U.S. Department
of Transportation

National Highway
Traffic Safety
Administration

Research Note

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Analysis of Combination-Unit Truck Fatal Crashes by Location of Fatality

This note provides comparative statistics on crash problem size and characteristics for two types of heavy combination-unit truck fatal crashes: (a) fatal to truck occupants and (b) fatal only to non-truck vehicle occupants or non-motorists (e.g., pedestrians, pedalcyclists). The principal data source was the 1991-1994 Fatal Accident Reporting System (FARS). A secondary data source was the 1991-94 General Estimates System (GES).

During 1991-94 there was an annual average of 3,241 combination-unit trucks involved in 3,068 fatal crashes which resulted in 3,634 fatalities. **Table 1** provides a breakdown of these crashes by location of the fatalities. As noted above, crashes with fatalities to *both* truck occupants and other involved persons are included in Type (a). Type (b) crashes includes only those crashes where fatalities occurred among occupants of other involved motor vehicles or non-motorists. In all, there were 3,174 fatalities "outside" the trucks versus 460 fatalities "inside" the trucks.

Table 1. Combination-Unit Truck Fatal Crashes and Associated Fatalities (FARS; Annual Average for 1991-94)

Crash Type	Fatal Crashes	Involved Trucks	Truck Occupant Fatalities	Fatalities to Occupants of Other Involved Vehicles/Non-Motorists	All Truck-Related Fatalities
Type (a): Fatal to Truck occupant	436	475	460	28	488
Type (b): Fatal to Occupants of Other Involved Vehicles/ Non-Motorists Only	2,632	2,766	0*	3,146	3,146
Total Truck Fatal Crashes	3,068	3,241	460	3,174	3,634

*By definition.
Note: 4.9% of the Type (a) crashes involved two or more trucks.

Considering the entire motor vehicle fatal crash population (i.e., all vehicle types), there was an annual average of 35,970 fatal crashes and 40,396 associated fatalities during the years 1991-94. Thus, 8.5% of all fatal crashes and 9.0% of all motor vehicle crash fatalities involved combination-unit trucks.

Considering the entire truck crash population (i.e., all severity levels based on the police-reported KACBO system), there was an annual average of 221,068 truck crashes including property damage only (0), possible injury (C), nonincapaciating (B), and incapaciating (A) crashes in GES and Fatal (K) crashes in FARS during the years 1991-94. Thus, 0.2% of all truck crashes result in a fatality in the truck (Type a) and another 1.2% result in a fatality outside the truck (Type b).

Statistical Characteristics

Figure 1 compares collision type frequency distributions for the two fatal crash types. Predominant collision types for Type (a) crashes were first-harmful-event rollover (49.3 percent), fixed-object (14.8 percent), rear-end (11 .0 percent), angle (7.1 percent), head-on (7.1 percent) and rail train (3.4 percent). Predominant collision types for Type (b) crashes were angle (36.5 percent), head-on (26.9 percent), rear-end (18.4 percent), pedestrian/pedalcyclist (9.2 percent), and sideswipe including same and opposite direction (4.4 percent).

