



Piercing The Passenger Compartment – Voluntary Efforts To Stop The Horrors Of Underride Truck Crashes

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Introduction

The automotive industry spent \$105 Billion in research and development in 2014.¹ Annual research and development includes improving a vehicle's safety features (energy absorbing bumpers, crumple zones, air bags, seat belts, etc.) all designed to keep vehicle occupants safe. The engineering behind these safety features can mean the difference between a minor injury and a tragic fatality. No matter how safe the car may actually be, the safety features are only effective if there is good structural interaction (crash compatibility) between collision partners. This means there is a geometrical match up of the crush structure of both the striking vehicle and the vehicle being struck.

A two vehicle collision involving a heavy commercial motor vehicle (CMV) and a light passenger vehicle frequently results in a mismatch of structural components at the first point of impact. This crash incompatibility is in large part due to the height of the CMV. This often results in an "underride" collision. The lower profile passenger vehicle physically goes underneath the higher profile commercial vehicle. The first point of impact is beyond the hood and into the glass windshield. The second point of impact then literally becomes the heads, faces, and chest of the lower profile vehicle's occupants.

Air bags do not deploy because the lower profile vehicle's bumpers and air bag sensors are not triggered. Energy absorbing bumpers and crumple zones, all designed to keep the passenger compartment intact, become irrelevant. The load path from the crash results in energy that does not initially strike the car's engineered crush structure. With no air bag and the vehicle traveling underneath the opposing vehicle, the occupant compartment is pierced resulting in a Passenger Compartment Intrusion (PCI).

Thereafter, the seat belts restraining the occupants fail to prevent catastrophic injury or deadly consequences as the energy from the collision is absorbed directly by the human body. The car's occupants then suffer the most gruesome crash consequences: death by blunt trauma; decapitation; open skull fractures; traumatic brain injuries; degloving of the face; spinal cord injuries; paraplegia; or quadriplegia.

1998 Federal Motor Vehicle Safety Standard (FMVSS) No. 223 and 224

Forty-five years after the 1953 rule requiring rear underride guards, the Nation-

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al Highway Traffic Safety Administration (NHTSA) promulgated an updated rear underride guard standard that became effective in 1998. The new rule required the following: rear guard ground clearance to be no more than 22 inches; rear wheel setbacks of no more than 12 inches from the cargo bed; and, strength testing requirements.² The new mandates were for combination tractor-trailers only. To date, the NHTSA has not updated rear underride guard requirements for single-unit trucks. The purpose of the new rear underride guard requirements is clearly defined "to reduce the number of deaths and serious injuries occurring when light duty vehicles impact the rear of trailers and semitrailers."³

Presently, the NHTSA has a website specifically designated for "truck under-ride."⁴ According to the agency, "current research into underride guard performance is focused on providing greater understanding of the characteristics of underride events and contributing factors, as well as providing next steps toward defining a computer model to evaluate underride guard designs and vehicle impacts." The analysis on existing rear underride regulations concluded that there "were 532 fatalities to occupants of vehicles that struck the rear of trucks. There was some underride reported in 59 percent of the fatalities."⁵ Unfortunately, the NHTSA report regarding front override and side underride concluded that even further, more accurate reporting was required before mandating front override protection or side underride guards (SUGs).⁶

Numerous studies have been performed attempting to delve further into the limited crash data relating to side impacts which is drastically under reported in the following resources: Fatality Analysis Reporting System (FARS); Trucks Involved in Fatal Accidents (TIFA); National Automotive Sampling System-Crashworthiness Data System (NASS-CDS); and, the Large Truck Crash Causation Study (LTCCS). The available police report data is inconsistent and lacks uniformity reporting the number of side underride and front override crashes resulting in PCI.⁷ Further study required a review of crash report specific on-scene crash photographs, scene diagrams, and case narratives to determine the accuracy of side underride reporting and whether SUGs would have reduced crash severity. One such study was able to conclude that, "SUGs could have reduced injury risk in around three fourths of the crashes" that produced a severe injury or fatality.⁸

