

UNDERRIDE TRUCK CRASHES – WORSE THAN HITTING A BRICK WALL

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ABBREVIATIONS

CLOCS	Construction Logistics and Cyclist Safety
CMV	Commercial Motor Vehicle
FARS	Fatality Analysis Reporting System
FMCSA	Federal Motor Carrier Safety Administration
FMVSS	Federal Motor Vehicle Safety Standards
FUP	Front Underride Protection
IIHS	Insurance Institute for Highway Safety
LTCCS	Large Truck Crash Causation Survey
NASS-CDS	National Automotive Sampling System-Crashworthiness Data System
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
OEM	Original Equipment Manufacturer
PCI	Passenger Compartment Intrusion
SUG	Side Underride Guard
TBI	Traumatic Brain Injury
TIFA	Trucks Involved in Fatal Accidents
UMTRI	University of Michigan Transportation Research Institute

UNDERRIDE CRASHES AND PASSENGER COMPARTMENT INTRUSION

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.

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

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.² This often results in an “**underride**” collision³ 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 horrific crash consequences: death by blunt trauma; decapitation; open skull fractures; traumatic brain injuries; degloving of the face; spinal cord injuries; paraplegia; or quadriplegia.

Underride Case Example

Underride crashes resulting in these devastating injuries and fatal results can even occur at lower speeds. A verdict was recently achieved in an underride collision involving a dump truck and a Honda sedan.⁴ The first point of impact was the windshield and “A Pillar” of the Honda’s front passenger side coming into contact with the back left corner of the dump truck’s cargo bed.⁵ The Honda’s front bumper and hood traveled underneath the dump truck’s steel

² Crashes in which one vehicle goes over another vehicle can be referred to as underride or override. This author has seen government studies and industry literature grammatically spelling “underride” in three different ways: “underride”; “under-ride”; and, “under ride.” “Underride” is the spelling utilized by U.S. Government publications, as such this author has adopted this spelling. The City of Boston Ordinance requiring lateral protection devices spells it as “under-ride.” In Europe, the phrase “underrun” “under-run” or “under run” is utilized to describe a crash wherein a smaller vehicle ends up beneath the larger vehicle.

³ A standard tractor-trailer sits 50 inches from the ground. This is the average height of a common loading dock.

⁴ *Kiara E. Torres and Joshua Rojas vs. Concrete Designs, Inc, et al.*, Case No. CV-12-795422 (Consolidated with Case No. 795422), In the Court of Common Pleas, Cuyahoga County, Ohio. Assigned to Judge Michael J. Russo, Visiting Judge Thomas J. Pokorny. This case was tried by this author to verdict.

⁵ The A pillar is the vertical or near vertical support between the Honda’s front windshield and front passenger window. The pillar between the front passenger window and the

cargo bed without damage. The geometrical mismatch of the collisions' two partners caused the corner of the dump truck cargo bed to cut through the Honda's windshield and into the skull of the right front seat passenger. This young man miraculously survived, but suffered an open skull fracture, a traumatic brain injury (TBI), and substantial physical limitations--all requiring a prohibitively expensive future life care plan. Unfortunately, the Honda had three other passengers and this young man was not the only one exposed to the PCI.

The PCI continued along the right side length of the Honda. The right backseat passenger succumbed to the PCI and also suffered a TBI. Intriguingly and not atypical of PCI collisions, the two occupants on the left side of the Honda (the driver and the passenger behind the driver) walked away from the accident with minor injuries. The dump truck driver was also uninjured. Frequently, occupants not effected by the PCI (particularly at lower speeds) can suffer no injury at all while those effected by the PCI can end up with injuries that result in eight figure verdicts.

U.S. HISTORY OF UNDERRIDE GUARD REQUIREMENTS

Vehicle occupants subject to PCI essentially become unprotected road users, similar to the horrors of a collision with a pedestrian, bicyclist, or motorcyclist. The National Highway Traffic Safety Administration (NHTSA) is the regulatory agency with the authority to mandate that adequate protective guards be installed by original equipment manufacturers (OEMs). The NHTSA has even studied the relationship between occupant compartment deformation and occupant injury. 6

The European Union and many other nations (United Kingdom, Brazil, Japan and China), have surpassed the U.S. in regulatory requirements for rear guards, front underrun protection (FUP), and side underride guards (SUGs).⁷ The side guards, however, are primarily intended to protect pedestrians and cyclists from falling under the side of the vehicle and being caught under the wheels. The NHTSA has passed rear underride guard requirements, but no regulatory standards for front override or side underride.

