



RoadSafetyBC

Literature Review on Car-Truck Crash Causation

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Literature Review on Causes and Responsibility in Car-Truck Crashes

Introduction

This literature review addresses research on crash causes and responsibility in collisions involving passenger vehicles and large trucks. Its purpose is to answer the following questions:

- What are the most common driver behaviours and actions that result car-truck crashes?
- How likely are passenger vehicle drivers and large truck drivers to display these behaviours and actions relative to one another?

The sources for this literature review consist mainly of reports and data documents produced by transportation and road safety bodies. Only one academic peer-reviewed study was found on the subject of the relative contribution of passenger vehicle and truck drivers to car-truck crashes and incidents (i.e., Hanowski et al.). Only one study was found that contained data for British Columbia and Canada (i.e., Jonas et al. 2009).

Overview: Common Approaches to Studying Crash Causes and Responsibility

Most of the studies on car-truck crashes in the United States (US) have taken two general approaches to examining the relative contributions of passenger vehicle and truck drivers to car-truck crashes. The first approach has been to measure the frequency with which either the passenger vehicle or truck drivers were reported to have driver factors (e.g., impairment, distraction, unsafe driving acts, etc.) that led to the crash. This is usually achieved by examining information from existing crash databases, with other less common methods being naturalistic studies involving the direct observation of driving incidents.

The second approach has been to assume that for certain types of crashes, and notwithstanding a small number of exceptions, the location of the collision and the relative position of the vehicles strongly suggests that one driver contributed more heavily than the other (e.g., in a head-on collision, it is highly likely that the driver that moved into the oncoming lane was primarily responsible for the crash) (Blower; Moonesinghe et al.).¹ However, in the absence of more fine-grained data, this second approach to determining crash causes and responsibility may have greater limitations than the literature acknowledges. For example, none of the reports that took this approach considered whether the striking vehicle in rear-end collisions was cut off by the lead vehicle or whether the collision resulted from a dangerous merging manoeuvre by the lead vehicle. With regards to same-direction sideswipes, it generally goes unasked whether one vehicle was travelling in another vehicle's blindspot or whether there were other contributing factors such as speeding. For crashes where one vehicle turns across the path of another, the reports do not include right-of-way considerations. Due to this critical limitation, this literature review does not cover research findings relying on this approach.

Readers should also note much of the research cited in this literature review dates from as early as the late 1990s and early 2000s, thus introducing the question of whether the same patterns and trends

¹ These crashes are generally considered to be: head-on, rear-end, opposite and same-direction sideswipes, and turning across the path of an oncoming vehicle (Blower; Moonesinghe et al.).

pertaining to car-truck crashes exists today. Only one example of a more recent report could be found (see USDOT), and the data do not contain much specific detail on specific driver actions committed. For this reason, it was decided that the older studies should be included in this document.

Most of the reports cited in this document rely on data from the Fatality Analysis Reporting System (FARS), which is a nationwide census of fatal crashes in the US. The definition of a large truck in the FARS is a vehicle weighing 10,000 lbs or more. Unless otherwise noted, the studies in this literature review use this definition.

The remainder of this literature review is divided in two sections:

- Section 1: Driver Factors Contributing to Car-Truck Crashes
- Section 2: Summary and Conclusion

Section 1: Driver Factors Contributing to Car-Truck Crashes

A study by the University of Michigan Transportation Research Institute (Blower) looked at fatal crashes involving one large truck and one passenger vehicle in the United States from 1994-1995. The study looked at driver factors assigned to passenger vehicles and truck drivers generally, without breaking the data down into specific factors. In fatal car-truck crashes, passenger vehicle drivers were reported to have contributing factors far more often than truck drivers. The following table summarizes the relevant data from this study:

Table 1. Driver Factors Recorded for Passenger Vehicle and Truck Drivers in Fatal Car-Truck Crashes, United States, 1994-1995

Type of Driver	All Recorded Crashes Involving Driver Factors	Crashes where Driver Factors were Recorded for One Driver Only
Passenger vehicle driver	80%	70%
Large truck driver	27%	16%

Source: Blower (1998), data drawn from page 3

Another study by the National Center for Statistics and Analysis (Moonesinghe et al.) examined fatal car-truck crashes in the US from 1996-2000. The study distinguished between crashes where the truck was a large combination truck (i.e., trucks that tow another vehicle such as tractor trailers) versus a single-unit truck (defined as trucks without a trailer). The study found that the critical driver factors that caused the crash were more likely to be recorded for passenger vehicle drivers than truck drivers (76% of the time for passenger vehicle drivers versus 24% of the time for truck drivers). The study also provided a limited breakdown of the types of factors involved. The table below summarizes this information:

