



Relative Contribution/Fault in Car-Truck Crashes

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This paper addresses the question of relative fault in crashes involving large trucks and light passenger vehicles, including cars, vans, SUVs, and pickup trucks. The principal policy reason for evaluating fault and the nature of errors that increase crash risk is to design and implement cost-effective truck safety programs that yield the greatest safety benefits.

For this paper, large trucks include both single-unit and articulated trucks with gross vehicle weight ratings (GVWRs) of greater than 10,000 pounds; 80-90% of their crashes involve trucks with GVWRs of greater than 26,000 pounds. For simplicity, the words “car” and “truck” are used in this report to refer to light passenger vehicles and to large trucks, respectively.

The past decades have seen major declines in the crash rates of both trucks and cars. Between 1975 and 2009, the large truck fatal crash rate per vehicle mile traveled (VMT) has fallen 77%, while that for cars has fallen 64% (FMCSA, 2011). Trucks have lower rates of involvement in police-report crashes and in crashes causing injuries than do cars. In 2009, the overall police-reported crash involvement rate for large trucks was 33% of that for cars (102 vs. 310 per 100 Million VMT), while their injury rate was just 19% of the car rate (18.5 vs. 97.8 per 100 MVMT). One safety

advantage trucks have over cars is the fact that a larger percentage of their mileage is on Interstates and other divided highways with relatively low crash risks.

Truck crashes are more likely to result in fatalities than those involving only cars. In 2009, 1.0% of truck crashes resulted in a fatality, versus 0.5% for car crashes. Thus, even though the overall truck crash rate is much lower than that for cars, their fatal crash rate is slightly higher. The 2009 large truck fatal crash rate was 1.04 per 100 MVMT, while that for cars was 1.02 per MVMT. The majority of fatalities and injuries from truck crashes occur to persons outside the truck. Of the 3,380 fatalities in 2009 occurring in crashes involving large trucks, 76% were occupants of another vehicle, 9% were pedestrians or bicyclists, and 15% were large truck occupants. Both the severity of truck crashes and the preponderance of their injuries to non-truck occupants reflect basic physics (i.e., the relative size differences between the vehicles involved).

This paper summarizes findings on the causes of truck crashes, with emphasis on relative fault in car-truck crashes. In the context of prevention, it's critical to understand relative fault since cars are involved in the large majority of truck crashes.

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Basic Concepts of Crash Causation

At any given time on the highway, many different factors interact to affect risk, and many different types of failures can result in a crash. Crash risk factors and causes are classified as human (i.e., driver), vehicle, or environmental (i.e., roadway and weather). Very few crashes have just a single cause, but in almost all crashes there is a primary, proximal error or other failure. In about 9 out of 10 crashes, the primary failure is a driver error. Some crash causation studies have used the term *Critical Reason* (CR) for these primary triggers of crashes. The CR is typically assigned to just one vehicle, even though other vehicles and their drivers may have contributed to the crash scenario. The lay term “fault” glosses over the complexities of crash scenarios, but it captures the single most important causal element. Thus, “fault” is used here to refer to the vehicle assigned the CR in crash investigations. Less in-depth investigations, such as those normally conducted by police, do not assign CRs, but they do cite driver, vehicle, or other factors contributing to the crash. Such driver and vehicle factors may be used as CR surrogates in interpreting crash datasets.

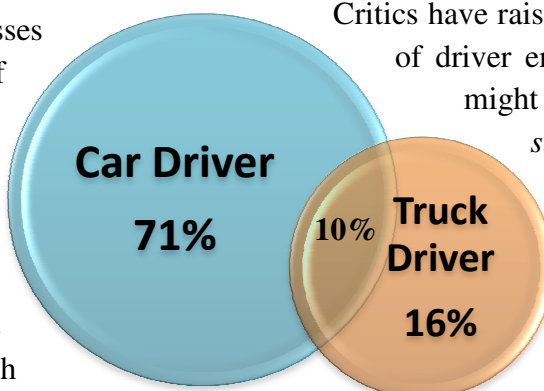


Figure 1 - 8,309 fatal large truck-passenger vehicle crashes

Research Institute (UMTRI; Blower, 1998, 1999). Results were summarized in a 1999 Federal Highway Administration analysis brief. UMTRI examined the records of 8,309 fatal car-truck crashes in UMTRI's Trucks in Fatal Accidents (TIFA) database for the years 1994-96. These records did not identify crash CRs but they did assign driver factors such as “too fast for conditions,” “improper following,” and “failure to keep in lane.” Figure 1 is a Venn diagram showing UMTRI's principal results. Car drivers were assigned driver factors in 81% of the fatal crashes, while 26% had factors for truck drivers. In 10% of the crashes, *both* drivers were assigned factors.