1953 Rear Underride Guard Requirement

backseat passenger window is called the "B Pillar" or center pillar on a four-door sedan. The "C Pillar" is the back near vertical support between the backseat passenger window and the rear window. To learn more see [http://en.wikipedia.org/wiki/Pillar_\(automobile\)](http://en.wikipedia.org/wiki/Pillar_(automobile))

⁶ Eigen, A.M.; Glassbrenner, D., Mathematical Analysis Division, National Center for Statistics and Analysis, U.S. Department of Transportation, National Highway Traffic Safety Administration, *The Relationship Between Occupant Compartment Deformation and Occupant Injury*, DOT HS 809 676, November, 2003.

⁷ United Nations Economic Commission for Europe ECE Regulation No. 73, Lateral Protection; United Nations Economic Commission for Europe ECE Regulation No. 93, Front Underrun Protection; and, United Nations Economic Commission for Europe ECE Regulation No. 58 for Rear Underrun Protection. <http://www.unece.org/trans/main/wp29/wp29regs41-60.html>

The first standard for underride guards on CMVs was issued in 1953 by the Bureau of Motor Carriers. This standard mandated rear guards for vehicles manufactured after December 31, 1952.⁸ This early standard required rear guards to have a minimum height of 30 inches. Guards were not required if the truck had a rear axle / wheel setback for rear tires of 24 inches or less from the rear of the CMV's cargo bed.⁹ This requirement was for both single-unit, straight trucks and combination tractor-trailers.

1967 – Actress Jayne Mansfield's Fatal Accident

On June 29, 1967, national attention was brought to the issue of rear underride guard protection and vehicle crash compatibility when Jayne Mansfield, American actress, was killed as a front seat passenger in a 1966 Buick Electra. In spite of the 1953 rear guard requirement, this Buick hit the back of a tractor-trailer resulting in beyond the windshield PCI.¹⁰ Three adults and three children were involved in the crash. The three adults, Jayne Mansfield, her companion Attorney Sam Brody, and the car driver, Ronald B Harrison were all killed. The actress' three children (eight-year-old Mickey, six-year-old Zoltan, and three-year-old Marie) all survived and were claimed to have been in the back seat of the car. Early media reports wrongly believed Ms. Mansfield to have been decapitated.¹¹

1969 – Failed Regulatory Attempt

In 1969, the NHTSA proposed an advance notice of rule making. Two successful proposals were introduced creating recommended standards that lowered the minimum rear guard height requirements to 18-inches from the ground.¹² A cost benefit analysis was eventually performed determining that the cost of implementing the proposed requirements were not commensurate with the benefits of saving lives and reducing injuries. It was not until a decade later that the Insurance Institute for Highway Safety claimed that the data utilized to cancel the additional rear underride requirements was based on a false assumption of costs.¹³

1977 - Failed Regulatory Attempt

⁸ Blower, D.; Woodrooffe, 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.

⁹ Id.

¹⁰ <http://www.history.com/this-day-in-history/actress-jayne-mansfield-dies-in-car-crash>
<http://www.youtube.com/watch?v=jNCj41jNyfg>

¹¹ Id.

¹² Insurance Institute for Highway Safety (IIHS), The Highway Loss Reduction - Status Report, Underride Hearing Leads to Call for Rulemaking, Vol. 12, No. 6, March 29, 1977, page 8. <http://www.iihs.org/externaldata/srdata/docs/sr1206.pdf>

¹³ Id.

At a 1977 Senate Consumer Subcommittee hearing, led by Subcommittee Chairman Sen. Wendell Ford (D-KY), IIHS President William Haddon, Jr., M.D., testified armed with crash test data, films and analysis to demonstrate that the 1953 (now 25 year-old) rear-guard regulation was faulty. IIHS testing demonstrated that the existing rear guards were inadequate allowing severe damage to the passenger compartment of cars at less than 30 miles per hour.¹⁴ Dr. Haddon concluded, “both the problem of needless passenger compartment penetration in auto-truck rear under ride crashes, and the availability of solutions to it, have been known for years both to industry and government - yet, neither has acted to apply the solutions.”¹⁵

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

Forty-five years after the 1953 rule requiring rear underride guards, the 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.¹⁶ 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.”¹⁷

2011 - Calls For Further Rear Underride Guard Improvement

In 2011, crash-test analysis by the IIHS showed that underride guards on tractor-trailer continued to fail in relatively low-speed crashes in spite of the 1998 regulatory purpose.¹⁸¹⁹²⁰

¹⁴ Insurance Institute for Highway Safety (IIHS), “the highway loss reduction” *Underride Hearing Leads to Call for Rulemaking*, Vol. 12, No. 6, March 29, 1977, page 3. <http://www.iihs.org/externaldata/srdata/docs/sr1206.pdf>

¹⁵ Id. page 5.

