

**NATIONAL TRANSPORTATION SAFETY BOARD  
Public Meeting of June 4, 2013  
(Information subject to editing)**

**Safety Study**

**Crashes Involving Single-Unit Trucks that Resulted in Injuries and Deaths**

**NTSB/SS-13-01**

This is a synopsis from the National Transportation Safety Board (NTSB) report and does not include the NTSB's rationale for the conclusions, and safety recommendations. The NTSB's staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible.

The attached information is subject to further review and editing.

**EXECUTIVE SUMMARY**

There are 8.22 million single-unit trucks registered in the United States which travel more than 110.7 billion miles each year. Single-unit trucks are large trucks (gross vehicle weight rating (GVWR) over 10,000 pounds) that have all axles attached to a single frame, and cargo units that are typically non-detachable. Although single-unit trucks comprise three percent of registered motor vehicles and four percent of miles traveled, they are involved in nine percent of fatalities among passenger vehicle occupants in multivehicle crashes. Crashes involving single-unit trucks and passenger vehicles pose a hazard to passenger vehicle occupants due to differences in weight, bumper height, and vehicle stiffness.

The National Transportation Safety Board (NTSB) undertook this study because of concerns about the safety record of single-unit trucks and to identify safety countermeasures appropriate for these vehicles. One of the concerns was that single-unit trucks are excluded from some safety rules applicable to tractor-trailers, the other type of large truck. Single-unit trucks do not have to meet the requirements for improved rear underride guards (mandatory in 1998 for new trailers) and conspicuity treatments to enhance visibility (mandatory in 1993 for new trailers; in 1997 for new truck-tractors; and in 2001 for trailers manufactured before 1993). Further, in 2012, the National Highway Traffic Safety Administration (NHTSA) proposed mandating electronic stability control for tractor-trailers and motorcoaches but not for single-unit trucks.

Many studies of truck safety have examined fatalities as the sole outcome of interest. Tractor-trailers result in a larger proportion of fatal injuries from large truck crashes. However, this study shows that there are substantial societal impacts resulting from non-fatal injuries arising from single-unit truck crashes. Emergency department visits, inpatient hospitalizations, and hospital costs that result from the crashes provide measures of the adverse effect of non-fatal injuries on the public. This study also shows that federal and state databases frequently misclassify single-unit trucks and thus undercount the total number of fatalities resulting from single-unit truck crashes by approximately 20 percent.

The primary focus of this study was on the risks of single-unit truck crashes, and these risks were compared with those of tractor-trailer crashes. This study used a variety of data sources. Crash Outcome Data Evaluation System (CODES) data, which links hospital discharge records with police accident reports, were obtained from five participating states (Delaware, Maryland, Minnesota, Nebraska, and Utah) and served as the primary source of data for injury severity and hospitalizations in relation to truck and crash characteristics. Additional databases used include Trucks in Fatal Accidents (TIFA) and the Fatality Analysis Reporting System (FARS) (fatal crashes), the National Automotive Sampling System/General Estimates System (GES) (national estimates of non-fatal injuries), and the Large Truck Crash Causation Study (LTCCS) (truck crash investigations with details not available from the other sources).

To improve the quality and accuracy of CODES data, the NTSB developed a program to decode truck vehicle identification numbers (VIN); this program was used in conjunction with VIN-derived GVWRs supplied by NHTSA. Additionally, statistical procedures to impute missing values for critical variables in the data set were used to maximize the data available for analysis and minimize potential bias from missing data. This comprehensive approach resulted in a detailed characterization of single-unit truck crash types and the associated fatalities and injuries.

In response to the findings of this study, the NTSB is issuing nine recommendations to NHTSA, four recommendations to the Federal Motor Carrier Safety Administration, one recommendation to the Federal Highway Administration, and two recommendations to the US Department of Transportation.

Recommendation areas include requiring modifications to enhance the ability of drivers of single-unit trucks to detect pedestrians and cyclists (bicyclists and other pedal cyclists), side underride protection systems for newly manufactured single-unit trucks, rear underride protection systems on newly manufactured single-unit trucks, and conspicuity treatments on the sides and rears of single-unit trucks.

The NTSB is also recommending improving federal and state data on large truck crashes (including the use of VINs to improve the coding of large trucks involved in crashes), continuing the functions that had been performed by the TIFA program and the CODES project, examining the frequency and consequences of single-unit truck drivers operating with an invalid license, and evaluating the potential benefits of expanding commercial driver license requirements to lower weight classes.