Critics have raised the concern that attribution of driver error in fatal car-truck crashes might reflect the story of who *survived* the crash (overwhelmingly the truck driver), not the true events of the crash. The theory of these critics contends that one driver survives to tell police his or her side of the story, while the other driver does not. UMTRI addressed this theory by studying those fatal crashes (1,245 fatal crashes or 15% of the total) where both drivers survived but there was some other fatality, usually a passenger. In 73% of these, the car driver was cited with a factor, while in 34% the truck driver was cited.

Fault Distribution in Fatal Crashes

One of the most exhaustive studies of U.S. fatal car-truck crashes was conducted by the University of Michigan Transportation

Analysts also looked at the physical location and configuration of the crash. For several major crash types, the encroaching (at-fault)

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vehicle can be discerned with high reliability from the crash configuration at the scene. Among two-vehicle car-truck crashes, the car was the encroaching vehicle in 89% of head-on crashes, 88% of the opposite-direction sideswipes, 80% of the rear-end crashes, and 72% of the same-direction sideswipes. A National Highway Traffic Safety Administration (NHTSA) study (Moonesinghe et al., 2003) assigned driver factors similarly for 10,092 fatalities occurring from 1996-99. The respective car percentages for the same four crash types were 91%, 91%, 71%, and 77%. Trucks were the encroaching vehicles for 87 of 89 backing crash fatalities (98%), but backing crashes represented less than 1% of car-truck crash fatalities during the period. The AAA Foundation for Traffic Safety (Kostyniuk et al., 2002) examined 10,732 fatal car-truck crash records from 1995-98 found that car drivers were also more likely to be cited for *multiple* unsafe acts. They found that 36% of car drivers were cited for two or more unsafe acts, versus 11% of truck drivers.

The crash fault picture has remained the same in the years since these comprehensive studies. FMCSA's *Large Truck and Bus Crash Facts* for three recent years show the following percentages of vehicles with cited driver factors in 6,131 car-truck fatal crashes:

- 2007: 85% of cars, 26% of trucks
- 2008: 85% of cars, 26% of trucks
- 2009: 81% of cars, 22% of trucks.

The Large Truck Crash Causation Study (LTCCS; Starnes, 2006, FMCSA 2007) involved a relatively small sample of crashes (from 2001-2003) but more in-depth investigations, including the assignment of

critical reasons (CRs) to involved drivers and vehicles. Twenty-three percent (23%) of the trucks in fatal LTCCS crashes were assigned the CR, while for 77% the CR was assigned to the other vehicle.

Fault Distribution Across Other Crash Severities

The severity of police-reported crashes is rated on a 5-level KABCO severity scale. The LTCCS included the highest three levels: K (fatal), incapacitating injury (A), and non-incapacitating injury (B). Possible injury (C) and non-injury (O) crashes were excluded. Overall, trucks were assigned the CR in 44% of LTCCS car-truck crashes, versus 56% for cars (Craft, 2008). CR assignment varied by crash severity. Trucks were assigned the CR in 23% of K, 37% of A, and 46% of B crash involvements with other vehicles (Knipling, 2009).

The NHTSA National Motor Vehicle Crash Causation Study (NMVCCS) was limited to crashes involving cars, but this included 219 car-truck crashes of all KABCO severity levels. Trucks were assigned the CR in 39% of these, passenger vehicles in 61% (Craft, 2011). The European Truck Accident Causation (ETAC; IRU, 2007) study conducted in-depth investigations of 624 fatal and injury truck crashes in seven European countries. A main cause (comparable to the CR) was assigned to an involved driver (or other road user), a vehicle, weather, or the roadway. Truck drivers were assigned the main cause in 25% of the crashes, versus 60.2% for car drivers or other persons involved. Remaining cause assignments were

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vehicle (5.3%), weather (4.4%), and roadway (5.1%).