¹⁶ 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.

¹⁷ Blower, D.; Woodrooffe, 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.

¹⁸ The American Trucking Association, *Transport Topics*, *Insurance Group Cites Concerns on Underride Guards*, March 1, 2011.

¹⁹ Brumbelow, M.L. and Blonar L., “Evaluation of US Rear Underride Guard Regulation for Large Trucks Using Real-World Crashes.” *Stapp Car Crash Journal* 54: 119-131, 2010.

²⁰ Insurance Institute for Highway Safety. 2011. “Petition for Rulemaking; 49 CFR Part 571 Federal Motor Vehicle Safety Standards; Rear Impact Guards; Rear Impact Protection.” Arlington, VA http://www.iihs.org/laws/petitions/pdf/petition_2011-02-28.pdf The petition

The IIHS once again requested stronger rear guards that will not collapse at lower speeds. The rationale is that occupants in even the best safety engineered vehicle (those receiving the highest frontal crash test safety ratings) still suffer horrific injuries when the rear guard of a tractor-trailer does not remain in place upon impact, resulting in underride and PCI. The NHTSA agreed that the underride regulatory requirements and rear guard performance required further study toward improvement.²¹

Presently, the NHTSA has a website specifically designated for “truck underride.”²² 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.” Found through the NHTSA website are the following two must read studies regarding underride:

“Analysis of Rear Underride in Fatal Truck Crashes, 2008” DOT HS 811 652, August 2012;²³ and,

“Heavy-Vehicle Crash Data Collection And Analysis to Characterize Rear and Side Underride and Front Override in Fatal Truck Crashes” DOT HS 811 725, March, 2013.²⁴

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.”²⁵ Both studies utilized data available through a study performed by the University of Michigan Transportation Institute (UMTRI) known as the Large

requested, among other things, a lower ground clearance from 22 inches and an inclusion of single-unit trucks.

²¹ The American Trucking Association, *Transport Topics*, *Insurance Group Cites Concerns on Underride Guards*, March 1, 2011.

²² National Highway Traffic Safety Administration, *Crashworthiness, Truck Underride* - <http://www.nhtsa.gov/Research/Crashworthiness/Truck%20Underride>.

²³ Blower, D.; Woodrooffe, 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.

²⁴ Blower, D.; Woodrooffe, J.; 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, *Heavy-Vehicle Crash Data Collection And Analysis to Characterize Rear and Side Underride and Front Override in Fatal Truck Crashes*, DOT HS 811 725, March, 2013.

²⁵ Blower, D.; Woodrooffe, 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.

Truck Crash Causation Survey (LTCCS). Unfortunately, the NHTSA report regarding side underride and front override concluded that even further, more accurate reporting was required before mandating front override protection and SUGs.²⁶

Underride Guard Crash Data

Numerous studies have been performed regarding side impacts attempting to decipher the little available crash data from 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.²⁷ 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.²⁸

2014 – The National Transportation Safety Board Urges Action

In a letter dated April 3, 2014, the National Transportation Safety Board (NTSB) urged the NHTSA to take action by the following safety recommendations regarding underride guards:

- < **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;**

- < **Add trailer vehicle identification number and trailer model year to the Fatality Analysis Reporting System database for trailers; and,**

²⁶ Id. at 61.

²⁷ 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, Cammisa 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, Cammisa 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.

²⁸ Id.

< **Work with the Model Minimum Uniform Crash Criteria expert panel to modify crash reports to include the trailer license plate number and trailer vehicle identification number.**²⁹

The above-referenced safety recommendations were followed by this statement, “[t]he NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives.”³⁰

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.³¹ 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.³² As of the date of these materials, the NHTSA remains silent regarding regulatory requirements for side underride guards and front override guards.³³

Underride Guard Requirements In Other Countries

Globally, side guards have been mandatory on CMVs in United Kingdom since 1986.³⁴ 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%.³⁵ Advances toward preventing passenger

²⁹ 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.

