Biennial Report to Congress and the Secretary of the Advisory Committee on Underride Protection

06.18.2024

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I. Majority Report of the Advisory Committee on Underride Protection

Crashes involving large commercial trucks are a leading cause of traffic-related death in America today with over 5,900 fatalities in 2022 (the last year for which data is available), representing an increase of 75% since 2009.[1] Over 160,000 people were injured,[2] causing estimated economic losses well over $170 billion, adjusted for inflation.[3] [4] A subset of those crashes is especially deadly: underride crashes in which victims experience life-threatening injuries to their heads and torsos due to the intrusion into the passenger vehicle occupant survival space of the high bottom edge of the trailers and the wheels of large commercial trucks or their cabs. Passenger compartment intrusion (PCI) can result in traumatic brain injuries, decapitation, Le Fort facial fractures, severe crush injuries, especially due to extended treatment and extrication time, as well as burning to death from fiery crashes.

The problem of lethal underride crashes has been known to the U.S. Department of Transportation (DOT) since its founding in 1967. Actress Jayne Mansfield died in an underride crash in that year. Thousands more have been killed or seriously injured due to underride since then and continue today. The National Highway Traffic Safety Administration (NHTSA) maintains the Fatality Analysis Reporting System (FARS), which contains data on all crashes involving a motor vehicle on a public road that results in the death of a vehicle occupant or non-occupant within 30 days of the crash. As DOT, until very recently, never encouraged the collection of underride crash data, exact figures of underride fatalities over time do not exist. However, a conservative overall estimate of underride crashes and fatalities over the 50 years since NHTSA was formed can be made utilizing FARS data: 25,100 underride crashes and 31,500 corresponding fatalities from side underride, rear underride, and front override crashes, averaging 630 underride-caused fatalities per year. They break down as follows:

- 7,850 side underride crashes and 8,950 corresponding fatalities, averaging 179 per year;

- 10,050 rear underride crashes and 14,350 corresponding fatalities, averaging 287 per year; and

[1] Overview of Motor Vehicle Traffic Crashes in 2022, NHTSA, Apr. 2024, DOT HS 813 560.
[2] Id.
[3] 2022 Pocket Guide to Large Truck and Bus Statistics, FMCSA, Dec. 2022, RRA-22-007.
[4] CPI Inflation Calculator, BLS, Jan. 2020 to Jan. 2023, available at <https://www.bls.gov/data/inflation_calculator.htm>

- 7,200 front override crashes and 8,200 corresponding fatalities, averaging 164 per year.[5]

In addition, NHTSA counts hundreds of thousands of incapacitating injuries per year due to vehicle crashes.[6]

Underride fatalities are caused by the physical mismatch between the dimensions of large commercial trucks (their sides, rear and front bumpers) and the passive safety features of other vehicles that share the roads with them. Bumpers, crumple zones, and restraint systems (airbags and seat belts) do not prevent PCI of the semitrailer's bottom edge (in the case of side and rear-underrides) or the truck cab (in the case of front underrides). Decades of public and private sector crashworthiness research, standards, rules, and technological innovation are useless in protecting passenger lives due to the physical mismatch that causes underrides.

Pedestrians, bicyclists, and motorcyclists are even more vulnerable (known as Vulnerable Road Users or VRUs) and can be crushed to death under the rear axles of large commercial trucks and trailers due to the lack of a physical barrier preventing them from sliding under the trailer boxes of single-unit and tractor-trailer trucks.

Underride deaths are gruesome and horrific. Underrides crashes are also extremely costly. Municipal emergency medical services and police incur much greater strain on resources when underrides occur compared to crashes that do not involve underride. More emergency personnel must be assigned to underride crashes for longer periods of time, and all of those costs are borne by taxpayers. The trucking industry also pays a high price for underrides, in the form of delayed delivery of transported goods, vehicle damage, civil lawsuits, loss of commercial driving license, and even jail time. It is worth noting that most long haul carriers have the ability to install underride protection systems without exceeding their weight limits. DOT research has found that "most long haul truck shipments cube-out before they weight-out", despite protestations from industry saying otherwise.[7]

Reducing the number of underrides crashes and increasing survivability is an attainable goal. Addressing the mismatch between the high bottom edge of large commercial truck trailers or their massive cabs and the bumpers of passenger vehicles is necessary to permit passenger vehicle passive restraints to protect human lives. Crumple zones and restraint systems can only work as intended when light passenger vehicles strike a physical barrier that provides sufficient vertical overlap. Automobile and motorcycle automatic braking technologies only work when their radar systems detect a

[5] Letter from Eric Hein to James Myers, Apr. 30, 2024, available in Appendices (online at https://www.regulations.gov/comment/NHTSA-2023-0012-2092).

[6] See Table 15, "KABCO-to- MAIS Translators, 2022 Update," DOT HS- 813 420 (Apr. 2023)(online at https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813420).

[7] USDOT Comprehensive Truck Size and Weight Study (Vol 3, Chap.4, p. IV-20), FWHA, August 2000.(available online at https://www.fhwa.dot.gov/reports/tswstudy/Vol3-Chapter4.pdf).

physical obstacle. The gaping open space under large commercial trucks defeats these safety innovations, many of which are deployed due to government-mandated rules. Physical underride guards, known as rear impact, side impact, and front impact guards, are necessary. Their effectiveness will be augmented when they are combined synergistically with truck crash avoidance technologies such as properly maintained conspicuity tape and automatic emergency braking on trucks to mitigate the closing speeds of crashes when they occur.

In 1999, known as the "second founding" of the DOT, Congress required that the Department pursue "safety as the highest priority, recognizing the clear intent, encouragement, and dedication of Congress to the furtherance of the highest degree of safety in motor carrier transportation."[8] In 2021, Congress passed Section 23011(d) of the Infrastructure Investment and Jobs Act (IIJA), creating the Advisory Committee on Underride Protection.[9] Section 23011(d)(1) required the Secretary of Transportation to establish the ACUP to "provide advice and recommendations to the Secretary on safety regulations to reduce underride crashes and fatalities relating to underride crashes." Section 23011(d)(6) required the ACUP to submit a biennial report to the Senate Committee on Commerce, Science, and Transportation and the House Committee on Transportation and Infrastructure that:

> (A) describes the advice and recommendations made to the Secretary; and
> (B) includes an assessment of progress made by the Secretary in advancing safety regulations relating to underride crashes.

This report satisfies Section 23011(d)(6).

The Advisory Committee on Underride Protection (ACUP) utilized a simple majority standard to adopt motions for Advice and Recommendations to the Secretary. Every controlling authority that imposes requirements on the ACUP does not use or define the word "consensus." The word does not appear in Section 23011 of the Infrastructure Investment and Jobs Act which created the ACUP. Similarly, there is no reference to "consensus" in the Federal Advisory Committee Act, which is the law that governs federal advisory committees. Additionally, the word "consensus" does not appear in guidance documentation produced by the General Services Administration that governs federal advisory committees. Finally, there is no consensus definition or requirement found in the ACUP Charter of its By-Laws.

[8] Pub. L. No. 106-159 (1999), codified at 49 U.S.C. § 113.
[9] Pub. L. No. 117-58 (2021), Section 23011(d).

The only mention of the word consensus that does occur, is in a Federal Register Notice, which has no legal effect or requirement. The Notices Section of "Federal Register 101," a US government publication reads as follows:

> The final section [of the Federal Register] contains documents describing official actions and functions of an agency that affect the public or provide important information, **but do not amend the CFR [Code of Federal Regulations]**. They **do not impose requirements with general applicability and legal effect** and do not affect a rulemaking proceeding. Some notices are required to be published by law, for example, advisory committee meeting notices, notices of the availability of environmental impact statements, and certain orders or decisions affecting named parties.
> (https://www.federalregister.gov/uploads/2011/01/fr_101.pdf)

The ACUP was created by an Act of Congress that explicitly defines the various categories of stakeholders whose views merit representation on the ACUP and the number of representatives each category is allotted. The majority of ACUP representatives agreed that in order to provide the most impactful advice and recommendations on "safety regulations to reduce underride crashes and fatalities relating to underride crashes" (per Sec 23011 of the IIJA) a simple majority standard for "consensus" was required.

A. Advice and Recommendations to the Secretary

The ACUP advises and recommends the following actions (as adopted by a majority of ACUP members and grouped by subject).

1) Rulemaking

Side underride

- NHTSA should withdraw its previously submitted advance notice of proposed rulemaking (ANPRM) or reissue a revised ANPRM and cost-benefit analysis that acknowledges and accommodates critiques made by commenters that the cost-benefit approach taken artificially constrained the number of lives saved and also failed to account for cost-savings (such as fuel efficiency gains provided by side underride guards).

- NHTSA should complete a new side impact guard cost-benefit analysis and rulemaking that counts previously omitted underride victim categories, including pedestrians, bicyclists, and motorcyclists.

- NHTSA should require all new semitrailers and single-unit trucks that have crash-incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.

- NHTSA should require semitrailers, and single-unit trucks manufactured after 1998 that have crash-incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.

- NHTSA should require side guards to also prevent a vulnerable road user (VRU) from passing underneath the guarded vehicle in an interaction with the side of the vehicle.

Rear underride

- The 2022 Rear Impact Guard Rule should be amended to require that all new trailers meet the IIHS TOUGHGUARD test protocol or equivalent, which includes the ability to withstand a 30% rear overlap crash at 35 mph.

- NHTSA should review and update FMVSS 223/224 standards in response to advancements in technology.

- All trailers manufactured between 1998 to the current time that do not have IIHS TOUGHGUARD awarded rear impact guards should be retrofitted with crash-proven reinforcement device(s). These reinforcement devices, at minimum, should be tested and proven to prevent underride, mitigate PCI and create crash compatibility consistent with a TOUGHGUARD awarded rear impact guard when attached to a minimally compliant FMVSS 223 rear impact guard.

- NHTSA should regulate single-unit trucks (SUTs) with the same rear impact guard standards that currently only apply to semitrailers.

- FMCSA & NHTSA must expeditiously complete Heavy Vehicle Automatic Emergency Brake Rulemaking for all classes of Commercial Motor Vehicles.

- FMCSA should issue stronger conspicuity tape requirements, at a minimum, a requirement to maintain and replace conspicuity tape every 5 years. [*Note – Industry commonly states the lifespan of a trailer is ten years, this equates to one replacement per lifespan of the trailer as conspicuity tape is notoriously poorly maintained]*

- FMCSA should require Single Unit Trucks to adhere to conspicuity tape requirements

Front underride

- NHTSA should issue an Advanced Notice of Proposed Rulemaking on Front Impact Guards.

- NHTSA may harmonize with global front override regulations, including UNECE-93 and any revisions to it, in order to provide improved motor vehicle safety, as indicated in Section 24211 of the IIJA:

> *The Secretary shall cooperate, to the maximum extent practicable, with foreign governments, nongovernmental stakeholder groups, the motor vehicle industry, and consumer groups with respect to global harmonization of vehicle regulations as a means for improving motor vehicle safety.*

2) <u>Research</u>

- NHTSA should expeditiously conduct rear impact guard testing at "highway speeds" (up to 65 mph) as IIJA already directed NHTSA to do (Sec 23011 (b)(2)(A,B) and publish the results within two years

- The ACUP shall recommend in its report that NHTSA create a field in the Fatality Analysis Reporting System to determine if an underride crash occurred involving a large truck and a pedestrian/cyclist.

- NHTSA should conduct a study to research how the survivability rate of rear underride crashes will change with increased passenger vehicle adoption of Automatic Emergency Braking at currently tested speeds (35 mph) as well as highway speeds (up to 65 mph).

- NHTSA should conduct comprehensive research on U.S. underride crash characteristics, including the frequency of 30 percent overlap crashes.

- DOT should continue research into Enhanced Rear Signaling Systems that could help better prevent rear underride crashes.

- DOT should research the efficacy of high visibility Clearance Lamps that illuminate the rear of a CMV to assist with potential Clearance Lamp rulemaking for all CMVs.

- DOT should conduct research into efficacious methods of reducing Distracted Driving such as flashing lamps.

- The department should conduct a study of conspicuity tape in service. This study focuses on actual rates of compliance with the regulated minimum reflectivity requirements, the ability of enforcement personnel to accurately and adequately enforce these requirements, and make recommendations on how to reduce the most common forms of non-compliance found.

- NHTSA should assess risks associated with deflection into adjacent lanes associated with partial offset rear crashes as well as side underride crashes. Final results should be made public.

- The ACUP shall recommend in its report that NHTSA request that the Department of Transportation's Volpe Center evaluate the effectiveness of a side underride guard to determine if their effectiveness is similar or greater than Lateral Protective Devices in mitigating the severity of pedestrian, cyclist, and motorcyclist fatalities.

- NHTSA should work with the Federal Railroad Administration to conduct research on potential impacts of side underride guards during highway-rail grade crossings and that research be made publicly available.

- NHTSA should investigate the potential for collision mitigation technologies for light and heavy-duty vehicles to prevent or reduce the risk associated with side underride crashes.

- The ACUP shall recommend in its report that DOT explore the need for Federal weight limit weight-based exemption for side underride guards.

3) <u>Miscellaneous</u>

- The ACUP shall recommend that DOT disseminate educational material in additional to existing brochure for law enforcement to help them identify and record side underride crashes.

- FMCSA should work with State law enforcement and other stakeholders to emphasize education and the need to issue rear impact guard violation citations and encourage maximum fines for violations affecting safety.

- NHTSA/DOT should provide the ACUP with all scoping documents, directions, and discussions between NHTSA/DOT and Elemance with regard to the rear guard analytical work between 2018 and 2024.

- NHTSA/DOT should provide the ACUP with all scoping documents, directions, discussions, test results, data, memoranda, reports and/or notes generated before, during, and following quasi-static testing of trailer rear underride guards conducted by Karco or other contractors on behalf of NHTSA/DOT between 2016 and 2024.

- NHTSA/DOT should produce all documents related to rear guard standards including test data, contracts, studies, scoping documents, analyses, reports, memoranda, and/or other communications or references related to trailer and/or straight truck rear guard strength, design, quasi static or dynamic testing, and/or test protocols between 1970 and 1998.

- NHTSA, per the Modernizing Regulatory Review Executive Memo and corresponding guidance, must fully account for regulatory benefits that are difficult or impossible to quantify when conducting rulemaking analysis.

- The ACUP report shall reflect whether each committee member concurs or does not concur with the report by allowing each member to make a statement of concurrence or non-concurrence with the report. The ACUP report include such documentation in an Appendix.

B. Assessment of DOT's Progress in Advancing Safety Regulations Relating to Underride Crashes

The United States lags behind many nations in adopting requirements for impact guards designed to prevent injuries and deaths from underride crashes.[10] DOT has not lead any significant requirements for underride protection since 1996. NHTSA's 2022 rear-impact guard final rule merely imitated a 2004 Canadian standard that had been adopted in previous decades by nearly all trailer manufacturers. NHTSA's 2023 ANPRM on side impact guards, while technically still an open rulemaking, concluded that the benefits of preventing side underride deaths are far outweighed by the costs, making further side impact guard regulation highly unlikely (more on that below).

Pressure from the truck and trailer industry has been a factor. In 1970, DOT began a rulemaking to require commercial trucks to be equipped with rear impact guards capable of withstanding 50,000 lb test force along all points of the guard, from the center to the outer edge.[11] But the trucking industry influenced the agency to withdraw it. According to a contemporaneous New York Times article, "Abandonment of the proposal was a victory for organized truckers and manufacturers of heavy trucks and trailers. They had vigorously opposed it on grounds that the cost would be unjustifiably high and that it would prove to be an excessive economic burden on the industry. They had also challenged its value in saving lives and reducing injuries."[12] DOT would not try again until 1996. When they did, the standard they proposed was weaker than the previous one by nearly 80%.[13]

In 2004, Transport Canada departed from its history of deferring to its southern neighbor and issued a standard for rear impact guards that would take the U.S. another generation to adopt.

In the meantime, private-sector safety advocates developed even more protective safety standards. The Insurance Institute for Highway Safety (IIHS) developed performance standards and carried out transparent safety testing for their

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[10] Forty-three nations, in addition to the countries of the European Union, have adopted UN Regulation 73, which requires trucks to be equipped with lateral protective devices having a maximum ground clearance of 550mm. Brazil, Peru, China have similar laws. Since 1979, Japan has required trucks and trailers to install lateral protective devices allowing for no more than 450mm of ground clearance. See Appendix A of A Literature Review of Lateral Protection Devices on Trucks Intended for Reducing Pedestrian and Cyclist Fatalities, Federal Motor Carrier Safety Administration (May 2020) (online at https://rosap.ntl.bts.gov/view/dot/49250).

[11] National Highway Safety Bureau, Notice of Proposed Rulemaking, 49 CFR Part 571, Rear Underride Protection, Trucks and Trailers (Aug. 13, 1970).

[12] *Agency Drops Safety Plan Opposed by Trucking Men*, New York Times (July 19, 1971)(online at https://www.nytimes.com/1971/07/19/archives/agency-drops-safety-plan-opposed-by-trucking-men.html).

[13] Comparison of rear impact guard standards, 1970, 1993, 2022, presentation by Aaron Kiefer, Collision Safety Consulting, "Rear Underride Prevention," available in Appendices.

TOUGHGUARD rear impact guard. This performance standard required underride prevention when the rear of the trailer was struck at 35 mph by a midsize passenger car with a horizontal overlap of 100%, 50%, and 30%. It was eventually voluntarily adopted by nine major semitrailer manufacturers, some of which offer compliant guards as standard, others as an option.

Yet when DOT finally adopted the 19-year-old Canadian standard, it rejected Congress' encouragement to modernize it with the safety advances developed by trailer manufacturers in response to IIHS testing. As a result, the 2022 rear impact final rule scarcely made a perceptible advance in public safety, since nearly all trailer manufacturers had already complied with the Canadian standard. NHTSA has not moved forward with meaningful rear-impact guard requirements for single-unit trucks, leaving these large trucks without any underride guard requirement other than a 1953 rule issued by the now-defunct Interstate Commerce Commission that contains no strength requirements for the guards.

Prior Assessments

Over the past decade, components within the U.S. government have expressed frustration at NHTSA's slow and inadequate response to underride crashes.

In 2013 and 2014, the National Traffic Safety Board (NTSB) recommended that the NHTSA issue regulations requiring rear impact guards that prevent underride "from full-width and offset trailer rear impacts," side-impact guards, and "visibility enhancement systems" to enable truck operators to detect passenger cars, bicyclists, motorcyclists, and pedestrians.[14] But NHTSA did not follow all of NTSB's recommendations, so NTSB wrote in 2015, "We are disappointed by the lack of progress you have made toward requiring a side underride protection system and are concerned that you consider this issue a secondary priority." More than two years later, NTSB wrote again to NHTSA, observing, "We are disappointed that you have not updated us regarding your progress toward developing performance standards and requirements for…side underride protection systems." NTSB deemed NHTSA's resistance to taking recommended action on side underride guards to be "unacceptable."[15]

The Government Accountability Office (GAO) has also criticized NHTSA and questioned NHTSA's basis for rejecting NTSB's side guard recommendation, concluding that, "NHTSA has not performed research on the overall effectiveness and

[14] National Traffic Safety Board Recommendations, H-14-001-007 (Apr. 13, 2014). NTSB first recommended that NHTSA require side guards in 1971 (National Transportation Safety Board Recommendation #H-71-042 (1971) Washington, DC (online at http://www.ntsb.gov/doclib/recletters/1971/H71_34_42.pdf).

[15] National Traffic Safety Board Recommendation Report, Recommendation # H-13-013, relaying correspondence to NHTSA, dated Mar. 30, 2015 and Nov. 13, 2017, publicly released on Feb. 27, 2023, pursuant to the Freedom of Information Act request of Marianne Karth (NTSB reference #R-2023-00004).

costs associated with or the design of side underride guards." GAO also questioned NHTSA's rear impact rulemaking, noting that IIHS had concluded, "NHTSA overestimated the additional weight of the rear guards, thereby overestimating the cost by about 35 to 40 percent. IIHS also stated that due to concerns with the underlying data, NHTSA underestimated the number of crashes into the rear of single-unit trucks with passenger compartment intrusion."[16]

ACUP's Assessment

During the period of ACUP's charter, but prior to NHTSA's convening the first meeting of the ACUP, DOT issued a final rule on rear underride protection and an advance notice of proposed rulemaking on side underride protection. These rulemakings did not significantly advance safety, and NHTSA declined to produce the basis for critical subjective assumptions it relied on when they were issued stating that the ACUP did not merit access to review deliberative materials. This conclusion is contested (see Appendix C), and NHTSA declined the ACUP's appeals to the contrary.

1. Rear Underride Protection

The Department promulgated a final rule on rear impact guards, published on July 15, 2022. That action came in response to a law passed in 2021 by Congress, which required the DOT to end a five-year delay in publishing a final rule mandating the installation of rear impact guards on tractor-trailers meeting standards established in its 2015 NPRM. In the 2021 law, Congress gave the Secretary discretion to determine whether rear impact guards should be even more protective and prevent death and injury in crashes where "30 percent of the width of the passenger motor vehicle overlaps the rear of the trailer or semitrailer." The Department had declined to require that standard in its 2015 NPRM. In 2022, Congress again directed the Department to publish its final rule on rear impact guards, but went further and required the Department's rule to meet the testing standards of the Insurance Institute for Highway Safety, which include the 30% overlap scenario, allowing for the DOT Secretary's discretion.[17]

But the final rule did not require rear impact guards to meet a 30% overlap standard.[18] It merely requires trailer manufacturers to meet standards that 94% of the

[16] Government Accountability Office, Truck Underride Guards: Improved Data Collection, Inspections and Research Needed (GAO-19-264)(Mar. 2019) (online at https://www.gao.gov/assets/gao-19-264.pdf).

[17] Joint Explanatory Statement, Division L, Consolidated Appropriations Act of 2022, Pub. L. No. 117-103 (Mar. 15, 2022) (online at https://docs.house.gov/billsthisweek/20220307/BILLS-117RCP35-JES-DIVISION-L.pdf).

[18] Federal Motor Vehicle Safety Standards; Rear Impact Guards, Rear Impact Protection, 87 Fed Reg 42339 (Jul. 15, 2022) (to be codified at 49 CFR Part 571) (online at https://www.federalregister.gov/documents/2022/07/15/2022-14330/federal-motor-vehicle-safety-standards-rear-impact-guards-rear-impact-protection).

industry already voluntarily meet to comply with 2004 Canadian regulations.[19] According to the Insurance Institute for Highway Safety, "NHTSA's updated rule does not go far enough to be meaningful... While the new standard is an improvement over the old one, nearly all newly manufactured guards on trailers already meet this new standard."[20]

NHTSA relied upon a number of unsupported assumptions in the final rule to justify its decision not to require protections meeting the 30% overlap scenario. To assess the agency's progress in advancing public safety, the ACUP formally requested NHTSA's basis for these methodological assumptions. NHTSA responded that the ACUP "should review" technical documents and published standards that are available online. These documents left much to be desired in terms of increasing the ACUP's understanding behind NHTSA's rationale and remains an open question:

- NHTSA excluded from its cost-benefit analysis the 30% overlap impact protection design marketed by Stoughton Trailers, which the manufacturer claims does not add weight or fuel costs.[21] Furthermore, NHTSA made the following unsupported assertion:

  > It does not appear feasible engineering-wise for the additional material (two steel vertical members on the outer edge of the horizontal member that is bolted to a reinforced undercarriage) not to add weight or cost to the trailer. Accordingly, NHTSA decided not to include this guard design in this analysis.

- NHTSA concluded that "trailers that have the main vertical supports for the guard more outboard *may not perform as well* in full overlap crashes as trailers that have the vertical supports more inboard" (emphasis added).

- NHTSA applied a 50% reduction in estimating the incremental beneficial effectiveness of rear guards meeting a 30% overlap standard.

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[19] According to IIHS, "While the new standard is an improvement over the old one, nearly all newly manufactured guards on trailers already meet this new standard, which is similar to a longstanding Canadian requirement." IIHS press release, "New Federal Rule on Truck Underride Protection Does Not Go Far Enough," (July 6, 2022) (online at https://www.iihs.org/news/detail/new-federal-rule-on-truck-underride-protection-does-not-go-far-enough).

[20] Insurance Institute for Highway Safety press release, *New Federal Rule on Truck Underride Protection Does Not Go Far Enough* (July 6, 2022) (online at (https://www.iihs.org/news/detail/new-federal-rule-on-truck-underride-protection-does-not-go-far-enough).

[21] Stoughton Trailers website, "Rear Impact Guard," (online at https://www.stoughtontrailers.com/products/rear-impact-guard). Stoughton Trailers claims, "The rear guard resists compartmental intrusion of an automobile when the location of impact is at 30% to 100% overlap of the width of the car to the underride guard," with "no added weight," "no negative impact on aerodynamics," and "no additional costs."

- NHTSA did not explain its decision to use telephone interview data collected by the University of Michigan Transportation Research Institute (UMTRI) to establish estimates of overlap and underride, in direct opposition to the advice of UMTRI researchers, who stated: "Collecting the data by means of telephone interview with people on the scene well after the fact probably is not sufficient to accurately measure degrees of underride."[22]

- NHTSA did not apply a 28% reduction to the estimated cost to account for NHTSA's estimate of the percentage of newly manufactured trailers and semitrailers that already met the 30% overlap standard, as expressed in footnote 19 of the final rule ("There were 211,807 new trailers sold in 2020, among which 65 percent (137,675 = 211,807 x 0.65) are required to be equipped with rear impact guards. Among applicable trailers, 28 percent are already equipped with guards that mitigate PCI in 30 percent overlap crashes").

- NHTSA did not explain how its estimate of underride guard weights exceeded the actual measured weights of guards by over 60%[23]

- NHTSA did not explain its basis for establishing that rear underride guards would have zero effectiveness at any speed above 35 mph

- NHTSA concluded that "available data do not show that a standard for a 30 percent overlap crash at 35 mph would be reasonable, practicable, or appropriate for *all* the vehicles subject to FMVSS No. 223 and FMVSS No. 224" (emphasis in original).

2. Side Underride Protection

On April 21, 2023, NHTSA issued an ANPRM on side underride protection. NHTSA concluded that the costs of side underride guards outweighed their benefits. NHTSA wrote, "On a per trailer basis, the total discounted lifetime costs of equipping new trailers and semitrailers with side underride guards is *six to eight times* the corresponding estimated safety benefits" (emphasis added) and a mere 17.2 preventable deaths per year. While technically still an open rulemaking, NHTSA's cost-benefit conclusion all but precludes a future side-guard requirement.