The National Transportation Safety Board Recommends SUGs

In a letter dated April 3, 2014, the National Transportation Safety Board (NTSB) urged the NHTSA to take action by adopting a number of safety recommendations, including but not limited to the following on SUGs:

- Require newly manufactured trailers be equipped with side underride protection systems that will reduce underride and injuries to passenger vehicle occupants;
- Revise requirements for rear underride protection systems for newly manufactured trailers to ensure that they provide adequate protection of passenger vehicle occupants; and,
- Add trailer vehicle identification number and trailer model year to the Fatality Analysis Reporting System database for trailers.⁹

The NTSB safety recommendations to the NHTSA were accompanied with this statement, "[t]he NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives."¹⁰

On July 10, 2014, the NHTSA granted a petition for rulemaking submitted by Ms. Marianne Karth and the Truck Safety Coalition requesting the agency improve the safety of rear underride guards on trailers and single-unit trucks.¹¹ The Petitioners also made a request to improve side underride guards and front override guards; however, the NHTSA indicated that it is still evaluating this request and that it will issue a separate decision on a later date.¹² As of the date of these materials, the NHTSA remains silent regarding regulatory requirements for SUGs and front override protection.¹³

Underride Guard Requirements In Europe

Globally, side guards have been mandatory on CMVs in United Kingdom since 1986. The lateral side guards are primarily intended to protect pedestrians and bicyclists. Bicycle fatalities in truck-bicycle collisions have decreased 61% and pedestrian fatalities in truck/pedestrian collisions have decreased 20%.¹⁴

The Vehicle Crash Compatibility (VC-Compat) project, funded by the European Commission, focused on test procedures to improve vehicle crash compatibility.¹⁵ The VC-Compat study specifically reviewed the load path of the car to match it up with the heavy vehicle. The goal was to further improve regulatory requirements so that when a collision occurred between a CMV and a car, the car would have something to react against.

Another study funded by the European Commission successfully designed and tested real-world SUGs for trailers that prevented PCI.¹⁶ The testing devices were designed as aftermarket add-ons or adaptations for conventional trucks or trailers.¹⁷ It was concluded that, an all-around underride protection can be realized. It was further recommended that Original Equipment Manufacturers (OEMs) allow for architectural frame concepts to permit add-on parts that close the critical gaps where cars can underride the heavy vehicle.¹⁸

On April 15, 2015, AAJ Trucking Litigation Group Chair, Lawrence Simon, and this author, as the Chair of the TLG's Underride Committee, met with Senior Research Engineer, Tanya Robinson. Ms. Robinson is a well-published author on the issues of SUGs and other CMV safety requirements. Our meeting took place at the annual trade show in Birmingham, England, known as "The Commercial Vehicle Show." We spent the day with Ms. Robinson gathering photographs, data, and learning historical information regarding SUG requirements, front underride protection, and rear guard



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requirements in the United Kingdom and the European Union. We also gathered data from industry safety vendors including but not limited to: larger windshields for greater visibility; cameras on the sides of CMVs; mirror requirements; telematics and many additional safety features. The information learned is in part shared in this article and is in the AAJ CLE materials at this summer's upcoming convention in July.



Industry Standards Evolving Beyond Minimum Mandatory Requirements

The NHTSA is slow to meaningfully regulate underride guard protection. Therefore, it is incumbent upon local and state governments, safety advocates, liability casualty insurance companies, and/or trucking company owners to have foresight in seeing the benefit of voluntarily installing underride protection. In fact, the industry standard is recognizing the proven safety benefits associated with SUGs and is rapidly evolving beyond mandatory minimums as is evidenced below.

Original Equipment Manufacturer – Freightliner

In March of 2015, at the Mid-America Trucking Show in Louisville, Kentucky, Freightliner, a division of Daimler Trucks North America, LLC, debuted a live concept truck that included a lower front bumper profile and all-around side under-ride protection.¹⁹ Freightliner's engineers seem to be sending the message that Freightliner is cognizant of the issues associated with vehicle crash compatibility. The message also appears to be that regulatory change is on the horizon.