³⁰ Id. page 15.

³¹ 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.

³² Id.

³³ 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.

³⁴ On April 15, 2015, Lawrence Simon, Chair of the Trucking Litigation Group of the American Association for Justice and this author, as the Chair of the Trucking Litigation Group’s Underride Committee, met with Senior Research Engineer, Tanya Robinson, who is a well-published author on the issues of side underride guards. Our meeting took place at the annual trade show in Birmingham, England, known as “The Commercial Vehicle Show.” We spent the day with her gathering photographs, data, and learning historical information regarding side underride guard requirements, front underride protection, and rear guard requirements in the United Kingdom and throughout the European Union.

³⁵ Robinson, Tanya; Cuerden, Richard; Transport Research Laboratory, *Safer Lorries In*

vehicles from side underride and energy absorbing front underride protection are continuing in Europe.

The Vehicle Crash Compatibility (VC-Compat) project, funded by the European Commission, focused on test procedures to improve vehicle crash compatibility.³⁶ 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 side underride guard for trailers that prevented PCI.³⁷ The testing devices were designed as aftermarket add-ons or adaptations for conventional trucks or trailers.³⁸ It was concluded that, an all-around underride protection can be realized. It was further recommended that OEMs allow for architectural frame concepts to permit add-on parts that close the critical gaps where cars can underride the heavy vehicle.³⁹

Beyond Compliance

The NHTSA is slow to meaningfully regulate underride guard protection. Therefore, it is incumbent upon local and state Governments, safety advocates, liability insurance companies, and/or trucking company owners to have foresight in seeing the benefit of voluntarily installing underride protection.

A Notice by the Federal Motor Carrier Safety Administration (FMCSA) was issued on April 23, 2015 seeking Public Comment on incentives for motor carriers to institute voluntary safety programs.⁴⁰ The Notice is entitled “Beyond Compliance Program.” The agency signals that it is going to be considering a motor carrier’s “proactive voluntary implementation of state-of-the-art best practices and technologies when evaluating the carrier’s safety.”⁴¹ The agency

London: Identifying The Casualties Associated With Side Guard Rails And Mirror Exemptions, Published Project Report PPR683, 2014.

³⁶ Vehicle Crash Compatibility (VC-Compat) project website:
<http://vc-compat.rtdproject.net/>

³⁷ 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

³⁸ Id. pg 20/27

³⁹ Id. pg 23/27

⁴⁰ The U.S. Department of Transportation, Federal Motor Carrier Safety Administration, Notice; Request For Public Comment, “*Beyond Compliance Program*” Federal Register, The Daily Journal of the United States Government.

<https://www.federalregister.gov/articles/2015/04/23/2015-09463/beyond-compliance-program>

⁴¹ Id.

cites studies on roll stability, tire pressure sensors, lane departure warning, all providing safety benefits but not mandated by regulation.⁴² Why not include rear guards on single-unit trucks, side guards, and front override protection to the list of best practices?

OEM – 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 showing all-around underride protection including the presently unregulated front override protection with a lower front bumper profile and all-around side underride protection.⁴³ With the debut of this concept truck, 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 likely to follow the change already in place on other continents.

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.”⁴⁴ The ordinance requires not only City trucks to have SUGs, but SUGs (lateral protection devices) installed on vehicles contracted by the City of Boston. The complete City of Boston Ordinance is typed below following the conclusion. The hope is that AAJ members share this ordinance with their local and state elected officials to institute similar methods.

CLOCS

Between 2008 and 2013, 55% of cyclist fatalities in London involved a CMV and a disproportionate number were construction vehicles, which are presently exempt from regulatory requirements.⁴⁵ After the study was published, the Construction Logistics and Cyclist Safety (CLOCS) Standard compliance initiative began for the purpose of improving construction CMV safety, including but not limited to SUGs and driver training.⁴⁶ This program is “an industry led

⁴² Jones, K., *FMCSA Seeks Input On Incentives For Voluntary Safety Programs - Agency opens comment period on ‘Beyond Compliance’ concept*, Fleet Owners, April 23, 2015
<http://fleetowner.com/regulations/fmcsa-seeks-input-incentives-voluntary-safety-programs>

⁴³ The trucking industry social media shared numerous photographs of this truck. 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 lecture.