The University of North Carolina Highway Safety Research Center (Council et al., 2003) used Police Accident Report (PAR) files from that state to examine a sample of 16,264 police-reported car-truck crashes of all severities from the years 1994-1997. The PARs were not in-depth investigation reports, but did include 26 possible contributory factors assigned to one or both vehicles. Based on these, the study classified fault as: truck only (48%), car only (40%), both (9%), and neither (3%). Similarly, Craft (2011) reported Michigan state PAR data tabulations for 2001-05 for all police-reported crash severities. In 86,638 two-vehicle crashes, hazardous actions were attributed to commercial vehicles [trucks] 42% of the time, versus 41% for other vehicles. The Michigan finding for all police-reported crash severities contrasts with a previous Michigan in-depth study of fatal car-truck crashes which assigned principal fault to the car driver about 70% of the time (Powers, 2001, ATA, 2007).

The Nature of Driver Errors in Car-Truck Crashes

The LTCCS (Starnes, 2006; Craft, 2008) and other crash investigations have generated extensive data on specific CRs and other factors in car-truck crashes. With some exceptions, the profiles of truck-related and car-related causes and other factors in car-truck crashes are similar. The following are comparisons for LTCCS car-truck crashes:

- Vehicle-related failure (all types): 7% of trucks, 4% of cars [“other vehicles”]

- Following too closely to respond to unexpected actions: 8% of truck drivers, 1% of car drivers
- Overcompensation [e.g., during evasive steering]: 1% of truck drivers, 6% of car drivers
- Asleep-at-the-wheel: 1% of truck drivers, 9% of car drivers
- Heart attack or other physical impairment: 2% of truck drivers, 6% of car drivers.

The LTCCS also noted driver, vehicle, and environmental factors associated with the crash. Such factors did *not* have to contribute to the crash, but were noted for their presence. Below are percentages for selected “associated factors” in LTCCS car-truck crashes from Craft, 2008:

- Brake problems: 27% of trucks, 2% of cars [“other vehicles”]
- Driver unfamiliarity with roadway: 19% of truck drivers, 10% of car drivers
- Driver felt under work pressure: 10% of truck drivers, 3% of car drivers
- Driver fatigue: 7% of truck drivers, 15% of car drivers
- Tire problems: 3% of trucks, 6% of cars
- Aggressive driving: 5% of truck drivers, 9% of car drivers
- Driver illness: 1% of truck drivers, 8% of car drivers
- Driver illegal drugs: 0.4% of truck drivers, 7% of car drivers
- Driver alcohol use: 0.3% of truck drivers, 9% of car drivers.

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The AAA Foundation (Kostyniuk et al., 2002) compared car driver actions in fatal car-truck crashes to those in car-car crashes to determine whether certain dangerous car driver actions were overrepresented in car-truck crashes. They found 90 of 94 factors to be statistically equal. Statistical causal profiles were the same across the vast majority of crashes. One of the four exceptions was the driver factor “drowsy, sleepy, asleep, [or] fatigued.” This factor was more frequent for car drivers in their crashes with trucks than in their crashes with other cars. When fatigue was listed as a factor in fatal car-truck crashes, the split was 87% car driver, 13% truck driver.

Conclusions & Perspectives on Prevention

Crashes are complex events resulting from the interplay of multiple risk factors and events. Nevertheless, there are legitimate legal and policy reasons for designating crash fault and tabulating findings. Almost all crashes are triggered by a particular driver error or other failure occurring in one of the involved vehicles. The majority of fatal and serious injury crashes involving a truck also involve at least one car. The preponderance of evidence suggests that car drivers are principally at-fault in about three-quarters (70-75%) of fatal car-truck crashes. This is based on multiple large-scale, in-depth crash investigation studies. Less severe crashes are far more numerous, but they have been studied in less depth. It appears the allocation of fault between trucks and cars becomes more equal (approximately 50-50) as crash severity level decreases.

The principal policy reason for evaluating fault and the nature of errors that increase

crash risk is to design and implement cost-effective truck safety programs that yield the greatest safety benefits. Most research suggests, however, that the factors and driver errors resulting in car-truck crashes are not unique to those crashes. Their rates and occurrence largely reflect the same factors affecting highway crashes in general. This includes traffic density, speeding, other unsafe operating behaviors like following too closely, alcohol use, and driver fitness. The benefits of traffic safety education, strong enforcement of traffic laws, and improved roads extend to all crash types, including car-truck crashes.

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