Table 2. Driver-Related Factors in Fatal Car-Truck Crashes by Vehicle Type, United States, 1996-2000²

Type of Driver Factor	Truck Type	Factor Reported for Driver of:	
		Truck	Passenger Vehicle
Any driver-related factor	Combination Truck	25%	75%
	Single-Unit Truck	28%	72%
	Total	26%	74%
Failure to yield	Combination Truck	23%	77%
	Single-Unit Truck	25%	75%
	Total	24%	76%
Speeding	Combination Truck	22%	78%
	Single-Unit Truck	20%	80%
	Total	22%	78%
Drowsy/asleep/inattentive	Combination Truck	19%	81%
	Single-Unit Truck	22%	78%
	Total	20%	80%

Source: Moonesinghe et al. (2003), data drawn from Table 14, page 24

² Note: The report did not explain why the three specific driver factors (failure to yield, speeding, drowsy) were singled out in the report, as opposed to other possible driver factors.

A further study by the American Automobile Association (AAA) (Kostyniuk et al.) provides greater insight into specific driver factors that lead to fatal car-truck crashes. This study examined both car-car and car-truck crashes from 1995-1998 in the US in order to identify specific driver-related factors that were more likely to occur in fatal car-truck crashes relative to fatal car-car crashes.

Most of the driving manoeuvres examined were equally likely to be present in car-car crashes and car-truck crashes. However, four driver-related factors were found to have at least a 50% greater chance of occurring in car-truck crashes. Two of these pertained to driver actions, one pertained to driver condition, and one pertained to environmental condition. The report found that all four of the factors were more likely to be recorded for the passenger vehicle driver than for the truck driver. The table below summarizes these findings:

Table 3. Factors Present in Fatal Car-Truck Crashes with a Likelihood Ratio of 1.5 or Greater when Compared to Fatal Car-Car Crashes, United States, 1995-1998

Type of Driver Factor	Number of Crashes	Factor Reported for Driver(s) of:		
		Passenger Vehicle Only	Truck Only	Both Passenger Vehicle and Truck
Following improperly (<i>driver action</i>)	373	272 (73%)	98 (26%)	N/A
Improper or erratic lane change (<i>driver action</i>)	243	183 (75%)	58 (24%)	2 (1%)
Drowsy, sleepy, or fatigued (<i>driver condition</i>)	344	300 (87%)	44 (13%)	0 (0%)
Vision obscured by rain, snow, fog, smoke, sand, or dust (<i>environment condition</i>)	165	79 (48%)	20 (12%)	66 (40%)
Total	1,125	834 (100%)	220 (100%)	68 (100%)

Source: Kostyniuk et al. (1999), data drawn from Table 1.5, page 18

The AAA report also examined a sample of crash reports in more detail in order to assess the relationship between driver factors and different crash configurations. The following table summarizes this information:

Table 4. Associations between Driver-Related Factors and Crash Configurations, United States, 1995-1998

Type of Driver Factor	Number of Crashes in Sample	Most Frequent Crash Configuration Associated with the Driver Factor	Factor Reported for Driver(s) of:		
			Passenger Vehicle Only	Truck Only	Both Passenger Vehicle and Truck
Following improperly	172	Rear-end 157 (91%)	124 (74%)	37 (22%)	N/A
Improper or erratic lane change	113	Rear-end 36 (32%) Sideswipe 31 (27 %)	83 (75%)	24 (21%)	6 (5%)
Drowsy, sleepy, asleep, or fatigued	158	Head-on 85 (54%)	137 (87%)	20 (13%)	1 (<1%)
Vision obstructed by rain, snow, fog, smoke, sand, or dust	86	Angle 38 (44%)	52 (61%)	13 (15%)	21 (24%)

Source: Kostyniuk et al. (1999), data drawn from Table 2.1, page 17

The AAA report also provides information on additional driver factors or actions that were associated with each of the primary factors identified. Of the 124 cases of passenger vehicle drivers that were following improperly, 21% also involved driver inattention with no attempt to slow down or stop, 17% involved speeding, and 16% involved alcohol. Of the 37 cases in which truck drivers followed improperly, 38% also involved inattention with no attempt to slow down.

