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The Impact of Driver Distraction in Tractor-Trailers and Motorcoach Buses

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Problem
Driver distraction has become an increasing concern over the last decade as portable technology has emerged and its use while driving has become more common. Driver distraction occurs when inattention leads to a delay in the recognition of information necessary to accomplish the driving task. In 2013, an estimated 16% of all police-reported crashes were reported as distraction-related (NHTSA, 2015).

Various contributing factors, including environmental, vehicle, and driver factors, may play a role in any given safety-critical event (SCE), including crashes, near-crashes, crash-relevant conflicts, and unintentional lane deviations. Research has found that driver factors (including driver errors) are by far the most prominent contributing factor in traffic crashes, playing a role in up to 75% of all police-reported crashes (Wierwille et al., 2002).

Method
Two studies were conducted using a naturalistic driving approach. The Commercial Motor Vehicle Driver Distraction study (Olson et al., 2009) was conducted using data collected from tractor-trailer (i.e., heavy truck) drivers, and the Distraction and Drowsiness in Motorcoach Drivers study (Hammond et al., in press) was conducted using motorcoach (bus) drivers. Data from 203 heavy vehicle drivers and 65 motorcoach drivers were used for the study reported here. Heavy truck data were collected under two different studies: one from May 2004 to September 2005, and the other from November 2005 to May 2007. The motorcoach data was collected from May 2013 to July 2014.

All data were collected using a naturalistic data collection approach where each participant drove a fleet vehicle instrumented with data collection equipment as part of their normal revenue-producing operations. Each vehicle contained several video cameras (recording views of the face, over-the-shoulder, front view, rear-view, and right/left side view – see Figure 1) and vehicle sensors to collect data on vehicle speed, global positioning system (GPS) locations, braking intensity, steering input, forward range to a lead vehicle, and many additional measures. (A complete description of the instrumentation and measures can be found in Olson et al., 2009, and Hammond et al., in press.) These data were collected continuously; that is, the data collection system started as soon as the vehicle ignition was turned on and continued to record until the vehicle was turned off. Unlike police accident reports that are collected after a crash has happened, the naturalistic data collection method enables researchers to see video of exactly what the driver was doing prior to a crash, in addition to assessing the driving environment (e.g., road type, traffic conditions, weather conditions, etc.).

Figure 1. Photo. Five Camera Images Multiplexed Into a Single Image. The driver depicted is a VTTI employee.

Results and Discussion

The data was grouped into secondary and driving-related tasks, secondary tasks only, and driving-related tasks only. The following research questions were asked for each data set:

1. What are the types and frequency of tasks in which drivers engage prior to involvement in SCEs?
2. What are the odds ratios of eyes off forward roadway? Does eyes off forward roadway significantly affect safety and/or driving performance?

First, only secondary tasks, which are typically associated with distraction, were assessed. Of all crashes that occurred in the truck data, 40% were found to have some type of distraction behavior. Some kind of distraction behavior was found for 55.6% of all crashes that occurred in the motorcoach data where the participating driver (i.e., the driver of the instrumented vehicle) was considered to be at fault.

Individual tasks were also assessed. Odds ratios were conducted using SCEs and baseline epochs to determine the relative risk of the driver being involved in a SCE while engaging in a secondary task. Some key distraction behaviors are shown in

Table 1, which shows that text messaging on a cell phone had the highest risk for truck drivers, with an Odds Ratio of 23.24, while Use Intercom had the highest risk for motorcoach drivers, with an Odds Ratio of 3.78.