This study reiterates previous recommendations to NHTSA to require front underride protection systems for large trucks and electronic stability control, adaptive cruise control, collision warning systems, and lane departure systems for large commercial vehicles.

## **FINDINGS**

1. Although single-unit truck crashes are neither as lethal nor as likely to cause the most severe injuries as compared with tractor-trailer crashes, available data show that they are involved in at least 37 percent of the fatalities, 49 percent of inpatient hospitalizations, and 61 percent of emergency department visits from large truck crashes.
2. Twice as many pedestrians and cyclists received non-fatal injuries in single-unit truck crashes as in tractor-trailer crashes, although the numbers of fatally injured pedestrians and cyclists were 19 percent lower in single-unit truck crashes than in tractor-trailer crashes.
3. Onboard systems and equipment that compensate for blind spots and allow drivers of single-unit trucks to detect vulnerable road users could prevent fatalities and injuries that occur in crashes involving single-unit trucks.
4. About half of all collisions resulting in injury between passenger vehicles and the side of single-unit trucks involve underride, pose a high risk of death and injury, and could be reduced by side underride guards.
5. The fatalities and serious injuries that are caused by rear underrides, which occur in most collisions resulting in injury between passenger vehicles and the rears of single-unit trucks, could be mitigated by well-designed rear underride protection systems.
6. Collisions between passenger vehicles and the front of single-unit trucks or tractor-trailers are common types of crashes that result in fatalities, and front underride contributes to crash severity.
7. Available data regarding single-unit truck crashes indicate that the rates of serious injury and hospitalization are higher in collisions on dark and unlit roads than during daylight conditions, and the injury rates could be reduced by conspicuity treatments on these trucks.
8. Single-unit trucks are involved in at least one-third of all large truck rollovers and single-vehicle run-off-road crashes, two types of crashes that can be mitigated by electronic stability control systems.
9. Collisions with the sides and fronts of large trucks could be prevented or mitigated by lane departure systems, adaptive cruise control, and collision warning systems installed on large trucks.

10. Nineteen percent of single-unit trucks in fatal crashes have been misclassified in police reports and thus undercounted by the Fatality Analysis Reporting System, and using information from vehicle identification numbers provides more accurate classification of single-unit truck and tractor-trailer crashes than relying solely on vehicle body type codes in federal and state databases.
11. The Trucks in Fatal Accidents database increases the understanding of truck safety through the improved accuracy of data on fatal large truck crashes collected by the Fatality Analysis Reporting System.
12. Data from the Crash Outcome Data Evaluation System provide detailed information on injury diagnoses and severity in relation to crash characteristics, cover a large proportion of the population of the participating states, are not available elsewhere, and provide useful insight into traffic safety problems.
13. The crash investigation data from the Large Truck Crash Causation Study can provide useful information on the details of crashes and identification of potential countermeasures.
14. A national repository of location-based information for crashes would be beneficial, and the Federal Highway Administration is well-positioned to leverage its experience in the Highway Safety Information System and its ability to collect expanded roadway geographic information systems data through the Highway Performance Monitoring System to compile location-based information of all crashes.
15. Drivers of single-unit trucks in fatal crashes were three times more likely to have invalid licenses than the drivers of tractor-trailers involved in fatal crashes; however, neither the frequency of invalid licensure among single-unit truck drivers involved in non-fatal crashes nor the risks associated with invalid licensure among single-unit truck drivers are known.
16. Requiring commercial driver's licenses for drivers to operate single-unit trucks with gross vehicle weight ratings less than 26,001 pounds may be an effective means of reducing the frequency and severity of single-unit truck crashes, but further data are needed to determine whether the requirements for commercial driver licensure should be expanded to some types of single-unit trucks.

## **RECOMMENDATIONS**

### **To the National Highway Traffic Safety Administration:**

1. Develop performance standards for visibility enhancement systems to compensate for blind spots in order to improve the ability of drivers of single-unit trucks with gross vehicle weight

ratings over 10,000 pounds to detect vulnerable road users, including pedestrians and cyclists, in their travel paths.

