driven in a CMV is not available for CDL holders and non-CDL holders, but it is likely that CDL holders drive more miles annually than non-CDL holders. The VMT information cited above shows that combination vehicles—typically tractor-semitrailers—accumulate more miles annually than smaller trucks, such as two-axle straight trucks. Most of the vehicles requiring a CDL are tractor-semitrailers, while two-axle, six tire straight trucks typically do not.

Crash-involved CMV drivers who did not have a CDL had on average 0.24 prior serious offenses, compared with 0.16 serious offenses for CMV drivers who did have a CDL. Thus, non-CDL holders were about 50 percent more likely to have had a previous serious offense on their driving record. The average number of any prior offense was also about 50 percent higher for non-CDL holders compared with CDL holders. On average, CMV drivers with no CDL had 1.38 prior offenses on their record, compared with 0.89 for CDL holders. Finally, non-CDL CMV drivers had almost twice the number of involvements in prior alcohol-related crashes than CMV drivers with a CDL. Even though the averages are very small, the difference is still statistically significant.

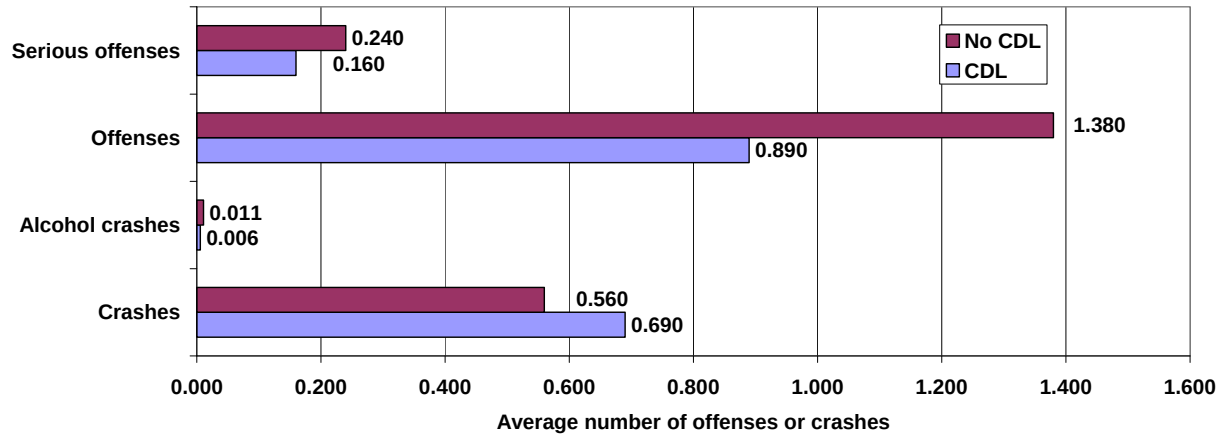

Figure 13 Prior Driving Record for CMV Drivers with and without a CDL Michigan 2001-2005

The driver history indicators also appear to be related to whether a CMV driver was judged by the reporting police officer to have contributed to the current crash. Figure 14 shows the average number of prior crashes and offenses for CMV drivers classified by whether they committed an action that contributed to the crash. The averages are low, but the differences are all statistically significant.

CMV drivers coded with a hazardous action on average have 36 percent more serious offenses on their records than CMV drivers with no hazardous action. The average number of serious offenses (resulting in three points on a license) for those with hazardous actions is 0.19, compared with 0.14 for CMV drivers with no hazardous action. The average for all offenses for CMV drivers with a hazardous action identified is 38 percent higher than for drivers who did not contribute to the crash. In addition, the average number of prior alcohol-related crashes is also 54 percent higher for CMV drivers assigned a hazardous action, compared with those who were not. The difference between the two groups is less for prior crashes than for the other measures, but this could be because involvement in a crash is not solely related to the driver's own behavior, but also attributable to the actions of other drivers and circumstances. However, drivers with a hazardous action in the current crash still had more prior crashes than those drivers who did not contribute to the current crash. Drivers whose risky driving behavior contributes to crashes tend to have poorer driving records than drivers who are not identified as causing a crash.