Table 1. Overview of secondary tasks

Secondary Task in Truck Data	Odds Ratio	LCL	UCL	Secondary Task in Motorcoach Data	Odds Ratio	LCL	UCL
Text message on cell phone	23.24	9.69	55.73	Other known secondary task	4.06	2.13	7.77
Interact with/look at dispatching device	9.93	7.49	13.16	Intercom use	3.78	2.13	6.75
Write on pad, notebook, etc.	8.98	4.73	17.08	Other personal hygiene (scratching nose)	3.47	1.94	6.19
Use calculator	8.21	3.03	22.21	Removing/adjusting clothing (removing coat)	2.84	1.37	5.92
Look at map	7.02	4.62	10.69	Reaching for object	2.14	1.23	3.72
Use/reach for other device	6.72	2.74	16.44	Object in vehicle, other	1.69	1.02	2.82
Dial cell phone	5.93	4.57	7.69	External distraction (look out window)	1.61	1.26	2.07
Personal grooming (brush hair)	4.48	2.01	9.97	Cell phone, holding	-	-	-
Read book, newspaper, paperwork, etc.	3.97	3.02	5.22	Cell phone, texting	-	-	-
Put on/remove/adjust glasses or sunglasses	3.63	2.37	5.58	Cell phone, browsing	-	-	-
Reach for object in vehicle	3.09	2.75	3.48	Cell phone, dialing hand-held	-	-	-
Look back in sleeper berth	2.30	1.30	4.07	Cell phone, locating/reaching/answering	-	-	-

Note: LCL = lower control limit, UCL = upper control limit.

Total time eyes off forward roadway was grouped into five different time bins: 1) less than or equal to 0.5 s; 2) greater than 0.5 s but less than or equal to 1.0 s; 3) greater than 1.0 s but less than or equal to 1.5 s; 4) greater than 1.5 s but less than or equal to 2.0 s; and 5) greater than 2.0 s. Table 2 shows the results of these calculations.

Table 2. Odds Ratios and 95% Confidence Intervals to Assess Likelihood of a Safety-Critical Event While Eyes off Forward Roadway

Secondary Task in Truck Data	Truck Data			Motorcoach Data		
	Odds Ratio	LCL	UCL	Odds Ratio	LCL	UCL
Less than or equal to 0.5 s	**1.28***	1.06	1.53	1.23	0.74	2.03
Greater than 0.5 s but less than or equal to 1.0 s	0.94	0.81	1.09	1.38	0.98	1.94
Greater than 1.0 s but less than or equal to 1.5 s	**1.18***	1.01	1.38	**1.87***	1.32	2.66
Greater than 1.5 s but less than or equal to 2.0 s	**1.52***	1.3	1.79	**1.64***	1.04	2.59

Greater than 2.0 s	**3.85***	3.44	4.3	**5.25***	4.01	6.88

Summary

One key difference in the data is that a smaller overall number of distractions was observed in the motorcoach data than was observed in the truck data. More specifically, there was little to no observance of cell phone use in the motorcoach data set (see

Table 1). One possible explanation for this is the time frame in which the data were collected and analyzed. The truck data were collected between 2004 and 2007 and the data were analyzed in 2009. In January, 2010, the Federal Motor Carrier Safety Administration issued a federal ban on texting while driving and on the use of hand-held mobile phones for all Commercial Motor Vehicle drivers. The motorcoach data were collected between May 2013 and July 2014, after the texting and hand-held cell phone use ban was in place. This time frame likely contributed to the decrease in cell phone use in the motorcoach data. A second possible explanation is that motorcoach drivers are transporting passengers and therefore their behaviors are observed. While there was not a cell phone policy in place for either participating company, drivers appeared to be less likely to interact with their cell phones while transporting passengers.

Another interesting finding was the observance of electronic secondary tasks. In the truck data, several electronic tasks were observed, such as the use of a dispatching device, calculators, and cell phones, which resulted in a significant odds ratio. However, the only electronic device that resulted in a significant odds ratio in the motorcoach data was use of the intercom to interact with passengers. During this task, drivers often looked in the rearview mirror at their passengers while talking, taking their eyes off of the forward roadway.

A third important finding was the increase in risk when the driver’s eyes were off the roadway for greater than 2.0 seconds. This finding is consistent in both the truck data and motorcoach data presented in this paper, as well as in previous naturalistic studies with light vehicles (Klauer et al., 2006).

References

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