The ANPRM, while supported by the truck and trailer industry, raised serious questions by other industry stakeholders. IIHS's Matthew Brumbelow submitted as a

[22] Daniel Blower and Kenneth L. Campbell, "Underride in fatal rear-end truck crashes," SAE Technical Paper 2000-013521 (2000)(online at https://www.jstor.org/stable/i40194386).

[23] See Table 2 in IIHS comment to NHTSA Docket 2015-0070 (online at https://www.regulations.gov/comment/NHTSA-2015-0070-0019).

public comment an eight-page analysis identifying serious deficiencies that led NHTSA to severely undercount preventable fatalities and also presented slides to the Committee:

- excluding multiple vehicle crashes, which likely account for around 25% of side underride deaths;

- excluding crashes that involved an initial impact with the passenger vehicle's side, roof, or any preceding impact with another object;

- excluding crashes occurring at the 1 o'clock, 5 o'clock, 7 o'clock, and 11 o'clock locations on the tractor trailer, which increase the number of deaths by 50%;

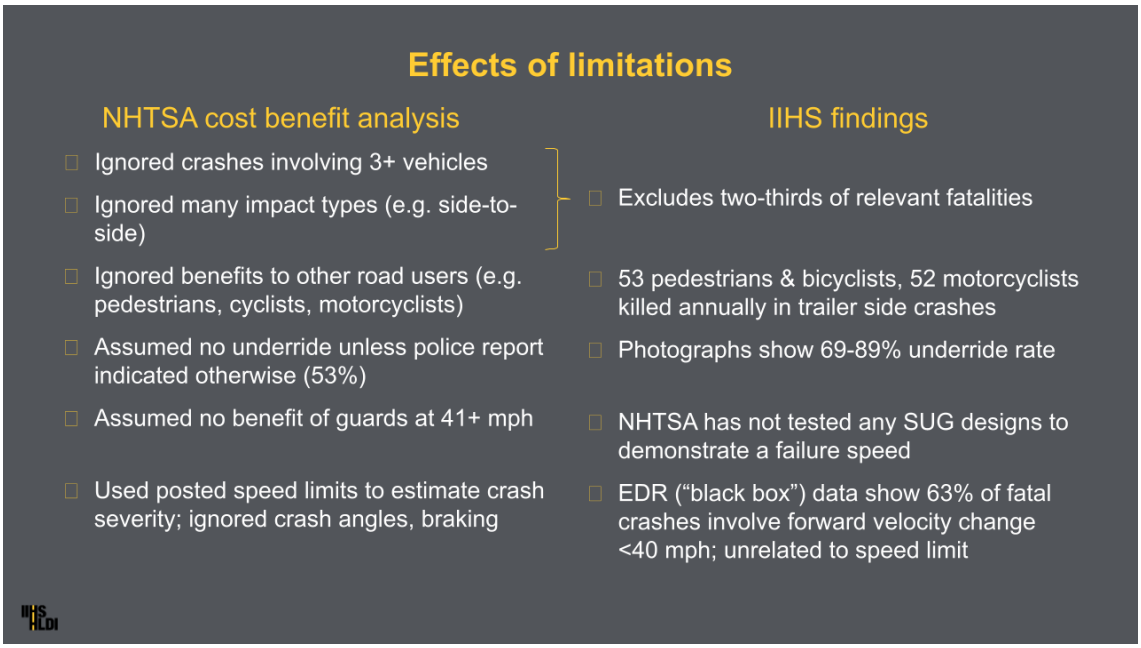
- excluding pedestrian, bicyclist, and motorcyclist fatalities involving the side of a trailer, which account for over 100 deaths per year;

- failing to utilize photographic crash documentation from the Large Truck Crash Causation Study or another source to establish underride incidence and severity rather than relying on phone interviews;

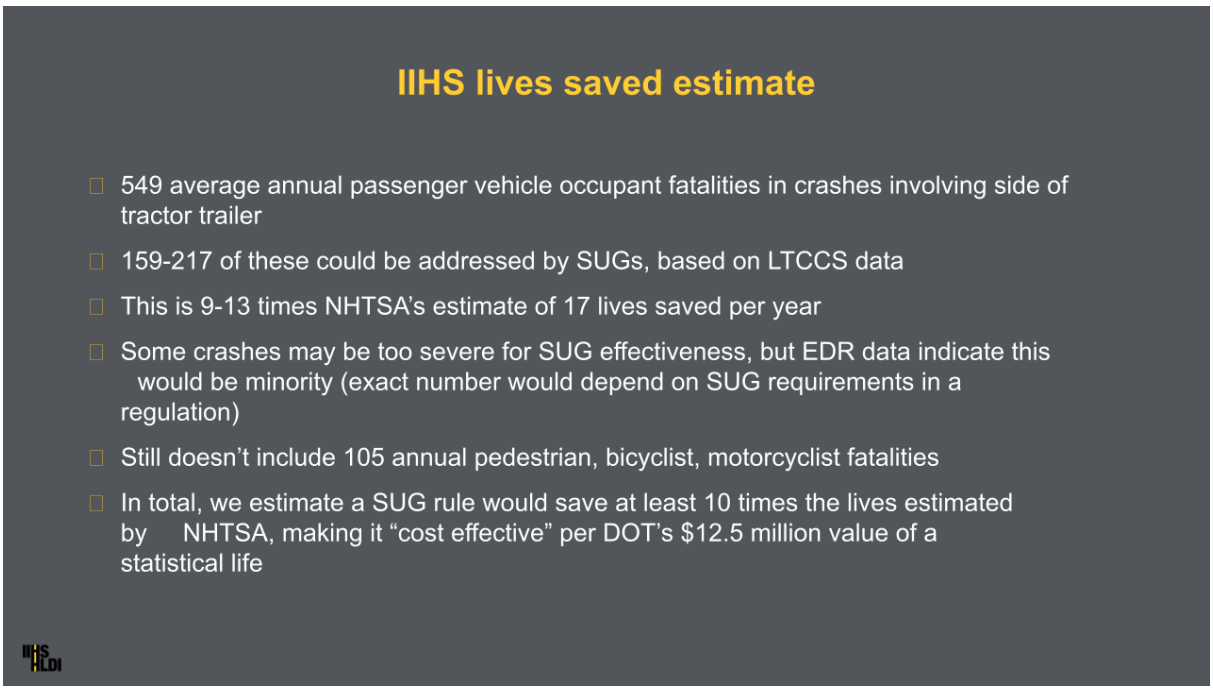
- assuming that underride did NOT occur, unless FARS database evidence indicated otherwise when academic studies have documented that underrides constitute the majority (69-89%) of side impact crashes;

- assuming that side impact guards would have zero beneficial safety effect at speeds over 40 mph.;

- utilizing unreliable estimates of impact speed (posted speed limit, police pre-crash estimates, evidence of braking, witness statements) while not utilizing electronic Event Data Recorder recordings of actual crash severity. IIHS studied EDR data contained in crash databases maintained by NHTSA and found no statistical correlation between crash severity and posted speed limits in fatal crashes as well as gross errors of police pre-crash estimates, causing NHTSA to exclude two-thirds of fatalities on the basis of speed.



The remainder of the IIHS public comment provided a detailed alternative analysis, with tables, graphs, and data. Correcting for NHTSA's unnecessarily restrictive approach, IIHS found, "relevant fatalities are roughly 9-13 times the 17.2 lives NHTSA estimated could be saved by a standard." Mr. Brumbelow spelled out IIHS's analysis and conclusion — that side impact guards are cost-effective.



To assess the agency's progress in advancing public safety, the ACUP requested from NHTSA its basis for assumptions that were identified as unjustified in IIHS's public comment. NHTSA responded that the ACUP "should review" technical documents and published standards that are available online, which were less than satisfactory, leaving this an open question. Ultimately, NHTSA declined to produce to the ACUP the basis for its reliance on the following methodological assumptions underlying the agency's conclusion that the costs outweigh the benefits of requiring side guards.

- NHTSA's cost-benefit analysis did not include fatalities from side-underride crashes involving: 1. pedestrians; 2. bicyclists; and 3. motorcyclists, thereby reducing the benefit of preventing underride fatalities.

- NHTSA did not count fatalities from crashes involving single-unit trucks, which reduced the benefit as well as the cost of preventing underride fatalities.

- In determining the number of preventable fatalities, NHTSA assumed that none of the side impact crashes it studied involved a side underride, unless evidence from police reports indicated to the contrary, in spite of academic findings that most side impact crashes (69-89%) result in underride.

- NHTSA counted only crashes with an estimated speed of up to 40 mph, assuming that side impact guards would have no protective value in crashes exceeding that speed, even though a 2018 NHTSA report demonstrated the effectiveness of side impact guards at speeds up to 50 mph.

- NHTSA failed to use their 2022 survey and reporting of all the semitrailer manufacturers regarding their side underride data, tests, analyses, and studies.

- NHTSA used posted speed limits and police estimates to determine the speed of crashes, rather than data from modern electronic event data recorders. Those recorders enable the determination of the change in velocity experienced by the passenger car, which is the effective speed of its crash and the force causing fatalities. According to IIHS, this oversight alone reduced the number of preventable fatalities and their benefit value in NHTSA's cost-benefit analysis by a factor of three.

- Although the Office of Management and Budget requires that baseline economic costs of Federal regulatory rulemaking actions are measured, NHTSA ignored

this requirement in the cost-benefit analysis, leaving the societal cost of side underride crashes and fatalities unclear and ambiguous.

- NHTSA did not make use of all relevant taxpayer-funded research to improve the accuracy of its estimate of the number of preventable fatalities. According to IIHS, had NHTSA drawn from federal data sources such as the Large Truck Crash Causation Study, its estimate of the number of preventable fatalities would have been 10 times greater. Correcting this oversight alone would have led NHTSA to conclude that the benefits of side underride guards outweigh the costs.

- NHTSA ignored the benefits of cost savings from fuel efficiency attributable to aerodynamic side skirts on side impact guards.

- NHTSA excluded from its consideration a currently available side guard-equipped trailer from a major manufacturer (Utility Trailer). It opted instead to base its cost calculation only on one retrofit product (AngelWing), rather than applying a discount that reflected reasonable economies of scale. NHTSA implausibly explained the exclusion this way:

> [They] have not been included in this analysis of guard costs and benefits because information needed for conducting the analysis are not available for these designs.

- In 2022, NHTSA denied a Petition to promptly initiate a safety defect investigation of semitrailers lacking side underride guards by concluding in a Federal Register notice that the issues raised in the Petition would be best addressed by a forthcoming Advisory Committee on Underride Protection.[24] However, NHTSA never informed the ACUP of the Petition, nor did NHTSA reveal the responses to its survey of all semi trailer manufacturers, which gathered submissions of side underride data, tests, analyses and other relevant information.

3. Front Underride Protection

[24] *See* National Highway Traffic Safety Administration, "Denial of petition for a defect investigation," Docket No. NHTSA–2022–055 (July 5, 2022) 87 FR 39899-39901 (online at https://www.federalregister.gov/documents/2022/07/05/2022-14165/denial-of-motor-vehicle-defect-petition-dp21-004). *See also* National Highway Traffic Safety Administration, Letter from the Office of Defects Investigation to Wabash National Corporation regarding a Defect Petition (DP21-004) concerning the lack of side underride guards on select semi-trailers and to request certain information. NEF-106ns (Dec. 9, 2021) (online at https://static.nhtsa.gov/odi/inv/2021/INIM-DP21004-86397P.pdf).

Front underride protection is designed to prevent a large commercial truck from riding up over the vehicles into which it crashes, supplementing the truck's inadequate front bumper. NHTSA has never issued a rule on front underride protection.

However, publicly-financed research undertaken in 2002 by the University of Michigan Transportation Research Institute (UMTRI) found that "Crashes involving the truck's front … account for most fatal and serious injuries." UMTRI also found that a "reduction of up to 27%-37% in fatality counts is possible by preventing underride."[25]

In 2009, the NTSB investigated a front underride crash in Miami, Oklahoma in which a semitrailer killed 10 occupants in three vehicles. The NTSB formally recommended in 2010 that NHTSA "develop performance standards for front underride protection systems for trucks with gross vehicle weight ratings over 10,000 pounds" and "require that all such newly manufactured trucks be equipped with front underride protection systems meeting the performance standards."[26] NHTSA has still not acted satisfactorily on those recommendations. In 2020, NTSB rejected the agency's request to accept its ongoing research into crash avoidance systems and close the open recommendations due to NTSB's "concern by the slow pace of your progress."[27]

In 2014, in response to a petition for comprehensive rulemaking on rear, side, and front underride protection, NHTSA said it was "still evaluating the Petitioners' request to improve…front override guards and will issue a separate decision… at a later date."[28] To date, ten years later, NHTSA has not issued the promised decision.

4. Automatic Emergency Braking

On April 29, 2024, NHTSA finalized a new Federal Motor Vehicle Safety Standard (FMVSS) that will make automatic emergency braking (AEB) standard on all passenger vehicles by September 2029.[29] These AEB systems will be required to

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[25] "Heavy Truck Aggressivity Reduction: Statistics, Analysis, and Countermeasures," Final Report, University of Michigan Transportation Research Institute, (Nov. 25, 2002)(online at https://trid.trb.org/view/702653).

[26] National Traffic Safety Board, "Truck-Tractor Semitrailer Rear-End Collision Into Passenger Vehicles on Interstate 44, Near Miami, Oklahoma, June 26, 2009," Highway Accident Recommendations #H-10-012 and H-10-013, Report NTSB/HAR-10/02, Washington, DC (2009)(online at https://www.ntsb.gov/investigations/AccidentReports/Reports/HAR1002.pdf).

[27] "Webpage: NTSB Open Recommendations to NHTSA" (online at https://www.nhtsa.gov/ntsb-open-recommendations-nhtsa)(accessed April 27, 2024), and NTSB Safety Recommendation #H-10-013, "Official Correspondence" (May 26, 2020)(online at https://data.ntsb.gov/carol-main-public/sr-details/H-10-013).

[28] "Federal Motor Vehicle Safety Standards; Rear Impact Guards, Rear Impact Protection," Docket No. NHTSA-2014-0080 (July 10, 2014)(online at https://www.federalregister.gov/documents/2014/07/10/2014-16018/federal-motor-vehicle-safety-standards-rear-impact-guards-rear-impact-protection).

[29] NHTSA, Final Rule, Federal Motor Vehicle Safety Standards; Automatic Emergency Braking Systems for Light Vehicles, 49 CFR Parts 571, 595, and 596 (online at https://www.nhtsa.gov/sites/nhtsa.gov/files/2024-04/final-rule-automatic-emergency-braking-systems-light-vehicles_web-version.pdf).

detect and brake to avoid or mitigate a crash with a stopped lead vehicle or with a pedestrian. Crashes with stopped lead vehicles must be completely avoided at speeds up to 62 mph and mitigated at speeds up to 90 mph.

In the past both NHTSA and representatives of the trucking industry have suggested AEB on passenger vehicles and/or large trucks could serve as an alternative to adequate underride protection.[30] While the new FMVSS undoubtedly will reduce the number of crashes between passenger vehicles and large trucks and, therefore, the number of underride fatalities, crash prevention and underride protection must be pursued concurrently to provide the maximum safety benefit. On its own, the new FMVSS represents an incomplete response to the societal harm caused by underride crashes for the following reasons:

a) The FMVSS requires passenger vehicle AEB systems to respond to stopped lead vehicles, when that lead vehicle is another passenger vehicle. Large trucks and trailers are not included as part of FMVSS testing. Research by IIHS has indicated that current AEB systems are less effective at preventing crashes with large truck lead vehicles.[31]

b) Even when passenger vehicle AEB systems are capable of detecting a stopped large truck, crashes will still occur in many scenarios. Examples include: crashes on curves or with offset alignment, which are not included in the FMVSS scenarios; higher speed crashes, which may be mitigated but not completely avoided; situations where evasive action taken by the driver results in AEB deactivation but does not prevent the crash; or crashes where a preceding impact results in the passenger vehicle striking the trailer.

c) Passenger vehicle AEB systems are unlikely to operate in most of the common scenarios that produce large truck side underride. In his presentation to the ACUP, Matthew Brumbelow shared research indicating almost half of trailer side impacts involved a “parallel” configuration in which the passenger vehicle and

[30] In its comment to NHTSA’s side underride guard ANPRM, the American Trucking Associations stated: “ATA believes that efforts to decrease and eliminate side underride crashes should be focused on preventing the crash from occurring in the first place. The mitigation method proposed by NHTSA [side underride guards] would force the trucking industry to expend limited resources on unproven designs with limited potential benefits, when we could instead focus efforts on proven and emerging mechanisms to reduce the likelihood of crashes occurring altogether. The transportation industry’s focus should be on crash avoidance achieved by advanced driver assistance systems (ADAS), such as automatic emergency braking.” (online at https://www.regulations.gov/comment/NHTSA-2023-0012-2063). *See also*, NTSB Safety Recommendation #H-10-013, “Official Correspondence” (May 26, 2020)(online at https://data.ntsb.gov/carol-main-public/sr-details/H-10-013).

[31] Cicchino, J. B., & Kidd, D. G., “Are front crash prevention systems less effective at preventing rear-end crashes where trucks and motorcycles are struck?” Traffic Injury Prevention (2024)(online at https://doi.org/10.1080/15389588.2024.2321910).

truck were initially traveling the same direction and one of the vehicles entered the adjacent lane. Another 25% of crashes involved a configuration in which the vehicles were initially traveling opposite directions prior to the passenger vehicle impact with the side of the trailer.[32]

d) While NHTSA has indicated that it is pursuing a separate rulemaking for large truck AEB, it has not yet been issued when this report was published, so front underride crashes remain unaddressed by crash avoidance regulation. Equipping large trucks with AEB is an important part of a comprehensive approach to preventing these crashes, but on its own, the technology will be subject to similar limitations as those mentioned above for passenger vehicle AEB systems.

e) Even with AEB requirements for new vehicles, it will take many years for this technology to be fully deployed in the U.S. vehicle fleet. Based on a voluntary commitment made by passenger vehicle manufacturers, nearly all of their vehicles produced in the year up to September 2023 were equipped with AEB.[33] The Highway Loss Data Institute has predicted it will be 2045 before 95 percent of all registered vehicles have the technology.[34] Improved underride protection on commercial trucks and trailers has the potential to reduce injury and fatality risk immediately for all passenger vehicles, regardless of their AEB status.

5. Allegations of Suppression of Underride Research Received by the ACUP

During the ACUP's deliberations, on June 13, 2023, FRONTLINE/ProPublica aired an investigative documentary, *America's Dangerous Trucks*, which made the revelation that a DOT research report on side guard protections intended to prevent underride fatalities of bicyclists and pedestrians had been heavily edited at the request of trucking industry lobbyists. When the Department published the report in 2020, major portions were "stripped and the results were changed. Most of the work was never published," according to an anonymous source inside DOT.[35]

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[32] "An Alternative Estimate of the Lives that Could be Saved by a Side Underride Guard standard," Matthew Brumbelow, IIHS. See appendices.

[33] IIHS, "Automakers fulfill autobrake pledge for light-duty vehicles,"(Dec. 21, 2023)(online at https://www.iihs.org/news/detail/automakers-fulfill-autobrake-pledge-for-light-duty-vehicles).

[34] "Predicted availability of safety features on registered vehicles — a 2023 update," (online at https://www.iihs.org/media/d14b1461-8b21-4d54-908d-6ebdcc25b82d/1NXhqg/HLDI%20Research/Collisions%20avoidance%20features/40-02-feats.pdf).

[35] "America's Dangerous Trucks," FRONTLINE/ProPublica (Jun 13, 2023)(online at https://www.pbs.org/wgbh/frontline/documentary/americas-dangerous-trucks/). See also Thompson, A.C., and K. Mehrotra, "DOT Researchers Suggested a Way to Make Big Trucks Safer. After Meeting With Lobbyists, Agency Officials Rejected the Idea," ProPublica and FRONTLINE (Jun 22, 2023)(online at https://www.pbs.org/wgbh/frontline/article/department-transportation-truck-side-guards-trucking-lobbyists-safety/).

In April 2024, Mr. Quon Kwan, the retired FMCSA project manager who conceived, proposed, and oversaw this research, submitted notarized statement to the ACUP and offered to testify before the ACUP to present the findings that DOT removed from the final publication and their potential implications to subsequent cost-benefit analyses. NHTSA did not allow the ACUP to discuss or hear his statement and referred the matter to the Department's Office of Inspector General.

These are very serious allegations that potentially have significant impacts to regulatory efforts. The unpublished Volpe Center final report's finding of cost-effectiveness would have been relevant to the agency's 2023 rulemaking on side impact guards, if the rulemaking's cost-benefit analysis had included the benefits of preventing pedestrian and bicyclist fatalities and achieving fuel efficiency cost savings with aerodynamically-designed side impact guards on both semitrailers and single-unit trucks. But it did not. The exclusion of those benefits led in significant part to the rulemaking's conclusion that the costs of regulation outweigh the benefits. The entirety of Mr. Kwan's statement and materials supplied to the ACUP are included as appendices to this report (Appendices C & D).

It is the assessment of the ACUP that NHTSA excluded relevant data from its cost-benefit analysis for its ANPRM on side impact guards. Disturbing allegations have been made regarding the potential suppression of or interference with publicly funded side-underride guard research by the Volpe Center that needs to be assessed by an impartial investigator. **The fact cannot be ignored that very little has changed regarding side underride guard advancements in the last 50 years and no substantial progress has been made by DOT to prevent these horrific crash fatalities and injuries.**

Majority Report authored by Lee Jackson, ACUP Chair

II. Minority Report

Biennial Report to Congress and the Secretary

MINORITY REPORT

OF THE

ADVISORY COMMITTEE ON UNDERRIDE PROTECTION

Table of Contents

I. Executive Summary

The Biennial Report fails to provide Congress and the Secretary with the requested consensus advice on reducing underride crashes and associated fatalities and injuries. While the Advisory Committee on Underride Protection ["**ACUP**"] did offer some recommendations aligned with this goal, most of the Committee's recommendations as contained in the Biennial Report reflect only the preconceived views and biases of a slim majority of Committee members, who wrote a report that both included significant material never considered by the ACUP in its deliberations and omitted items that did not further the majority's desired narrative.

The dissenting opinion strongly advocates for objective and evidence-based studies before the Secretary adopts comprehensive underride-related regulations. Specifically, immediate efforts should focus on obtaining reliable, scientifically grounded data that accurately describes the scope of the underride problem, the ability to solve that defined problem with available technologies, and the cost of doing so, including costs imposed through unforeseen consequences.

Regarding side-underride guards, further investigation is needed to assess their effectiveness in preventing fatalities and injuries, as well as the specific crash scenarios leading to those outcomes. Additionally, research should explore potential unforeseen consequences resulting from adopting side-underride guard technology, such as additional fatalities or injuries resulting from damage to trailers, high centering, and increased trips required by cargo displacement.

For rear-impact guards, additional research is needed to evaluate the benefits of enhanced requirements. Although most trailers currently meet the TOUGHGUARD standard, the extent of additional fatality reduction achievable through stronger regulations remains unclear. Investigating secondary impacts resulting from collisions with reinforced rear guards is crucial.

Lastly, the dissenting opinion recommends that the National Highway Traffic Safety Administration ["**NHTSA**"] should prioritize crash-avoidance requirements and distracted-driver mitigation measures to prevent underride accidents proactively. On many of these issues, the ACUP demonstrated true consensus, particularly those recommendations emphasizing collision avoidance for both passenger vehicles and tractor trailers, and those promoting technologies that enhance driver awareness and encourage collision prevention.

II. The Majority Report[1] does not meet NHTSA's unambiguous directive to the Advisory Committee on Underride Protection to provide "written consensus advice"; many of the Report's key recommendations fall far short of any recognized definition of "consensus."

The Bipartisan Infrastructure Law established the ACUP to "provide advice and recommendations to the Secretary of Transportation on safety regulations to reduce underride crashes and fatalities relating to underride crashes."[2] At the designation of the Secretary, NHTSA directed that the ACUP, in carrying out this function, perform the following functions, among others: gather information, deliberate, and then "provide ***written consensus advic*e** to the Secretary on underride protection to reduce underride crashes and fatalities relating to underride crashes"(emphasis supplied).[3] This requirement is echoed in ACUP's Charter.[4]

We believe all ACUP members share a dedication to improving highway safety, saving lives, and reducing underride fatalities. For this reason, the ACUP members united behind 18 substantive motions, in each instance passing the motion by with at least two-thirds voting in favor. These substantive motions – calling for additional research on underride crash characteristics, rulemaking for Automatic Emergency Braking and front override, enhanced conspicuity requirements, research on avoiding collisions into trailers through lamp technologies, and work on assessing benefits to pedestrians, bicyclists, and motorcyclists, among other topics– are all listed in Appendix B to the Minority Report. This was the Committee working as it should, with give and take and arriving at views that represented the consensus advice it was directed to provide.

But this is only part of the story. Despite the ACUP members' commitment to improving highway safety, saving lives, and reducing underride fatalities, our meetings

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[1] Mr. Lee Jackson, the Chair of the ACUP, agreed to prepare the Report for submission to Congress and the Secretary. Recognizing that many of the votes of the ACUP did not have true broad-based support, the ACUP voted at its March 13, 2024 meeting to have a "Minority Report" that would accompany the "Majority Report" prepared by Mr. Jackson. The entire Biennial Report submitted to Congress and the Secretary, except for this Section II ("Minority Report") and Appendix III.B ("Individual ACUP Member Reason for Concurrence or Dissent") is Mr. Jackson's synthesis alone of what was the "majority view" of the ACUP. From time to time in this "Minority Report," Mr. Jackson's submission is referred to as the "**Majority Report**."

[2] Public Law 117-58, section 23011(d)(1).

[3] 87 FR 40347.

[4] Advisory Committee on Underride Protection, NHTSA Docket No. NHTSA-2022-0052 (4. Description of Duties: The Committee shall act solely in an advisory capacity. Duties include the following: … c. ***Providing written consensus advice*** to the Secretary on underride protection to reduce underride crashes and fatalities relating to underride crashes" (emphasis supplied)).

clearly exposed disagreements about the most practical policies to achieve such objectives. Unfortunately, ACUP lost its commitment to working in a collaborative and consensus manner over the course of these discussions. In our opinion, this eliminated ACUP's ability to produce a unified, fair, and reputable report. This is exemplified by the fact that the Majority Report was produced solely by ACUP Chair Lee Jackson.