⁴⁴ Mayor Martin J. Walsh, The City of Boston, Letter Addressed To The City Council, dated September 8, 2014.

⁴⁵ 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.

⁴⁶ Construction Logistics and Cyclists Safety (CLOCS) Standard Compliance.

response to improve safety” by creating a common standard for road safety. It is aimed at encouraging voluntary participation in utilizing state-of-the-art techniques to improve vehicle and driver safety.⁴⁷ 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.”⁴⁸

At “The Commercial Motor Vehicle Show” in Birmingham, England, a major Insurance Underwriter, Towergate Insurance, advertized the CLOCs initiative, indicating that participation will result in lower insurance premiums.⁴⁹ 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.⁵⁰

Driver Training

For purposes of this lecture, elements number 2 and 5 are of a particular focus. The **driver training** element is important to any litigation strategy involving an underride collision. The following crash scenarios have been identified as the most common collisions resulting in side impacts and the potential for underride:

1. Lane change or lane departure resulting in a side-to-side collision interaction between same direction vehicles;

<http://www.clocs.org.uk/about/>

⁴⁷ Id.

⁴⁸ Id.

⁴⁹ On April 15, 2015, this author took a photograph of the Towergate Insurance display at the Birmingham, England, “The Commercial Vehicle Show.” The photograph depicts the six elements of the CLOCs Standard compliance requirements and is incorporated into a slide presentation for AAJ attendees.

⁵⁰ This author took a photograph of the Towergate Insurance Display outlining the six elements of the CLOCs Standard compliance requirements.

2. Loss of control resulting in a same direction vehicle then crossing the path of another;
3. Perpendicular front-to-side crashes (intersection collisions, improper backing across lanes, or u-turns);
4. Crossing the centerline into oncoming traffic; and,
5. A truck approaching the vehicle from behind and losing control causing a side impact.⁵¹

By attending AAJ sponsored seminars or AAJ Trucking Litigation Group members-only seminars, attendees will benefit from individual lectures that frequently are dedicated to each of these crash scenarios. Members will learn the subtleties and nuances required to depose the safety director and truck driver on each of these various crash types.

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 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 the aforementioned crash scenarios to exercise further caution to avoid an underride accident. The truck company safety director and/or owner needs 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 voluntary 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.

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.

* * * *

Below is the actual ordinance by the City of Council of Boston requiring SUGs. Please take it back to your local government officials to implement in your City.

⁵¹ Bumbelow, Matthew L., "Potential Benefits of Underride Guards in Large Truck Side Crashes." *Traffic Injury Prevention* 13(6); 592-599

**City of Boston
In the City Council**

Be it ordained by the City Council of Boston, as follows, that the City of Boston Code be amended by adding the following ordinance:

SECTION 1. City of Boston Code, Ordinances, Chapter IV is hereby amended by inserting after Section4-7 the following new section: -

**4-8 AN ORDINANCE REQUIRING CITY VENDORS TO SAFEGUARD
UNPROTECTED ROAD USERS.**

4-8.1 Purpose.

Vehicles covered by this ordinance shall be so constructed and/or equipped as to offer effective protection to unprotected road users against the risk of falling under the sides of the vehicle and being caught under the wheels.

4-8.2 Definitions.

The words defined in this ordinance shall have the meanings set forth below whenever they appear in this section unless the context in which they are used clearly requires a different meaning, or a different definition is prescribed for a particular paragraph or provision.

(I) *Approval of a vehicle* means the approval of a complete vehicle type with regard to its lateral protection.

(ii) *City* means the City of Boston.

(iii) *Department(s)* shall mean those City of Boston Departments, Authorities, Agencies, Commissions and any other instrumentality acting on behalf of another (“Awarding Authorities”) under the supervision of the Mayor or persons appointed by him/her.

(iv) *Contract* means the contract between a Vendor and a Department resulting from a request for proposals or an invitation for bids issued by the City to do any work or to make any purchase.

(v) *Gross weight* means the sum of the weights transmitted to the road surface by all the wheels of the vehicle.

(vi) *Large vehicle* means a motor vehicle with a gross weight exceeding 10,000 lbs; or a trailer with an unladen mass exceeding 10,000 lbs; or a semi-trailer with a gross weight exceeding 26,000 lbs.

(vii) *Lateral protective device* means an apparatus installed on large vehicles between the front and rear wheels to help prevent injuries to unprotected road users, particularly from falling underneath the vehicle.

