



# The impact of driver distraction in tractor-trailers and motorcoach buses

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## ABSTRACT

Driver distraction has become an increasing concern over the last decade as portable technology has emerged and its presence while driving has become more common. Driver distraction occurs when inattention leads to a delay in recognition of information necessary to accomplish the driving task. Two recent studies were conducted using a naturalistic data collection method and analysis of driver distraction. The Commercial Motor Vehicle Driver Distraction study (Olson et al., 2009) was conducted using heavy truck data, and the Distraction and Drowsiness in Motorcoach Drivers study (Hammond et al., 2016) was conducted using motorcoach data. Data were collected continuously every time the instrumented vehicle was turned on and in motion. Data were reduced to identify safety-critical events such as crashes, near-crashes, crash-relevant conflicts, and unintentional lane deviations. Results show that 40% of truck crashes and 56% of motorcoach crashes had some kind of distracting behavior. Odds ratios were calculated on individual secondary tasks and analyses of variance (ANOVAs) were calculated on eye-glance data to determine the effects of eyes off the forward roadway. Fewer distractions were identified in the motorcoach data, most notably the use of handheld cell phones. This suggests that the 2010 ban on handheld phones has had a positive effect on decreasing cell phone use while driving.

## 1. Introduction

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

In 2013, 409,000 large trucks and buses were involved in traffic crashes in the United States (U.S.) and 4,186 were involved in fatal crashes (National Highway Traffic Safety Administration, 2015). For any given safety-critical event (SCE; e.g., crashes, near-crashes, crash-relevant conflicts, and unintentional lane deviations), various contributing factors may play a role, including environmental, vehicle, and driver factors. Research has found that driver factors (including driver errors) are by far the most prominent contributing factor in traffic crashes (Treat et al., 1979; Wierwille et al., 2002).

One of the earliest, and perhaps most cited, driver distraction studies was conducted by Indiana University by Treat et al. (1979). Data were collected between 1972 and 1975 and grouped into three “levels.” Level A was a collection of baseline data and included vehicle registration and driver’s license information as well as surveys from the general population. Level B was a data set collected from police

accident reports. Investigators identified crashes by listening to police scanners and then went to the scene of the crash to collect data. A total of 2,258 crashes were investigated (crashes involving heavy vehicles and vehicles pulling trailers were *not* included). Level C was an in-depth investigation of Level B data and included 420 crashes. For each crash in Level C, there was an investigation of human, environmental, and vehicle factors that may have contributed to the crash. The drivers were interviewed by a psychologist or sociologist and participated in dynamic vision and driver knowledge tests. An automotive engineer also inspected the vehicle(s) involved in the crash. The data from these crashes were divided into three sections: accident summary, identification of causal factors, and a probability assessment to determine how likely a factor was the reason for the accident. The results of this study found that human factors were most often (71%–93%) cited as the cause in the crashes, followed by environmental (12%–34%) and vehicle factors (5%–13%). Five major categories of human direct causes were identified: recognition errors, decision errors, performance errors, critical non-performance errors, and non-accident/intentional involvement. In addition, five specific human causes were identified: improper lookout (18%–23%), excessive speed (8%–17%), inattention (10%–15%), improper evasive action (5%–13%), and internal distraction (6%–9%). It can be seen that two of the five specific human causes were related to inattention and distraction, indicating their prevalence during vehicle crashes.

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Fig. 1. Five camera images multiplexed into a single image.

A second key distraction study was the Large Truck Crash Causation Study (LTCCS), which assessed the causal factor as well as associated factors for fatal crashes involving large trucks (FMCSA, 2005). Considered the most comprehensive safety database for crashes involving large trucks, the LTCCS collected data on crashes at 24 sites in 17 states from 2001 through 2003. Investigators traveled to crash sites to collect crash scene data and conducted thorough interviews with drivers about conditions before the crash and inspected the trucks. Critical events, the critical reason, and other crash-associated factors to assess crash risk were coded in the LTCCS. The results of the LTCCS indicate that 9% of the crashes studied were attributed to driver inattention, 8% were attributed to an external distraction (i.e., the driver was looking at something outside of the truck), and 2% were attributed to an internal distraction. It is important to note that these driver errors were determined to be the causal factor of the crash (i.e., had they not been present, the crash would not have happened), but if these driver errors had also been considered as an associated factor, they would likely result in higher percentages.