Over its two years, the ACUP gathered information (although, much of it, as discussed below, lacked scientific basis and instead was based on anecdote), and deliberated. But it failed completely to meet the key mandate from NHTSA – to arrive at and provide "***written consensus advice***" from its work. Rather, the slimmest majority of Committee members used a distorted definition of "consensus" to make pre-arranged recommendations that barely reflected a majority view, let alone a "consensus" view. The result is that the so-called Majority Report reflects views of those who from the very beginning were and are committed to requiring underride guards on semitrailers, regardless of the evidence-based demonstrated benefit, the cost, or the danger to the motoring public from unintended consequences.

Safety advocacy representatives manipulated their numerical advantage in Committee membership and the departure of an impartial Chairperson beginning in February 2024 to minimize opposing viewpoints of ACUP participants. At its February 8, 2024 meeting, a bare majority of the ACUP members considered the NHTSA's directive to provide "consensus advice" and decided (with only 9 of the 16 members present voting in favor; although not reflected one way or the other in the minutes, the best recollection is that the remaining seven voted against the motion) to redefine the word "consensus" in the context of ACUP's work to mean a simple majority.[5]

There can be no doubt that the term "consensus" means more than a simple majority; it requires a much higher level of agreement, as recognized by wide-ranging authorities.[6] We have not located any reputable contrary authority defining

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[5] Advisory Committee on Underride Protection, February 8, 2024, Meeting Minutes, p. 2, "Welcome and Call to Order" – ⁋. 5.

[6] For example, the *Oxford English Dictionary* defines "consensus" as "Agreement in opinion; the collective unanimous opinion of a number of persons"; *Black's Law Dictionary* (10th ed) defines "consensus" as "A general agreement; collective opinion" (citing Floyd M. Riddick & Miriam H. Butcher, *Riddick's Rules of Procedure 56 (1985)* for the following: "The regular method for the chair to use is to ask the members, 'Is the consensus of this meeting that. .. agreed to?' or, 'Is it the will of the assembly that. .. is this agreed to?' or, 'Is there an objection?'. .. . "); *Collins Dictionary* defines "consensus" as "general agreement among a group of people," and lists as synonyms "agreement, general agreement, unanimity, common consent"; *Merriam Webster* defines "consensus" as (1)(a) general agreement: UNANIMITY; (b) the judgment arrived at by most of those concerned; (2) group solidarity in sentiment and belief." The Thesaurus lists 40 synonyms and similar words for "consensus" – none of those is "majority"; and the American National Standards Institute's *Manual on Motor Vehicle Traffic Crashes,* 8th ed. (ANSI D.16-2017)

"consensus" as did those ACUP members interested in having recommendations reflect the views of a simple majority of members rather than views arrived at after hard work directed at obtaining general agreement. The "Majority Report" certainly does not mention any. Had NHTSA been interested in the views of a simple majority of the ACUP members voting (i.e., 50% +1), NHTSA would have said so. Instead, it asked for a "consensus." Unfortunately, the Majority Report fails to deliver this.

The Majority Report recognizes that it has a problem with its successful manipulation to make recommendations based only on a majority vote. At the end of its narrative, it attempts to justify its decision by noting that the consensus requirement is not in the Infrastructure and Investment and Jobs Act ["**IIJA**"] or in the Federal Advisory Committee Act ["**FACA**"]. Also, according to the Majority Report, it is not in the ACUP's Charter or bylaws and appears only in the Federal Register notice, which, according to the Majority, has no legal effect.[7]

But the Majority Report is misleading, at best. First, although the majority states that "there is no consensus definition of requirement found in the ACUP Charter or the Bylaws," this is simply wrong. The "Charter for Advisory Committee on Underride Protection" lists in its "Description of Duties," "The Committee shall act solely in an advisory capacity. Duties include the following: … c. Providing ***written consensus advice*** to the Secretary on underride protection to reduce underride crashes and fatalities relating to underride crashes" (emphasis supplied). This requirement, which was inserted in the NHTSA docket on June 27, 2022, was then included in the Federal Register notice published on July 6, 2022 soliciting applications for appointment to the Committee. Every one of the individuals who voted to redefine consensus as majority knew from the moment that person applied for an ACUP position that NHTSA was seeking "written consensus advice" – it is disingenuous to suggest that these individuals applied and worked relying on the absence of such a term in IIJA.

Second, in focusing on the language of IIJA, the Majority Report ignores the role of NHTSA. All the requirements of IIJA regarding ACUP are directed to "the Secretary." The Federal Register notice, which the majority claims has no effect, noted that NHTSA was soliciting recommendations to the ACUP, and cited as authority 49 C.F.R. § 1.95, which delegates authority to NHTSA's administrator to act. NHTSA's administrator then prepared the Charter and the Federal Register notice requiring that the report provided to the Secretary and Congress contain "written consensus advice." This is the standard NHTSA's leadership wanted the ACUP to use in providing recommendations to the Secretary. It is a valid requirement in the duties of the ACUP and should not be

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notes that consensus is established when "substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority …."

[7] Biennial Report to Congress and the Secretary of the Advisory Committee on Underride Protection, Section 1.A, pp. 4-5.

permitted to be ignored or thwarted by a linguistic exercise that redefines the word consensus to mean something it does not.

A. Significant preconceived biases by certain ACUP members preordained many of the ACUP's recommendations.

That a simple majority decided to make its decisions the ACUP's recommendations is not surprising in light of the ACUP's composition. A significant number of those who applied for and were selected to the Committee were bent from the beginning on requiring underride guards; the result was that those who wished to see underride guards installed on trailers, regardless of whether they were cost justified or supported by evidence, were overrepresented.

The IIJA required that ACUP members be selected from 10 groups. Members of four of those groups – families of underride crash victims; truck safety organizations; motor vehicle crash investigators, and the insurance industry[8] - were predisposed (and as it turns out unyielding) in their desire to make sure the ACUP's recommendations strongly favored underride guards. A significant number of Committee members hold ties to multiple representative groups. As such, this skewed the ACUP's composition.

The two victim representatives (Marianne Karth and Jane Mathis), predictably, are in favor of underride guards of all kinds and any added protection that would reduce fatalities and injuries, often without regard to unintended consequences or cost.[9] The two representatives of the truck safety organizations (Harry Adler and Jennifer Tierney) also are vocal proponents of underride guards. Mr. Adler worked for the Truck Safety Coalition[10] from 2015 through 2020, including as Executive Director, and is now Co-chair and Principal of the Institute for Safer Trucking.[11] Ms. Tierney was on the Truck Safety Coalition's Board of Directors with Mr. Adler, as it turns out is ACUP member Lee Jackson. Also, Ms. Tierney is a victim of underride, and her insistence from the very beginning that the ACUP recommend underride guards is understandable.

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[8] Pub. L. No. 117-58 (2021), Section 23011(d)(2).

[9] Ms. Karth, for example, has petitioned Congress and NHTSA on behalf of underride guards; her website and the promoted "Stop Underride Crash Tour" are devoted to this issue, among others. *See https://annaleahmary.com/*; and meeting on November 9, 2023, with Advocates for Side Underride Guards, Docket No. NHTSA-2023-0012, ANPRM – Side-Underride guards on trailer and semitrailers – RIN:2127-AM54.

[10] According to its website, the Truck Safety Coalition is dedicated to reducing the number of deaths and injuries caused by truck-related crashes (https://trucksafety.org/about-tsc/) and supports underride guards (https://trucksafety.org/issues/).

[11] According to its website, the Institute for Safer Trucking is committed to reducing crashes, injuries, and fatalities involving large trucks in the United States and lists as its "Top Priorities" "Improving Underride Protection" (https://www.safertrucking.org/about).

The representatives of the motor vehicle crash investigators are Lee Jackson and Aaron Kiefer. As noted, Mr. Jackson – who is the sole signatory of the Majority Report and chaired the ACUP after Adrienne Gildea of the CVSA resigned – is a Director of the Truck Safety Coalition with its dedication to supporting underride guards. Mr. Kiefer, a consulting engineer with Accident Research Specialist, is the founder of Collision Safety Consulting founded "to develop truck and trailer guards." He is the inventor of the SafetySkirt, a rubber-band-type underride guard, and his is website (https://www.trailerguards.com/) is filled with information about the dangers of underride and preventing underride through underride guards. Were NHTSA to adopt a requirement for side-underride guards, he might stand to benefit economically as a supplier of such a guard. He appears on the "Stop Underrides Crash Tour" wearing a shirt supporting those efforts, and frequently serves as a paid expert witness in litigation opining that an underride guard could have prevented injury in a given accident and that a trailer without such a guard is defectively designed and manufactured.

Finally, Matthew Brumbelow and Clair Mules represent the insurance industry. Mr. Brumbelow, who is well-known to the Department, is the Senior Research Engineer for the IIHS. The IIHS has conducted tests of the AngelWing guard, and the organization roundly criticized NHTSA's study of the potential impact of side guards, with Mr. Brumbelow himself claiming both on the IIHS website and in a presentation to the ACUP that NHTSA's study understated by roughly 10 times the benefits of side guards.[12] We have not located any information one way or the other suggesting that Ms. Mules was predisposed to support underride guards.

It is worth noting that no other group of ACUP members appears to have had such preconceived commitments to a point of view when joining the Committee. The trailer manufacturer representatives – John Freiler and Kristen Glazner – have been open to underride guards. The Truck Trailer Manufacturers Association, where Mr. Freiler serves as Vice President of Engineering, for example, has said repeatedly, including in statements filed with the government, that it "will support rulemaking that calls for installation of side guards if they are shown to be technologically feasible and justified." Similarly, Wabash International has developed a side-underride guard and demonstrated it on a trailer at a national trucking show. The other engineer representative, Jeff Bennett, is the President and CEO of Utility Trailer Manufacturing Company, LLC, and formerly was the Vice President of Product Design and Manufacturing. Utility Trailer has developed its own Side-Impact Guard and installed it on roughly 65 trailers, and it has conducted extensive testing both of its guard and the

[12] https://www.iihs.org/news/detail/nhtsa-study-underestimates-benefits-of-side-underride-guards-for-trucks.

only other guard commercially available, the AngelWing.[13] Indeed, Utility Trailer has more trailers on the road with side-impact guards than do all other suppliers of side-impact guards combined.

B. ACUP members who joined the Committee intent on recommending underride guards prevented the Committee's recommendations from being based on anything other than a simple majority decision.

The individuals described above had an agenda from the beginning of the ACUP: to recommend side guards. And allowing all recommendations to be decided by a simple majority directly furthered that goal.

As noted, the vote to define "consensus" as majority was decided by a 9 out of 16 people voting in favor. And then, when a motion was made to provide a proper definition of consensus, the group resisted it. Mr. Jackson, who by then had been elected the replacement Chair, refused to allow the motion (which was brought by Engineer Jeff Bennett) to proceed at the February 8, 2024 meeting because under Robert's Rules of Order, he said, someone who originally voted in favor of the definition of consensus as majority must bring the motion – this excluded Mr. Bennett.[14] There is no such Rule when bringing up a new motion on the same topic.[15] Notably, ACUP's bylaws state that, "Robert's Rules of Order will be used for the conduct of ACUP business unless it is in conflict with legal requirements, these bylaws, or the charter." However, Robert's Rule of Orders were loosely and selectively followed throughout ACUP proceedings.

Following Mr. Jackson's attempt to avoid the motion by an erroneous application of the Rules, Mr. Doug Smith (who had originally voted for the motion) agreed to bring up the motion at the next meeting. Mr. Jackson moved Mr. Smith's motion to the end of the meeting and when it came up, he attempted to avoid having it heard: first, by repeating

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[13] Numerous times during ACUP's meetings, Mr. Bennett offered to buy two sets of SafetySkirts from Mr. Kiefer so that they could be tested, evaluated, and the results of those tests reported. Mr. Kiefer refused to provide a price and imposed conditions on any potential transaction that he did not impose on other potential customers and that are atypical in the industry. Mr. Bennett ultimately concluded that Mr. Kiefer does not have a commercially available product.

[14] Minutes, March 13, 2024 ACUP Meeting, p. 3: "Motion 1 was Mr. Bennett's motion to change consensus to two-thirds. Mr. Jackson reiterated per Robert's Rules, someone who voted for the original motion would have to reconsider."

[15] Rather, the restriction cited by Mr. Jackson applies only to a "Motion to Reconsider," which is not what Mr. Benett's motion advocated. To the contrary, Robert's Rules allows anyone to reintroduce a motion or bring up a motion at a later meeting, which is exactly what Mr. Bennett did. MRSC "Changing Course: Using Robert's Rules to Alter a Prior Action," https://mrsc.org/stay-informed/mrsc-insight/january-2021/using-robert-s-rules-to-alter-a-prior-action.

his erroneous claim that the motion could not be considered, and – when that gambit was rejected – by attempting to run out the clock by ending the meeting before it could be considered.[16] Only intervention by NHTSA's James Myers, and the persistence of the motion's proponent Doug Smith, prevented Mr. Jackson's attempts to derail the motion entirely. At the very end of the meeting, a vote was taken. The motion to properly define consensus as something greater than a majority then failed, but the vote was 8-9 against, again the barest majority (Motion B16). Of the nine votes rejecting a proper definition of consensus, eight of those came from the individuals previously mentioned.[17]

C. The decision to improperly define consensus as a simple majority significantly affected the ACUP's recommendations and defeated the mandate to provide "consensus advice."

The simple majority vote redefining consensus had the effect of removing the consensus requirement from the ACUP's chartered duties. This had significant repercussions for what became listed as ACUP's recommendations, enabling a group of 7-8 ACUP members, all with similar backgrounds and biases, to vote as a unified bloc and dictate the majority recommendations of the ACUP, regardless of whether those recommendations reflected a true consensus.

Following the baseless redefinition of "consensus," ACUP adopted dozens of proposed motions that merited substantive opposition. These finalized motions contradict the duties of a Committee designed to identify recommendations that garnered broad agreement. Instead, ACUP has advanced numerous policies that were supported by a slim margin of Committee members. This is wholly unacceptable and a dramatic departure from previous Advisory Committee work conducted under the oversight of U.S. Department of Transportation. The move that transformed "consensus" into a simple majority resulted in a final report that lacks legitimacy.

The ACUP recommendations are largely based on the ACUP's vote on a total of 42 motions – 20 voted on at the March 13, 2024, meeting, and a further 22 at the April 24 and May 22, 2024 meetings. Importantly, the list of votes contained in the Appendix to the Majority Report is not accurate.[18] That list omits motions, does not always match the

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[16] *See* Video recording of April 24, 2024 meeting, beginning at 3:55:16, showing Mr. Jackson's attempt to avoid having the motion considered and delaying a vote since the meeting was required to end in a few minutes.

[17] Minutes, April 24, 2024 ACUP Meeting, p. 7 (referred to in these minutes as Motion 16). *See* ACUP Spreadsheet recording individual votes of ACUP members for March 13, April 24, and May 22 meetings.

[18] The "Record of ACUP Motions' contained in the Appendix to the Majority Report is not accurate and does not match the motions considered as described in the meeting minutes. For example, the minutes of the March 13, 2024, meeting show that 31 motions were considered, but only items 1 through

motion numbering to what is used in the minutes from the meeting, and uses confusing Roman numerals (presumably because the same numbering was used in the March 13, 2023 meeting and again started in the April 24 meeting). To avoid or at least minimize this confusion, the Minority Report includes as Appendix H its "Corrected Record of ACUP Motions and Votes," which is a revised table of all motions considered by the Committee, regardless of whether they were later withdrawn or combined with other motions. Those considered during the March 13, 2024 meeting now have an "A" prefix followed with the sequential number of the motion. Those considered during the April 24 and May 22, 2024 meetings have a "B" prefix and also are numbered sequentially, again starting with the number "1" to match how they are addressed in the meeting minutes and video. And the motion considered during the February 8, 2024 meeting has a "C" prefix (numbered C1). For ease of reference, the Minority Report's table of motions also includes a column showing how the motion is referred to in the meeting minutes and where in the Majority Report Appendix A the motion is located. But in the Minority Report, references are to motions as numbered in Minority Report Appendix H.

We do not have a record of how each person voted on the first 20 motions – only the vote totals as are presented in the Appendix for Motions listed (using Roman numerals) as numbers I through XXII.

But at the April 24 and May 22, 2024 meetings, NHTSA recorded how each person voted on the 22 motions actually considered (out of 29 that came up for discussion – the remaining six were withdrawn and one combined with a different motion). The voting patterns are remarkable and demonstrate the significant and immediate effect of the nine ACUP members – at least seven or eight of whom were predisposed to vote for underride guards as noted above – who alone decided that the Biennial Report would reflect only a majority view, not true consensus advice.

Of the 22 motions decided in the April and May meetings, the eight-person bloc consisting of members Karth, Mathis, Adler, Tierney, Jackson, Kiefer, Brumbelow, and Mules all voted together 15 times. Of the seven times they did not vote as a bloc, four were because of abstentions by one of the Members. In fact, only four times out of 22 did any member of this group vote "no" when the others voted "yes," or vice versa.

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24 (although it listed them using Roman Numerals) in the Appendix contain those motions. Similarly, the April and May meetings considered a total of 29 motions as shown in the spreadsheets disseminated by NHTSA recording the votes at the meeting. Yet only 26 of these motions appear in the Appendix (listed in the Majority Appendix as items 25 through 50, again using Roman Numerals). To be fair, some of the motions that do not appear concerned administrative matters or were withdrawn or were duplicates, but the Appendix does list some motions that were withdrawn. In any event, a proper listing of the motions should include all the motions and should reflect the same numbering as was used in the meeting and is reflected in the minutes. The correct list is included in Minority Report Appendix H: "Corrected Record of ACUP Motions and Votes."

And this bloc voting made a difference, including some key recommendations. For example, on an 8-6-3 vote, with the 8-member bloc voting 6-1-1 in favor,[19] the ACUP voted to require all semitrailers produced after 1998 to have a side-underride guard capable of withstanding a 40 mph impact. On a 9-8 vote, including seven votes by the bloc mentioned above, the ACUP voted that the required side guards must also prevent injuries to vulnerable road users: pedestrians, bicyclists, and motorcyclists.[20] In fact, the bloc vote comprised all or nearly all of the votes in favor of (or against) the ultimate decision in seven of the 15 motions decided at the April and May 2024 meetings.[21]

The previous list concerns only those instances where the vote was extremely close. In those instances, the clear predisposition of seven or eight ACUP members to require underride guards at nearly any cost propelled these hotly disputed issues into recommendations of the ACUP.

But had ACUP followed its Charter and provided only "consensus advice" to the Secretary, the recommendations would be significantly different. Using a conservative estimate of consensus meaning just two-thirds of those voting, only 21 of the 39 motions adopted by the ACUP[22] would have been included as ACUP's written consensus advice to the Secretary,[23] and 16 motions would not have been included.[24]

This means that nearly half of the recommendations in the Majority Report are based on views that did not have a consensus vote, using a conservative definition of consensus as two-thirds. Accordingly, the Majority Report, taken as a whole, is an illegitimate expression of the directive contained in the ACUP Charter, that the duty of

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[19] Mr. Kiefer abstained because he claims he has a side guard that could be retrofitted on the 26 years of trailers covered by this motion; Ms. Mules voted no.

[20] See motion B11.

[21] Appendix A to the Minority Report contains a chart showing each of the seven motions decided in the April and May meetings for which the bloc vote comprised all or nearly all of the votes needed to pass or defeat the motion, setting forth for each the number of the motion, the vote, and the text of the motion.

As previously noted, the 16 motions decided during the April and May meetings are the only motions for which NHTSA recorded individual votes; for the 22 motions decided during the March 13, 2024 meeting for which individual member votes were not documented, the group described above also largely voted as a bloc.

[22] The ACUP voted on 42 motions; 39 were approved; three were defeated.

[23] Appendix B to the Minority Report contains a chart showing each of the motions for which there was a true consensus and therefore were entitled to be included in the Biennial Report of the ACUP, setting forth for each the number of the motion, the vote, and the text of the motion.

[24] Appendix C to the Minority Report contains a chart showing each of the motions for which there was NOT a true consensus and should not have been included in the Biennial Report of the ACUP, setting forth for each the number of the motion, the vote, and the text of the motion.

the ACUP was, among other things, to provide "written consensus advice" to the Secretary. A small group of ACUP members distorted the Charter's directive and have substituted their limited, pre-determined views for a true consensus of ACUP members.

This is not to say, however, that all of the motions that failed to achieve a consensus vote are ill-advised. Some are worthwhile. But because there is not universal agreement among those joining in the Minority Report as to which ones fall into that category, discussion of that issue is included in the section of the Biennial Report that discusses individual ACUP Member Reason for Concurrence or Dissent.

III. The "Biennial Report to Congress and the Secretary of the Advisory Committee on Underride Protection" not only fails to reflect a consensus of the ACUP, but it also both includes significant material that never was considered, let alone voted upon, by the ACUP, and it omits technical presentations made by ACUP members at various meetings that contradict the Majority Report's narrative.

The ACUP voted unanimously that the Biennial Report purporting to provide written consensus advice to the Secretary would be provided to ACUP members a week before it is submitted to the Secretary so that those members with dissenting or differing views could prepare their own submission to be submitted simultaneously.[25] Mr. Jackson, who as ACUP Chair authored the Majority Report portion of the Biennial Report, did not submit his draft in advance of the 1-week deadline for review, comment, or input.

But Mr. Jackson significantly overstepped in preparing the Majority Report. The Report included significant material that never was considered in any way by the ACUP, let alone voted upon or agreed upon by a majority of ACUP members.

For example, the Report includes 135 pages related to disgruntled-employee Quon Kwan's allegation that NHTSA suppressed a report, or significantly altered a report for nefarious reasons, related to pedestrian side guards (but not side guards designed to stop an automobile). These are appendixes III.D.E.F., labeled, respectively, "Quon

[25] Minutes of ACUP April 24, 2024 meeting, p. 9 – Motion 14. For some reason, the Appendix A submitted by Mr. Lee Jackson for review by those who wish to have dissenting views did not include this motion. The text of Motion B14 was as follows: "Therefore it is resolved that any report from the ACUP to the Secretary that claims or purports to contain written consensus advice to the Secretary on underride protection to reduce underride crashes and fatalities relating to underride crashes will be provided in final form to all members of the ACUP at one week before such a report or advice is actually submitted to the Secretary so that those ACUP members who have dissenting or differing views may prepare their own submission to be submitted to the Secretary at the same time the report of the ACUP is submitted to the Secretary."

Kwan Testimony"; "Volpe Center Scope of Work – 'Truck Side Guards to Reduce Vulnerable Road User Fatalities'"; and "Alleged Suppressed Volpe Center Final Report: 'Truck Side Guards and Skirts to Reduce Vulnerable Road User Fatalities: Final Report on Net Benefits and Recommendations.'"

The ACUP never considered these reports. Rather, they were sent – unsolicited – to Mr. Jackson, and he forwarded them to the Committee suggesting that they be considered at the April 24, 2024 meeting. According to Mr. Jackson's statements in the "Majority Report" at p. 22, "NHTSA ***did not allow the ACUP to discuss or hear [Mr. Kwan's] testimony*** and referred the matter to the Department's Office of Inspector General."

Since NHTSA was not allowed to and did not discuss or consider the material related to Mr. Kwan's allegations, they cannot be said to be the majority view of the ACUP. Including them in the Biennial Report is improper. On June 20, 2024, ACUP Member Jeff Bennett sent an email to James Myers, copying all ACUP members, noting this impropriety and asking that the materials be removed. Mr. Jackson admitted in his response to the email that the ACUP was not given an opportunity to discuss the materials, but that, as he said, "***I believe*** that Congress should be made aware of it, and that it is relevant to the report." In other words, Mr. Jackson again substituted his personal views for the views of the ACUP – the material should be stricken before being sent to the Secretary or Congress.

In addition to including material that never was presented to the ACUP, the Biennial Report prepared by Mr. Jackson omits a number of Technical Briefings presented during ACUP meetings – Technical Briefings that contradict the general narrative in the Majority Report supporting underride guards. Specifically, the "Technical Briefings" section of the Biennial Report (Appendix III.C.) omits at least the following Technical Briefings:

- "*A History of NHTSA's Position Concerning Side-Underride Guards on Semitrailers and One Trailer OEM's Response*," Technical Briefing of Jeff Bennett – November 15, 2023 ACUP Meeting – see video at 1:47:27 (the Minority Report includes this Technical Briefing as Appendix D to the Minority Report)

- "*Side Underride Guards – Initial Operational Concerns and Challenges*," Technical Briefing of Dan Horvath – November 15, 2023 ACUP Meeting – see video at 2:49:42 (the Minority Report includes this Technical Briefing as Appendix E to the Minority Report)

- "*Problems of Side Underride Guards to be Overcome*," Technical Briefing of Doug Smith – November 15, 2023 ACUP Meeting – see video at 3:10:35 (the Minority Report includes this Technical Briefing as Appendix F to the Minority Report)

- "*Crash Test Evidence of Commercially Available Side-Underride Guards*," May 22, 2024 ACUP Meeting (the Minority Report includes this Technical Briefing as Appendix G to the Minority Report)

IV. The Secretary should commission comprehensive, evidence-based studies to determine the scope of the underride problem, the ability to solve it, and the costs of doing so before adopting comprehensive underride-related regulations.

The IIJA directs ACUP to provide written consensus advice and recommendations to the Secretary "on safety regulations to reduce underride crashes and fatalities relating to underride crashes" and to include in its Biennial Report an assessment concerning the Secretary's progress in advancing safety regulations relating to those crashes.[26] In working to fulfill this mandate, ACUP focused on the three areas of a semi-trailer where underride can occur: side, rear, and front (the IIJA does not address the last of these, but the ACUP included it in its work).

The common theme underlying most of ACUP's work and deliberations is uncertainty and disagreement concerning (1) the scope of the underride problem in terms of deaths, injuries, and costs; and (2) the ability to reduce both crashes and fatalities through available technologies including (a) the percentage of deaths, injuries, and costs that are capable of being reduced; (b) the ability of various technologies to reduce these items; and (c) the unintended consequences of implementing these technologies.

Those predisposed to requiring underride guards on the side and front of trailers, and stronger or different guards on the rear of trailers, claim that current estimates of underride-associated death and injuries are greatly understated and that the numbers they propose – without much evidence – are far more reliable. This group also claims that existing side-guard technology should be required on all trailers manufactured after 1998 because such a requirement will save sufficient lives and injuries to meet the cost-benefit threshold required of new regulations.