In the 83 cases where an improper lane change was reported for the passenger vehicle driver alone, 18% involved the driver moving laterally into a truck in the next lane, 11% involved the driver cutting off the truck, 11% involved the driver losing control during a lane change, and 8% involved the driver making an unsafe turn. In the 24 crashes where improper lane change was reported for the truck driver alone, 79% involved the driver moving laterally into a passenger vehicle in the next lane, 12% involved losing control during a lane change, and 8% involved cutting off the passenger vehicle.

Of the 52 cases where obstructed vision was reported for the passenger vehicle driver alone, 21% also involved failing to yield the right of way, 19% involved losing control, 17% were speeding-related, 6% involved fatigue, and 6% involved inattention.

Another study conducted for the US Department of Transportation (Stuster) captured somewhat more detailed information about the types of driver factors involved in fatal car-truck crashes. Driver factors were recorded for the passenger vehicle driver in 67% of fatal car-truck crashes versus 29% of the time for drivers of large trucks. The most common factors recorded for the passenger vehicle drivers were “ran off road/lane”, “failure to yield right of way”, and “unsafe speed.” The table below summarizes the report’s data on driver factors for passenger vehicle and truck drivers:

Table 5. Driver-Related Factors Involved in Fatal Car-Truck Crashes, United States, 1995

Driver-Related Factors	Factor Reported for Driver of:	
	Passenger Vehicle	Large Truck
Ran off road/lane	20%	5%
Failure to yield right of way	14%	5%
Unsafe speed	14%	6%
Driving inattentively	9%	3%
Failure to obey traffic devices	8%	3%
Erratic/reckless driving	4%	2%
Driving into opposing traffic	4%	1%
Ice, water, snow on road	3%	1%
Following too closely	3%	2%
Vision obscured by weather	2%	2%

Source: Stuster (1999), data drawn from Table 12, page 17

The same study also gathered more detailed information on specific dangerous passenger vehicle driver behaviours by interviewing subject matter experts including truck drivers, collision investigators, police, and government employees from the Office of Motor Carriers, and by reviewing a sample of collision reports from seven states. The researcher produced a list of unsafe passenger vehicle driver actions, which interviewees were later asked to score based on how dangerous they were perceived to be, and how often they were perceived to occur. It is important to note that the researcher's approach relied solely on the subjective opinions and recollections of interviewees, and was not directly supported by data. However, these qualitative findings – which are based on subject matter experts' and truck drivers' experience – may still be useful in light of the fact that the quantitative data-driven research on driver behaviours typically does not provide a great amount of detail about driver actions in car-truck crashes. The following table presents the study's ranked list of dangerous passenger vehicle driver behaviours in descending order of their combined score for severity and frequency:

Table 6. Unsafe Driving Acts: Experts' Rating of Criticality (Danger + Frequency)

Rank	Unsafe Driver Action
1	Driving inattentively (e.g., reading, talking on phone, fatigue-induced inattention)
2	Merging improperly into traffic, causing a truck to maneuver or brake quickly
3	Failure to stop for a stop sign or light (also, early or late through a signal)
4	Failure to slow down in a construction zone
5	Unsafe speed (e.g., approaching too fast from the rear/misjudging truck's speed)
6	Following too closely
7	Failure to slow down in response to environmental conditions (e.g., fog, smoke, rain, bright sun)
8	Changing lanes abruptly in front of a truck
9	Driving in the "no zones" (left rear quarter, right front quarter, and directly behind)
10	Unsafe passing, primarily passing with insufficient headway
11	Unsafe turning, primarily turning with insufficient headway
12	Pulling into traffic from roadside in front of a truck without accelerating sufficiently
13	Driving while impaired by alcohol or other drug
14	Changing lanes in front of a truck, then braking (for traffic, obstacle, toll gate, etc.)
15	Unsafe crossing, primarily crossing traffic with insufficient headway
16	Driving left of center or into opposing traffic
17	Failure to permit a truck to merge
18	Failure to discern that the trailer of a maneuvering truck is blocking the roadway
19	Nearly striking the front or rear of a truck or trailer while changing lanes
20	Maneuvering to the right of a truck that is making a right turn (the "right turn squeeze")
21	Operating at dawn or dusk without headlights
22	Crossing a lane line near the side of a truck or trailer while passing
23	Driving between large trucks
24	Nearly striking the rear of a truck or trailer that is stopped or moving slowly in traffic
25	Nearly striking an unattended or parked truck at roadside
26	Abandoning vehicle in travel lane or impeding traffic