One limitation to the methods used by the studies above is that the data were collected after the fact. Police accident reports and on-scene investigations are unable to determine pre-crash driver behavior or eye-glance patterns. Naturalistic driving studies, on the other hand, provide a more complete picture of a driver's behavior prior to a crash.

In the naturalistic approach, research participants are asked to drive an instrumented vehicle as they would drive their personal or company vehicle. Video and vehicle data are generally collected continuously; that is, the data collection system is started as soon as the vehicle ignition starts and continues to record until the vehicle is turned off. This 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.). Continuous data collection also provides a greater amount of data for use in analyses as it captures more than just crash data. For instance, all near-crashes and close calls are recorded as well as baseline (normative/uneventful) data to be used as a comparison or control.

## 2. Materials and methods

Two recent studies were conducted using a naturalistic data collection method and analysis of driver distraction. The Commercial Motor Vehicle Driver Distraction study (Olson et al., 2009) was conducted using heavy truck data, and the Distraction and Drowsiness in Motorcoach Drivers study (Hammond et al., 2016) was conducted using motorcoach data. The remainder of this paper will compare the methods and results from these two studies.

### 2.1. Participants

The Olson et al. (2009) study used data from two heavy truck studies: Hanowski et al. (2008) and Blanco et al. (2016); a total of 203 drivers were included in this data set. One hundred three drivers participated in the Hanowski et al. (2008) study, and data were collected for approximately three months per driver between May 2004 and September 2005. These participants worked for one of three fleets with home terminals in Virginia and North Carolina and had an average age of 40 years. One hundred drivers participated in the Blanco et al. (2016) study for approximately one month each between November 2005 and May 2007. These participants worked for one of four fleets with home terminals in Virginia and North Carolina. These drivers had an average age of 44.5 years.

The Hammond et al. (2016) study used data from motorcoach vehicles. Data were collected from 65 participants for up to one year each from May 2013 to July 2014. These participants worked for one of two fleets: one located in San Antonio, Texas, and one located in Los Angeles, California. These drivers had an average age of 49 years.

All drivers and fleets involved in these studies were volunteers. Virginia Tech served as the Institutional Review Board (IRB) of record and all participants signed an Informed Consent Form (ICF) prior to the start of data collection.

### 2.2. Data collection

Both sets of data were collected using a naturalistic data collection approach. Each vehicle typically contains several video cameras (e.g.,

recording views of the face, over-the-shoulder, front view, rear-view, and right/left side view – see Fig. 1) and vehicle sensors to collect data on vehicle speed, global positioning system (GPS), braking intensity, steering input, forward range to a lead vehicle, and many additional measures. 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.).

### 2.3. Data reduction

Collected data were reduced by trained data analysts. The first step in this process was to run an event trigger program. Because of the large quantity of data obtained from the continuous data collection, it was necessary to create flags in the data to identify points of interest. To do this, the data were scanned for notable events, including hard braking, quick steering maneuvers, short time to collision (TTC), and lane deviations. To identify these events, previously established threshold values were used to flag instances in the video and quantitative data where the threshold values were met or exceeded. Trigger thresholds were originally developed using a sensitivity analysis of varying sensor values in an effort to maximize valid events and minimize invalid and missed events. These triggers are defined in Table 1.

Once the triggers were created, analysts reviewed each flagged event to determine if it was caused by a valid or invalid trigger. Valid events were those events where recorded dynamic motion values actually occurred and were verified by video and other sensor data. Invalid events were those where sensor readings were spurious due to a transient spike or some other anomaly such as driving over a pothole (i.e., false positive).

Valid events were classified into one of five SCE types, shown in Table 2 below. During this process, 4452 SCEs were identified in the two truck data sets (Olson et al., 2009), and 1086 SCEs were identified in the motorcoach data set (Hammond et al., 2016).