In fact, neither the extent of the underride problem, nor the ability to solve it, is known with sufficient evidence-based certainty to serve as the basis for wide-ranging regulation and public-policy changes. Instead, the Secretary should devote its immediate efforts to obtaining reliable, quality, scientific-based data that accurately describes the scope of the problem, the ability to solve that defined problem with

[26] Pub. L. No. 117-58 (2021), Sections 23011(d)(1) and (d)(6)(B); Advisory Committee on Underride Protection Charter, Section 4, Duties ("Duties include the following: … c. Providing written consensus advice to the Secretary on underride protection to reduce underride crashes and fatalities relating to underride crashes").

available technologies, and the cost of doing so, including costs imposed through unforeseen consequences.

A. Additional unbiased, evidence-based research should be undertaken to determine the scope of the underride problem.

In 2019, the Government Accountability Office [**"GAO"**] issued its report in response to a request to review data on truck underride crashes and underride guards. Because of data variability and lack of direction concerning how to identify and report those crashes, the GAO concluded that the number of fatalities and injuries attributed to underride collisions is underreported, meaning that NHTSA may not have fully accurate data on which to base its conclusions. It therefore recommended modifications to the Model Minimum Uniform Crash Criteria to provide a standard definition of underride crashes and to include a data field for such crashes, to educate police departments regarding identifying those crashes, to require inspections of rear guards during annual inspections, and to conduct research on side-underride guards to understand their true effectiveness.[27]

In response to the GAO Report, NHTSA conducted additional research and prepared its 2022 Report "Side-Impact Guards for Combination Truck Trailers: Cost Benefit Analysis" that, among other things, provided detailed "analysis of crash databases for estimating annual fatalities and serious injuries in side-underride crashes and NHTSA's analysis of the benefits and costs of requiring trailers to be equipped with side-underride guards to mitigate injuries and fatalities" resulting from those crashes.[28] This "preliminary estimate" formed the basis for NHTSA's April 2023 ANPRM on side-underride protection, which concluded that a side-underride guard was not cost beneficial because "the total discounted lifetime costs of equipment new trailers and semitrailers with side-underride guards is six to eight times the corresponding estimated safety benefits"[29] and would prevent only 17.2 deaths.[30]

Although the ACUP majority ignores the costs of its proposed recommendations, it recognizes that the current cost-benefit analysis is antithetical to its goal of requiring underride guards on trailers. The Majority Report itself recognizes, "While technically

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[27] *See* GAO Report to Congressional Requesters GAO-19-264 – *Truck Underride Guards – Improved Data Collection, Inspections, Research Needed*, March 2019, pp. 32-33.

[28] NHTSA-2023-0012; Side-Underride Guards, ANPRM, April 20, 2023, p. 25.

[29] This is the cost-benefit determination for new trailers only. The ACUP Majority Report recommends that side-underride guards be required and retrofitted on all trailers and single-unit trucks manufactured since 1998. Minutes, ACUP April 24, 2024 Meeting, Motion 10. See Appendix III.I. Of course, this would dramatically increase the immediate cost of any regulation.

[30] NHTSA-2023-0012; Side-Underride Guards, ANPRM, April 20, 2023, pp. 6, 18.

still an open rulemaking, NHTSA's cost-benefit conclusion all but precludes a future side-guard requirement."[31]

As a consequence, members of the Majority have engaged in an assault on the conclusion concerning the number of lives that would be saved and injuries prevented. Less than a month after NHTSA published the ANPRM, Mr. Brumbelow submitted a comment to NHTSA Director Carlson claiming that NHTSA's analysis is flawed and substantially understated the number of lives that could be saved.[32] Other members of the Committee have submitted comments to NHTSA challenging NHTSA's conclusions. For example, on November 29, 2023, the so-called "Advocates for Side Underride Guards on Trucks and Trailers" led by ACUP Member Karth participated in an ex parte meeting with NHTSA to challenge NHTSA's ANPRM on side-underride guards and to insist that it be removed. Also attending were ACUP members (and members of the Majority bloc discussed in section I of the Minority Report) Harry Adler, Matthew Brumbelow, and Aaron Kiefer. Mr. Brumbelow echoed the material he provided in his May 2023 comment on the ANPRM.

Mr. Brumbelow had presented the same information to the ACUP at its November 15, 2023 meeting; Ms. Karth made her own presentation on the same topic at the meeting. At the February meeting, Mr. Brumbelow again made a presentation criticizing NHTSA's findings concerning the number of lives that would be saved. At the April meeting, Eric Hein again presented information attacking NHTSA's conclusions regarding side-underride fatalities and proposed revised numbers. Mr. Hein, who was part of the ex parte November 29, 2023 meeting, lost a son in a collision involving a trailer. He formerly worked for the U.S. Forest Service and has no special expertise that would allow him to opine on the number of lives that underride guards would save, how NHTSA's estimates should be revised, or whether side-underride guards are cost beneficial. Predictably, the presentations offered by ACUP majority members during the meetings reach results that are consistent with the conclusion the ACUP majority members have desired from the very beginning: Underride guards are cost beneficial.

The problem, though, is that decisions must be based on unbiased, fact-based evidence. The Majority Report recommendations fall short. Each attack on NHTSA's conclusions presented to the ACUP was brought by or supported by an individual or organization that has an admitted bias in favor of underride guards. There is no independent support for the conclusions the Majority Report reaches.

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[31] Majority Report, p. 14.

[32] Docket No. NHTSA-2023-0012; May 19, 2023 Comment of IIHS HLDI on Side Underride Guards; Advance Notice of Proposed Rulemaking.

The Majority Report claims there are 7,850 side-underride crashes and 8,950 corresponding fatalities (179 per year), 10,050 rear-underride crashes and 14,350 corresponding fatalities (287 per year), and 7200 front override crashes and 8,200 corresponding fatalities (164 per year). But the only support provided for these numbers is a letter from Eric Hein to James Myers dated April 30, 2024. As noted, Mr. Hein is not qualified to provide data on which public policy should be made, and – tragically – he is biased in his zeal to have the 2023 ANPRM withdrawn and side-underride guards mandated. As for front fatalities and injuries, it is impossible to confirm the numbers provided in the Majority Report from the data – there are no overall numbers provided, and the conclusion appears to be an extrapolation from an exceedingly small sample.

Although the Minority Report does not have its own view concerning the precise number of individuals who are killed or injured in underride crashes of all types, it is clear that there is significant disagreement on the subject and that there is no independent, fact-based, comprehensive analysis that is better than NHTSA's research to date concerning the scope of the problem. Recognizing this disagreement, the Minority Report supports the two ACUP motions recommending additional research into the scope of the underride problem, all of which received more than 66% of the ACUP Committee's vote:

- **Motion A-3** – Committee recommend that NHTSA conduct comprehensive research on U.S. underride crash characteristics, including the frequency of 30 perfect overlap crashes. Include photos as much as possible.

- **Motion B-5** – NHTSA should complete a new Side-Impact Guard cost-benefit analysis and rulemaking that counts previously omitted underride victim categories, including pedestrians, bicyclists, and motorcyclists.

To make sure that the information NHTSA gathers from this research is as accurate as possible, the Minority Report also supports the three ACUP motions recommending improvement in how data concerning the scope of the side-underride problem is gathered:

- **Motion B-19** – To further GAO recommendation # 1 regarding improvements to Model Minimum Uniform Crash Criteria, NHTSA should take additional steps to include both vehicle-related side-underride crashes, and Vulnerable Road Users (VRU) side-underride crashes in reporting of injuries and fatalities related to side-underride guard crashes.

- **Motion B-27** – The ACUP shall recommend in its report that NHTSA create a field in the Fatality Analysis Reporting System to determine if an underride crash occurred involving a large truck and a pedestrian/cyclist.

- **Motion B-28 –** The ACUP shall recommend that DOT disseminate educational material in addition to existing brochure for law enforcement to help them identify and record side-underride crashes.

It is crucial that this improved data gathering, and resulting research, be accomplished as the immediate next steps in evaluating whether NHTSA should implement underride-guard regulations. To determine whether underride guards are cost justified, at least the following information must be obtained:

- Number of individuals who die or are injured in underride collisions of all kinds
- The types of all injuries the individuals sustained and, if a fatality, the cause
- Location of the victim in the vehicle, and whether the victim was wearing a seatbelt
- Location of the collision on the trailer / truck: rear, side, front
- Location on the trailer / truck (in relation to where a guard would be) where the impact occurred – center, end, overlap of edge of a guard
- Angle of impact
- Speed of impact
- Assessment of potentially increased injury from deceleration injuries (including deceleration loads and interior contact), particularly if rear guards are strengthened or side guards are implemented
- Type of vehicle involved
- Whether the vehicle had airbags and, if so, whether they deployed
- Whether the vehicle had automatic emergency braking
- Whether the occupants were belted

B. After obtaining unbiased, fact-based research defining the true scope of the underride problem, NHTSA should undertake fact-based research into the ability of guard technologies to solve the defined underride problem.

Only after the information listed in the previous section is obtained can it be determined the extent to which current guard technologies would have prevented fatalities or minimized or eliminated injuries that occurred. As noted below, current guard technologies have significant limitations, and it cannot be said that current guard designs – whether Perry Ponder's AngelWing, Utility's Side-Impact Guard, or Aaron Kiefer's SafetySkirt – would still allow many of the fatalities and injuries to occur in side-crashes. Similarly, even the strong rear guards existing today allow a significant number of fatalities and injuries to occur, as there are limits to the abilities of the

technology to prevent these consequences. And not enough is known about front override crashes to reach any conclusions.[33]

(1) There are significant uncertainties concerning the ability of side-guard technologies to significantly reduce side-underride fatalities and injuries

As recommended by the GAO Report, and noted in the ANPRM, additional work needs to be done on both the efficacy of side-underride guards in preventing the types of deaths and injuries that occur and in the types of crashes leading to those deaths and injuries. The uncertainties arise from two areas: the ability of the guard to prevent fatality and injury in a specific crash scenario, and unintended consequences of installing side-underride guards.

Although the Majority Report devotes significant ink to criticizing NHTSA's conclusions regarding the number of fatalities and injuries that occur, it presents no significant analysis concerning the ability of side-underride guards to prevent or lessen that injury. Rather, those interested in mandating side-underride technology showed a number of videos of crash tests conducted either by the IIHS or by the Stop Underrides Group and extrapolated conclusions that guards would be widely effective.

The IIHS tests involved perpendicular crashes of a Chevrolet Malibu into the center of an AngelWing guard at 35 mph and 40 mph.[34] In a number of Stop Underride-sponsored tests, the AngelWing guard and SafetySkirt stopped passenger-compartment intrusion at roughly the same speeds. Along the same lines, Utility Trailer showed video of its Side-Impact Guard stopping a Malibu at 35 mph with no passenger-compartment intrusion.[35]

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[33] Although it did not achieve a 2/3 approval vote, Motion B6 was approved on an 11-1-5 vote: "NHTSA should issue an Advanced Notice of Proposed Rulemaking on Front Impact Guards."

[34] The IIHS tests are open to criticism as the IIHS, in testing the AngelWing, departed from the testing methodology it used for all rear-underride guard tests. Specifically, the IIHS did not fully load the trailer to capacity, and it put the partial load (35,561 lbs. out of 65,000 gross vehicle weight rating) into the rear half of the trailer. (*See* "*Crash Test Evidence of Commercially Available Trailer Side Underride Guards*," Jeff Bennett Technical Briefing presented at May 22, 2024 ACUP Meeting, slide 2.) As a result, the trailer moved significantly laterally upon impact – roughly 2 feet. This dissipated significant energy. In contrast, IIHS's rear-guard tests were on fully loaded trailers with the load evenly distributed, and the brakes of the tractor-trailer may have been engaged, further preventing movement of the trailer. All tests were conducted on a relatively slick floor, further decreasing the inertia of the trailer. Mr. Kiefer reports that some of his tests of the Safety Skirt did not suffer these flaws as they were on a fully loaded trailer on a non-slick surface.

[35] The Technical Briefing Jeff Bennett presented to the ACUP on May 22, 2024 – slide #5. The Majority Report / Biennial Report omitted this Briefing ("*Crash Test Evidence of Commercially Available Trailer Side*

Putting aside the IIHS testing deficiencies, there is not much question that a properly designed guard will stop a medium-size car at 35 mph when the guard is struck in the center at a perpendicular angle. At higher speeds, the challenge increases, as the force of the impact increases with the square of the speed.

But the real challenge is what happens when the crash is not into the center of the guard, and is not at a 90-degree angle. Here, there has been almost no testing. Not all crashes occur at 90 degrees into the center of the guard. Better data is needed to know the full range and distribution of crash scenarios, but reviewing the crashes that have been subject to litigation would show that such a scenario is the exception; most occur at an angle and are either closer to the end of the guard, overlapping where the end of a guard would be, or in the gap that would exist between the end of the guard and the wheels of either the trailer or tractor. And for crashes that occur in this last area, a side-underride guard such as the AngelWing or Utility Trailer's Side-Impact Guard will not be at all effective.

Gathering data on the nature of these crashes is essential because research shows that the guard is not as effective, or is not effective at all, as the crash departs from the center / 90-degree impact perfect scenario. Utility Trailer has requested that the IIHS and the Stop Underrides Group test guards such as the AngelWing or the SafetySkirt in a way similar to how the IIHS tests rearguards: in scenarios involving first 50% overlap and 30% overlap with the end of the guard. Utility even offered to provide its Side-Impact Guard to the IIHS if it would include those tests in the testing protocol. As far as is known, neither the IIHS nor the Stop Underrides group has conducted these tests.

Utility Trailer, however, has crash tested its guard in an overlap situation and shown the resulting video the ACUP. Also, it has dynamically tested the AngelWing simulating loads toward the end of the guard.[36] In the crash test, Utility's Side-Impact Guard dramatically failed to prevent passenger-compartment intrusion, as shown by the following photos[37]; in the dynamic test, the AngelWing failed to resist the force that would be associated with an impact near the end.

Underride Guards") from the list of Technical Briefings it included in its Appendix III.C. A complete copy of Mr. Bennett's presentation is included as Appendix G to the Minority Report

[36] After Mr. Kiefer claimed the SafetySkirt was commercially available (there are only two actually in use), Utility Trailer publicly offered to buy two sets of SafetySkirts from Mr. Kiefer at retail cost so it could test those guards. Mr. Kiefer has refused to sell the guards to Utility Trailer absent unusual requirements that do not apply to other potential customers and are unusual in the industry.

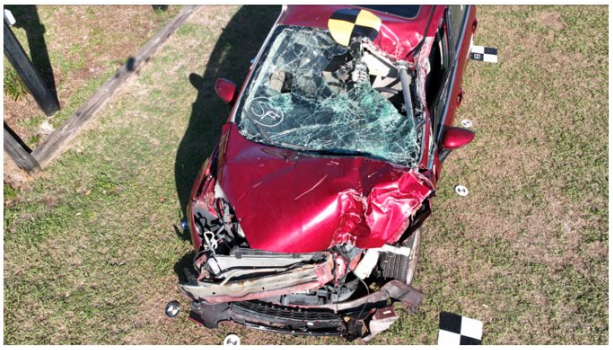
[37] Photos of Utility's 30% overlap test were included in the Technical Briefing Jeff Bennett presented to the ACUP on November 15, 2024 – slide #11. The Majority Report / Biennial Report omitted this Briefing ("*A History of NHTSA's Position Concerning Side-Underride Guards on Semitrailers and One Trailer OEM's Response*") from the list of Technical Briefings it included in its Appendix III.C. A complete copy of Mr. Bennett's presentation is included as Appendix D to the Minority Report. Other photos were included in Mr. Bennett's omitted Technical Briefing ("*Crash Test Evidence of Commercially Available Trailer*

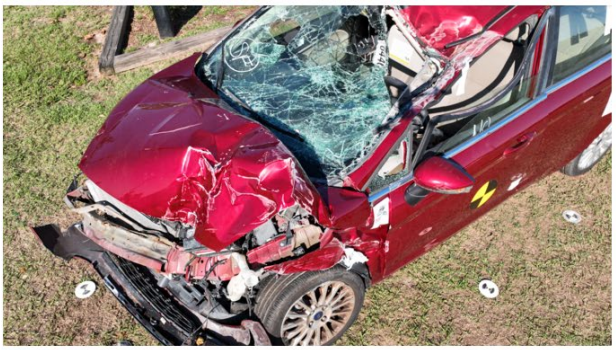
Similarly, there are substantial questions concerning how well the side-underride guard works in an angled crash. Again, 90-degree impacts are the exception; a wide variety of angles are the norm. The results of a crash test of a Ford Fiesta into an AngelWing guard at 45 mph shows that the guard does not protect the occupants.

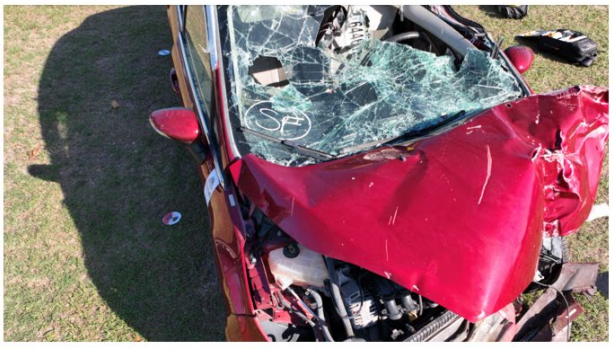
ACUP members Karth and Keifer showed the ACUP a number of crash tests during various ACUP meetings. In each such test video, the guard being tested prevented passenger-compartment intrusion. But Karth and Kiefer both were present at the April 2023 test of the Ford Fiesta mentioned in the previous paragraph, yet they never mentioned this test to the ACUP. But an ACUP member obtained a copy of the video when Mr. Kiefer was required to disclose it in connection with his serving as an expert witness in litigation involving a side-impact crash. As shown in the following photos, the guard ripped off the trailer in the angled impact, and there was significant passenger-compartment intrusion.[38]

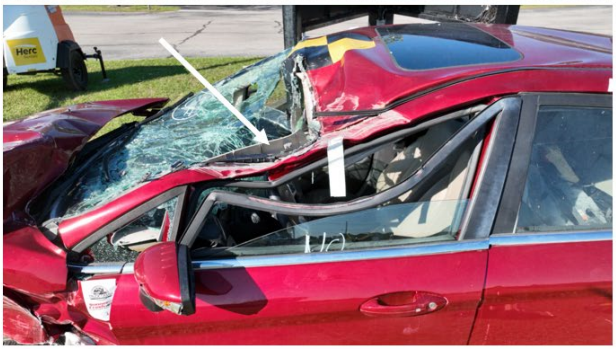
Side Underride Guards") provided to the ACUP on May 22, 2024, slides, 6-8, included as Appendix G to the Minority Report.

[38] Photos of this test showing the failure of the AngelWing were included in the Technical Briefing Jeff Bennett presented to the ACUP on May 22, 2024 – slides #9-17. The Majority Report / Biennial Report omitted this Briefing ("*Crash Test Evidence of Commercially Available Trailer Side Underride Guards*") from the list of Technical Briefings it included in its Appendix III.C. Mr. Bennett's Technical Briefing is included as Appendix G to the Minority Report.









There is no indication that the Majority Report took these limitations into consideration in extrapolating their view of how many fatalities or injuries could be eliminated or mitigated.

Finally, it is important to understand the scope and types of injuries suffered by so-called vulnerable road users (pedestrians, bicyclists, and motorcyclists) because the technology required to mitigate injuries is far different than the technology required to prevent side underride from an automobile. Although Mr. Jackson claimed that he visited Europe and saw many trailers with side-underride guards,[39] he was in error. What he saw in Europe were pedestrian guards; they are not designed to and will not stop a vehicle.[40] Despite having this confusion corrected, the Majority Report claims that the "United States lags behind many nations in adopting impact guards designed to prevent industries and deaths from underride crashes."[41] But the citation for this conclusion – contained in Majority Report footnote 10 – actually is not about side-underride guards as focused upon by the ACUP. Rather, it is about Lateral Protective Devices, which are pedestrian guards and apply to trucks, as is confirmed by the title of the publication cited by the Majority Report: "A Literature Review of Lateral Protection Devices on Trucks Intended for Reducing Pedestrian and Cyclist Fatalities."

These pedestrian guards are lightweight and do not impose the same stresses and costs as do the rigid side-underride guards. They can also function as aerodynamic devices. And as of recently, the Mexican authorities require that certain trailers imported into Mexico have these type of guards. As with rigid side-underride guards, there are potential unintended consequences as discussed in the next section, as the guards become damaged in normal use.

(2) Requiring side-underride guards on trailers is likely to result in significant unforeseen consequences; additional research should be conducted on these issues before adopting such technologies.

ACUP received information concerning the side-underride devices currently on the market: the AngelWing, Utility Trailer's Side-Impact Guard, and Kiefer's SafetySkirt. Real-world experience with these devices is limited, given the few trailers so equipped. According to testimony, AngelWing has sold roughly four sets of guards to end users, plus six to trailer manufacturers (presumably for testing). Kiefer has two sets of SafetySkirts mounted on trailers; and Utility Trailer has mounted its prototype Side-Impact Guard on roughly 65 trailers. And non-crash testing of the AngelWing and SafetySkirt to demonstrate its performance in day-to-day operations is either limited or non-existent.

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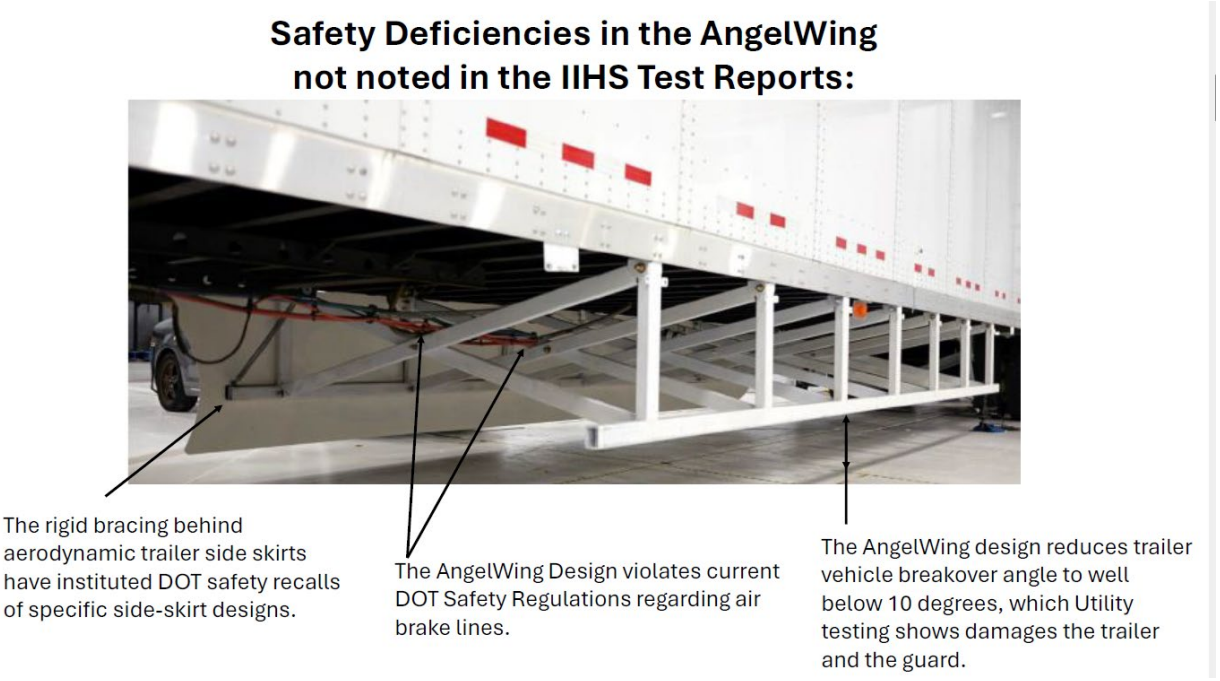
[39] November 15, 2023 ACUP Meeting. See video at 2:00:07.

[40] *See* Technical Briefing of Doug Smith, November 13, 2023 Meeting. The Majority Report omitted it in its list of Technical Briefings. It is included as Appendix F to the Minority Report.

[41] Majority Report, p. 10

The limited testing that does exist is of the AngelWing, and it was conducted not by AngelWing's inventor but by Utility Trailer. In 2018, Utility Trailer purchased two sets of AngelWing guards for testing. It tested the guards extensively, concluding in a detailed report that the guards were not safe because they caused failure of the AngelWing mounting bracket before completing a standard floor tests of both refrigerated and dry-van trailers failure, and also caused high centering in real-world situations, damaging the guard and the trailer itself.[42] The AngelWing also violates DOT brake-line regulations, as the guard rubs against air hoses, as shown in this photograph of the AngelWing[43]:



The AngelWing also impermissibly restricts the travel of the slider, which would render the trailer unable to be used in certain states. Utility provided a copy of its report to AngelWing's inventor and marketing company and it previously has submitted it to NHTSA. None of the report's findings have been challenged or controverted. As noted earlier, Utility Trailer has attempted to purchase at retail two sets of SafetySkirts so it

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[42] Photos of the damage to the guard and trailer from the high-centering tests is included in the Technical Briefing Jeff Bennett presented to the ACUP on November 15, 2024 – slide #10. The Majority Report / Biennial Report omitted this Briefing ("*A History of NHTSA's Position Concerning Side-Underride Guards on Semitrailers and One Trailer OEM's Response*") from the list of Technical Briefings it included in its Appendix III.C. A complete copy of Mr. Bennett's presentation is included as Appendix D to the Minority Report.

[43] "*Crash Test Evidence of Commercially Available Trailer Side Underride Guards*," Technical Briefing by Jeff Bennett to ACUP, May 22, 2024, slide 4.

could test that device, but Mr. Kiefer has not been willing to sell them in a normal commercial transaction.

After discovering the flaws of the AngelWing that caused significant safety concerns, Utility Trailer developed its own Side-Impact Guard design that eliminated the cause of the bracket failure and high centering, as shown by even more strenuous tests than those that caused damage to the AngelWing. But there remain problems with the Side-Impact Guard that need to be resolved. For example, attaching the aerodynamic side skirt to the rigid Side-Impact Guard causes damage and tears to the aerodynamic device in normal operations. Customers also complain about the weight of the device, and the need to run additional loads in those instances where the trailer "weighs out."