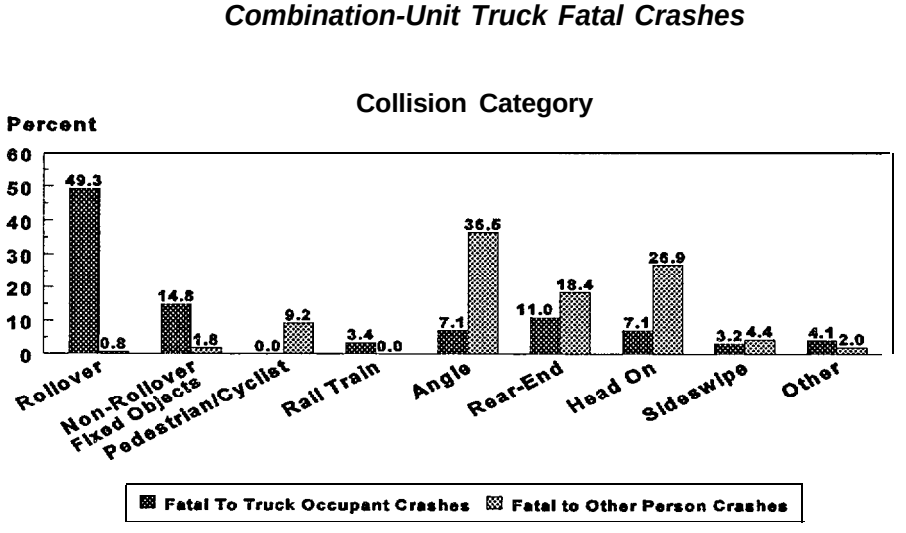

Figure 1. Combination-Unit Truck Fatal Crashes by Collision Category

Figure 2 compares roadway type/location distributions. The eight roadway categories presented are rural Interstate, urban Interstate, other rural 4+ lane, other urban 4+ lane, rural 2-3 lane/speed limit = 55 mph, rural 2-3 lane/speed limit <55 mph, urban 2-3 lane/speed limit < 55 mph, and other. Both types of crashes were most prevalent on rural 2-3 lane/speed limit = 55 mph roadways. Type (a) crashes were most over-presented on rural Interstates whereas Type (b) crashes were most overrepresented on urban non-Interstate roadways, including both 4-lane and 2-3-lane In all, 39.7 percent of Type (a) crashes occurred on Interstate highways, compared to 22.0 percent of Type (b) crashes.

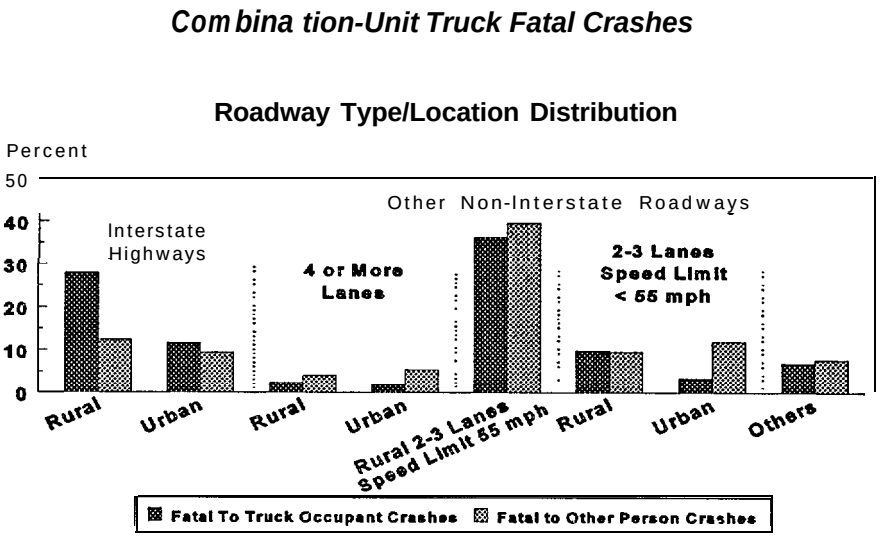

Figure 2. Combination-Unit Truck Fatal Crashes by Roadway Type and Location

Figure 3 compares time-of-day distributions for the two crash types. The data were smoothed by the use of 3-hour rolling averages. Type (a) crashes peaked between 5:00 am and 7:00 am and were least frequent in the evening before midnight. Type (b) crashes had a peak period in the afternoon between 2:00 and 5:00 pm.