Source: Stuster (1999), data drawn from Table 12, page 17

The most recent data located for this literature review confirms the pattern whereby passenger vehicle drivers more often have driver-related factors in fatal car-truck crashes. According to a US Department of Transportation report containing data for 2015, driver-related factors were recorded for the passenger vehicle driver in 87% of fatal car-truck crashes, versus 34% of the time for truck drivers (USDOT). The following table includes more specific information about driver factors involved in different types of crashes:

Table 7. Large Trucks in Fatal Crashes with Passenger Vehicles by Crash Type and Driver-Related Factors Recorded, United States, 2015

Crash Type	Fatal Crashes	Driver-Related Factors Recorded:	
		For Truck Driver	For Passenger Vehicle Driver
Large truck rear-ending passenger vehicle	86	54 (63%)	54 (63%)
Passenger vehicle rear-ending large truck	335	95 (28%)	303 (90%)
Large truck crossing center median (head-on)	34	31 (91%)	17 (50%)
Passenger vehicle crossing center median (head-on)	343	74 (22%)	337 (98%)
Large truck striking passenger vehicle (other)	717	209 (29%)	630 (88%)
Passenger vehicle striking large truck (other)	344	167 (49%)	276 (80%)
Other collisions	134	52 (39%)	112 (84%)
Total	1,993	682 (34%)	1,729 (87%)

Source: USDOT (2017), data drawn from Vehicles Table 20, page 77

A study by Hanowski et al. (2007) analyzed incidents involving trucks and light vehicles, including both crashes and near misses. This study collected data from a sample of short-haul and long-haul trucks equipped with various recording instruments, including video cameras, which allows for greater insight into *how* car-truck incidents occur. This approach complements the other reports cited in this literature review by incorporating richer qualitative data generated from a detailed analysis of each driver's actions in a crash or near miss.

Among the study's key findings was that only 22% of car-truck incidents were caused primarily by the truck driver, versus 78% that were caused primarily by the passenger vehicle driver. The table below provides a more detailed summary of the information, broken down by incidents involving short-haul and long-haul trucks:

Table 8. Light and Heavy Vehicle Dangerous Interactions (Crashes and Near Misses) by Type of Truck, United States, Unknown Year

Type of Driver	Incidents Involving Short-Haul Trucks	Incidents Involving Long-Haul Trucks	All Incidents Involving Trucks
Passenger vehicle driver initiated	117 (82%)	47 (69%)	142 (78%)
Truck driver initiated	25 (18%)	21 (31%)	46 (22%)
Total	142 (100%)	68 (100%)	210 (100%)

Source: Hanowski et al. (2007), data drawn from pages 171 and 175-176

In order to identify the most common dangerous behaviours involved in car-truck crashes, the study examined the incidents that were initiated by the light vehicle driver in order to identify the nature of the light vehicle driver's dangerous action. The following table summarizes the findings, and highlights the top three most frequent light vehicle driver actions in each type of incident in red:

Table 9. Light Vehicle Driver Critical Action in Dangerous Interactions with Heavy Vehicles (Crashes and Near Misses), United States, Unknown Year

Light Vehicle Driver Manoeuvre	Incidents Involving Short-Haul trucks	Incidents Involving Long-Haul Trucks
Lane change without sufficient gap	25%	32%
Roadway entrance without clearance	18%	9%
Left-turn without clearance	18%	0%
Wide turn into adjacent Lane	4%	0%
Improper passing	5%	4%
Backing in roadway	3%	0%
Low speed	3%	17%
Merge out of turn	3%	0%
Through traffic does not allow merge	4%	0%
Obstruction in roadway	3%	9%
Exit then re-entrance onto roadway	3%	0%
Turn/exit from incorrect lane	3%	0%
Late braking for stopped/stopping traffic	0%	0%
Slow upon passing	3%	4%
Turn without sufficient warning	2%	19%
Lateral deviation of through vehicle	1%	6%
Conflict between merging and exiting traffic	2%	0%
Following too closely	0%	0%
Obscene gesture (to other driver)	0%	0%
Proceeding through red traffic signal	0%	0%