And then there is the cost. When Utility Trailer purchased the AngelWing, it paid over $6,000 for each set of guards. Mr. Kiefer has not provided an exact cost for the SafetySkirt, although he says it likely is about $4,000 per set in volume. Utility Trailer estimates the costs of its guards would exceed $5,000 per set. Those advocating requiring guards claim that the cost would decrease significantly with volume. This is not accurate in Utility Trailer's experience. As noted, Utility Trailer has installed roughly 65 sets of its prototypical Side-Impact Guard, and because it uses the same raw materials it purchases in bulk for building trailers, there are no material cost savings to be had. Nor will there be significant labor savings, as Utility already produced jigs to manufacture the guards it installed on trailers, and its assembly lines prevent installation of the guards until the trailer is largely completed.

Equally important, customers have not been eager to adopt the technology at any cost. Utility Trailer has not charged its customers retail price for the guards it has installed. Rather, because the Side-Impact Guard is a prototype, it leases the guards to the customer for $1 / year – essentially free. Utility Trailer has had to persuade customers to take the guard so Utility Trailer can monitor its performance in the real world. No customer has asked for additional guards. In Utility Trailer's view, it cannot give the guards away.

As noted, the possibility of high centering in day-to-day operations causes safety concerns in that the trailer and guard are damaged. This damage could result in failure or detachment on the road. Other related unintended consequences from high centering include trailers being stuck on railroad tracks and detachment of aerodynamic devices that become damaged as the trailers traverse significant changes in grade. The Minority Report supports the recommendation in Motion B18, which passed on a 15-0 vote:

> *"NHTSA should work with the Federal Railroad Administration (FRA) to conduct research to examine potential impacts the installation of side-underride guards would have during highway-rail grade crossings."*

Additional unintended consequences arise from the weight of current underride guards. The AngelWing and Utility's Side-Impact Guard weighs 962 lbs. for the set.[44] This has two consequences. First, a significant number of trailers weigh out.[45] This means that there will be more trailers on the road as additional loads are required to carry the same capacity, meaning (a) an increase in costs; (b) increase in carbon emissions; and (c) increase in truck/trailer accidents, which are correlated with total mileage.[46] Second, increased weight, even in cubed-out trailers, means additional fuel and operating costs.

Those in support of side-underride guards often counter by saying that attaching an aerodynamic device to the guard would offset the increased fuel costs. The problem with this argument is that many trailers already have aerodynamic devices, or could have aerodynamic devices without installing the side-impact device – for these, there is no savings, only cost. Also, as noted previously, testing has shown incompatibility between side-impact guards and aerodynamic devices causing the guards to become torn or damaged. This means increased maintenance costs for the owner/operator at least; it may also present the possibility of danger to the motoring public if the damaged aerodynamic device, or pieces of it, come loose from the trailer.

Side-underride guards may obstruct access to critical areas during safety inspections, or pre-trip inspections, potentially hiding or causing the operator to overlook maintenance issues or structural problems.

Finally, there are significant operational concerns involved in side-underride guards. At the November 15, 2023 meeting, Mr. Horvath presented information showing the challenges and incompatibility issues between sideguards and various trailers and intermodal chassis (which retract and are stacked for transport and storage). His presentation also addressed the significant real-world problems that will develop as the guard interacts with loading docks and railroad crossings, and the need for changes

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[44] "*A History of NHTSA's Position Concerning Side-Underride Guards on Semitrailers and One Trailer OEM's Response*," Technical Briefing of Jeff Bennett – November 15, 2023 ACUP Meeting, slide 5, included as Minority Report Appendix D.

[45] The Majority Report points to a 24-year-old study stating that most long-haul shipments cube out before they weigh out. (Majority Report, p. 3, FN 7.) Aside from the fact that the data is a quarter of a century old, if accurate it applies only to long-haul routes. And regardless of whether it is a majority, the number of loads that weigh out is significant. *Comprehensive Truck Size and Weight Limits Study, November 2013, Modal Shift Analysis, p. 8*.

[46] The ACUP voted 7-6-2 to recommend that the DOT explore a weight exemption for side-underride guards. (Motion B25.) Although it passed by the narrowest of majority, there was significant disagreement on this issue, with those voting against noting the danger of heavier trailers on the road and increased damage to the nation's bridges and roadways.

in routing to accommodate the guards.[47] Similarly, Mr. Smith presented a Technical Briefing at the same meeting showing the real-world challenges a side-guard would experience as it traversed changes in grade, harsh weather conditions, and as various trailer configurations were involved.[48]

(3) Additional research is needed into what benefits can be achieved from additional requirements for rear-impact guards.

Mr. Brumbelow and Ms. Karth each noted that the nine largest trailer manufacturers all offer rear-underride guards that meet the IIHS's TOUGHGUARD standard, meaning it will prevent passenger-compartment intrusion in a perpendicular impact by a Chevrolet Malibu traveling at 35 mph into the rear of a fully loaded trailer, regardless of whether the impact occurs in the center, overlapping the end of the guard by 50% of the car width, or overlapping the end of the guard by 30% of the car width (70% of the car outside the edge of the guard). Seven manufacturers make the TOUGHGUARD-awarded guard standard; two manufacturers have it as an option.

With the vast majority of trailers manufactured today meeting the TOUGHGUARD standard, it is difficult to say how much additional reduction in fatalities would result from additional strength-related regulations in this area.[49] Of note, the Majority Report says that there are at least 287 fatalities from crashes into the rear of the trailer – the highest number of any location.[50] The fact that this many people die while crashing into strengthened guards[51] at least raises the question as to what additional benefit may be obtained from further regulation concerning the rear guard. It also raises the question whether a strong guard on the side of the trailer will have a significant effect on fatalities.

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[47] Although Mr. Horvath made his presentation at the November 15, 2023 meeting, the Majority Report omitted it in its list of Technical Briefings. It is included as Appendix E to the Minority Report: "*Side Underride Guards – Initial Operational Concerns and Challenges*."

[48] *See* "*Problems of Side-Underride Guards to be Overcome*," Doug Smith, included as Appendix F to the Minority Report.

[49] The ACUP majority adopted three recommendations relating to strengthening rear guards – none were adopted by close to a two-thirds majority: Motion A6 (require all trailers to meeting TOUGHGUARD standard) – 10-1-6 (58.8%); Motion A12 (all trailers manufactured since 1998 to be retrofitted with TOUGHGUARD guards) – 8-1-6 (53.3%); Motion A13 (single-unit trucks to meet same rear-guard standards as semitrailers) – 9-2-4 (60%); Motion A17 (expeditiously conduct rear-guard testing at speeds up to 65 mph) – 9-5-1 (60%).

[50] Majority Report, p. 2.

[51] IIHS notes that "nearly all newly manufactured guards on trailers already meet this new standard, which is similar to a longstanding Canadian requirement." IIHS Press Release, cited in Majority Report, p. 13, FN 19.

Additional research should also be performed on secondary impacts resulting from crashes into strengthened rear guards. As noted, trailers meeting the TOUGHGUARD standard prevent passenger-compartment intrusion in both 50% and 30% overlap collisions. But in these collisions, the striking vehicle rotates significantly into what is very possibly an adjacent or oncoming lane of traffic, as shown in the following photos, which show separate IIHS-conducted crash tests of a Malibu into, respectively, a Stoughton, Wabash, and Great Dane trailer[52]

This deflection and rotation could also occur in side-impact crashes. The ACUP voted to recommend that NHTSA assess the risks associated with such deflection and make the results public, but the motion did not pass with a 2/3 vote – only 60% voted for it (9-6-0). [53] Of the six votes against this recommendation, 5 came from the Majority bloc referred to in section I of this Minority Report. The Minority Report supports this recommendation.

C. Until the additional research discussed in the previous sections is considered and evaluated, and the costs of requiring guards is determined, the Secretary and Congress should not act on the Majority Report recommendations.

Predisposed toward recommending that NHTSA require underride guards, and with a solid group of at least 7 or 8 votes in pocket, the majority bloc voted in favor of broad, sweeping requirements for underride guards. None of the motions on these topics, however, came close to being adopted by a true consensus of members, whether that amount is two-thirds or higher.

For example, the ACUP recommended on a 7-6-4 vote that NHTSA withdraw the ANPRM or reissue a revised ANPRM to reflect that the cost-benefit analysis artificially constrained lives and failed to account for cost savings (Motion B3). Seven votes in favor is not even a <u>majority</u> of those who voted, let alone two-thirds of those voting. That this does not represent the true views of the ACUP is dramatically demonstrated

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[52] Photos of the rotation were shown to the ACUP as part of Jeff Bennett's Technical Briefing at the February 8, 2024 Meeting, "*A History of Trailer Rear-Impact Guard RIG) from Utility's Perspective," slide 11.*

[53] Motion B12.

by the result of the immediately following motion (Motion B4), in which the ACUP defeated (7-7-3) Ms. Karth's motion that NHTSA underestimated the number of preventable side-underride deaths and erroneously concluded that costs outweigh benefits. The seven votes in favor of the defeated motion all came from the majority bloc discussed in section I of the Minority Report.

Similarly, ACUP recommended 8-6-0 that all trailers and single-unit trucks manufactured after 1998 be equipped with side guards that prevent passenger-compartment intrusion when struck by a midsize vehicle at any angle and any location at speeds up to 40 mph (Motion B10). It made the same recommendation for new semitrailers, passing the motion 11-6-0 (Motion B9). And it recommended that the guards referred to in Motions B9 and B10 prevent injuries to vulnerable road users – meaning pedestrians, bicyclists, and motorcyclists, passing the motion 9-8-0 (Motion B11). Again, these votes do not reflect a true consensus view of ACUP, even putting aside the fact, discussed earlier, that it has not been demonstrated that the technology to accomplish this exists.

These recommendations were virtually preordained once the ACUP members were selected. They do not advance the goals of doing the hard work to find common ground that accounts for different perspective and recognizes the need for scientific, evidence-based decisions. Conducting the research discussed previously in this Minority Report will provide this necessary evidence and lead to defensible policy, regardless of what that policy is.

Finally, costs must be considered. Determining the true costs of requiring underride guards was not part of ACUP's Charter. But determining costs is part of the cost-benefit analysis NHTSA must undertake in considering what recommendations to make concerning underride guards. We recommend performing the same thoughtful, evidence-based analysis in exploring the full costs of underride guards that we have recommended in evaluating the scope of the underride problem, and the ability to solve that problem with existing technology.

D. NHTSA should focus on adopting crash-avoidance requirements or distracted-driver mitigation measures that will help prevent the underride accident from occurring in the first place.

As part of his Technical Briefing at the November 13, 2023 ACUP meeting, Mr. Horvath started a discussion of the benefits of focusing on avoiding the underride crash entirely, rather than attempting to dissipate the significant energy involved in the crash or mitigate the fatalities and injuries resulting from the crash.[54] Similarly, Keith

[54] *See* "*Side Underride Guards – Initial Operational Concerns and Challenges*," Horvath Technical Briefing, included in Minority Report Appendix E.

Friedman of Friedman Research Corporation made a Technical Briefing to the ACUP at the April 24, 2023 meeting regarding front override crashes, noting the role that "Advanced Technology System Opportunities" such as collision detection, automated braking, and deployable systems can play in eliminating the harm from front override crashes.[55] This is an attractive alternative, since crashes that do not occur have zero fatalities and injuries.

Most underride accidents are not fault free. Most frequently, the driver of the vehicle underriding the trailer is not paying attention for one reason or another, attempts a last-minute maneuver losing control of the vehicle, or is inexperienced and does not react to changing circumstances in time to avoid impact with the side or rear of a trailer. For collisions that involve a vehicle driving into the rear of a trailer, or the sides of a trailer (vs. side swiping a trailer), the driver of the vehicle either failed or was unable to brake in time to avoid the impact (or to mitigate the speed at impact), or overestimated the ability to stop or misjudged the speed or distance involved as the situation evolved. There are many causes of this, including: poor judgment; distraction caused by phones, multimedia, eating, or drinking; fatigue; drug or alcohol impairment; visibility; excessive speed; and inexperience.

Technology available today can largely avoid impacts caused by these factors. These technologies include adaptive cruise control, advanced driver assistance systems and other crash-avoidance technology. Although it will take time before these technologies are present in the vast majority of vehicles and tractor trailers, NHTSA can take steps to encourage or require auto and truck manufacturers to include this equipment as standard.

Recognizing this, the ACUP voted – this time by a clear consensus – to recommend that NHTSA pursue various options designed to avoid the collision entirely. These include motions focusing on collision mitigation or avoidance by both the passenger vehicle and the tractor/truck, specifically

- Motion B20: "*NHTSA should investigate the potential for collision mitigation technologies for light and heavy-duty vehicles to prevent or reduce the risk associated with side-underride crashes.*" Approved 15-0-0.

- Motion A17: "*The ACUP should include in its Report to Congress a recommendation that NHTSA conduct a study to research how the survivability rate of rear-underride crashes will change with increased passenger vehicle adoption of Automatic Emergency Braking at currently tested speeds (35 mph) as well as highway speeds (up to 65 mph).*" Approved 15-0-0.

[55] *See* "*Front Underride*, "Friedman Technical Briefing, including as Appendix C.h. to Biennial Report.

- Motion A16: "*The ACUP should include in its Report to Congress a recommendation that NHTSA must expeditiously complete Heavy Vehicle Automatic Emergency Brake Rulemaking for all classes of CMVs (RIN 2127-AM36).*" Approved 15-0-0.

The ACUP also focused on technologies that would make it more likely that a driver notice a trailer and take steps herself to avoid the collision, both those involving new technologies and those involving existing visibility measures, specifically

- Motion A20: "*The ACUP should include in its Report to Congress a recommendation that DOT should continue research into Enhanced Rear Signaling Systems that could help better prevent rear-underride crashes.*" Approved 16-0-0.

- Motion A22: "*The ACUP should include in its Report to Congress a recommendation that DOT conduct research into efficacious methods of reducing Distracted Driving such as flashing lamps.*" Approved 16-0-0.

- Motion A21: "*The ACUP should recommend that DOT research the efficacy of high visibility ID lamps that illuminate the rear of a CMV to assist with potential Clearance Lamp rulemaking for all CMVs.*" Approved 14-1-0.

- Motion A18: "*The ACUP should include in its Report to Congress a recommendation that FMCSA should issue stronger conspicuity requirements, at minimum, a requirement to maintain and replace conspicuity tape every 5 years.*" Approved 11-4-1.

- Motion A19: "*The ACUP should include in its Report to Congress a recommendation that NHTSA should additionally require Single-Unit Trucks to adhere to conspicuity requirements.*" Approved 15-0-1.

The Minority Report agrees with these recommendations and believes devoting resources to these approaches are likely to have significant effects on underride fatalities and injuries and, because they involve avoiding crashes in all types of accidents, are likely to have a far greater return on investment than focusing on underride guards.[56]

Minority Report authored by Jeff Bennett and Doug Smith,

with input from other ACUP members

[56] In performing its ultimate cost-benefit analysis, the Minority Report also recommends that NHTSA consider explicitly the reduction in underride collisions that will occur as these collision-avoidance technologies became more widespread.

Appendix A
to Minority Report

LIST OF ACUP MOTIONS
FOR WHICH THE BLOC VOTE COMPOSED ALL OR NEARLY ALL THE VOTES NECESSARY TO DECIDE THE MOTION

Motions Where Bloc Vote Made Significant Difference			
Motion # (as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
XXV	B2	7-6-4 (7 bloc votes in favor - Adler abstained)	NHTSA should withdraw its previously submitted ANPRM or reissue a revised ANPRM and cost-benefit analysis that acknowledges and accommodates critiques made by commenters that the cost-benefit approach taken artificially constrained the number of lives saved and also failed to account for cost-savings (such as fuel efficiency gains provided by side-underride guards).
XXVII	B3	9-2-6 (7 bloc votes in favor – Brumbelow abstains)	ACUP affirms that NHTSA, per the Modernizing Regulatory Review Executive Memo and corresponding guidance, must fully account for regulatory benefits that are difficult or impossible to quantify when conducting rulemaking analysis.
XXVIII	B4	7-7-3 (defeated) (7 bloc votes against – Adler abstains)	Based on the rigorous analysis of the IIHS' Public Comment, the ACUP finds that NHTSA underestimated the number of preventable side-underride deaths. NHTSA erroneously concluded that costs outweigh benefits, when the opposite is true. NHTSA should withdraw the 2023 side-impact guard ANPRM.
XXXIV	B10	8-6-3 (Bloc voted 6-1-1 – Mules voted no; Kiefer abstained because he sells guards that could be retrofitted on trailers)	To require semitrailers, and single-unit trucks manufactured after 1998 that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger-compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.
XXXV	B11	9-8-0 (Bloc voted 7-1-0 – Mules voted no)	To require the side guards referenced in motions [above] above to also prevent a vulnerable road user (VRU) from passing underneath the guarded vehicle in an interaction with the side of the vehicle.

Motions Where Bloc Vote Made Significant Difference			
Motion # (as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
XXXVIII	B16	8-9-0 (defeated) (Bloc voted 0-8-0 to defeat the motion)	For purposes of providing 'written consensus advice' to the Secretary of Transportation on underride protection to reduce underride crashes and fatalities relating to underride crashes, 'consensus' on any piece of advice will mean the agreement of two-thirds of the then-serving ACUP members, and any piece of advice that does not have the agreement of two-thirds of the then-serving ACUP members will not be represented to be the consensus advice of the ACUP.
XL	B21	9-6-0 (Bloc voted 1-6-0 against this motion; Mules voted yes; Mathis was not present)	NHTSA should assess risks associated with deflection into adjacent lanes associated with partial offset rear crashes as well as side-underride crashes. Final results should be made public.

Appendix B
to Minority Report

LIST OF ACUP MOTIONS FOR WHICH THERE WAS A CONSENSUS

Motions Agreed to by Consensus of ACUP members			
Motion # (as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
II	A3	13-4-0	The committee recommends that NHTSA conduct comprehensive research on U.S. underride crash characteristics, including the frequency of 30 percent overlap crashes. As much as possible, photos should be used. This research should be in addition to the agency's congressionally directed research into the feasibility of developing guards to protect in certain crash scenarios.
IV	A5	13-4-1	Request a deadline extension for the committee.
VI	A7	13-0-3	Include in the report to the Secretary and Congress the following recommendation, that pursuant to the IIJA, within five years of implementing (V), the Secretary shall review and update FMVSS 223/224 standards in response to advancements in technology.
VIII	A10	12-3-1	The ACUP should request from NHTSA/DOT all scoping documents, directions, discussions, test results, data, memoranda, reports, and/or notes generated before, during, and following quasi-static testing of trailer rear-underride guards conducted by Karco or other contractors (i.e., Elemance) on behalf of NHTSA/DOT between 2016 and 2024. (Combined 8 & 9).
XIV	A16	15-0-0	The ACUP should include in its Report to Congress a recommendation that NHTSA must expeditiously complete Heavy Vehicle Automatic Emergency Brake Rulemaking for all classes of CMVs (RIN 2127-AM36).

Motions Agreed to by Consensus of ACUP members			
Motion # (as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
XV	A17	15-0-0	The ACUP should include in its Report to Congress a recommendation that NHTSA conduct a study to research how the survivability rate of rear-underride crashes will change with increased passenger vehicle adoption of Automatic Emergency Braking at currently tested speeds (35 mph) as well as highway speeds (up to 65 mph).
XVI	A18	11-4-1	The ACUP should include in its Report to Congress a recommendation that FMCSA should issue stronger conspicuity requirements, at minimum, a requirement to maintain and replace conspicuity tape every 5 years.
XVII	A19	15-0-1	The ACUP should include in its Report to Congress a recommendation that NHTSA should additionally require Single-Unit Trucks to adhere to conspicuity requirements.
XVIII	A20	16-0-0	The ACUP should include in its Report to Congress a recommendation that DOT should continue research into Enhanced Rear Signaling Systems that could help better prevent rear underride crashes.
XIX	A21	14-1-1	The ACUP should recommend that DOT research the efficacy of high visibility ID lamps that illuminate the rear of a CMV to assist with potential Clearance Lamp rulemaking for all CMVs.
XX	A22	16-0-0	The ACUP should include in its Report to Congress a recommendation that DOT conduct research into efficacious methods of reducing Distracted Driving such as flashing lamps.

Motions Agreed to by Consensus of ACUP members			
Motion # (as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
XXI	A23	14-1-0	The ACUP should include in its Report to Congress a recommendation that FMCSA work with State law enforcement and other stakeholders to emphasize education and the need to issue RIG violation citations and encourage maximum fines for violations affecting safety.
XXIV	A27	15-0-0	Motion for minority report to accompany majority report.
XXIX	B5	11-1-5	NHTSA should complete a new side-impact guard cost-benefit analysis and rulemaking that counts previously omitted underride victim categories, including pedestrians, bicyclists, and motorcyclists.
XXX	B6	11-1-5	NHTSA should issue an Advanced Notice of Proposed Rulemaking on Front Impact Guards.
XXXVII	B13	16-1-0	The Department should conduct a study of conspicuity tape in service. This study focuses on actual rates of compliance with the regulated minimum reflectivity requirements, the ability of enforcement personnel to accurately and adequately enforce these requirements, and make recommendations on how to reduce the most common forms of non-compliance found.
XLIII	B18	15-0-0	NHTSA should work with the Federal Railroad Administration (FRA) to conduct research to examine potential impacts the installation of side-underride guards would have during highway-rail grade crossings.
XXXIX	B19	14-0-0	To further GAO recommendation # 1 regarding improvements to Model Minimum Uniform Crash Criteria, NHTSA should take additional steps to include both vehicle-related side-underride crashes, and Vulnerable Road Users (VRU) side underride crashes in reporting of injuries and fatalities related to side-underride guard crashes.

Motions Agreed to by Consensus of ACUP members			
Motion # (as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
XLII	B26	13-1-1	The ACUP shall recommend in its report that NHTSA request that the Department of Transportation's Volpe Center evaluate the effectiveness of a side-underride guard to determine if their effectiveness is similar or greater than Lateral Protective Devices in mitigating the severity of pedestrian, cyclist, and motorcyclist fatalities.
XLIV	B27	13-0-2	The ACUP shall recommend in its report that NHTSA create a field in the Fatality Analysis Reporting System to determine if an underride crash occurred involving a large truck and a pedestrian/cyclist.
L	B29	15-0-0	The ACUP report shall reflect whether each committee member concurs or does not concur with the report by allowing each member to make a statement of concurrence or non-concurrence with the report. The ACUP report include such documentation in an Appendix.

Appendix C
to Minority Report

LIST OF ACUP MOTIONS
FOR WHICH THERE WAS
NOT A CONSENSUS

Motions Not Agreed to by Consensus of ACUP members			
Motion #(as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
V	A6	10-1-6	Include in the report to the Secretary and Congress the following recommendation that the 2022 RIG Rule should be amended to require that all new trailers meet the ToughGuard test protocol or equivalent.
IX	A11	10-6-0	NHTSA/DOT should produce all documents related to rear-guard standards including test data, contracts, studies, scoping documents, analyses, reports, memoranda, and/or other communications or references related to trailer and/or straight truck rear-guard strength, design, quasi-static or dynamic testing, and/or test protocols between 1970 and 1998.
X	A12	8-1-6	The ACUP should include in its congressional report a recommendation that all trailers manufactured between 1998 to the current time that do not have ToughGuard-awarded rear-impact guards should be retrofitted with crash proven reinforcement device(s). These reinforcement devices, at minimum, should be tested and proven to mitigate PCI and create crash compatibility consistent with a ToughGuard-awarded rear-impact guard when attached to a minimally compliant FMVSS 223 rear-impact guard.
XI	A13	9-2-4	The ACUP should recommend in its report to congress that Congress regulate single-unit trucks (SUTs) with the same rear-impact guard standards that currently only apply to semitrailers.
XIII	A15	9-5-1	The ACUP should include in its Report to Congress a recommendation NHTSA expeditiously conduct rear-impact guard testing at "highway speeds" (up to 65 mph) as IIJA already directed NHTSA to do (Sec 23011 (b)(2)(A,B)) and publish the results within 2 years.
XXIII	A25	7-4-4	The ACUP should include in its Report to Congress a fact-based history of underride crashes.
XXV	B2	7-6-4	NHTSA should withdraw its previously submitted ANPRM or reissue a revised ANPRM and cost-benefit analysis that acknowledges and accommodates critiques made by commenters that the cost-benefit approach taken artificially constrained the number of lives saved and also failed to account for cost-savings (such as fuel efficiency gains provided by side-underride guards).
XXVII	B3	9-2-6	ACUP affirms that NHTSA, per the Modernizing Regulatory Review Executive Memo and corresponding guidance, must fully account for regulatory benefits that are difficult or impossible to quantify when conducting rulemaking analysis.

Motions Not Agreed to by Consensus of ACUP members			
Motion #(as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
XXVIII	B4	7-7-3 Motion failed	Based on the rigorous analysis of the IIHS' Public Comment, the ACUP finds that NHTSA underestimated the number of preventable side-underride deaths. NHTSA erroneously concluded that costs outweigh benefits, when the opposite is true. NHTSA should withdraw the 2023 side-impact guard ANPRM.
XXXI	B8	1-12-4	The Secretary should recommend, and the President should establish, a Presidential Advisory Committee on Integrity of Underride Research. It should be composed of a diverse group of stakeholders, including: (i) Truck and trailer manufacturers. (ii) Motor carriers, including independent owner operators. (iii) Law enforcement. (iv) Motor vehicle engineers. (v) Motor vehicle crash investigators. (vi) Truck safety organizations. (vii) The insurance industry. (viii) Emergency medical service providers. (ix) Families of passenger vehicle underride crash victims. (x) Families of Vulnerable Road User underride crash victims. (xi) Labor organizations. The ACUP should review all underride-related research, conducted by or contracted with the Department of Transportation, including the Statement of Work and the draft report prior to publication.
XXXIII	B9	11-6-0	To require all new semitrailers, and single-unit trucks that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger-compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.