2. Once the performance standards requested in Recommendation 1 have been developed, require newly manufactured single-unit trucks with gross vehicle weight ratings over 10,000 pounds to be equipped with visibility enhancement systems meeting the performance standards.
3. Develop performance standards for side underride protection systems for single-unit trucks with gross vehicle weight ratings over 10,000 pounds.
4. Once the performance standards requested in Recommendation 3 have been developed, require newly manufactured single-unit trucks with gross vehicle weight ratings over 10,000 pounds to be equipped with side underride protection systems meeting the performance standards.
5. Develop performance standards for rear underride protection systems for single-unit trucks with gross vehicle weight ratings over 10,000 pounds.
6. Once the performance standards requested in Recommendation 5 have been developed, require newly manufactured single-unit trucks with gross vehicle weight ratings over 10,000 pounds to be equipped with rear underride protection systems meeting the performance standards.
7. Require conspicuity treatments on the sides and rears of newly manufactured single-unit trucks with gross vehicle weight ratings over 10,000 pounds consistent with the requirements for such treatments on truck-tractors and trailers specified in 49 CFR Part 571.108 (Federal Motor Vehicle Safety Standards: Lamps, Reflective Devices, and Associated Equipment).
8. Develop and implement a plan for using vehicle identification numbers and other variables, such as cargo type or trailers, to improve the coding and classification of large commercial vehicles in the Fatality Analysis Reporting System and the National Automotive Sampling System.
9. Include data from each calendar year of the Trucks in Fatal Accidents database on the Fatality Analysis Reporting System website.

**To the Federal Motor Carrier Safety Administration:**

10. Ensure that the data collection for the successor to the initial Large Truck Crash Causation Study includes full crash investigations that will enable scrutiny of crash, vehicle, environmental, roadway, and driver variables contributing to non-fatal injuries and deaths in large truck crashes.

11. Conduct an assessment of the frequency with which single-unit truck drivers are operating with invalid licenses, together with the associated risks of invalid licensure, and publish the findings.
12. Evaluate the potential benefits of extending commercial driver licensure requirements to the operation of single-unit trucks with gross vehicle weight ratings below 26,001 pounds.
13. If the evaluation in Recommendation 12 indicates a benefit from extending commercial driver's licensure, require commercial driver's licenses for drivers of single-unit trucks in gross vehicle weight rating classes for which benefits have been shown.

**To the Federal Highway Administration:**

14. Develop and implement a strategic plan for facilitating technology transfers between states that will lead to a complete and accurate database of spatially referenced highway crash locations for integration with roadway inventory and traffic operation data captured by the Highway Performance Monitoring System.

**To the US Department of Transportation:**

15. While the National Highway Traffic Safety Administration is developing the conspicuity standards for newly manufactured single-unit trucks requested in Recommendation 7, direct either the National Highway Traffic Safety Administration or the Federal Motor Carrier Safety Administration, as appropriate, to determine and implement the most efficient method to require the retrofit of treatments, according to the standards, on the sides and rears of single-unit trucks with gross vehicle weight ratings over 10,000 pounds.
16. Develop and implement a plan to ensure the continued collection of data as performed for the Trucks in Fatal Accidents database and the continuation of state linkage of hospital and police-reported data as performed by the Crash Outcome Data Evaluation System.

**REITERATED RECOMMENDATIONS**

**To the National Highway Traffic Safety Administration:**

Develop standards for adaptive cruise control and collision warning system performance standards for new commercial vehicles. At a minimum, these standards should address obstacle detection distance, timing of alerts, and human factors guidelines, such as the mode and type of warning (Safety Recommendation H-01-6).

After promulgating performance standards for collision warning systems for commercial vehicles, require that all new commercial vehicles be equipped with a collision warning system (Safety Recommendation H-01-7).

Require new commercial motor vehicles with a gross vehicle weight rating above 10,000 pounds to be equipped with lane departure warning systems (Safety Recommendation H-10-1).

To improve highway vehicle crash compatibility, develop performance standards for front underride protection systems for trucks with gross vehicle weight ratings over 10,000 pounds (Safety Recommendation H-10-12).

Once the performance standards in Safety Recommendation H-10-012 have been developed, require that all such newly manufactured trucks be equipped with front underride protection systems meeting the performance standards (Safety Recommendation H-10-13).

Develop stability control system performance standards for all commercial motor vehicles and buses with a gross vehicle weight rating greater than 10,000 pounds, regardless of whether the vehicles are equipped with a hydraulic or a pneumatic brake system. (Safety Recommendation H-11-7)

Once the performance standards in Safety Recommendation H-11-7 have been developed, require the installation of stability control systems on all newly manufactured commercial vehicles with a gross vehicle weight rating greater than 10,000 pounds. (Safety Recommendation H-11-8).