### 2.4. Question reduction and eye-glance analysis

Once valid events were identified and classified as one of the above SCE types, analysts answered a set of questions relating to each event. These questions included information on the conflict itself such as the pre-incident movements of each vehicle involved, precipitating event (e.g., lead vehicle brakes), and evasive maneuvers. Analysts also answered questions on the environment, such as weather, lighting, surface conditions, number of lanes, and relation to junction (e.g., intersection). Finally, analysts identified up to four different distractions that took place in the 5 s prior to the precipitating event and 1 s after. The behaviors were coded as potential distractions and did not necessarily contribute to the conflict. Distractions were grouped into driving-related tasks, such as checking mirrors and checking the speedometer, and secondary tasks, such as cell phone use, eating, smoking, and reading paperwork. The full list of distractions can be found in Olson et al. (2009) and Hammond et al. (2016).

The next step in the data reduction process was to conduct eye-

glance analysis. Analysts used a specialized software program to watch the video and code the eye glances by pressing a key on the keyboard associated with the location of where the driver was looking.

## 3. Results

### 3.1. Research questions

The same research questions were used in both the truck analysis and the motorcoach analysis. The data were grouped into secondary and driving-related tasks, secondary tasks only, and driving-related tasks only. The following research questions were asked of each data set:

- 1 What are the types and frequency of tasks in which drivers engage prior to involvement in SCEs? What are the odds ratios and the Population Attributable Risk (PAR) percentage for each task?
- 2 What are the odds ratios for eyes off forward roadway? Does eyes off forward roadway significantly affect safety and/or driving performance?

The results of each of these questions are discussed in more detail below. Note, PAR percentage is discussed in more detail in the final report but will not be discussed further in this paper.

### 3.2. Frequency of tasks prior to SCE involvement

To answer the first research question, the data were grouped into the three categories noted above: secondary and driving-related tasks, secondary tasks only, and driving-related tasks only. This paper will only present results of the secondary tasks only grouping, as that is typically what is thought of when discussing distraction. It can be seen from Table 3 that 40% of all crashes that occurred in the truck data had some kind of secondary task (i.e., distraction behavior), while 55.6% of all crashes that occurred in the motorcoach data had some kind of distraction behavior. These data represents events where the driver of the instrumented vehicle was considered to be at fault for the conflict.

Next, individual tasks were considered. Odds ratios were conducted using SCEs and baseline epochs to determine the relative risk of the driver being involved in an SCE while engaging in a secondary task. Odds ratios are a comparison of the odds of occurrence based on the presence or absence of a condition (e.g., driver inattention versus no driver inattention). Odds ratios of 1.0 indicate the outcome is equally likely to occur given the condition. An odds ratio greater than 1.0 indicates the outcome is more likely to occur given the condition. Odds ratios of less than 1.0 indicate the outcome is less likely to occur (Pedhazur, 1997).

Some key distraction behaviors are shown in Table 4. It can be seen that text messaging on a cell phone had the highest risk for truck drivers with an odds ratio of 27.71, while other known secondary tasks (i.e., driver is seen performing a secondary task but unable to determine that specific task) had the highest risk for motorcoach drivers with an odds ratio of 6.97. These data also represent events where the driver of the instrumented vehicle was considered to be at fault for the conflict.

**Table 1**  
Trigger definitions.

Trigger Type	Description
Longitudinal Acceleration TTC	Deceleration greater than or equal to $ 0.20\text{ g} $ . Speed greater than or equal to 3.5 mph (1 mph for truck data). A forward TTC value of less than or equal to 2 s, coupled with a range of less than or equal to 250 ft, a target speed of greater than or equal to 5 mph, a yaw rate of less than or equal to $ 6^\circ/\text{s} $ , and an azimuth of less than or equal to $ 12^\circ $ .
Swerve Lane Deviation	Swerve value of greater than or equal to $2^\circ/\text{s}^2$ . Speed greater than or equal to 5 mph. A lateral acceleration value of greater than 0.2 g (either left or right) while traveling greater than 25 mph with a lane distance off center greater than 1.4 m.
Critical Incident Button	Activated by the driver pressing a button located by the driver's visor when an incident occurred that the driver deemed critical.