Motions Not Agreed to by Consensus of ACUP members			
Motion #(as listed in Appendix)	**Motion # (as listed in Minority Appendix H)**	**Vote**	**Subject**
XXXIV	B10	8-6-3	To require semitrailers, and single-unit trucks manufactured after 1998 that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger-compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.
XXXV	B11	9-8-0	To require the side guards referenced above also prevent a vulnerable road user (VRU) from passing underneath the guarded vehicle in an interaction with the side of the vehicle.
XXXVIII	B16	8-9-0 Motion failed	For purposes of providing 'written consensus advice' to the Secretary of Transportation on underride protection to reduce underride crashes and fatalities relating to underride crashes, 'consensus' on any piece of advice will mean the agreement of two-thirds of the then-serving ACUP members, and any piece of advice that does not have the agreement of two-thirds of the then-serving ACUP members will not be represented to be the consensus advice of the ACUP.
XL	B21	9-6-0	NHTSA should assess risks associated with deflection into adjacent lanes associated with partial offset rear crashes as well as side-underride crashes. Final results should be made public.
XLI	B25	7-6-2	The ACUP shall recommend in its report that DOT explore the need for Federal weight limit weight-based exemption for side-underride guards.

Appendix D
to Minority Report

"A History of NHTSA's Position Concerning Side-Underride Guards on Semitrailers and One Trailer OEM's Response"

TECHNICAL BRIEFING BY JEFF BENNETT

A History of NHTSA's Position Concerning side-underride Guards on Semi Trailers And One Trailer OEM's Response

1) **DEPARTMENT OF TRANSPORTATION Federal Highway Administration I 49 CFR Part 371 1 [Docket No. 1—11; Notice 2]**

MOTOR VEHICLE SAFETY STANDARDS

Rear Underride Protection; Trailers and Trucks With Gross Vehicle Weight Rating Over 10,000 Pounds

1969 NHTSA STATED

"It is anticipated that the proposed Standard will be amended, after technical studies have been completed, to extend the requirement for underride protection to the sides of large vehicles."

F.R. Doc. 70-10663; Filed, Aug. 13, 1970;

2) National Highway Safety Bureau

[49 CFR Part 571]

[Docket No. 1-11; Notice 5]

REAR UNDERRIDE PROTECTION; TRUCKS AND TRAILERS

Notice of Proposed Rule Making

"Further consideration will be given, after issuance of the standard and completion of technical studies, to the inclusion of energy management of underride protection to the sides of large vehicles."

DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

Denial of Petition for Rulemaking

This notice denies a petition submitted by Mr. William H. Page, Jr. requesting rulemaking to require side underride protection devices on large trailers. Mr. Page indicated that the problems of smaller vehicles underriding the sides of trailers are now significant and will increase as the size of passenger cars decreases.

The National Highway Traffic Safety Administration (NHTSA) has reviewed Mr. Page's request. Currently, the NHTSA is pursuing rulemaking in the area of truck rear underride devices. In the course of that rulemaking, the agency will collect information relating to the problem of side underride. Until the agency has gathered this material on side underride, it does not consider it appropriate to invest more of its limited agency resources in this area.

The agency will continue to gather information on side underride during the rear underride rulemaking. If the evidence gathered by the agency indicates that side underride rulemaking could contribute significantly to safety, the agency will commence rulemaking.

The agency will continue to gather information on side underride during the rear underride rulemaking. If the evidence gathered by the agency indicates that side underride rulemaking could contribute significantly to safety, the agency will commence rulemaking.

U.S. Department of Transportation
National Highway Traffic Safety Administration

Memorandum

01-11-N09-002

1-11-N09

SUBJECT: Docket Submission: Docket No. 1-11; Notice 09

DATE: DEC 30 1991

FROM: Donald C. Bischoff
Associate Administrator for Plans and Policy

REPLY TO ATTN OF:

TO: DOCKET

THRU: Paul Jackson Rice
Chief Counsel

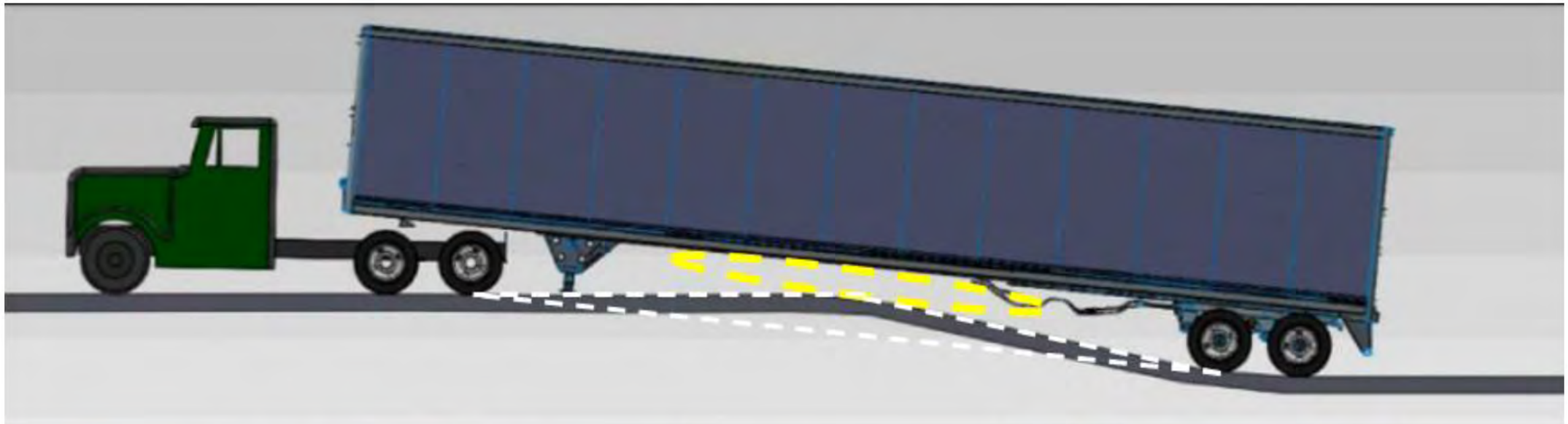
FILE

102 pgs

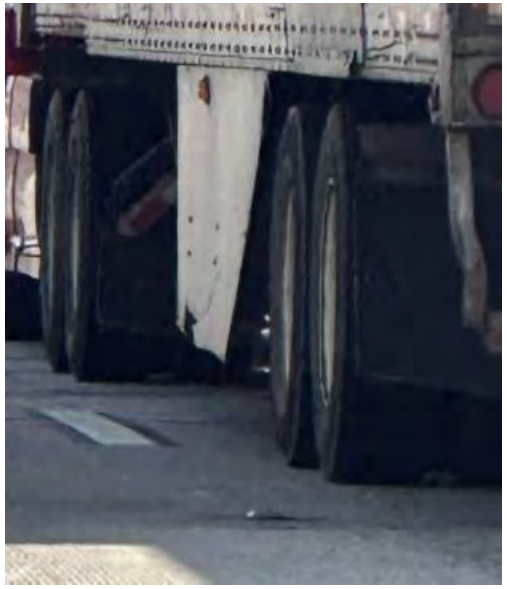
problem is worse than the single unit trucks by a factor of 5. Combination truck side underride countermeasures have been determined not to be cost-effective.


The SIG adds 962 lbs. to a trailer with Utility side skirts.
There are $1 SIG leases available to qualified customers.

All Vehicles Require Sufficient Center Ground Clearance



Earlier Aerodynamic Trailer Side Skirt Designs Were Too Rigid To Avoid Ground Damage



May 11, 2018 **NHTSA CAMPAIGN NUMBER: 18E031000**

Trailer Skirt Panel May Separate from Trailer

If multiple brackets separate, the trailer skirt could detach from the trailer, increasing the risk of a crash.

OMB Control No.: 2127-0004

Part 573 Safety Recall Report 18E-031

Manufacturer Name : Strehl, LLC
Submission Date : MAY 08, 2018
NHTSA Recall No. : 18E-031
Manufacturer Recall No. : NR

Manufacturer Information :
Manufacturer Name : Strehl, LLC
Address : 15957 N. 81st Street
Suite 102 Scottsdale AZ 85266
Company phone : 6160985

Population :
Number of potentially involved : 152
Estimated percentage with defect : 30 %

Equipment Information :

Brand / Trade 1 : TrailerBlade
Model : Fleet
Part No. : 404000
Size : NR
Function : trailer skirt
Descriptive Information : Population was identified from inventory and shipment records, combined with laboratory testing.
Production Dates : OCT 25, 2017 - NOV 27, 2017

Description of Defect :

Description of the Defect : Bracket separation from skirt panels
FMVSS 1 : NR
FMVSS 2 : NR
Description of the Safety Risk : Multiple, adjacent brackets, left unchecked, could cause skirt panels to come loose from bracket.
Description of the Cause : Metallurgical problem/manufacturing defect with bracket channel.
Identification of Any Warning that can Occur : Cracking on bracket channel.

Supplier Identification :

Component Manufacturer
Name : Shanghai Shenyi Special Vehicle Parts Co

The information contained in this report was submitted pursuant to 49 CFR §573

Part 573 Safety Recall Report 18E-031 Page 2

Address : No. 900 Baiyin Road
Jiading District Shanghai FOREIGN STATES 201821
Country : China

Chronology :

Late January, 2018—Received initial report from customer of bracket channel cracks on 2 trailers. Sent samples to Progressive Engineering for testing.
Mid-February—Test results showed current inventory performed above standard. Failed channels showed higher tensile strength steel. Tested non-cracked struts on failed trailer and struts performed above standard. Snow damage suspected. Manufacturer advised that there was a metal switch in June, 2017 but material was within specifications. Manufacturer also advised that they had returned to original material after only one build. Contacted all dealers and unable to locate any new brackets from those shipments.
March 14—After 3rd report of cracked struts, all from trailers in snowy conditions, sent Service Bulletin 10.
Early April—Report of cracked struts from November, 2017 shipment. Dealer still had inventory (Build 808) which was past the shipments with different steel. Channel manufacturer advised that certain channels may have been rejected on first run, re-plated and then were used in Build 808. Manufacturer could not determine number of bad channels. We replaced the inventory from the dealer. We also located from a sub-dealer inventory from the order with the higher strength steel. We replaced that inventory.
Late April-received the replaced inventory from both builds. Disassembled brackets to remove channels for testing.
April 30—Sent 275 channels to Canyon State Inspections for magnetic particle testing.
May 3—Received report that 20% of the channels from batch 808 were cracked, though many were not cracked in areas that would affect performance. Prior batches had zero failures.

There have been no injuries related to any of the product failures.

Description of Remedy :

Description of Remedy Program : There are 8 brackets per trailer. Each bracket will be inspected and a safety cable will be installed on each bracket. The cable functions as a fail-safe. If cracks are noted on any bracket, the bracket channels on all brackets will be replaced. The repairs may be performed at any of approximately 50 dealers, or at the shop of the customer's choosing, or the customer themselves may perform the repairs. All of the parts are provided free of charge and we will reimburse 1/2 hour of labor for the inspection and cable installation, and an additional hour of labor should channel replacement be required.
How Remedy Component Differs from Recalled Component : The metallurgy of the remedy channels has been corrected. Also, the remedy channels have a greater radius at the corners to make them relatively impervious to cracking.

The information contained in this report was submitted pursuant to 49 CFR §573

Part 573 Safety Recall Report 18E-031 Page 3

Identify How/When Recall Condition was Corrected in Production : The problem was limited. Channels that should have been rejected were mistakenly sent for replating and then added to the build. Installations as of May 1, 2018 will feature the replacement channel and have safety cables installed as a fail-safe.

Recall Schedule :

Description of Recall Schedule : NR
Planned Dealer Notification Date : MAY 14, 2018 - MAY 31, 2018
Planned Owner Notification Date : MAY 21, 2018 - JUN 30, 2018

Purchaser Information :

The following manufacturers purchased this defective/noncompliant equipment for possible use or installation in new motor vehicles or new items of motor vehicle equipment:

Name : NR
Address : NR
NR
Country : NR
Company Phone : NR

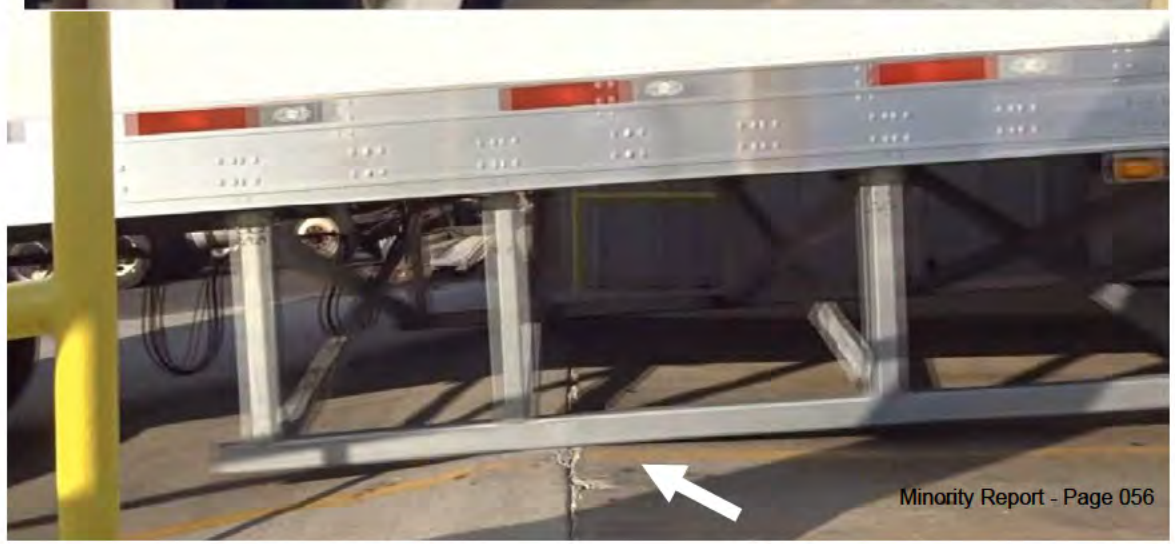
* NR - Not Reported

The information contained in this report was submitted pursuant to 49 CFR §573

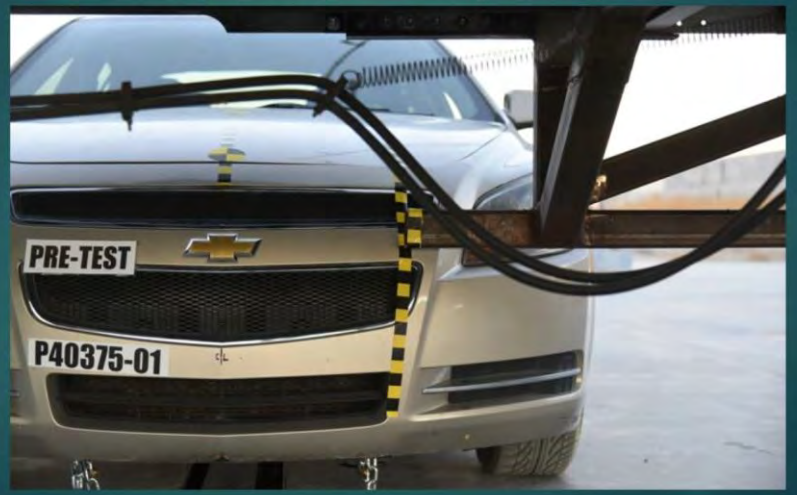
UTILITY TESTING OF STREHL / TRAILERBLADE SIDE SKIRT

– STANDARD CHANGE OF GRADE TEST –

Angelwing Rigid Side Impact Guard Reduces Trailer Ground Clearance Resulting In High Centering Damage To Itself And The Trailer's Structural Integrity



Repeat Test
SIG overlapping 30% (max) of Malibu



NHTSA

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

MISSION

To save lives, prevent injuries, and reduce the costs of traffic crashes – among drivers, passengers, pedestrians, and bicyclists

Appendix E
to Minority Report

"Side-Underride Guards – Initial Operational Concerns and Challenges,"

TECHNICAL BRIEFING BY DAN HORVATH

Side Underride Guards

Initial Operational Concerns and Challenges

American Trucking Associations

Known Operational Concerns…

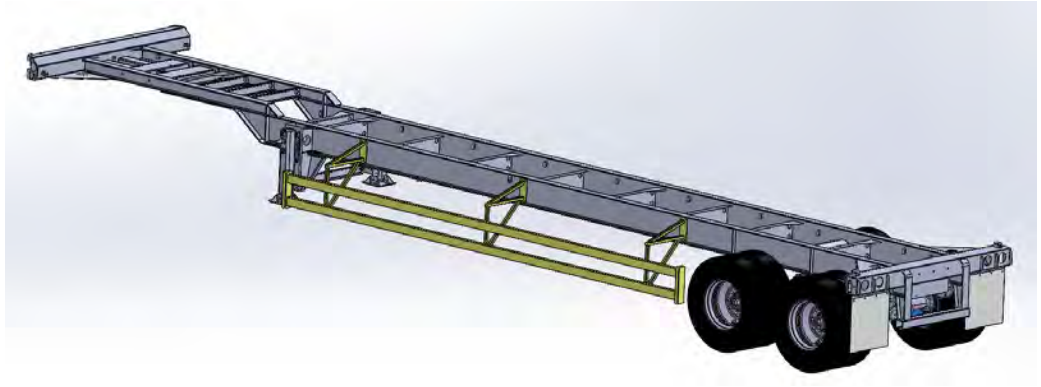
- Compatibility with various trailer configurations
  - Tank Trailers
  - Intermodal
  - Agricultural Use
    - Belt trailer
    - Grain Hopper
- Highway-rail grade crossings
  - High-centering events
  - Ongoing work with Federal Railroad Administration
- Second story and below ground loading docks
  - Increase in high-centering events


1203


1500
1200

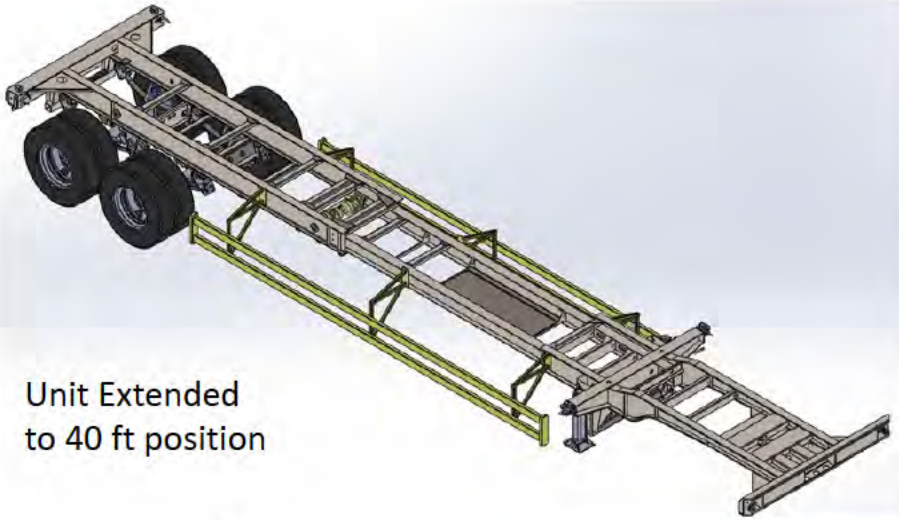
Trailer Compatibility

- Intermodal Chassis have unique designs. While adding a side guard to a standard non extendable chassis may be a relatively simple solution, there are weight and cost impacts.
- Additionally, industry demands that the chassis be stackable for storage when not in use. Side guards would prohibit this practice or could lead to damaged side guards.

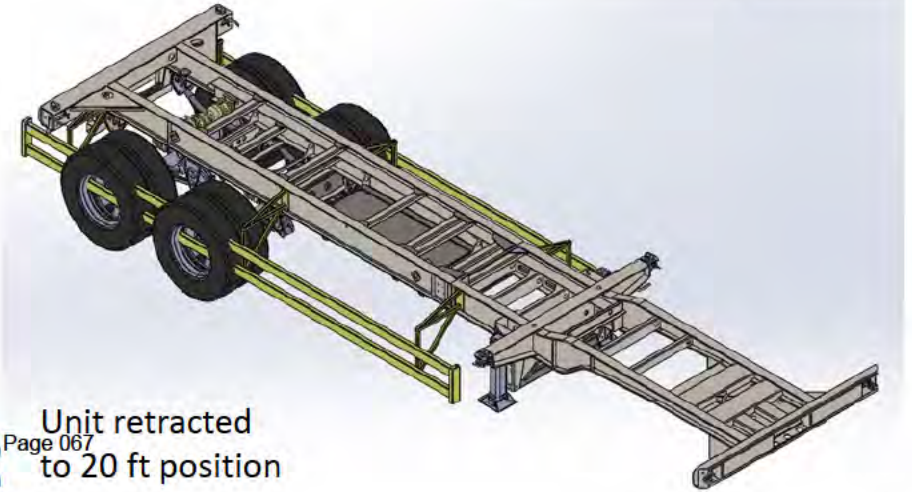


Trailer Compatibility

- Sliding and or Extendable chassis pose a difficult challenge to apply appropriate side impact guards to prevent intrusion. These type of chassis are now the most useful type and becoming the most desired.



Unit Extended
to 40 ft position



Unit retracted
to 20 ft position

Rail Grade Crossings

- Average of 300 crashes per year involving train and truck-tractor
- Installation of side-guards will lead to more.
- In 2014 FRA estimated 130,000 public and 80,000 private rail crossings in U.S.
  - Route planning to avoid these crossings can be problematic.
- Federal Railroad Administration in the process of addressing highway-grade crossing events.

Loading Docks

- Second story or below ground (depressed) loading docks common in retail or grocery

- ATA members report these are not compatible with aerodynamic skirts. Skirts drag on slope

Challenges not yet addressed

- Trailer Resiliency Over Time
- Maintenance
- Routing to accommodate side guards

Ways to address side underride crashes

- Using side underride guards to ***mitigate*** a crash at highway speeds ***after*** *impact* focuses only on mitigation and not prevention and is a difficult engineering challenge.
  - What occurs *after* impact with the side guard ?
  - The crash sequence does not conclude at the impact with the side guard.
- Opportunities to address side underride crashes ***before*** impact:
  - Prevention (Forward-collision alerts, distraction/drowsiness detection)
  - Vehicle to Vehicle/Infrastructure capabilities
  - Mitigation via braking (AEB)
  - Mitigation versus speed enforcement/aggressive driving
  - Defensive Driver training

Appendix F
to Minority Report

"Problems of Side-Underride Guards To Be Overcome"

TECHNICAL BRIEFING BY DOUG SMITH


NOW
LEASING
320-4400


VN.20.572.z
VIZ PEOP


SCHWARZMULLER


REFRIGERATED
LTL
855-WANSHIP
WANSHIP.COM
wanship


LOW
GROUND
CLEARANCE


AF190


RAM


DOT

End Slideshow

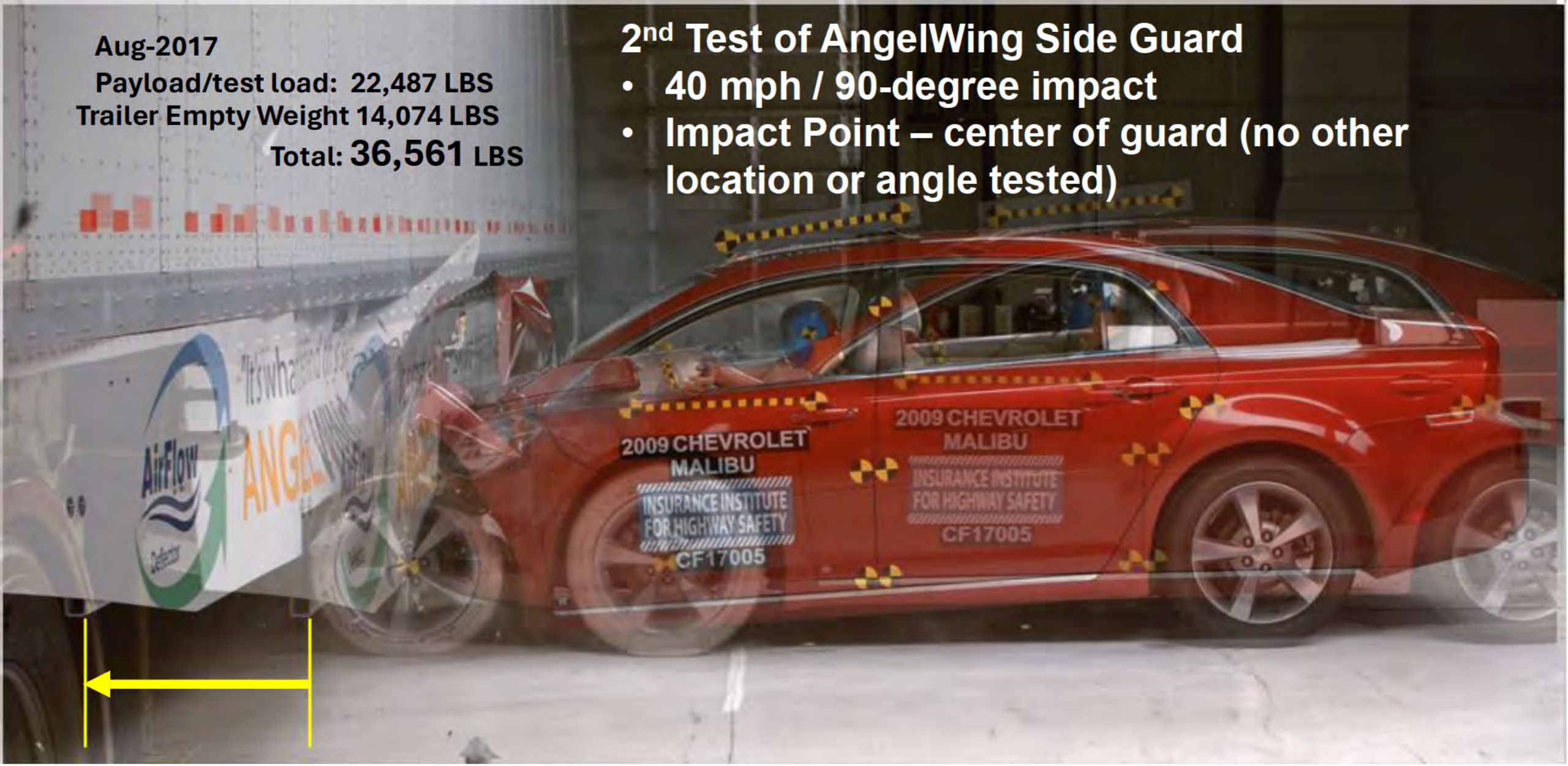
Appendix G
to Minority Report

"Crash Test Evidence of Commercially Available Side-Underride Guards"

TECHNICAL BRIEFING BY JEFF BENNETT

Crash Test Evidence of Commercially Available Trailer Side Underride Guards

March 2017 IIHS Crash Test of AngelWing Side Underride Guard
35 MPH - 90 Degrees - Centered On Guard



Excessive slide (approximately 24”) from impact of trailer (poor test boundary condition – lightly loaded trailer, smooth floor).