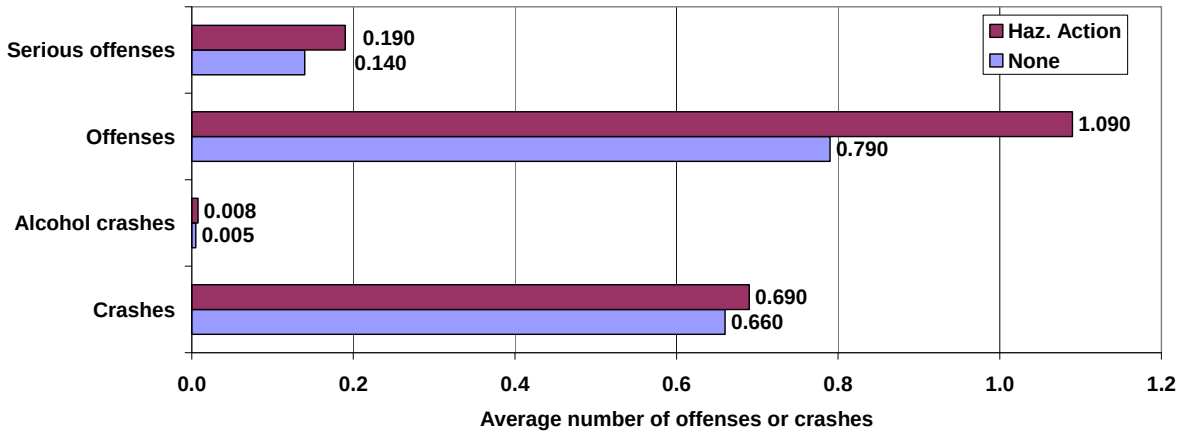

Figure 14 Prior Driving Record for CMV Drivers by Hazardous Action in Crash Michigan 2001-2005

4 Summary and Findings

This research sought to identify differences in safety records between drivers who held commercial drivers licenses and those who did not. The research also examined the question of whether previous offenses and crashes in CDL drivers' records are reasonable indicators of future offenses and crashes.

The ages of CDL drivers included in the analyses reported here were 21-69 years. This age range was selected to start at the age at which a driver can first obtain a CDL, and to end at an age by which most people retire from jobs requiring CDLs. This age range was divided into three categories to reflect three phases in the life of driver of commercial vehicles: 1) age 21-29 years, young new inexperienced CDL drivers, 2) age 30-54 years, experienced middle-aged drivers, and 3) age 55-69 years, experienced drivers whose driving ability may be changing from the effects of age.

Examination of the driving records from 2001-2005 by the three age groups showed that the older CDL drivers (age 55-69) had better driving records than the two younger groups. While the oldest drivers accounted for 29 percent of all CDL drivers, they made up 32 percent of CDL drivers with no crashes, and 39 percent of CDL drivers with no crashes or offenses. The oldest CDL drivers constituted 22 percent of CDL drivers with two or more crashes, 16 percent of those with two or more speeding offenses, 14 percent of those with a serious offense, and only 13 percent of those with an alcohol offense during 2001-2005. The youngest drivers, (21-29 years) who were three percent of the CDL population were overrepresented in crashes and offenses. They made up five percent of the CDL drivers with two or more crashes, seven percent of those with speeding offenses, nine percent of those with serious offenses, and six percent of those with alcohol offenses. The middle age group (30-54) was overrepresented in speeding and alcohol offenses. This age group was 68 percent of the CDL drivers, but accounted for 81 percent of

those with alcohol offenses, 77 percent of those with speeding offenses, and 78 percent of those with serious offenses.

Overall, female CDL drivers had better driving records than male CDL drivers. While women were 12 percent of all CDL drivers examined here, they were 14 percent of the group that did not have a crash or offense in 2001-2005. Furthermore, women constituted only six percent of those with speeding offenses, four percent of those with alcohol offenses, and five percent of those with serious offenses.

Crash and offense rates from 2001-2005 were compared between drivers holding CDLs and a random sample of light vehicle drivers (i.e., licensed drivers from the general driving population of the same age who did not hold CDLs). When only the numbers of crashes were considered, CDL drivers had higher crash rates than drivers from the general population, but the rates of offenses were relatively similar for the two groups. The number of crashes per driver per year was more than two times as high for CDL holders than light vehicle drivers (0.133 vs. 0.056). Similarly, the number of injury crashes per year of CDL drivers was two times that of the injury crash rate for light vehicle drivers (0.26 vs. 0.13 injury crashes per year), and the number of fatal crashes was almost eight times as high for CDL drivers than for light vehicle drivers (0.00062 vs. 0.00008 fatal crashes per year). The number of crashes involving alcohol of the two groups was not much different from each other with 0.0019 alcohol crashes per driver per year for CDL drivers and 0.0014 alcohol crashes per driver per year for light vehicle drivers.