The City of Boston

The City of Boston was the first to pass a law with meaningful SUG requirements. Mayor Martin J. Walsh submitted the "Ordinance to Protect Vulnerable Road Users in the City of Boston."²⁰ The ordinance requires both City trucks and companies that contract with the City to install "lateral protection devices" on their fleet of CMVs. AAJ TLG member Valerie Yarashus is from the City of Boston and is spearheading an effort to enlist AAJ TLG members across the country to follow Boston's lead on this initiative.

The University of Washington

On May 11, 2015, the University of Washington announced that it has installed side guards on the thirty-one box trucks that are part of its campus fleet.²¹ The UW cites previously mentioned studies authored by Ms. Robinson and performed in the United Kingdom that have demonstrated the life-saving aspects of SUGs as the rational basis for installing SUGs on its trucks.²²



A North American Concrete Company

A large Canadian concrete company, Innocon, has voluntarily installed SUGs using a thick nylon panel called "The Guardian" to close the gap on its cement mixers. They have installed SUGs on thirty trucks at a cost of \$1,100.00 each. They intend to install them on all of their trucks.²³ Yet, another example of a volunteer effort in North America, beyond compliance, where industry is leading the way and voluntarily seeing the safety benefits of adding SUGs.

The CLOCS Standard Compliance Initiative

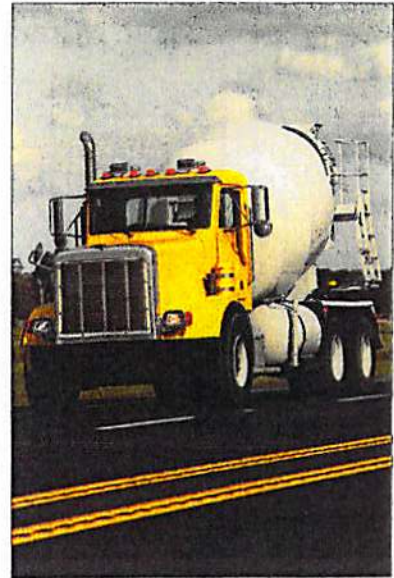
Between 2008 and 2013, 55% of cyclist fatalities in London involved a CMV and a disproportionate number were construction vehicles. These single-unit construction trucks are presently exempt from regulatory requirements.²⁴ After the study was published, the Construction Logistics and Cyclist Safety (CLOCS) Standard compliance initiative began for the purpose of improving construction truck safety.²⁵ This program is "an industry led response to improve safety." It is aimed at encouraging voluntary participation in utilizing state-of-the-art techniques to improve vehicle and driver safety.²⁶ It brings the construction logistics industry together to implement a road safety culture to "help protect pedestrians, cyclists, motorcyclists and other road users who share the roads with construction vehicles."²⁷

At "The Commercial Motor Vehicle Show" in Birmingham, England, a major insurance underwriter, Towergate Insurance, promoted the CLOCS initiative, indicating that participation will result in lower insurance premiums. Towergate Insurance even had a Cement Mixer on display utilizing and advertising all of the following elements for CLOCS Standard compliance:

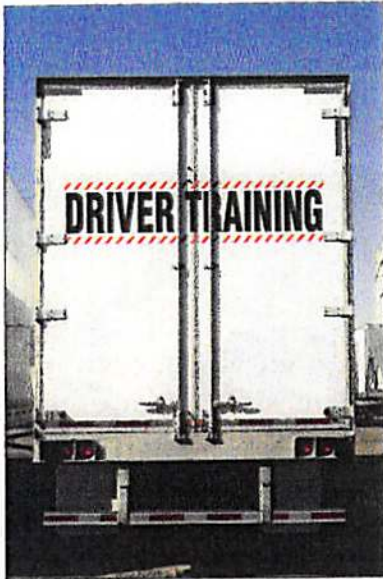
1. Warning signage - Fitment of prominent signage that visually warns other road users not to get too close to the vehicle.
2. Side under-run protection - Fitment of side-guards to minimize the probability and severity of under-run collisions with vulnerable road users.
3. Blind-spot minimization - Fitment of a combination of fully operational vision aids and driver audible alerts to improve visibility for drivers and reduce the risk of close proximity blindspot collisions.
4. Vehicle maneuvering warnings - Enhanced audible systems to warn other road users of a vehicle's turning maneuver.
5. Driver training - Approved progressive training and continued professional development for all drivers, specifically concerning the safety of vulnerable road users.
6. Driver licensing - A system to ensure all drivers hold a valid license for the category of vehicle they are tasked to drive and any risk associated with endorsements or restriction codes are effectively managed.²⁸