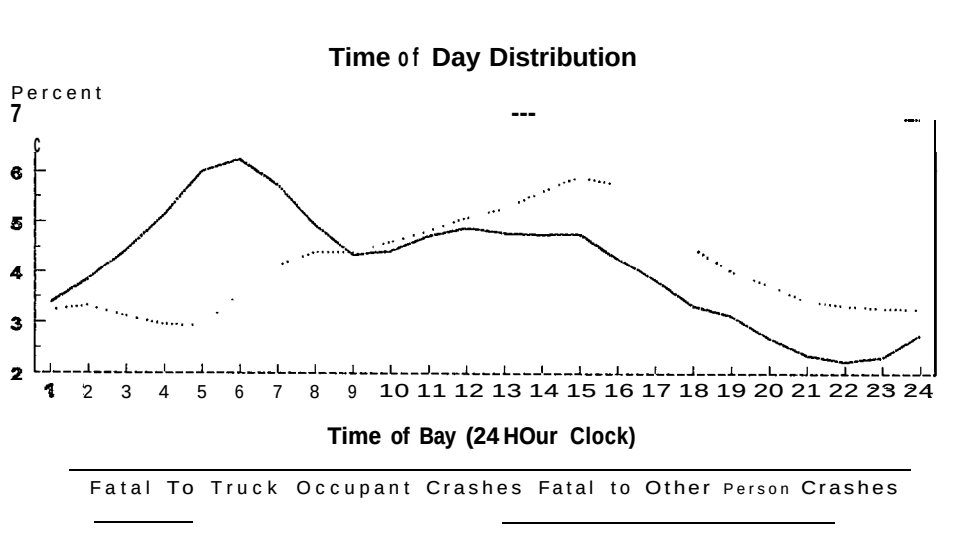

Figure 3. Combination-Unit Truck Fatal Crashes by Time of Day (3-Hour Rolling Average)

Figure 4 presents a cumulative percentage distribution of associated fatalities by known truck travel speeds. Overall, the travel speed was unknown in about 46 percent of the cases, with little difference between the two types of crashes. About 34.8 percent of fatalities associated with Type (a) crashes occurred at coded travel speeds of 54 mph and less, compared to 64.1 percent of Type (b) crashes. For both crash types, approximately one-forth of fatalities associated with crashes occurred at travel speeds 55 mph. For Type (a) crashes, 29.5

percent of fatalities were associated with truck travel speeds from 56 mph to 65 mph. **For Type** (b) crashes, only 10.5 percent occurred at travel speeds of 56-65 mph.

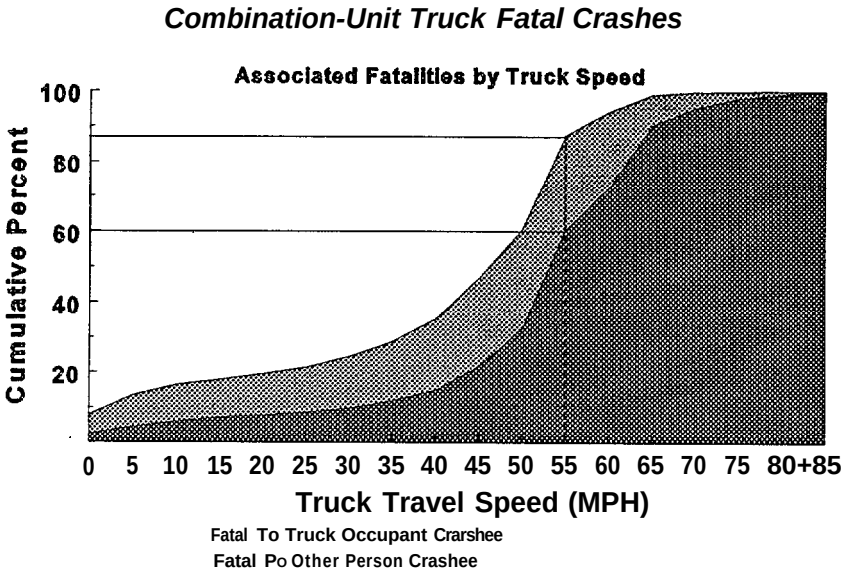

Figure 4. Associated Fatalities By Truck Travel Speed

Figure 5 presents a variety of other crash characteristics more prevalent among Type (a) crashes than Type (b) crashes. Some of these characteristics described environmental circumstances, some were coded vehicle factors and others were human-related factors. Therefore, percentages shown will not add to 100 percent. These include the following comparisons:

- Rollover was indicated as the first event or subsequent harmful event in 59.6 percent of the Type (a) crashes. Less than 10 percent of Type (b) crashes involved rollover.

- About 67.1 percent of Type (a) crashes were single vehicle crashes. In contrast, only 9.2 percent of Type (b) were single vehicle crashes, i.e. crashes fatal only to pedestrians or pedalcyclists.

- The first harmful event of more than half (55.4 percent) of the Type (a) crashes occurred off the roadway: 25.2 percent on the roadside, 12.6 percent off the roadway, 7.7 percent on shoulder and 6.4 percent on the median. Only 5.3 percent of **Type (b)** crashes were associated with **an occurred off roadway first harmful event. (Note: "roadside" refers to an** on-grade area just outside the shoulder but within the road right-of-way. "Off roadway" implies outside the road right-of-way.)

- Type (a) crashes were twice as likely to occur on curved roadways than Type (b) crashes.

