

National Association of State Directors of Pupil Transportation Services

Information Report

Rear Underride Crashes and School Buses

Background

Over the past few years, a number of crashes have occurred around the country in which passenger motor vehicles have impacted the rear of school buses. In a very few of these crashes, the occupants of the passenger motor vehicles were killed or seriously injured when the smaller vehicle went under the rear bumper of the school bus. As a result, questions have been raised concerning whether school buses should be equipped with rear impact guards that would prevent a smaller vehicle from underriding a school bus in a rear-impact crash. Such devices are required by Federal Motor Vehicle Safety Standards (FMVSS) on trailers and semitrailers with a gross vehicle weight rating (GVWR) of 10,000 pounds or more.

Discussion

In January 1996, the National Highway Traffic Safety Administration (NHTSA) issued two new FMVSSs that are designed to reduce the number of injuries and fatalities resulting from the collision of passenger vehicles with the rear ends of heavy trailers and semitrailers. The first standard, FMVSS No. 223, "Rear Impact Guards," specifies the performance requirements that rear impact guards must meet. The second standard, FMVSS No. 224, "Rear Impact Protection," requires that most new trailers and semitrailers with a GVWR of 10,000 pounds or more be equipped with a rear impact guard that meets the requirements of FMVSS No. 223. The requirements of these FMVSSs became effective in January 1998.

NHTSA had been studying the issue of rear underride crashes for many years and first proposed solutions to the problem as early as 1981. The agency has taken two approaches to the problem. The first deals with increasing the conspicuity of large vehicles in an effort to prevent rear impact crashes. FMVSS No. 108, "Lamps, Reflective Devices and Associated Equipment," requires retroreflective materials on the sides and rear of all trailers of 80 or more inches in width and with a GVWR of 10,000 pounds or more. That standard became effective in December 1993 and has proven to be very effective in reducing the incidence of rear and side impacts into trailers and semitrailers.

The second approach taken by NHTSA involves the reduction of injuries and fatalities due to underride given that a rear impact crash has occurred. As mentioned above, FMVSS Nos. 223 and 224 were issued to attain that objective.

Magnitude of the Safety Problem

NHTSA estimates:

- 11,500 rear impact crashes into trucks, trailers and semitrailers each year
- 400 fatalities to occupants of the passenger motor vehicles
- 5,000 injuries to occupants of the passenger motor vehicles
- Only 27 percent of the fatalities and 18 percent of the injuries occurred when a passenger motor vehicle impacted the rear of a single unit truck, even though single unit trucks represent 72 percent of the heavy vehicles registered in the U.S.
- Trailers and semitrailers represent 28 percent of the heavy vehicles registered in the U.S., but account for 73 percent of the rear impact fatalities and 82 percent of the rear impact injuries.

Potential Benefits of Rear Impact Guards

NHTSA estimates that rear impact guards would be between 11 percent and 17 percent effective in preventing fatalities and injuries due to passenger motor vehicles underriding heavy vehicles. But not all fatalities in rear impact crashes into heavy vehicles are due to underride. Many rear impact crash fatalities and injuries will occur despite the rear impact guard. While NHTSA has established the energy absorption characteristics for the rear impact guards themselves, it is possible that the rear impact guard itself could worsen the crash severity in some instances.

NHTSA's overall estimate is that rear impact guards on trailers and semitrailers would save 4 to 15 lives per year. In addition, 29 non-minor and 145 minor injuries would be prevented.

If the same effectiveness rates were applied to single unit trucks and buses, it would appear that 1 to 6 lives might be saved and 6 to 32 injuries might be prevented by the installation of rear impact guards on both single unit trucks and buses. School buses are a subset of this group. As a result, the potential safety benefits of rear impact guards on school buses are even smaller.

School Buses and Rear Impact Guards

During the course of its research and analyses to develop and promulgate FMVSSs Nos. 223 and 224, NHTSA reviewed and analyzed considerable real-world data on the rear impact guards on heavy motor vehicles. Of particular concern were any effects such devices would have on the operation of the vehicles.

The major operational consideration was whether the rear impact guard would cause the bottom of the guard to scrape or “hang” on the ground when the vehicle mounts a steep incline. This type of situation could occur when approaching or departing a raised railroad grade crossing, a steep driveway entrance, or any number of situations in a hilly or mountainous area.

In comments received to the Notice of Proposed Rulemaking for FMVSSs Nos. 223 and 224, numerous commenters cited operational concerns to single unit vehicles if rear impact guards were required, and noted that statistically very limited benefit would be gained from putting such devices on single unit vehicles. One of the commenters cited school buses as an example of how a rear impact guard would severely impact the vehicle’s “angle of departure.” [The “angle of departure” is the acute angle formed by the ground and a line connecting the point where the rear tires meet the ground with the bottom of the guard. The lower the bottom of the rear impact guard, the smaller the departure angle and the greater the chance the vehicle will scrape or “hang” on the ground when the vehicle mounts a steep incline.]

NHTSA’s Rationale for Excluding Single Unit Trucks and Buses

In issuing the Final Rule establishing FMVSSs No. 223 and 224, NHTSA concluded that single unit trucks and buses, including school buses, should not be included in FMVSS No. 224. The agency pointed to a number of facts:

- single unit trucks and buses represent a very small portion of the rear underride safety problem;
- the potential benefits of rear impact guards on single unit trucks and buses are small; and
- the variety, complexity and relatively low weight of many single unit trucks and buses could require much more sophisticated and expensive rear impact guards, which seriously effects the net benefits to society of requiring rear impact guards on single unit trucks and buses.