Conclusion

Whenever a truck crash involves PCI, a critical analysis is required to determine if there was vehicle crash compatibility or a geometrical mismatch of the crush



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structures of the collision partners resulting in an underride. This analysis then requires further exploration into whether or not the truck driver was trained in various crash scenarios to exercise further caution to avoid an underride accident. The truck company safety director and/or owner need to be questioned to determine if the offending motor carrier exercises best practices beyond regulatory mandates and utilizes state-of-the-art equipment (such as lane departure warning systems and/or installation of side guards) designed to prevent an underride accident. Lastly, depending on liability and the accident scenario, are the OEMs of the truck and/or trailer vulnerable to a product liability claim for failing to have an all-around lower CMV profile to allow for better vehicle crash compatibility between collision partners.

Understanding the U.S. regulatory history and the global approach the industry is currently taking regarding underride guards will ensure a thorough analysis and beneficial result for victims of underride crashes. Heavy vehicle automotive engineers and motor carriers must start looking beyond the windshield toward better crash compatibility with light vehicles because the AAJ is educating its members on this trending safety topic. Most importantly, the industry standard is evolving beyond regulatory mandates with Cities, Universities and Companies leading the way by voluntarily installing SUGs on their truck fleets.

¹ Sources: Bloomberg data; Capital IQ data; Strategy& analysis. Results reflect the previous year as of June 30 of the respective year shown. See PDF on the following web page: http://www.strategyand.pwc.com/media/file/Infographic_2014-Global-Innovation-1000_Automotive-industry-findings.pdf

² National Highway Traffic Safety Administration. Federal Motor Vehicle Safety Standards: Rear Impact Protection; Final rule. *Federal Register*; Vol. 61, p. 2004, January 24, 1996. Federal Motor Vehicle Safety Standards 223 and 224: 49 C.F.R. §571.223 Standard No. 223; Rear impact guards. 49 C.F.R. §571.224 Standard No. 224; Rear impact protection.

³ Blower, D.; Woodroffe, J.; Page, O.; University of Michigan Transportation Research Institute; on behalf of the U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Applied Vehicle Safety Research, *Analysis of Rear Underride in Fatal Crashes, 2008*, DOT HS 811 652, August, 2012, page 38.

⁴ National Highway Traffic Safety Administration, Crashworthiness, Truck Underride - <http://www.nhtsa.gov/Research/Crashworthiness/Truck%20Underride>.

⁵ Blower, D.; Woodroffe, J.; Page, O.; University of Michigan Transportation Research Institute; sponsored by the U.S. Department of Transportation, National Highway Traffic Safety Administration, Office of Applied Vehicle Safety Research, *Analysis of Rear Underride in Fatal Crashes, 2008*, DOT HS 811 652, August, 2012, page 50.

⁶ *Id.* at page 61.

⁷ Bumbelow, Matthew L., "Potential Benefits of Underride Guards in Large Truck Side Crashes." *Traffic Injury Prevention* 13(6): 592-599 citing to: Padmanaban J, Martz B, Salvage J. *Evaluation of Light Vehicle Side Underride Collisions Into Combination Trucks*. Warrendale, PA: Society of Automotive Engineers; 2008. SAE Technical Paper Series 2008-01-2696; Braver ER, Cammis MX, Lund AK, Early N, Mitter EL, Powell MR. Incidence of large truck-passenger vehicle underride crashes in the Fatal Accident Reporting System and the National Accident Sampling System. *Transp Res Rec.* 1997; 1595: 27-33; Braver ER, Mitter EL, Lund AK, Cammis MX, Powell MR, Early N. A photograph-based study of the incidence of fatal truck underride crashes in Indiana. *Accid Anal Prev.* 1998, 30:235-243.