Offense rates for the two groups were similar. The overall rate of offenses per driver per year was 0.18 for CDL drivers and 0.16 for light vehicle drivers. The rate for serious offenses that result in three or more points on the driver license, was 0.03 for both groups, and the rate for offenses involving alcohol was 0.009 for CDL drivers and 0.011 for light vehicle drivers. Only for speeding offenses was the number of offenses per driver per year for CDL drivers higher than for light vehicle drivers (0.102 vs. 0.074).

The crash and offense rates given above were calculated with no consideration of differences in exposure, that is, differences in the number of miles driven by CDL and light vehicle drivers. Although it is commonly accepted that drivers with CDLs drive more miles in a year than drivers in the general driving population, reliable estimates of CDL drivers' annual mileage are not available. However, even when very conservative estimates of exposure are used, crash and offense rates per mile for CDL drivers become comparable to or fall below that of light vehicle drivers. The only exception is that the fatal crash rate continues to be higher for CDL drivers than for light vehicle drivers. This is most likely due to the higher probability of a fatality in a crash between a truck (driven by CDL holder) and a light vehicle than in the case of a crash involving just light vehicles.

Previous offenses and crashes in CDL drivers' records were reasonable indicators of future offenses and crashes. Examination of crash and offense rates for 2006-2007 across CDL drivers grouped by patterns of crashes and offenses from 2001-2005 showed that drivers with safe driving records in the prior period continued to have safe driving records in the after period, and drivers with crashes, speeding offenses, and alcohol offenses continued their risky driving behavior in the after period. Overall, about two-thirds of all the crash involvements and offenses of CDL drivers were in light vehicles and about one-third in trucks.

CDL drivers who had no crashes or no crashes or offenses in the prior period also had the lowest crash involvement for crashes of all severities in the after period. Furthermore, these drivers also had the lowest offense rates of all the driver groups. Drivers who had been involved in two of more crashes in the prior period had the highest rate of crash involvement, including injury crash involvement in the after period.

CDL drivers with records of speeding offenses had the highest rates of fatal crashes. The overall rate of fatal crashes per CDL driver in the after period is 0.0009 per driver or about one fatal crash per 1,111 drivers. Drivers who had at least two speeding tickets in the prior period had the highest rate of fatal crashes per driver at one fatal crash per 588 drivers. Furthermore, drivers who had at least two speeding offenses in the prior period also had the highest rate of speeding offenses in the after period.

The rate of alcohol offenses for CDL drivers is very low. However, drivers who had at least one alcohol offense have the highest rate of alcohol offenses and alcohol crashes of all the groups in the after period. Their rate of alcohol offense in the after period was 0.047 alcohol offenses per driver, which is seven times more than overall average, and their rate of alcohol crash involvement was 0.12 alcohol crashes per driver in the after period, which is 52 times that of the overall alcohol crash involvement of CDL drivers.

We also performed a series of comparisons within the set of CMV drivers who were involved in traffic crashes in the 2001-2005 period. Comparisons were made between CMV drivers who had a CDL and those who did not. A second set of comparisons were made between those who were identified by the police as contributing to the crash and those who did not contribute, as determined by whether the reporting officer coded the driver with a hazardous action.

The purpose of the first comparison was to see if there is any evidence in the available data of a safety difference between those CMV drivers who have a CDL, because they drive a vehicle requiring one, and those who do not have a CDL. The data available for this purpose are the crash data and evidence from the driver history files. CDL holders are obviously subject to the licensing requirements of the commercial drivers license, while drivers of CMVs that do not require a CDL are just as obviously not subject to those requirements.

Overall, non-CDL holders among crash-involved CMV drivers formed a relatively small part of the population. In the Michigan crash data from 2001 to 2005, there were almost 60,000 CMV drivers licensed in Michigan. Almost 92 percent possessed a CDL, while only 8.3 percent did not. In addition, there appeared to be no significant differences in terms of the severity of the crashes they were involved in. That is, the crashes of non-CDL holders had about the same proportions of fatal, injury, and property damage only crashes. If anything, the percent of fatal crashes was slightly higher for CDL holders than non-CDL holders, at 0.7 percent compared with 0.5 percent. But this difference is small and not of practical significance.