(vii) *Mayor* shall mean the Mayor or persons designated by him/her.

(ix) *Otherwise qualified* means any Vendor that meets all other criteria for the award of a Contract.

(x) *Unladen mass* means the weight of the vehicle in running order, unoccupied and unloaded, but complete with fuel, coolant, lubricant, tools, and spare wheel, if supplied by the vehicle manufacturer as standard equipment.

(xi) *Unprotected road users* mean pedestrians, cyclists, or motorcyclists using the road in such a way that they are liable to fall under the sides of the vehicle and to be caught under the wheels.

(xii) *Vendor* means any firm, vendor, contractor, or supplier of goods and/or services to the City of Boston, and any of its subcontractors.

4-8.3 Requirements for Large Vehicles.

When any officer or board in charge of a Department or other awarding agency of the City issues requests for proposals or invitations for bids to do any work or make any purchase, said officer or board shall contract with a responsible and eligible Vendor that has also installed, or that demonstrates that it will install, side under-ride guards, convex mirrors, and appropriate warning signage on all large vehicles it uses or will use within the City of Boston in connection with the Contract in preference of otherwise qualified Vendors.

4-8.4 Policy Implementation.

Every Large vehicle or a conventional cab configuration in which more than half of the engine length is forward of the foremost point of the windshield base and the steering wheel hub is in the forward quarter of the vehicle length used by a Vendor in connection with a Contract shall be equipped with convex mirrors, cross-over mirrors, decals, and side under-ride guards affixed to the sides of such vehicles in a manner consistent with this section and with rules and regulations further promulgated by the Boston Transportation Department, the Boston Police Department, and the Inspectional Service Department. As future technical innovations to improve safety for vulnerable road users become available, the City will make efforts to test and update those requirements.

4-8.5 Technical Specifications for the Equipment of Lateral Protective Devices, Convex Cross-over Mirrors, and Safety Decals.

(a) Lateral Protective Devices

Large vehicles must be constructed or equipped in such a way as to offer, throughout their length, effective protection to unprotected road users against the risk of falling under the side of the vehicle and being caught under the wheels. This requirement will be considered satisfied either

1. If the vehicle is equipped with a special lateral protective device (side under-ride guard) in accordance with the requirements of Section 4-8.5b

2. If the vehicle is so designed and/or equipped at the side that, by virtue of their shape and characteristics, its component parts can be incorporated and/or regarded as replacing the lateral protective device.

Components whose combined function satisfies the requirements set out in Section 4-8.5b below are considered to form a later protective device.

(b) Technical Specifications

The lateral protective device can use horizontal rails or a continuous flat surface that meets the following dimensional requirements:

1. The lower edge of the lateral protection device shall at no point be more than 21.5 inches above the ground.

2. The upper edge of the lateral protective device shall not be more than 14 inches below that part of the structure of the vehicle, cut or contracted by a vertical plane tangential to the outer surface of the tires, excluding any bulging close to the ground.

3. Not more than 12 inches to the rear of the vertical plane perpendicular to the longitudinal plane of the vehicle and tangential to the outer surface of the tire on the wheel immediately forward of the guard.

4. The rearward edge of the lateral protective device shall not be more than 12 inches forward of the vertical plane perpendicular to the longitudinal plane of the vehicle and tangential to the outer surface of the tire on the wheel immediately to the rear.

5. The lateral protective device shall not increase the overall widths of the large vehicle and the main part of its outer surface shall not be more than 5 inches inboard from the outermost plane (maximum width) of the vehicle.

6. Every lateral protective device shall be essentially rigid and securely mounted. They shall not be liable to loosening due to vibration in normal use of the vehicle. The lateral protective device shall be considered suitable if it is capable of withstanding a force of 440 pounds applied perpendicularly to any part of its surface by the center of a ram the face of which is circular and not more than 8.5 inches in diameter, and during such application.

7. No part of the side under-ride guard shall be deflected by more than 6 inches; and,

8. No part of the side under-ride guard which is less than 10 inches from its rearmost part shall be deflected by more than 1.25 inches.

(c) Convex Mirrors

Large vehicles must be equipped with convex mirrors to enable the operator of the large vehicle to see all points on an imaginary horizontal line which:

1. Is three feet above the road.
2. Is one foot directly forward from the midpoint upon the longitudinal axis of the front of such large vehicle; and extends the full width of such large vehicle.