  Approximately 41 .O percent of Type (a) crashes and 28.2 percent of Type (b) crashes occurred on non-level roadways, i.e, grade/hillcrest/sag roadways. Type (a) crashes occurred more frequently on roadways with a speed limit of'60 mph and above and less

frequently on highways with a speed limit of less than 50 mph than did Type (b) crashes.

- A high proportion of both Type (a) and Type (b) crashes occurred on rural roads (78.9 percent and 67.2 percent, respectively).

  Driver-related factors relating to how the truck driver operated his vehicle were cited for 76.3 percent of Type (a) crashes and 30.3 percent of Type (b) crashes. Other than the factor "ran-off-road/lane" (41.1 percent), the most frequently cited driver factors for Type (a) crashes were: driving too fast (26.1 percent), drowsy (10.0 percent), inattentive (9.7 percent) and erratic/reckless (7.4 percent). For Type (b) crashes, the most. frequently cited factors for truck drivers were: driving too fast (5.6 percent), failure to yield (5.1 percent), run-off-road/lane (4.6 percent) and inattentive (3.4 percent). Note that more than one factor could be cited for a particular crash,

- The majority of involved trucks were going straight. However, trucks in Type (a) crashes were negotiating a curve three times as frequently as those in Type (b) crashes. A slightly higher percentage of trucks in Type (b) crashes were making a left turning maneuver or were stopped in the traffic lanes.

- About 17.6 percent of Type (a) crashes were multiple-vehicle crashes involving at least two trucks. These crashes caused 17.4 percent of fatalities associated with Type (a) crashes. Only 2.8 percent of Type (b) were multiple truck crashes.

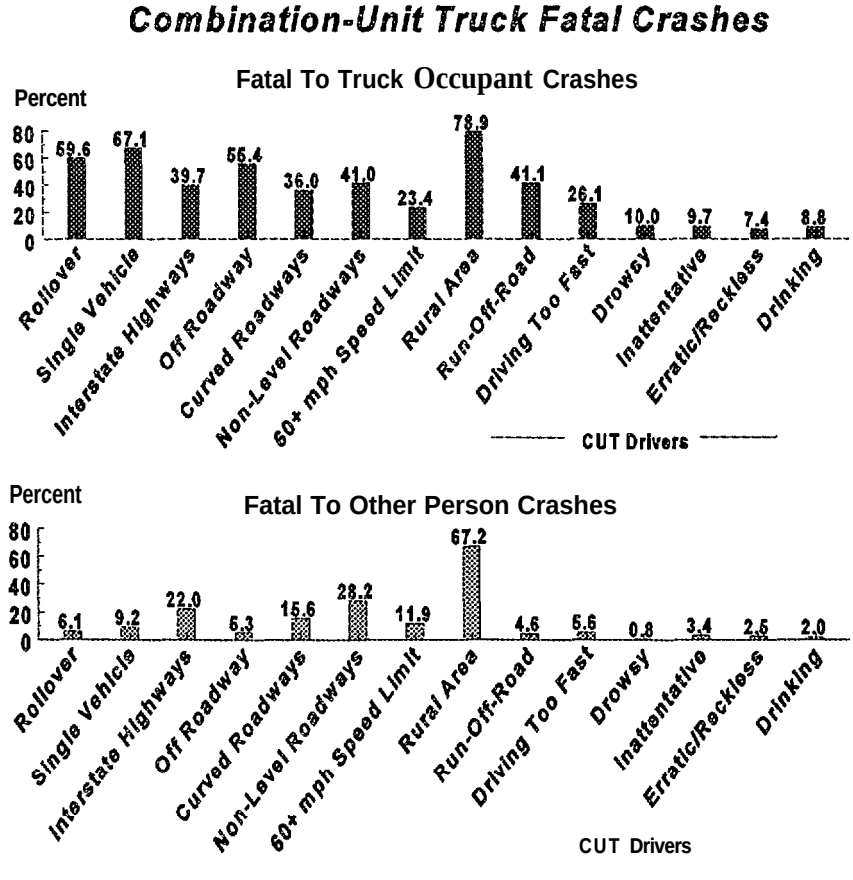

Figure 5. Characteristics for Which Fatal To Truck Occupant Crashes **Were Overrepresented**

Figure 6 presents a variety of other crash characteristics more prevalent among Type (b) crashes than Type (a) crashes. These include the following comparisons (as **described in the** Figure 5, **percentages shown will not add** to 100 percent):

About 3 1.3 percent of Type (b) crashes occurred at non-interchange/intersection **or** intersection-related areas, which was four times higher than that of the Type (a) crashes. Also, 4.1 percent of Type (a) crashes occurred at railroad crossings and 3.0 percent occurred at interchange-ramp areas.