**Table 2**  
SCE definitions.

Trigger Type	Description
Crash	Any contact that the subject vehicle has with an object, either moving or fixed, at any speed. Also included are non-premeditated departures of the roadway where at least one tire leaves the paved or intended travel surface of the road.
Crash: Tire Strike	Tire strike only with little or no risk element (e.g., clipping a curb during a tight turn).
Near-Crash	Any circumstance that requires a rapid evasive maneuver by the subject vehicle or any other vehicle, pedestrian, cyclist, or animal to avoid a crash.
Crash-Relevant Conflict	Any circumstance that requires an evasive maneuver on the part of the subject vehicle or any other vehicle, pedestrian, cyclist, or animal that is less urgent than a rapid evasive maneuver (as defined above in near-crash), but greater in urgency than a normal maneuver to avoid a crash. A crash avoidance response can include braking, steering, accelerating, or any combination of control inputs.
Unintentional Lane Deviation	Any single vehicle situation where the subject vehicle unintentionally drifts or crosses over a lane line (e.g., into the shoulder or adjacent lane) where there is NOT a hazard present (i.e., guardrail, steep ditch, vehicle, etc.) or the hazard is never closer than one lane width to the subject. If the hazard is closer than one lane width away, the event should be classified as crash-relevant, near-crash, or crash, as appropriate.

**3.3. Does eyes off forward roadway affect driving performance?**

To answer the second research question, all SCEs and baseline epochs with valid eye-glance data were used where the driver of the instrumented vehicle was considered to be at fault. Glances were grouped by “forward roadway” and “not forward roadway”.

Total time 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 5 shows the results of these calculations. Drivers from the truck study were 1.3 times more likely to be involved in an SCE (compared to a baseline epoch) when eyes off forward roadway was less than or equal to 0.5 s, 1.2 times more likely when eyes off forward roadway was greater than or equal to 1.0 s and less than or equal to 1.5 s, 1.5 times more likely when eyes off forward roadway was greater than or equal to 1.5 s and less than or equal to 2.0 s, and 3.9 times more likely when eyes off forward roadway was greater than 2.0 s.

Drivers from the motorcoach study were 1.9 times more likely to be involved in an SCE (compared to a baseline epoch) when eyes off forward roadway was greater than or equal to 1.0 s and less than or equal to 1.5 s, 1.6 times more likely when eyes off forward roadway was greater than or equal to 1.5 s and less than or equal to 2.0 s, and 5.3 times more likely when eyes off forward roadway was greater than 2.0 s. Fig. 2 shows a plot of these calculations.

It can be seen that the data follow a mostly linear trend where longer eyes of forward roadway time lead to a higher odds ratio, or higher chance of being involved in a safety-critical event; this becomes more noticeable once the glance duration reaches two seconds. This is consistent with the National Highway Traffic Safety Administration (NHTSA) guidelines for distraction which suggest limiting a single glance to two seconds or less.

**3.4. Duration of eyes off forward roadway**

The data were then grouped by event type, and the mean duration of eyes off forward roadway was calculated for all events where the participant driver was considered to be at fault. The results of this can be seen in Fig. 3. A one-way analysis of variance (ANOVA) found a significant difference in the mean duration of eyes off forward roadway

**Table 3**  
Frequency of secondary tasks.

Event Type	Truck SCEs with Secondary Task	Truck Frequency and Percent of SCEs	Motorcoach SCEs with Secondary Task	Motorcoach Frequency and Percent of SCEs
Crash	40.0%	n = 10 (0.3%)	55.6%	n = 9 (2.1%)
Near-Crash	50.0%	n = 112 (3.1%)	43.3%	n = 157 (36.8%)
Crash-Relevant Conflict	57.4%	n = 2281 (63.0%)	42.2%	n = 185 (43.3%)
Unintentional Lane Deviation	77.5%	n = 1215 (33.6%)	79.5%	n = 39 (9.1%)
Baseline Epoch	56.5%	n = 19,888 (100%)	28.8%	n = 4600 (100%)