Source: Hanowski et al. (2007), data drawn from Table 2, page 172

A North Carolina study examining car-truck crashes from 1994-1997 challenges the results of the previous research in suggesting that, when looking at car-truck crashes of all severities rather than just fatal ones, truck drivers have a slightly larger share of the fault. According to this study, truck drivers are solely at fault in 48% of crashes, as compared to passenger vehicle drivers who are solely at fault in 40% of crashes. This literature review was unable to determine why results from the North Carolina study differed from the study by Hanowski et al., which also did not look only at fatal crashes. However, passenger vehicle drivers were still more often at fault in crashes involving left-turns across oncoming traffic, right-turn crashes involving crossing traffic, head-on crashes, and angle crashes. The following table summarizes data from the Federal Highway Administration's North Carolina Study:

Table 10. Fault for Truck and Passenger Vehicle Drivers by Crash Type (Crashes of All Severities), North Carolina, 1994-1997

Type of Crash	Driver Fault Identified for:			
	Truck Driver Only	Passenger Vehicle Driver Only	Both Truck and Passenger Vehicle Drivers	Neither Driver
Rear-end slow	2,127 (51%)	1,722 (41%)	258 (6%)	92 (2%)
Rear-end turn	203 (52%)	142 (36%)	42 (11%)	7 (2)
Left turn-both same roadway	646 (45%)	549 (39%)	200 (14%)	28 (2%)
Left turn-crossing traffic	413 (43%)	466 (48%)	67 (7%)	16 (2%)
Right turn-both same roadway	330 (43%)	272 (36%)	142 (19%)	22 (3%)
Right turn-crossing traffic	135 (36%)	203 (54%)	27 (7%)	8 (2%)
Head-on	50 (23%)	158 (71%)	9 (4%)	5 (2%)
Sideswipe	1,813 (51%)	1,246 (35%)	380 (11%)	109 (3%)
Angle	1,371 (40%)	1,690 (49%)	276 (8%)	150 (4%)
Backing	725 (82%)	86 (10%)	52 (6%)	27 (3%)
Total	7,813 (48%)	6,534 (40%)	1,453 (9%)	464 (3%)

Source: Council et al. (2003), data drawn from Table 2, page 4. Note: numbers are rounded and may not add up to 100%.

Finally, one study by Jonas et al. (2009) examined data from Canada for the years 2000-2006, including at regional levels and in British Columbia specifically. For the most part, the results of this study mirror the general results that have been identified so far in the car-truck literature. Specifically, drivers of non-truck vehicles were found to contribute to fatal crashes more often than truck drivers (57% of fatal crashes for non-truck drivers versus 19% for truck drivers).³ However, when looking at less severe

³ Readers should take note of a key limitation of this study: responsibility for the crash was determined by examining whether police recorded a human condition (e.g., impairment) or a human action (e.g., speeding) for either the truck driver or the driver of the other vehicle. If a factor was noted for one of the driver, that driver was deemed to have caused the crash. If a factor was coded for multiple drivers, that crash was excluded from the data since it was not possible to distinguish truck driver fault from the fault of the other driver. This approach does not take into account important considerations for determining fault more precisely, such as specific driver actions or right-of-way.

crashes that only resulted in an injury, passenger vehicle drivers and truck drivers were about as equally likely to be the primary contributor to the crash. The two tables below summarize the data for fatal and injury- only crashes in British Columbia, along with data for different Canadian regions and Canada as a whole:

Table 11. Primary Contribution to Car-Truck Fatal Crashes in B.C., Canadian Regions, and Whole-of-Canada, 2000-2006

Region	Truck Driver Primary Contributor (%)	Other Driver Primary Contributor (%)
British Columbia	19%	57%
Western Canada	15%	57%
Central Canada	10%	27%
Atlantic Canada	12%	59%
Whole-of-Canada	13%	39%

Source: Jonas et al. (2009), data drawn from Table 2.6, page 22.

Table 12. Primary Contribution to Car-Truck Injury Crashes in B.C., Canadian Regions, and Whole-of-Canada, 2000-2006

Region	Truck Driver Primary Contributor (%)	Other Driver Primary Contributor (%)
British Columbia	37%	40%
Western Canada	29%	27%
Central Canada	24%	22%
Atlantic Canada	38%	37%
Whole-of-Canada	27%	26%

Source: Jonas et al. (2009), data drawn from Table 2.7, page 22.