However, in terms of hazardous actions contributing to the crash and prior driving records, CMV drivers without a CDL had significantly poorer records. CMV drivers without a CDL were much more likely to be assigned a hazardous action in the crash than CDL holders. Almost 55 percent of the non-CDL holding CMV drivers were coded with a hazardous action, i.e., an action judged by the reporting officer to have helped produce the crash. This is in marked contrast with CDL holders, of whom only 44.5 percent were coded with a hazardous action. In addition, the non-CDL holders were about 50 percent more likely to be given a hazardous citation than CDL holders. It appears that CMV drivers not subject to the requirements of the CDL regime are more likely to commit the acts that lead to traffic crashes; and then they are more likely to be charged by the police for the acts.

Crash-involved CMV drivers with a CDL and those without had about the same proportions recorded with illegal drugs, or fatigue or asleep, but non-CDL holders had much higher rates of alcohol use. Only 0.04 percent of each type of CMV driver was recorded as under the influence of illegal drugs at the time of the crash. And only about 0.23 to 0.26 percent of the CMV drivers were coded as fatigued or asleep at the time of the crash. But in regard to alcohol use, the non-CDL CMV drivers were three times more likely to be recorded for alcohol use than CDL drivers. The absolute percentages were small, with only 0.25 percent of CDL CMV drivers and 0.75 percent of non-CDL CMV drivers coded with alcohol use. (It should also be noted that the rates of each of these measures in the whole population of drivers, primarily private light vehicle drivers, are much higher than those for either set of CMV drivers.)

The purpose of examining the driving history of CMV drivers was to determine whether the driving record is predictive of contribution to subsequent crashes. The driver history of CMV drivers was compared between CDL holders and non-CDL holders, as well as between CMV drivers who committed a hazardous action and those who did not. Prior crashes, prior alcohol-related crashes, all offenses, and serious offenses were used in the comparison.

Among CMV drivers involved in a crash in Michigan from 2001 to 2005, CDL holders on average had a slightly higher number of previous crashes than those who did not have a CDL, though the difference was small. On the other hand, non-CDL holders had significantly worse records in terms of offenses, serious offenses (defined as three or more points on the license),

and alcohol-related crashes. Non-CDL CMV drivers averaged 55 percent more prior driving offenses, 50 percent more serious offenses, and 86 percent more prior alcohol-involved crashes.

In the same way, CMV drivers who were identified by the reporting officer has having committed a hazardous action, and who thus contributed to the crash, were much more likely to have worse prior driving records than drivers who did not. The number of prior crashes was only somewhat higher, but their involvement in prior alcohol-related was substantially higher, about 50 percent, though it should be noted that the absolute number is small. On the other hand, CMV drivers identified with a hazardous action in the period had about 38 percent more prior moving offenses and 36 percent more prior serious moving offenses.

What may be concluded here? It appears that among CMV drivers involved in crashes, drivers with a CDL are somewhat safer than CMV drivers who have not obtained a CDL. The non-CDL drivers are more likely to have made the mistake that led to the crash. They also typically have worse driving records, in terms of all offenses, serious offenses, and alcohol-related crashes. It cannot be said, on the available evidence, that the requirements for obtaining a CDL are the reason for these differences. There are certainly operational differences between the types of vehicles requiring a CDL and those that do not. For example, driving is a profession for most of the vehicles requiring a CDL, so there may be less tolerance within the job for unsafe driving behaviors, while for many CMVs that do not require a CDL, the driving is just part of the business. On the other hand, the CDL requirement is certainly designed to improve safety and was mandated to make it easier to identify and weed out unsafe drivers. It should be emphasized, however, that non-CDL drivers account for only about 8.3 percent of CMV crash involvements, and there appears to be no significant difference in the severity of the crashes, as measured by fatalities and injuries.

It is also clear that the past driving record is related to unsafe or hazardous actions that result in traffic crashes. In this sense, the past is prologue. Drivers who have committed violations in the past are likely to do so in the future, and thus are likely to be involved in crashes in which their risky behavior led to the crash. The results presented here have demonstrated this from many perspectives—in the comparison of CMV CDL holders with the general population of light vehicle drivers, in the before and after comparison for CDL holders, and in the comparison of the CMV CDL holders with CMV non-CDL holders. While CMV drivers as a whole compare favorably in several respects with non-CMV drivers, among CMV drivers, the group with CDLs typically performs better than those not required to have a CDL.

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