between the five event types ( $F(4, 8098) = 418.43, p < 0.0001$ ) for the truck data. As the ANOVA was significant, *post hoc* Tukey *t*-tests were conducted on all pair-wise combinations of event types to determine simple effects. Tukey *t*-tests indicated that the mean duration of eyes off forward roadway during unintentional lane deviations (3.1 s) was significantly longer than crash-relevant conflicts (2.4 s;  $t(8098) = 10.46, p < 0.0001$ ), and baseline epochs (1.2 s;  $t(8098) = 35.19, p < 0.0001$ ). Both near-crashes (2.6 s;  $t(8098) = 5.11, p < 0.0001$ ) and crash-relevant conflicts (2.4 s;  $t(8098) = 23.31, p < 0.0001$ ) had a significantly longer mean duration of eyes off forward roadway time than baseline epochs (1.2 s).

A one-way ANOVA also found a significant difference in the mean duration of eyes off forward roadway between the five event types for the motorcoach data ( $F(5, 1452) = 9.61, p < 0.0001$ ). Tukey *t*-tests indicated the mean duration of eyes off forward roadway during near-crashes (2.0 s;  $t(1452) = 4.853, p < 0.0001$ ) and unintentional lane deviations (1.8 s;  $t(1452) = 3.924, p = 0.0013$ ) was significantly longer than baseline epochs (1.2 s).

**3.5. Number of glances away from forward roadway**

Next, the data were grouped by event type, and the mean number of glances away from forward roadway was calculated. The results can be seen Fig. 4. A one-way ANOVA found a significant difference in the mean number of glances away from the forward roadway between the five event types ( $F(4, 8098) = 209.37, p < 0.0001$ ) for the truck data. Tukey *t*-tests indicated that the mean number of glances away from forward roadway during unintentional lane deviations (2.5) was significantly higher than crash-relevant conflicts (2.1;  $t(8098) = 6.94, p < 0.0001$ ) and baseline epochs (1.3;  $t(8098) = 24.71, p < 0.0001$ ). Crash-relevant conflicts (2.1;  $t(8098) = 16.92, p < 0.0001$ ) had a significantly higher mean number of glances away from forward roadway than baseline epochs (1.3).

A one-way ANOVA also found a significant difference in the mean number of glances away from forward roadway between the five event types for the motorcoach data ( $F(5, 1453) = 9.61, p < 0.0001$ ). Tukey *t*-tests indicated that the mean duration of eyes off forward roadway during near-crashes (2.0 s;  $t(1453) = 4.853, p < 0.0001$ ) and unintentional lane deviations (1.8 s;  $t(1453) = 3.924, p = 0.0013$ ) was significantly longer than baseline epochs (1.2 s).

**Table 4**  
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	27.71	11.52	66.61	Other known secondary task*	6.97	3.36	14.46
Interact with/look at dispatching device	11.90	8.97	15.80	Other personal hygiene (scratching nose)	5.96	3.09	11.51
Write on pad, notebook, etc.	11.07	5.82	21.05	Reaching for object	2.88	1.42	5.82
Use calculator	10.11	3.73	27.34	External distraction (look out window)	2.28	1.65	3.16
Look at map	8.67	5.70	13.20	Object in vehicle, other**	2.06	1.04	4.07
Use/reach for other device	7.58	3.05	18.85	Cell phone, holding	–	–	–
Dial cell phone	7.06	5.42	9.18	Cell phone, talking/listening hand-held	–	–	–
Personal grooming (brush hair)	5.05	2.23	11.46	Cell phone, texting	–	–	–
Read book, newspaper, paperwork	4.76	3.61	6.27	Cell phone, browsing	–	–	–
Put on/remove/adjust glasses or sunglasses	4.00	2.57	6.24	Cell phone, dialing hand-held	–	–	–
Reach for object in vehicle	3.65	3.24	4.12	Cell phone, locating/reaching/answering	–	–	–
Look back in sleeper berth	2.52	1.39	4.56	Cell phone, other	–	–	–

\* Unable to determine what type of secondary task.

\*\* Unable to determine what the object was.