Summary and Conclusion

The research on car-truck crash causes and responsibility for passenger vehicle and truck drivers has consistently found that passenger vehicle drivers are more often the primary contributors to the crash. In car-truck crashes, driver-related factors (for example speeding or unsafe manoeuvres) are reported for passenger vehicle drivers about 65% to 85% of the time according to the various studies, and are reported for trucks in only about 20% to 25% of car-truck crashes.

Most of the reports comprising the car-truck crash literature rely on databases (typically the FARS) which do not contain rich information about the crash circumstances or the exact nature of each driver's actions. This shortcoming is alleviated somewhat by the academic research study conducted by Hanowski et al., which supported the general notion that passenger vehicle drivers are more often responsible for dangerous car-truck incidents, while providing more nuanced qualitative information about the exact nature of car-truck incidents.

Nonetheless, given the small amount of information about specific driver actions involved in car-truck crashes, it is difficult to make conclusive statements about which actions occur most often. The following table summarizes and compares each study's findings on the most common passenger vehicle driver behaviours involved in car-truck crashes:

Table 13. Summary of Study Findings on Most Common Passenger Vehicle Driver Factors/Actions by Study

Study	Most Frequent Critical Driver Factors/Actions Identified:
Stuster, Daniel (1999)	• Ran off road/lane • Failure to yield right of way • Unsafe speed • Driving inattentively • Failure to obey traffic devices
Kostyniuk et al. (2002)	• Following improperly • Improper or erratic lane change • Drowsy, sleepy, or fatigued
Council et al. (2003)	• Left-turns across oncoming traffic • Right-turn crashes involving crossing traffic • Head-on crashes • Angle crashes
Moonesinghe et al. (2003)	• Failure to yield • Speeding • Drowsy/asleep/inattentive
Hanowski et al. (2007)	• Lane change without sufficient gap • Roadway entrance without clearance • Left-turn without clearance • Low Speed • Turn without sufficient warning

References:

- Blower, Daniel F. (1998) "The Relative Contribution of Truck Drivers and Passenger Vehicle Drivers to Truck-Passenger Vehicle Traffic Crashes." The University of Michigan Transport Research Institute.
- Council, F.M., D.L. Harkey, D.T. Nabors, A.J. Khattak, & Y.M. Mohamedshah (2003). "An Examination of Fault, Unsafe Driving Acts, and Total Harm in Car-Truck Collisions." Federal Highway Administration. Retrieved from: <https://www.hsisinfo.org/pdf/04-085.pdf>
- Hanowski, Richard J., Jeffery S. Hickman, Walter W. Wierwille, and Aysha Keisler (2007) "A Descriptive Analysis of Light Vehicle-Heavy Vehicle Interactions Using In Situ Driving Data." Accident Analysis & Prevention 39.1: 169-179.
- Jonas, Brian, Dan Mayhew, Steve Brown, Ward Vanlaar, and Kyla Marcoux (2009). "Best Practices for Truck Safety: Final Report." Traffic Injury Research Foundation, British Columbia Trucking Safety Council.
- Kostyniuk, L., F. Streff, and J. Zakrajsek (2002). "Identifying Unsafe Driver Actions that Lead to Fatal Car-Truck Crashes." Vol. 9. No. 10. American Automobile Foundation for Traffic Safety. Retrieved from: <https://www.aaafoundation.org/sites/default/files/CarTruck.pdf>
- Moonesinghe, R., Longthorne, A., Shankar, U., Singh, S., Subramanian, R., & Tessmer, J. (2003) "Analysis of Fatal Large Truck Crashes." NHTSA National Center for Statistics & Analysis, DOT HS 809 569, March. Retrieved from: <https://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiogI0dvqzVAhVWHGMKHf4AATMQFggoMAA&url=https%3A%2F%2Fcrashstats.nhtsa.dot.gov%2FApi%2FPublic%2FPublication%2F809569&usg=AFQjCNGcj2wLEWBr0pxTsng-HZCk3qyng>
- Stuster, Daniel (1999). "The Unsafe Driving Acts of Motorists in the Vicinity of Large Trucks." Report Conducted for the United States Department of Transportation. Retrieved from: <http://www.dotsafety.net/pdffpubs/udarepo.pdf>
- United States Department of Transportation (USDOT) (2017). "Large Truck and Bus Crash Facts 2015." Federal Motor Carrier Safety Administration Analysis Division. Retrieved from: <https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/safety/data-and-statistics/Large-Truck-and-Bus-Crash-Facts-2015.pdf>