⁸ *Id.*

⁹ Hersman, Deborah A.P., Chair, National Transportation Safety Board, Safety Recommendations, H-14-001 through -007, letter to The Honorable David J. Friedman, Acting Administrator, National Highway Transportation Safety Administration, page 14.

¹⁰ *Id.* at page 15.

¹¹ Department of Transportation, National Highway Traffic Safety Administration, "Grant of Petition for Rulemaking: 49 CFR Part 571 Federal Motor Vehicle Safety Standards; Rear Impact Guards; Rear Impact Protection." Ms. Marianne Karth lost her two (2) daughters in an underride collision on May 8, 2013.

¹² *Id.*

¹³ Front override guards are front bumpers that have low profiles allowing for crash compatibility between the striking CMV and the back of the light vehicle. As the bumpers geometrically match up the CMV should not override into the passenger compartment of the light vehicle.

¹⁴ Robinson, Tanya; Cuerden, Richard; Transport Research Laboratory, *Safer Lorries In London: Identifying The Casualties Associated With Side Guard Rails And Mirror Exemptions*, Published Project Report PPR683, 2014.

¹⁵ 2006 - Vehicle Crash Compatibility (VC-Compat) project website: <http://vc-compat.rtdproject.net/>

¹⁶ Gugler, J. *Heavy Vehicles* (SP2). Integrated Project on Advanced Protection Systems (Aprosys), European Commission, AP-90-0002, Project No. FP6-PLT-506503 http://www.transport-research.info/Upload/Documents/201203/20120313_143923_9154_Final%20SP2%20report%20AP-90-0002.pdf

¹⁷ *Id.* page 20/27.

¹⁸ Id. page 23/27.

¹⁹ The trucking industry shared numerous photographs of this truck via various forms of social media. This author captured one of the numerous photographs taken by a Mid-America Trucking Show attendee and will be utilizing this photograph during the slide presentation at the time of the Montreal AAJ Conference.

²⁰ Mayor Martin J. Walsh, The City of Boston, Letter Addressed To The City Council, dated September 8, 2014. See the City of Boston Underride Ordinance - <http://www.cityofboston.gov/isd/weightsandmeasures/sideguards/documents/ordinance.pdf>

²¹ Press Release, University of Washington, Transportation Services, University Transportation Center, 3745 15th Ave., NE, Box 355360, Seattle, Washington 98105, May 11, 2015. <http://www.washington.edu/facilities/transportation/files/images/blog/UW-sideguards.jpg>, AAJ TLG member Valerie Yarashus is to be credited with finding this press release.

²² Id.

²³ Id.

²⁴ Robinson, Tanya; Cuerden, Richard; Transport Research Laboratory, *Safer Lorries In London: Identifying The Casualties Associated With Side Guard Rails And Mirror Exemptions*, Published Project Report PPR683, 2014.

²⁵ Construction Logistics and Cyclists Safety (CLOCS) Standard Compliance. <http://www.clocs.org.uk/about/>

²⁶ Id.

²⁷ Id.

²⁸ This information came from a photograph, taken by this author, of the Towergate Insurance booth display outlining the six elements of the CLOCs Standard Compliance requirements.

Andy Young is a partner at the Cleveland, OH firm Nurenberg, Paris, Heller & McCarthy Co., L.P.A. Mr. Young is the Chair of the TLG's Underride Committee. He holds an active Class A CDL and owns a Peterbilt 359 Semi-tractor. He is also the immediate past chair of the Ohio Association for Justice's Trucking Safety Section. He has testified before the Ohio Senate Transportation Committee successfully advocating against legislation to allow for heavier trucks on Ohio's Highways.