Safety Deficiencies in the AngelWing not noted in the IIHS Test Reports:

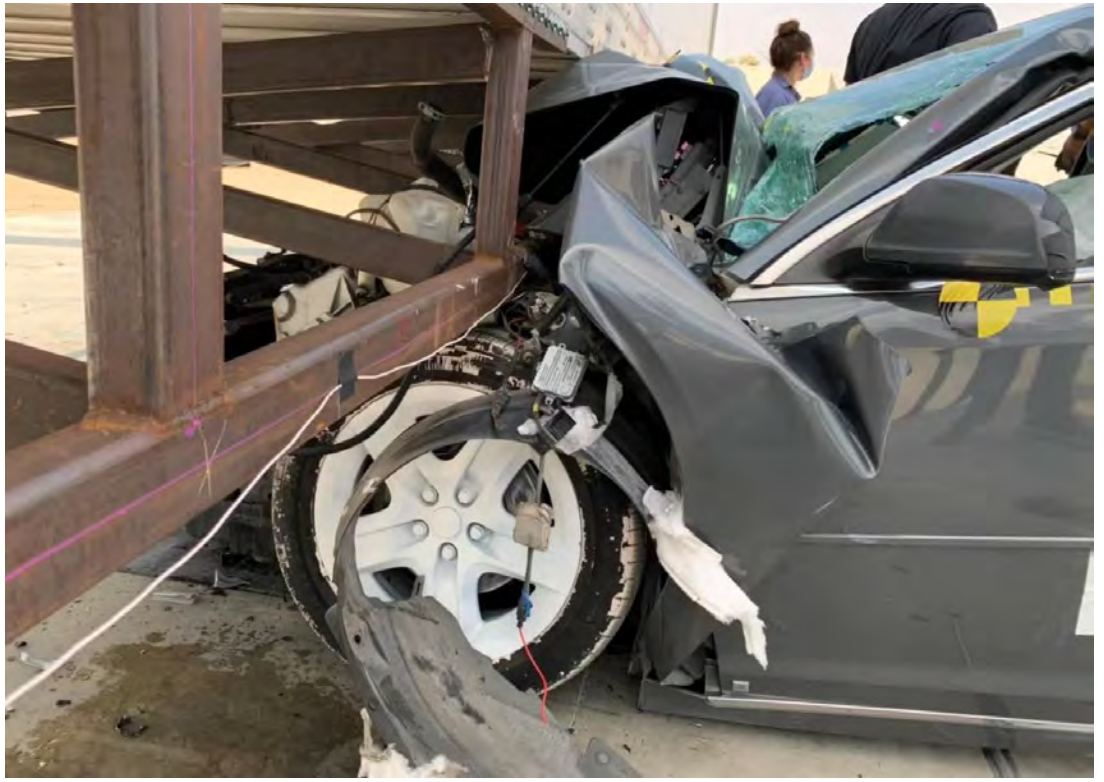
The rigid bracing behind aerodynamic trailer side skirts have instituted DOT safety recalls of specific side-skirt designs.

The AngelWing Design violates current DOT Safety Regulations regarding air brake lines.

The AngelWing design reduces trailer vehicle breakover angle to well below 10 degrees, which Utility testing shows damages the trailer and the guard.

Utility Side Impact Guard (SIG) Crash Test
– 35 mph / 90-degree impact / center of guard –

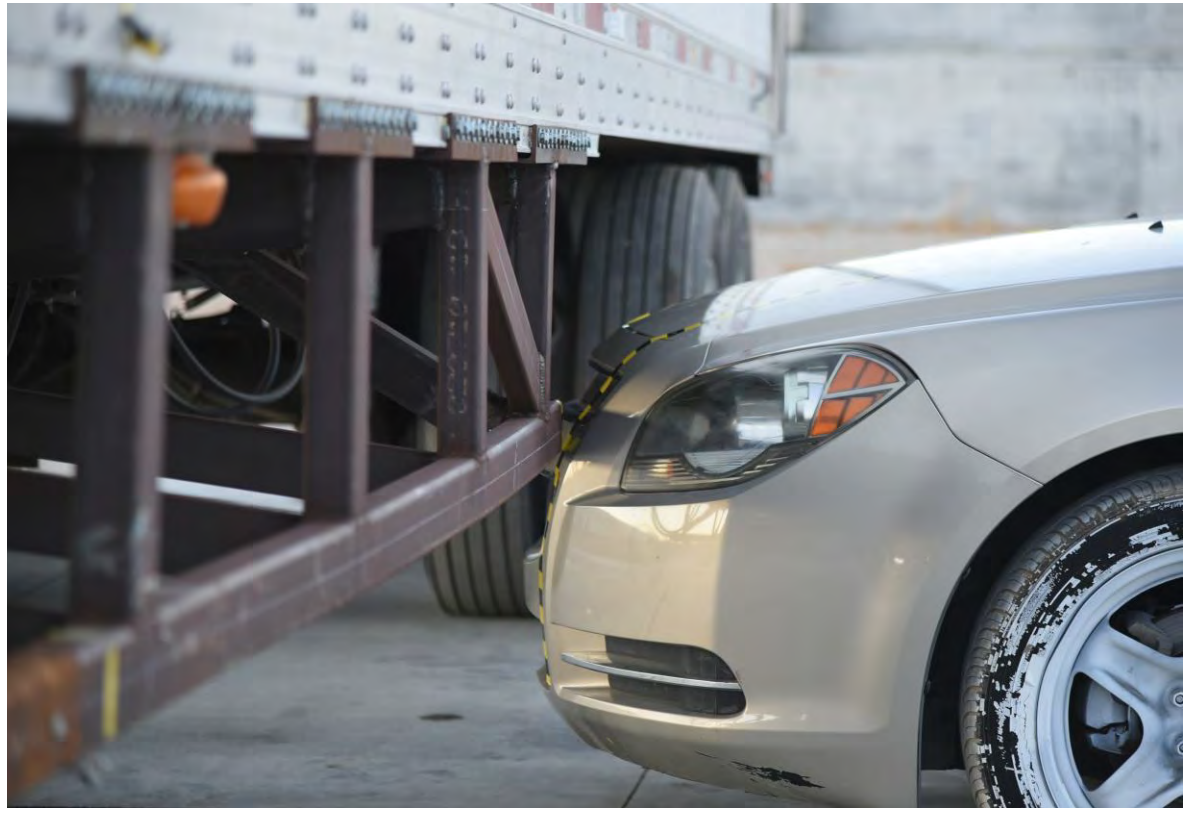
2011 Chevrolet Malibu




Utility Base Refrigerated Trailer

40,000 Pound Payload in Trailer (vs 22,487 at IIHS)
(Utility *trailer moved approx. 3" at impact*.)

Utility SIG Crash Test Rear - 30% Overlap / 35 mph / 90-degree Impact



Rear end of guard overlaps 30% of car width.

Utility Base Reefer Van (Trailer axles at wheels-back location)

2011 Chevrolet Malibu

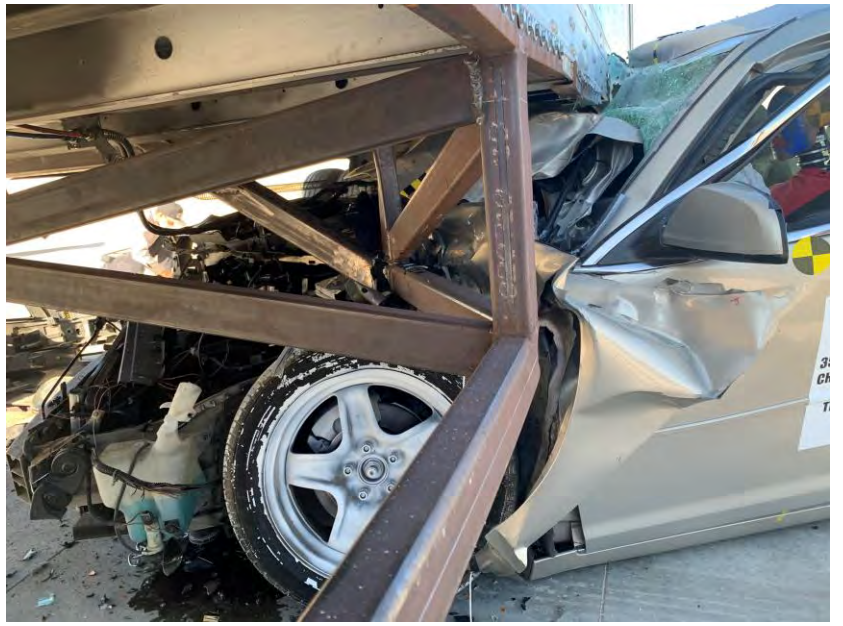
40,000 Pound Payload in Trailer (vs 22,487 at IIHS) (*Trailer moved approx. 3" at impact.*)


P40375-01
1


P40375-01
2


P40375-01
P40375-01
3


P40375-01
P40375-01
4



UTM Side Impact Guard was not effective when impacted at one end.
This is the only test we know of conducted at 30% (car to guard) overlap.

Collision and Crime Forensic Solutions & Stop Underrides crash test – April 2023.
Ford Fiesta / 45 mph / 45 degree impact angle / center of AngelWing

Ford Fiesta initially impacts the center of the AngelWing at 45 mph / 45 degrees.

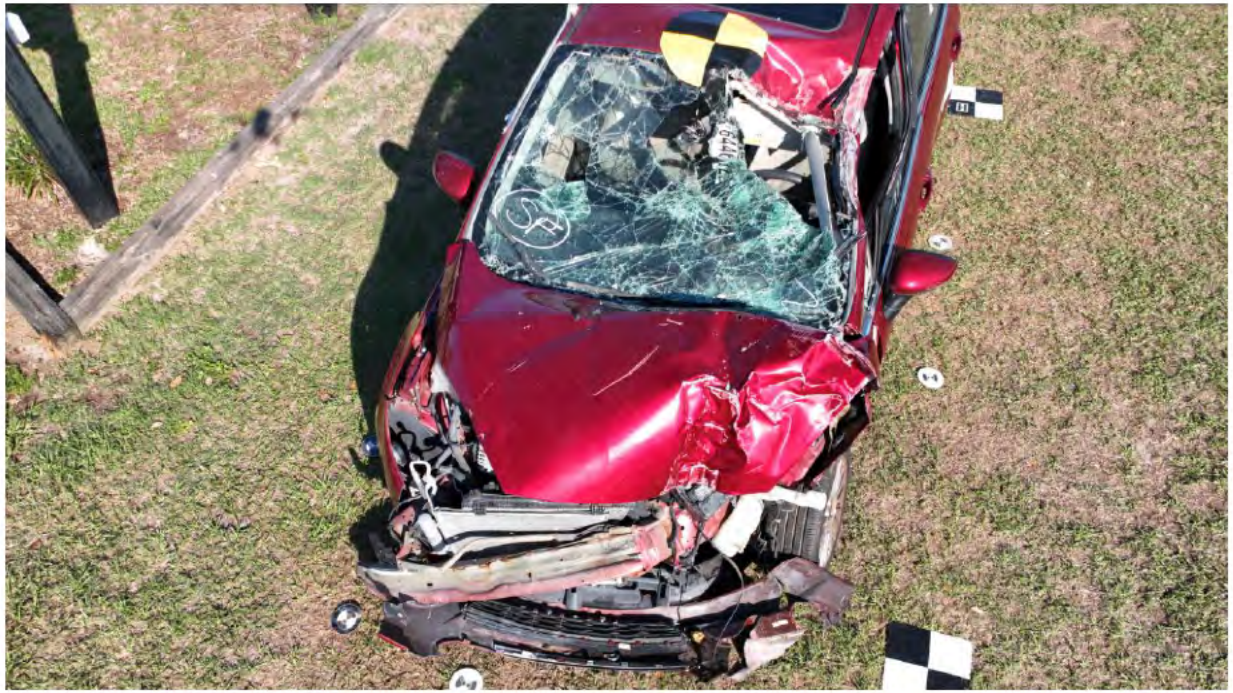

The AngelWing deflects rearward and detaches from trailer
Ryder
THERMO KING

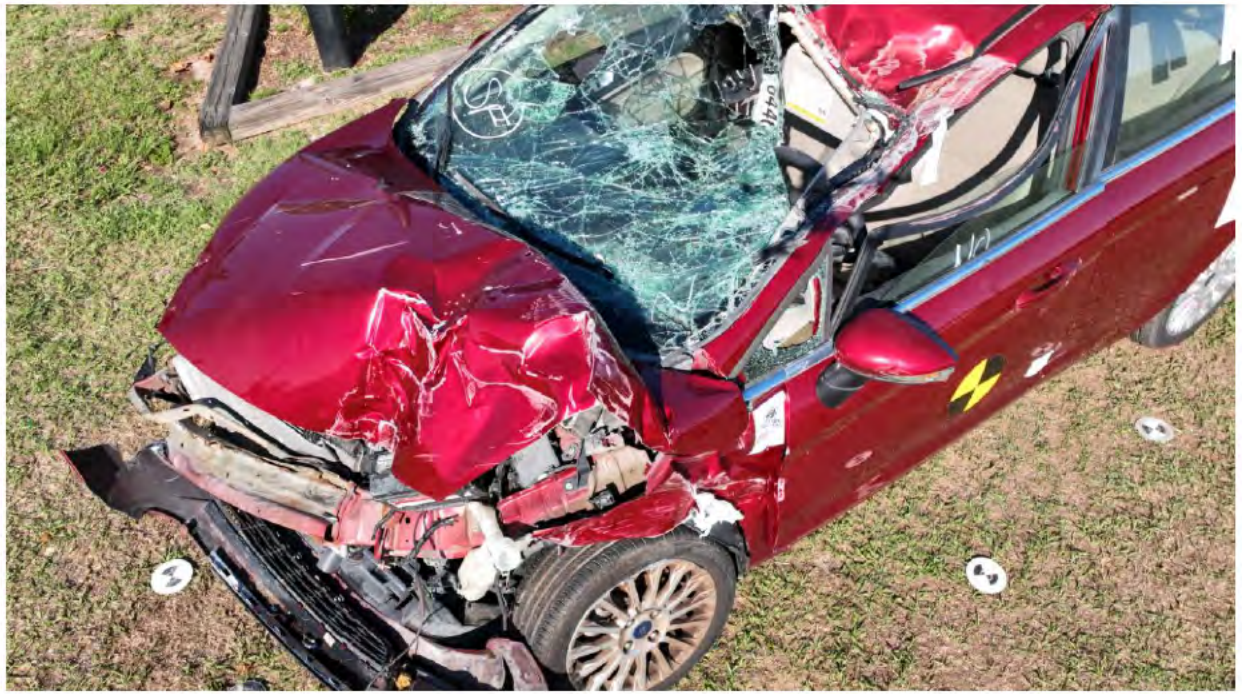

Ford Fiesta
underrides the trailer
Ryder
THERMO KING

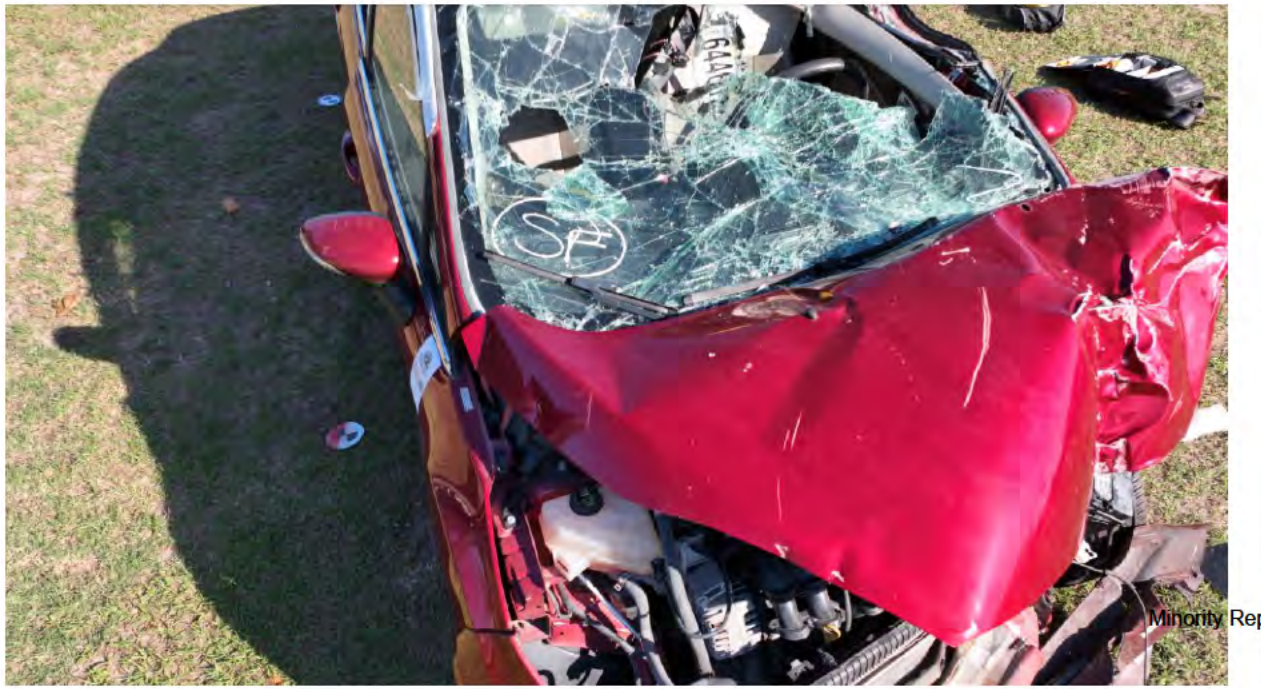

Initial 45-degree
impact

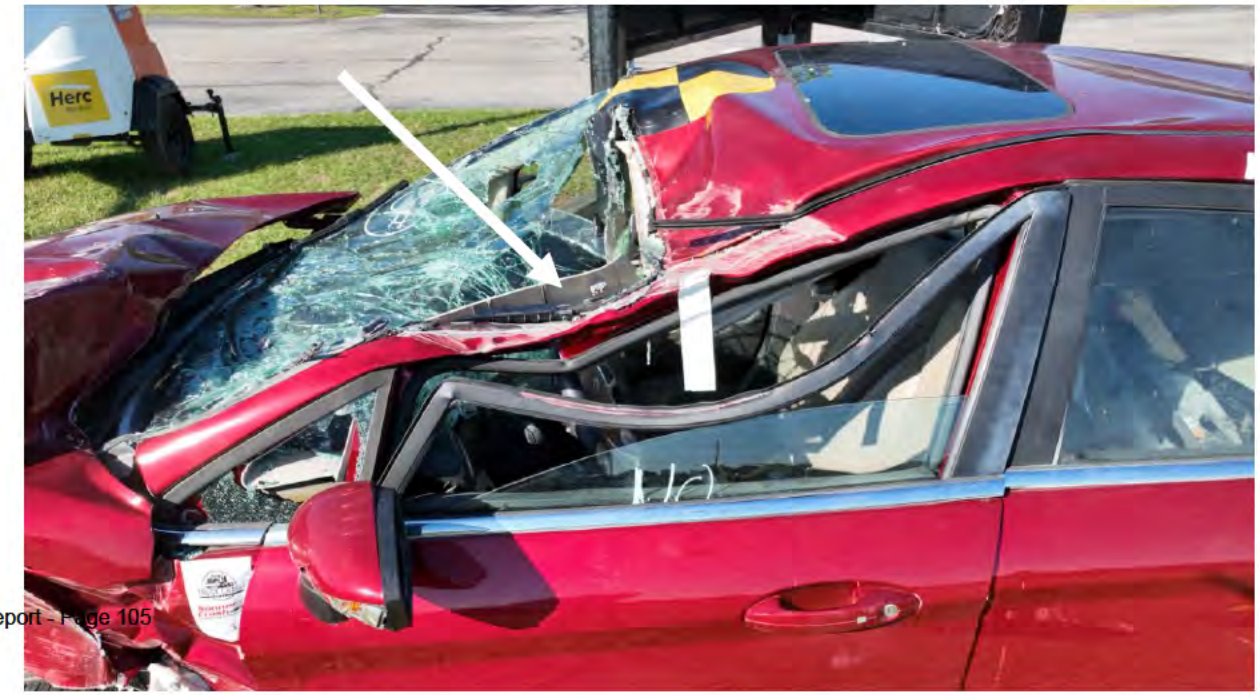

AngelWing detaches
and car underrides


STOP
UNDERRIDES
Combined (45 degree)
longitudinal and lateral impact
caused AngelWing to detach








Herc


TEAM
UNDERRIDE
TEAM
UNDERRIDE
TEAM
UNDERRIDE
TEAM
UNDERRIDE
CAR CLOUDS


TEAM
UNDERRIDE
36
CAR CLOUDS
COLLISION
CRIME
TITANIUM

Ford Fiesta AngelWing Test Performed by “Stop Underrides and Collision & Crime Forensic Solutions” Confirmed AngelWing Side Underride Guard not effective in a 45-mph center impact at 45 degrees.

Appendix H
to Minority Report

CORRECTED RECORD OF ACUP MOTIONS AND VOTES

Compilation of Votes from ACUP Meetings

MOTION	DATE	AUTHOR	SUMMARY	RESULT	VOTE	Name of Motion in Minutes	Included in Majority Report Appendix A. Record of ACUP Motions
C1	2/8/2024	Jennifer Tierney	Motion for "consensus" to be defined as 51%.	**Motion Carried**	9 Yes; 16 Members Present	Does not have motion name in minutes. Brought up by Jennifer Tierney during Welcome and Call to Order. Refer to 2/8/2024 Minutes.	Included: See Majority Report Appendix A.I **(Vote count incorrect in Majority Report Appendix A)**
A1	3/13/2024	Lee Jackson	Motion to amend the Bylaws to require a simple majority of members for quorum instead of 75%	**Motion Carried**	11 Yes; 6 No; 0 Abstain	Does not have motion name in minutes. Brought up by Chairman Lee Jackson during Welcome and Call to Order. Refer to 3/13/2024 Minutes.	**Omitted from Majority Report Appendix A**
A2	3/13/2024	Jeff Bennett	Use two-thirds as the threshold of consensus.	Delayed to future meeting	N/A	Motion 1	**Omitted from Majority Report Appendix A**
A3	3/13/2024	Kristen Glazner	Committee recommend that NHTSA conduct comprehensive research on U.S. underride crash characteristics, including the frequency of 30 perfect overlap crashes. Include photos as much as possible (goes into final report).	**Motion Carried**	13 Yes; 4 No; 0 Abstain	Motion 2	Included: See Majority Report Appendix A.II
A4	3/13/2024	Lee Jackson	Conduct an in-person meeting for all ACUP members to attend.	Withdrawn	N/A	Motion 3	Included: See Majority Report Appendix A.III
A5	3/13/2024	Lee Jackson	Request a deadline extension for the committee.	**Motion Carried**	13 Yes; 4 No; 1 Abstain	Motion 4	Included: See Majority Report Appendix A.IV
A6	3/13/2024	Marianne Karth	Include in the report to the Secretary and Congress the following recommedation that the 2022 RIG rule should be amended to require that ll new trailers meet the TOUGHGUARD test protocol or equivalent.	**Motion Carried**	10 Yes; 1 No; 6 Abstain	Motion 5	Included: See Majority Report Appendix A.V
A7	3/13/2024	Marianne Karth	Include in the report to the Secretary and Congress the following recommendation, that pursuant to the IIJA, within five years of implementing (V), the Secretary shall review and update FMVSS 223/224 standards in response to advancements in technology.	**Motion Carried**	13 Yes; 0 No; 3 Abstain	Motion 6	Included: See Majority Report Appendix A.VI
A8	3/13/2024	Marianne Karth	The ACUP include in the report to the Secretary and Congress the following Assessment: NHTSA's performance with respect to protecting the public from death and injury caused by rear underrides has been inadequate. Over the past 50 years, thousands of Americans have died potentially preventable deaths from rear impact collisions with semitrailers. During this period, NHTSA's only finalized rear impact guard rulemakings occurred in 1996 and 2022, the latter of which the agency was compelled to do by Congress. NHTSA merely adopted a 17 year-old Canadian standard with which nearly all American manufacturers (93%) already complied. NHTSA chose not to require advances in rear guard safety protection marketed by nine large trailer manufacturers in response to the Insurance Institute for Highway Safety's TOUGHGUARD test protocol.	Withdrawn	N/A	Motion 7	Included: See Majority Report Appendix A.VII
A9	3/13/2024	Aaron Kiefer	The ACUP should request from NHTSA/DOT all scoping documents, directions, and discussions between NHTSA/DOT and Elemance with regard to the rear guard analytical work between 2018 and 2024.	Combined with another motion	N/A	Motion 8	Included: See Majority Report Appendix A.VIII **(Incorrect year date in Majority Report Appendix A)**
A10	3/13/2024	Aaron Kiefer	The ACUP should request from NHTSA/DOT all scoping documents, directions, discussions, test results, data, memoranda, reports and/or notes generated before, during, and following quasi static testing of trailer rear underride guards conducted by Karco or other contractors on behalf of NHTSA/DOT between 2016 and 2024.	**Motion carried**	12 Yes; 3 No; 1 Abstain	Motion 9	Included: See Majority Report Appendix A.VIII
A11	3/13/2024	Aaron Kiefer	NHTSA/DOT should produce all documents related to rear guard standards including test data, contracts, studies, scoping documents, analyses, reports, memoranda, and/or other communications or references related to trailer and/or straight truck rear guard strength, design, quasi static or dynamic testing, and/or test protocols between 1970 and 1998.	**Motion carried**	10 Yes; 6 No; 0 Abstain	Motion 10	Included: See Majority Report Appendix A.IX
A12	3/13/2024	Aaron Kiefer	The ACUP should include in its congressional report a recommendation that all trailers manufactured between 1998 to the current time that do not have ToughGuard awarded rear impact guards should be retrofitted with crash proven reinforcement device(s). These reinforcement devices, at minimum, should be tested and proven to mitigate PCI and create crash compatibility consistent with a ToughGuard awarded rear impact guard when attached to a minimally compliant FMVSS 223 rear impact guard.	**Motion carried**	8 Yes; 1 No; 6 Abstain	Motion 11	Included: See Majority Report Appendix A.X
A13	3/13/2024	Aaron Kiefer	The ACUP should recommend in its report to congress that congress regulate single unit trucks (SUTs) with the same rear impact guard standards that currently only apply to semitrailers.	**Motion carried**	9 Yes; 2 No; 4 Abstain	Motion 12	Included: See Majority Report Appendix A.XI
A14	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation that NHTSA issue revised RIG performance standards to withstand 30% rear overlap crash at 35 mph as the IIJA already directed NHTSA to do (Sec 23011 (b)(1)(A)(iii), FMVSS 223 & 224).	Withdrawn	N/A	Motion 13	Included: See Majority Report Appendix A.XII