**Table 5**  
Odds ratios and 95% confidence intervals to assess likelihood of SCE while eyes off forward roadway.

Secondary Task in Truck Data	Truck Data			Motorcoach Data		
	Odds Ratio	LCL	UCL	Odds Ratio	LCL	UCL
≤ 0.5 s	<b>1.28</b>	1.06	1.53	1.23	0.74	2.03
> 0.5 s but ≤ 1.0 s	0.94	0.81	1.09	1.38	0.98	1.94
> 1.0 s but ≤ 1.5 s	<b>1.18</b>	1.01	1.38	<b>1.87</b>	1.32	2.66
> 1.5 s but ≤ 2.0 s	<b>1.52</b>	1.3	1.79	<b>1.64</b>	1.04	2.59
≥ 2.0 s	<b>3.85</b>	3.44	4.3	<b>5.25</b>	4.01	6.88

\* Asterisk indicates a significant OR. These ratios are also shown in bold.

3.6. Length of longest glance away from forward roadway

Finally, the data were grouped by event type and the mean length of the longest glance away from forward roadway was calculated. The results can be seen in Fig. 5. A one-way ANOVA found a significant difference in the mean length of longest glance away from the forward roadway between the five event types ( $F(4, 8098) = 264.63, p < 0.0001$ ) for the truck data. Tukey  $t$ -tests indicated that the mean length of longest glance away from forward roadway during unintentional lane deviations (1.6 s) was significantly longer than crash-relevant conflicts (1.3 s;  $t(8098) = 8.19, p < 0.0001$ ), and baselines

(0.8 s;  $t(8098) = 27.76, p < 0.0001$ ). Crashes (2.6 s;  $t(8098) = 3.50, p = 0.004$ ), near-crashes (1.5 s;  $t(8098) = 4.87, p < 0.0001$ ), and crash-relevant conflicts (1.3 s;  $t(8098) = 18.48, p < 0.0001$ ) had a significantly longer mean length of longest glance away from forward roadway than baselines (0.8 s).

A one-way ANOVA also found a significant difference in the mean length of longest glance away from forward roadway between the five event types for the motorcoach data ( $F(5, 1453) = 11.16, p < 0.0001$ ). Tukey  $t$ -tests indicated the mean length of longest glance away from forward roadway during near-crashes (1.3 s) was significantly longer than during baselines (0.8 s;  $t(1453) = 2.918, p = 0.0416$ ).

4. Discussion

The purpose of this paper was to compare distraction observed in naturalistic truck data to distraction observed in naturalistic motorcoach data. One key difference is that the overall number of distractions observed in the motorcoach data was less than that observed in the truck data. More specifically, little to no cell phone use was observed in the motorcoach data set (see Table 4). 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 (FMCSA) issued a federal ban for all commercial motor vehicle (CMV) drivers prohibiting texting while

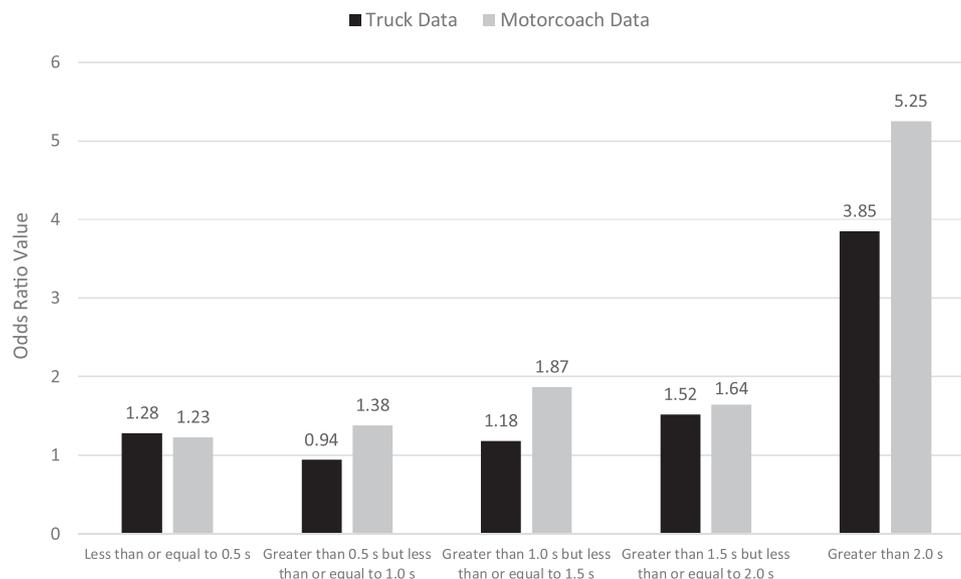


Fig. 2. Odds ratio values for eyes off forward roadway time.