. A higher proportion of Type (b) crashes occurred on wet roadways and under adverse weather (rain, sleet, snow, fog, and rain & fog weather conditions) than did Type (a) crashes.

• Alcohol use was involved in 22.0 percent of Type (b) crashes. While 2.0 percent involved the truck driver drinking, the majority of these (20.0 percent) involved the other vehicle driver drinking. Truck drivers in Type (a) crashes were found to have been drinking alcohol in 8.8 percent of the crashes.

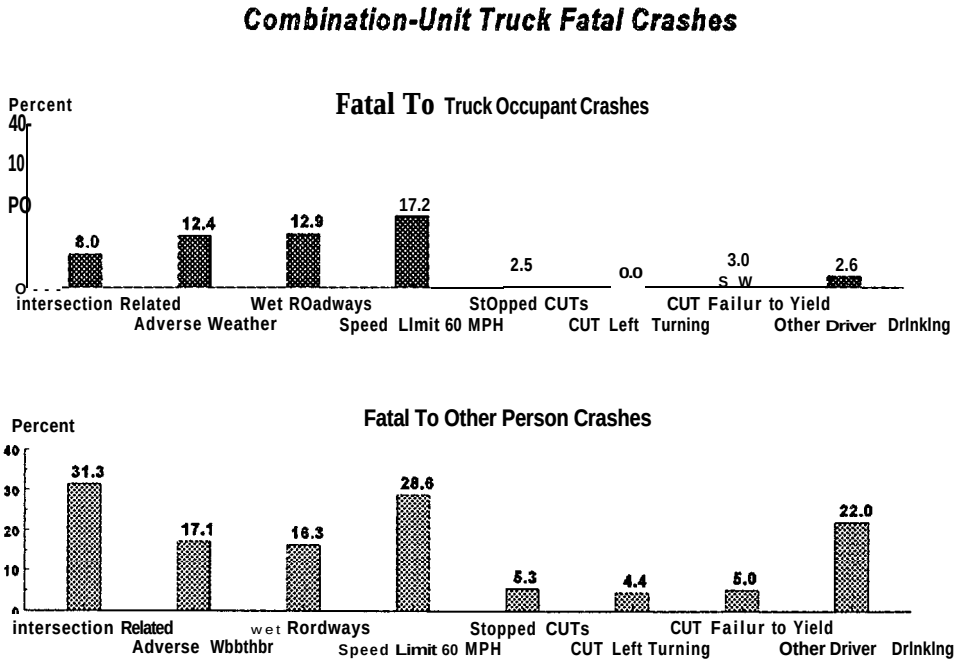

Figure 6. Characteristics for Which Fatal To Truck Occupant Crashes Were Underrepresented

Conclusion

This research **note** has presented problem size statistics and characteristic differences between two types of combination-unit truck fatal crashes. Type (a) crashes were much less common than Type (b) crashes. During 1991-1994, there were an annual average of 436 Type (a) **crashes** and 2,632 Type (b) crashes. Not surprisingly, Type (a) crashes tended to be single vehicle roadway departure crashes, often involving rollover. This type of crash occurred more

often on Interstate highways and more often in the early morning hours. Other factors observed more frequently in Type (a) crashes included trucks negotiating a curved roadway and driver drowsiness, inattentation, and drinking. Type (b) crashes were usually angle, rear-end, or head-on impacts and often occurred at intersections or intersection-related areas. **They** peaked during the mid- to late-afternoon hours. Other factors observed more frequently in Type (b) crashes included adverse weather, wet roadways and truck drivers' failure to yield. Type (a) crashes were five times more likely to involve truck driver alcohol use than were Type (b) crashes. Nevertheless, the overall involvement of alcohol was greater in Type (b) crashes due to alcohol use by non-truck drivers. It is apparent from these findings that, since the two crashes types are distinctly different in many key aspects, safety countermeasure development efforts which focus on combination-unit trucks likewise need to be different and tailored to the type of crash scenario and trauma outcome being addressed.