(d) Cross-Over Mirrors

Large vehicles must be equipped with convex cross-over Mirrors on the front of the vehicle to enable the operator of the large vehicle with a conventional cab configuration in which at least more than half of the engine length is forward of the foremost point of the windshield base and the steering wheel hub is in the forward quarter of the vehicle length to allow the driver to see:

1. Any person or object at least three feet tall in front of the vehicle.
2. The area from the front bumper to where direct vision is possible.

(e) Safety Decals

Large vehicles must be equipped with a minimum of three (3) safety decals on the rear and sides that warn pedestrians and cyclists of blind spots:

1. Decals should be 'safety yellow' in color.
2. Decals should include language or images warning of the blind spot locations on the vehicle.
3. Decals should be placed, when possible, on or near the lateral protection devices.

4-8.6 Compliance and Enforcement.

(a) Non-compliance with the provisions of this section 4-8 by a Vendor shall be grounds for

I. A fine of \$100 for the first offense on a Contract, escalating to \$150 for the second offense, and \$200 for the third offence.

ii. Termination of the Contract.

(b) This section 4-8 shall be enforced by the Inspectional Services Department's Weights and Measures Division and the Boston Police Department. The Boston Police Department and The Inspectional Services Department shall determine non-compliance with the provisions of this section 4-8 and any applicable regulations and may make recommendations, if any, to the contracting Department.

(c) The Inspectional Services Department shall issue, for a Vendor's large vehicles, a compliance certification through a vehicle inspection of convex mirrors, lateral protective devices, and decals prior to the date Vendor begins work on a Contract. A fee to cover the costs associated with inspection will be determined by the Commissioner of the

Inspectional Services Department and passed on to the Vendor.

(d) Vehicle compliance will be certified with a sticker denoting the year of inspection. Inspections must be updated Biennially.

(e) Vendors may file for a waiver as stipulated in section 4-8.7. Waiver of applications must be made in writing at the time of contract bid to the Commissioner of Inspectional Services, the Department requesting services, and the Commissioner of Transportation. Waiver applications filed after contract bids will not be considered.

(f) Inspectional Services Department shall issue an annual report to be filed with the Mayor and the City Clerk and transmitted by the Clerk to the City Council on the actions undertaken by the Inspectional Services Department on enforcement of this ordinance no later than May 31st of each year. The annual written report shall include, but not be limited to, the following items for the twelve (12) month period prior to the report's due date:

1. Any financial costs to the City associated with this ordinance;
2. The number of vehicles this ordinance applied to;
3. The number of vehicle exemptions, if any;
4. The total number of inspections performed by inspectors and any subsequent violations of this ordinance; and,
5. Evaluation of safety performance on equipped vehicles from Boston EMS and BPD reports of incidents.

4-8.7 Waiver.

(a) If a Vendor or Department determines that extenuating circumstances exist which prevent the Vendor from complying with this section 4-8, then such Vendor or Department may request an exemption from compliance to the City of Boston with its provisions. Waivers are issued at the sole discretion of the City of Boston.

(b) This ordinance does not apply to;

(I) A motor vehicle which has a maximum speed not exceeding 15mph;

(ii) An agricultural trailer;

(iii) A fire engine;

(iv) An emergency medical vehicle;

(v) A vehicle which is being driven or towed to a place where by previous arrangement a side under-ride guard is to be fitted so that it complies with this section 4-8;

(vi) Vehicles used solely for the purpose of snow removal;

- (vii) Street sweeper vehicles; and,
- (viii) City of Boston Fleet Vehicles purchased before July 1, 2014.

4-8.8 Conformity with Existing State and Federal Law.

This section shall be implemented in conformity with state and federal law.

4-8.9 Severability.

The provisions of this section are severable and if any provision, or portion thereof, should be held unconstitutional or otherwise invalid by any court of competent jurisdiction, such unconstitutionality or invalidity shall not affect the remaining provisions, which shall remain in full force and effect.

4-8.10 Effective Date.

- (a) This section shall take effect one hundred and eighty days after passage and shall apply to all new Contracts awarded and to all renewal terms of existing Contracts executed after that date.
 - (b) City of Boston fleet vehicles purchased after July 1, 2014 that are Large Vehicles as defined herein will be required to comply with the provisions of this section.
 - (c) The Inspectional Services Department, Boston Police Department, and the Transportation Department shall issue rules and regulations to implement the provisions of this section within ninety days of the date it take effect.