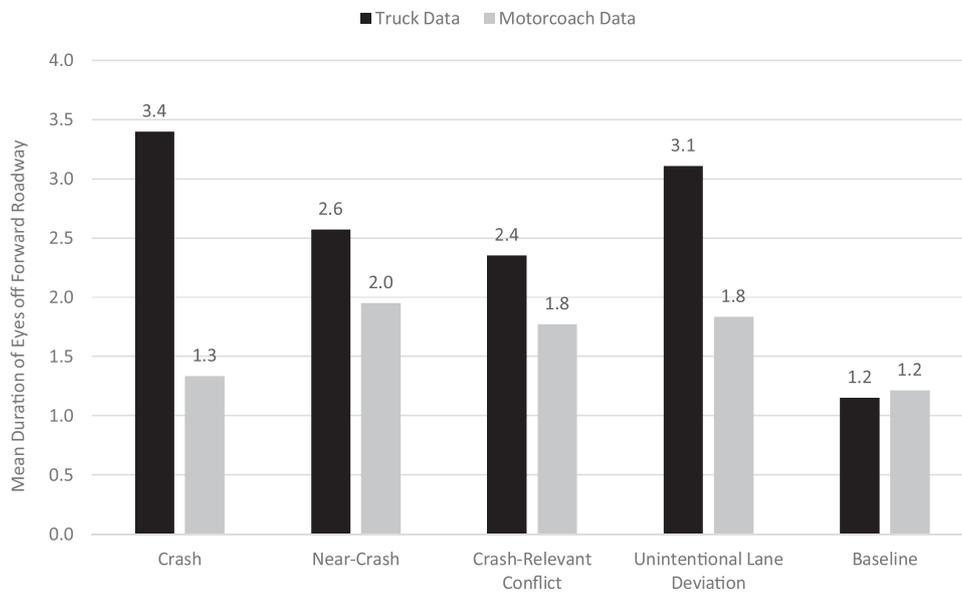


Fig. 3. Mean duration of eyes off forward roadway by event type for secondary tasks where the participant driver was at fault.

driving and the use of handheld mobile phones. The motorcoach data were collected between May 2013 and July 2014; hence that study took place after the ban on texting and handheld cell phone use was in place. This time frame likely contributed to the decrease in cell phone use in the motorcoach data.

Another interesting finding was the observance of electronic secondary tasks. In the truck data, several electronic tasks were observed that resulted in a significant odds ratio, such as the use of a dispatching device, calculators, and cell phones. 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 look in their rearview mirror to see their passengers while talking, which takes their eyes off the forward roadway.

The results of the eye-glance analyses were similar between the truck data and motorcoach data. When odds ratios were calculated, glances longer than 1 s in duration were significant for both data sets and the odds ratio value generally increased as glance duration away from the forward roadway increased. This reinforces the conclusion that the longer a driver’s eyes are off the forward roadway, the greater

the risk of being involved in an SCE. When comparing the three different glance analyses, results show that unintentional lane deviations were significant for all three glance groupings: duration of eyes off forward roadway, number of glances away from forward roadway, and length of longest glance away from forward roadway. This is not surprising as unintentional lane deviations most often occurred on long stretches of highway where drivers were more likely to engage in secondary tasks. This frequent secondary task engagement may be from boredom, or perhaps the perception of less surrounding traffic while driving in rural areas.

While the data from these two studies provide a valuable look into the secondary tasks that drivers engage in while driving, one key secondary task is missing, the use of hands-free cell phones. Hands-free cell phone use was not examined in the motorcoach data during the previous study, but is currently being examined in an ongoing study. The results from that study will provide a better picture of handheld versus hands-free cell phone use and the impact of the 2010 ban on handheld cell phones.

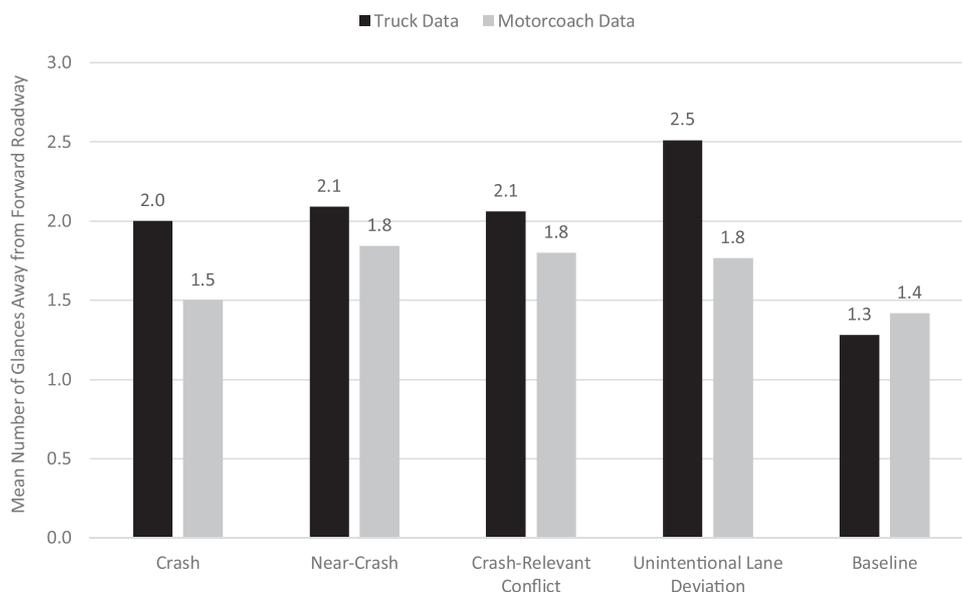


Fig. 4. Mean number of glances away from forward roadway by event type for secondary tasks where the participant driver was at fault.

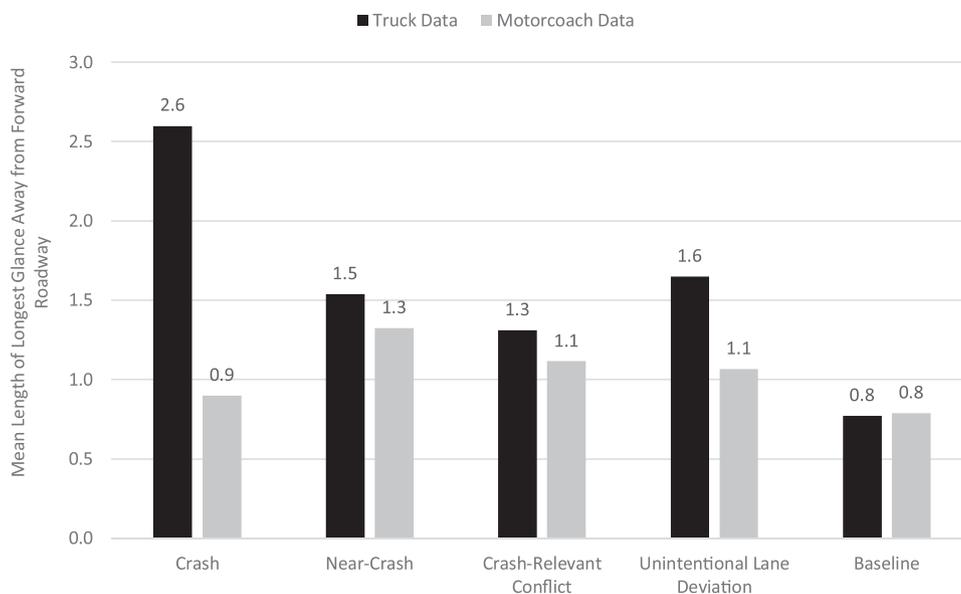


Fig. 5. Mean length of longest glance away from forward roadway by event type for secondary tasks where the participant driver was at fault.

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