MOTION	DATE	AUTHOR	SUMMARY	RESULT	VOTE	Name of Motion in Minutes	Included in Majority Report Appendix A. Record of ACUP Motions
A15	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation NHTSA expeditiously conduct rear impact guard testing at "highway speeds" (up to 65 mph) as IIJA already directed NHTSA to do (Sec 23011 (b)(2)(A,B) and publish the results within 2 years.	**Motion carried**	9 Yes; 5 No; 1 Abstain	Motion 14	Included: See Majority Report Appendix A.XIII
A16	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation that NHTSA must expeditiously complete Heavy Vehicle Automatic Emergency Brake Rulemaking for all classes of CMVs (RIN 2127-AM36).	**Motion carried**	15 Yes; 0 No; 0 Abstain	Motion 15	Included: See Majority Report Appendix A.XIV
A17	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation that NHTSA conduct a study to research how the survivability rate of rear underride crashes will change with increased passenger vehicle adoption of Automatic Emergency Braking at currently tested speeds (35 mph) as well as highway speeds (up to 65 mph).	**Motion carried**	15 Yes; 0 No; 0 Abstain	Motion 16	Included: See Majority Report Appendix A.XV
A18	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation that FMCSA should issue stronger conspicuity requirements, at minimum, a requirement to maintain and replace conspicuity tape every 5 years.	**Motion carried**	11 Yes; 4 No; 1 Abstain	Motion 17	Included: See Majority Report Appendix A.XVI
A19	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation that NHTSA should additionally require Single Unit Trucks to adhere to conspicuity requirements.	**Motion carried**	15 Yes; 0 No; 1 Abstain	Motion 18	Included: See Majority Report Appendix A.XVII
A20	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation that DOT should continue research into Enhanced Rear Signaling Systems that could help better prevent rear underride crashes.	**Motion carried**	16 Yes; 0 No; 0 Abstain	Motion 19	Included: See Majority Report Appendix A.XVIII
A21	3/13/2024	Jennifer Tierney	The ACUP should recommend that DOT research the efficacy of high visibility ID lamps that illuminate the rear of a CMV to assist with potential Clearance Lamp rulemaking for all CMVs.	**Motion carried**	14 Yes; 1 No; 1 Abstain	Motion 20	Included: See Majority Report Appendix A.XIX
A22	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation that DOT conduct research into efficacious methods of reducing Distracted Driving such as flashing lamps.	**Motion carried**	16 Yes; 0 No; 0 Abstain	Motion 21	Included: See Majority Report Appendix A.XX
A23	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a recommendation that FMCSA work with State law enforcement and other stakeholders to emphasize education and the need to issue RIG violation citations and encourage maximum fines for violations affecting safety.	**Motion carried**	14 Yes; 1 No; 0 Abstain	Motion 22	Included: See Majority Report Appendix A.XXI
A24	3/13/2024	Jennifer Tierney	NHTSA should provide a staff member on a contractor to the ACUP Committee to help proofread, edit, and format the Committee's written report to Congress, consistent with IIJA 23011 (d)(5), "On request of the Committee, the Secretary shall provide information, administrative services, and supplies necessary for the Committee to carry out the duties of the Committee."	Withdrawn	N/A	Motion 23	Included: See Majority Report Appendix A.XXII
A25	3/13/2024	Jennifer Tierney	The ACUP should include in its Report to Congress a fact-based history of underride crashes.	**Motion carried**	7 Yes; 4 No; 4 Abstain	Motion 24	Included: See Majority Report Appendix A.XXIII
A26	3/13/2024	Jennifer Tierney	The ACUP should request the Secretary of DOT to extend the ACUP charter for an additional 2-years in accordance with FACA.	Withdrawn	N/A	Motion 25	Included: See Majority Report Appendix A.XXVI
A27	3/13/2024	Lee Jackson	Motion for minority report to accompany majority report.	**Motion carried**	15 Yes; 0 No; 0 Abstain	Motion 26	Included: See Majority Report Appendix A.XXIV
A28	3/13/2024	Harry Adler	Motion for proxies.	Ran out of time	N/A	N/A	**Omitted from Majority Report Appendix A**
B1	4/24/2024	Jeff Bennett	Therefore it is resolved that for purposes of providing 'written consensus advice' to the Secretary of Transportation on underride protection to reduce underride crashes and fatalities relating to underride crashes, 'consensus' on any piece of advice will mean the agreement of two-thirds of the then-serving ACUP members, and any piece of advice that does not have the agreement of two-thirds of the then-serving ACUP members will not be represented to be the consensus advice of the ACUP.	Combined with Motion 16	N/A	Motion 1	**Omitted from Majority Report Appendix A, but Motion was combined with Motion 16**
B2	4/24/2024	Jennifer Tierney	NHTSA should withdraw its previously submitted ANPRM or reissue a revised ANPRM and cost-benefit analysis that acknowledges and accommodates critiques made by commenters that the cost-benefit approach taken artificially constrained the number of lives saved and also failed to account for cost-savings (such as fuel efficiency gains provided by side underride guards).	**Motion Carried**	7 Yes; 6 No; 4 Abstain	Motion 2	Included: See Majority Report Appendix A.XXV
B3	4/24/2024	Jennifer Tierney	ACUP affirms that NHTSA, per the Modernizing Regulatory Review Executive Memo and corresponding guidance, must fully account for regulatory benefits that are difficult or impossible to quantify when conducting rulemaking analysis.	**Motion Carried**	9 Yes; 2 No; 6 Abstain	Motion 3	Included: See Majority Report Appendix A.XXVII
B4	4/24/2024	Marianne Karth	Based on the rigorous analysis of the IIHS' Public Comment, the ACUP finds that NHTSA underestimated the number of preventable side underride deaths. NHTSA erroneously concluded that costs outweigh benefits, when the opposite is true. NHTSA should withdraw the 2023 side impact guard ANPRM.	**Motion did not carry**	7 Yes; 7 No; 3 Abstain	Motion 4	Included: See Majority Report Appendix A.XXVIII
B5	4/24/2024	Marianne Karth	NHTSA should complete a new side impact guard cost benefit analysis and rulemaking that counts previously omitted underride victim categories, including pedestrians, bicyclists, and motorcyclists.	**Motion Carried**	12 Yes; 5 No; 0 Abstain	Motion 5	Included: See Majority Report Appendix A.XXIX **(Vote count incorrect in Majority Report Appendix A)**
B6	4/24/2024	Marianne Karth	NHTSA should issue an Advanced Notice of Proposed Rulemaking on Front Impact Guards.	**Motion Carried**	11 Yes; 1 No; 5 Abstain	Motion 6	Included: See Majority Report Appendix A.XXX

MOTION	DATE	AUTHOR	SUMMARY	RESULT	VOTE	Name of Motion in Minutes	Included in Majority Report Appendix A. Record of ACUP Motions
B7	4/24/2024	Marianne Karth	NHTSA may harmonize with global front override regulations, including UNECE-93 and any revisions to it, in order to provide improved motor vehicle safety, as indicated in Section 24211 of the IIJA: The Secretary shall cooperate, to the maximum extent practicable, with foreign governments, nongovernmental stakeholder groups, the motor vehicle industry, and consumer groups with respect to global harmonization of vehicle regulations as a means for improving motor vehicle safety. (IIJA, p. 397, https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf)	**Motion Carried**	11 Yes; 1 No; 5 Abstain	Motion 7	Included: See Majority Report Appendix A.XXXII
B8	4/24/2024	Marianne Karth	The Secretary should recommend, and the President should establish, a Presidential Advisory Committee on Integrity of Underride Research. It should be composed of a diverse group of stakeholders, including: (i) Truck and trailer manufacturers. (ii) Motor carriers, including independent owner operators. (iii) Law enforcement. (iv) Motor vehicle engineers. (v) Motor vehicle crash investigators. (vi) Truck safety organizations. (vii) The insurance industry. (viii) Emergency medical service providers. (ix) Families of passenger vehicle underride crash victims. (x) Families of Vulnerable Road User underride crash victims. (xi) Labor organizations. The ACIUR should review all underride-related research, conducted by or contracted with the Department of Transportation, including the Statement of Work and the draft report prior to publication.	**Motion did not carry**	1 Yes; 12 No; 4 Abstain	Motion 8	Included: See Majority Report Appendix A.XXXI
B9	4/24/2024	Aaron Kiefer	To require all new semitrailers, and single unit trucks that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.	**Motion Carried**	11 yes; 6 No; 0 Abstain	Motion 9	Included: See Majority Report Appendix A.XXXIII
B10	4/24/2024	Aaron Kiefer	To require semitrailers, and single unit trucks manufactured after 1998 that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.	**Motion Carried**	8 Yes; 6 No; 3 Abstain	Motion 10	Included: See Majority Report Appendix A.XXXIV
B11	4/24/2024	Aaron Kiefer	To require the side guards referenced in motions 9 & 10 above to also prevent a vulnerable road user (VRU) from passing underneath the guarded vehicle in an interaction with the side of the vehicle.	**Motion Carried**	9 Yes; 8 No; 0 Abstain	Motion 11	Included: See Majority Report Appendix A.XXXV
B12	4/24/2024	Aaron Kiefer	To require NHTSA to conduct a cost analysis of the total average cost of a fatal side underride crash including loss of life, lost productivity, court costs, equipment costs, expert witness and attorney costs, property damage, judgements and/or settlements and other related costs. This study should be based on data from fatal side underride crashes such as the crash of Riley Hein.	Withdrawn	N/A	Motion 12	Included: See Majority Report Appendix A.XXXVI
B13	4/24/2024	John Frieler	The department should conduct a study of conspicuity tape in service. This study focuses on actual rates of compliance with the regulated minimum reflectivity requirements, the ability of enforcement personnel to accurately and adequately enforce these requirements and make recommendations on how to reduce the most common forms of non-compliance found.	**Motion Carried**	16 Yes; 1 No; 0 Abstain	Motion 13	Included: See Majority Report Appendix A.XXXVII
B14	4/24/2024	Jeff Bennett	Therefore it is resolved that any report from the ACUP to the Secretary that claims or purports to contain written consensus advice to the Secretary on underride protection to reduce underride crashes and fatalities relating to underride crashes will be provided in final form to all members of the ACUP at one week before such a report or advice is actually submitted to the Secretary so that those ACUP members who have dissenting or differing views may prepare their own submission to be submitted to the Secretary at the same time the report of the ACUP is submitted to the Secretary.	**Motion Carried**	17 Yes; 0 No; 0 Abstain	Motion 14	Included: See Majority Report Appendix A.XLV
B15	4/24/2024	Kristen Glazner	I move that NHTSA set deadlines for drafts of the majority and minority reports to be circulated, deadlines for comments to be submitted on each draft report, deadlines for revised drafts to be circulated, and deadlines for reports to be deemed final.	Withdrawn	N/A	Motion 15	Included: See Majority Report Appendix A.XLVI
B16	4/24/2024	Doug Smith	For purposes of providing 'written consensus advice' to the Secretary of Transportation on underride protection to reduce underride crashes and fatalities relating to underride crashes, 'consensus' on any piece of advice will mean the agreement of two-thirds of the then-serving ACUP members, and any piece of advice that does not have the agreement of two-thirds of the then-serving ACUP members will not be represented to be the consensus advice of the ACUP.	**Motion did not carry**	8 Yes; 9 No; 0 Abstain	Motion 16	Included: See Majority Report Appendix A.XXXVIII

MOTION	DATE	AUTHOR	SUMMARY	RESULT	VOTE	Name of Motion in Minutes	Included in Majority Report Appendix A. Record of ACUP Motions
B17	5/22/2024	Doug Smith	Moving forward, NHTSA should use an independent moderator to assist ACUP in executing Committee duties, covering all agenda items, and facilitating member discussion.	Withdrawn	N/A	Motion 17	Included: See Majority Report Appendix A.XLVII
B18	5/22/2024	Dan Horvath	NHTSA should work with the Federal Railroad Administration (FRA) to conduct research to examine potential impacts the installation of side underride guards would have during highway-rail grade crossings.	**Motion carried**	15 Yes; 0 No; 0 Abstain	Motion 18	Included: See Majority Report Appendix A.XLIII
B19	5/22/2024	Dan Horvath	To further GAO recommendation # 1 regarding improvements to Model Minimum Uniform Crash Criteria, NHTSA should take additional steps to include both vehicle-related side underride crashes, and Vulnerable Road Users (VRU) side underride crashes in reporting of injuries and fatalities related to side underride guard crashes.	**Motion carried**	14 Yes; 0 No; 0 Abstain	Motion 19	Included: See Majority Report Appendix A.XXXIX **(Vote count incorrect in Majority Report Appendix A)**
B20	5/22/2024	Dan Horvath	NHTSA should investigate the potential for collision mitigation technologies for light and heavy-duty vehicles to prevent or reduce the risk associated with side underride crashes.	**Motion carried**	15 Yes; 0 No; 0 Abstain	Motion 20	Included: See Majority Report Appendix A.XLVIII
B21	5/22/2024	Dan Horvath	NHTSA should assess risks associated with deflection into adjacent lanes associated with partial offset rear crashes as well as side underride crashes. Final results should be made public.	**Motion carried**	9 Yes; 6 No; 0 Abstain	Motion 21	Included: See Majority Report Appendix A.XL
B22	5/22/2024	Harry Adler	The ACUP shall recommend in its report that NHTSA advance rulemaking to mandate that all new applicable semitrailers install side underride guards.	Withdrawn	N/A	Motion 22	**Omitted from Majority Report Appendix A**
B23	5/22/2024	Harry Adler	The ACUP shall recommend in its report that NHTSA advance rulemaking to mandate retrofitting all applicable semitrailers built since 1998 install side underride guards.	Withdrawn	N/A	Motion 23	**Omitted from Majority Report Appendix A**
B24	5/22/2024	Harry Adler	The ACUP shall recommend in its report that NHTSA advance rulemaking to mandate that all new applicable single unit trucks install side underride guards.	Withdrawn	N/A	Motion 24	**Omitted from Majority Report Appendix A**
B25	5/22/2024	Harry Adler	The ACUP shall recommend in its report that DOT explore the need for Federal weight limit weight-based exemption for side underride guards.	**Motion carried**	7 Yes; 6 No; 2 Abstain	Motion 25	Included: See Majority Report Appendix A.XLI
B26	5/22/2024	Harry Adler	The ACUP shall recommend in its report that NHTSA request that the Department of Transportation's Volpe Center evaluate the effectiveness of a side underride guard to determine if their effectiveness is similar or greater than Lateral Protective Devices in mitigating the severity of pedestrian, cyclist, and motorcyclist fatalities.	**Motion carried**	13 Yes; 1 No; 1 Abstain	Motion 26	Included: See Majority Report Appendix A.XLII **(Vote count incorrect in Majority Report Appendix A)**
B27	5/22/2024	Harry Adler	The ACUP shall recommend in its report that NHTSA create a field in the Fatality Analysis Reporting System to determine if an underride crash occurred involving a large truck and a pedestrian/cyclist.	**Motion carried**	13 Yes; 0 No; 2 Abstain	Motion 27	Included: See Majority Report Appendix A.XLIV
B28	5/22/2024	Harry Adler	The ACUP shall recommend that DOT disseminate educational material in additional to existing brochure for law enforcement to help them identify and record side underride crashes.	**Motion carried**	15 Yes; 0 No; 0 Abstain	Motion 28	Included: See Majority Report Appendix A.XLIX
B29	5/22/2024	Kristen Glazner	I move that the ACUP report reflects whether each committee member concurs or does not concur with the report by allowing each member to make a statement of concurrence or non-concurrence with the report. The following link contains an example from another DOT Committee: APPENDIX_F-Combined_Voting_Ballots_03242022.pdf (faa.gov). My motion is that the ACUP report include similar documentation in an Appendix.	**Motion carried**	15 Yes; 0 No; 0 Abstain	Motion 29	Included: See Majority Report Appendix A.L

III. Appendices

A. Record of ACUP Motions

I. ACUP threshold to constitute consensus for recommendations to the Secretary in its Final Report shall be 50+%

Motion carried 9 yes no other votes were recorded 16 attendees

II. The committee recommends that NHTSA conduct comprehensive research on U.S. underride crash characteristics, including the frequency of 30 percent overlap crashes. As much as possible, photos should be used. This research should be in addition to the agency's congressionally directed research into the feasibility of developing guards to protect in certain crash scenarios

Motion carried 13 – 4

III. Conduct an in-person meeting for all ACUP Members

Withdrawn

IV. Request a deadline extension for the committee.

Motion carried 13 – 4 – 1

V. Include in the report to the Secretary and Congress the following recommendation that the 2022 RIG Rule should be amended to require that all new trailers meet the TOUGHGUARD test protocol or equivalent

Motion carried 10 – 1 – 6

VI. Include in the report to the Secretary and Congress the following recommendation, that pursuant to the IIJA, within five years of implementing (V), the Secretary shall review and update FMVSS 223/224 standards in response to advancements in technology

Motion carried 13 – 0 – 3

VII. Include in the report to the Secretary and Congress the following Assessment:

- NHTSA's performance with respect to protecting the public from death and injury caused by rear underrides has been inadequate. Over the past 50 years, thousands of Americans have died potentially preventable deaths from rear impact collisions with semitrailers. During this period, NHTSA's only finalized rear impact guard rulemakings occurred in 1996 and 2022, the latter of which the agency was compelled to do by Congress. NHTSA merely

adopted a 17 year-old Canadian standard with which nearly all American manufacturers (93%) already complied. NHTSA chose not to require advances in rear guard safety protection marketed by nine large trailer manufacturers in response to the Insurance Institute for Highway Safety's TOUGHGUARD test protocol.

Withdrawn

VIII. The ACUP should request from NHTSA/DOT all scoping documents, directions, discussions, test results, data, memoranda, reports and/or notes generated before, during, and following quasi static testing of trailer rear underride guards conducted by Karco or other contractors (i.e. Elemance) on behalf of NHTSA/DOT between 2016 and 2024. (Combined 8 & 9)

(Combined Motion) carried 12 – 3 – 1

IX. NHTSA/DOT should produce all documents related to rear guard standards including test data, contracts, studies, scoping documents, analyses, reports, memoranda, and/or other communications or references related to trailer and/or straight truck rear guard strength, design, quasi static or dynamic testing, and/or test protocols between 1970 and 1998.

Motion carried 10 – 6 – 0

X. The ACUP should include in its congressional report a recommendation that all trailers manufactured between 1998 to the current time that do not have ToughGuard awarded rear impact guards should be retrofitted with crash proven reinforcement device(s). These reinforcement devices, at minimum, should be tested and proven to mitigate PCI and create crash compatibility consistent with a ToughGuard awarded rear impact guard when attached to a minimally compliant FMVSS 223 rear impact guard.

Motion carried 8 – 1 – 6

XI. The ACUP should recommend in its report to congress that congress regulate single unit trucks (SUTs) with the same rear impact guard standards that currently only apply to semitrailers.

Motion carried 9 – 2 – 4

XII. The ACUP should include in its Report to Congress a recommendation that NHTSA issue revised RIG performance standards to withstand 30% rear overlap crash at 35 mph as the IIJA already directed NHTSA to do (Sec 23011 (b)(1)(A)(iii), FMVSS 223 & 224)

Withdrawn

XIII. The ACUP should include in its Report to Congress a recommendation NHTSA expeditiously conduct rear impact guard testing at “highway speeds” (up to 65 mph) as IIJA already directed NHTSA to do (Sec 23011 (b)(2)(A,B) and publish the results within 2 years.

Motion carried 9 – 5 – 1

XIV. The ACUP should include in its Report to Congress a recommendation that NHTSA must expeditiously complete Heavy Vehicle Automatic Emergency Brake Rulemaking for all classes of CMVs (RIN 2127-AM36)

Motion carried 15 – 0 – 0

XV. The ACUP should include in its Report to Congress a recommendation that NHTSA conduct a study to research how the survivability rate of rear underride crashes will change with increased passenger vehicle adoption of Automatic Emergency Braking at currently tested speeds (35 mph) as well as highway speeds (up to 65 mph).

Motion carried 15 – 0 – 0

XVI. The ACUP should include in its Report to Congress a recommendation that FMCSA should issue stronger conspicuity requirements, at minimum, a requirement to maintain and replace conspicuity tape every 5 years.

Motion carried 11 – 4 – 1

XVII. The ACUP should include in its Report to Congress a recommendation that NHTSA should additionally require Single Unit Trucks to adhere to conspicuity requirements.

Motion carried 15 – 0 – 1

XVIII. The ACUP should include in its Report to Congress a recommendation that DOT should continue research into Enhanced Rear Signaling Systems that could help better prevent rear underride crashes

Motion carried 16 – 0 – 0

XIX. The ACUP should recommend that DOT research the efficacy of high visibility ID lamps that illuminate the rear of a CMV to assist with potential Clearance Lamp rulemaking for all CMVs

Motion carried 14 – 1 – 1

XX. The ACUP should include in its Report to Congress a recommendation that DOT conduct research into efficacious methods of reducing Distracted Driving such as flashing lamps

Motion carried 16 – 0 – 0

XXI. The ACUP should include in its Report to Congress a recommendation that FMCSA

work with State law enforcement and other stakeholders to emphasize education and the need to issue RIG violation citations and encourage maximum fines for violations affecting safety.

Motion carried 14 – 1 – 0

XXII. NHTSA should provide a staff member on a contractor to the ACUP Committee to help proofread, edit, and format the Committee's written report to Congress, consistent with IIJA 23011 (d)(5), "On request of the Committee, the Secretary shall provide information, administrative services, and supplies necessary for the Committee to carry out the duties of the Committee."

Withdrawn

XXIII. The ACUP should include in its Report to Congress a fact-based history of underride crashes

Motion carried 7 – 4 – 4

XXIV. Motion for minority report to accompany majority report

Motion carried 15 – 0 – 0

XXV. NHTSA should withdraw its previously submitted ANPRM or reissue a revised ANPRM and cost-benefit analysis that acknowledges and accommodates critiques made by commenters that the cost-benefit approach taken artificially constrained the number of lives saved and also failed to account for cost-savings (such as fuel efficiency gains provided by side underride guards).

Motion carried 7– 6 – 4

XXVI. The ACUP should request the Secretary of DOT to extend the ACUP charter for an additional 2-years in accordance with FACA.

Withdrawn

XXVII. ACUP affirms that NHTSA, per the Modernizing Regulatory Review Executive Memo and corresponding guidance, must fully account for regulatory benefits that are difficult or impossible to quantify when conducting rulemaking analysis.

Motion carried 9 – 2– 6

XXVIII. Based on the rigorous analysis of the IIHS' Public Comment, the ACUP finds that NHTSA underestimated the number of preventable side underride deaths. NHTSA erroneously concluded that costs outweigh benefits, when the opposite is true. NHTSA should withdraw the 2023 side impact guard ANPRM.

Motion failed 7 – 7 – 3

XXIX. NHTSA should complete a new side impact guard cost benefit analysis and rulemaking that counts previously omitted underride victim categories, including pedestrians, bicyclists, and motorcyclists.

Motion carried 11 – 1– 5

XXX. NHTSA should issue an Advanced Notice of Proposed Rulemaking on Front Impact Guards.

Motion carried 11 – 1 – 5

XXXI. The Secretary should recommend, and the President should establish, a Presidential Advisory Committee on Integrity of Underride Research. It should be composed of a diverse group of stakeholders, including:

(i) Truck and trailer manufacturers.
(ii) Motor carriers, including independent owner operators.
(iii) Law enforcement.
(iv) Motor vehicle engineers.
(v) Motor vehicle crash investigators.
(vi) Truck safety organizations.
(vii) The insurance industry.
(viii) Emergency medical service providers.
(ix) Families of passenger vehicle underride crash victims.
(x) Families of Vulnerable Road User underride crash victims.
(xi) Labor organizations.

The ACIUR should review all underride-related research, conducted by or contracted with the Department of Transportation, including the Statement of Work and the draft report prior to publication.

Motion failed 1 – 12 – 4

XXXII. NHTSA may harmonize with global front override regulations, including UNECE-93 and any revisions to it, in order to provide improved motor vehicle safety, as indicated in Section 24211 of the IIJA: The Secretary shall cooperate, to the maximum extent practicable, with foreign governments, nongovernmental stakeholder groups, the motor vehicle industry, and consumer groups with respect to global harmonization of vehicle regulations as a means for improving motor vehicle safety. (IIJA, p. 397, https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf)

Motion carried 11 – 1 – 5

XXXIII. To require all new semitrailers, and single-unit trucks that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of

preventing injurious passenger compartment intrusion (pci) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.

Motion carried 11– 6 – 0

XXXIV. To require semitrailers, and single-unit trucks manufactured after 1998 that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (pci) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.

Motion carried 8 – 6 – 3

XXXV. To require the side guards referenced above also prevent a vulnerable road user (VRU) from passing underneath the guarded vehicle in an interaction with the side of the vehicle.

Motion carried 9 – 8 – 0

XXXVI. To require NHTSA to conduct a cost analysis of the total average cost of a fatal side underride crash including loss of life, lost productivity, court costs, equipment costs, expert witness and attorney costs, property damage, judgements and/or settlements and other related costs.This study should be based on data from fatal side underride crashes such as the crash of Riley Hein.

Withdrawn

XXXVII. The department should conduct a study of conspicuity tape in service. This study focuses on actual rates of compliance with the regulated minimum reflectivity requirements, the ability of enforcement personnel to accurately and adequately enforce these requirements, and make recommendations on how to reduce the most common forms of non-compliance found.

Motion carried 16 – 1– 0

XXXVIII. For purposes of providing 'written consensus advice' to the Secretary of Transportation on underride protection to reduce underride crashes and fatalities relating to underride crashes, 'consensus' on any piece of advice will mean the agreement of two-thirds of the then-serving ACUP members, and any piece of advice that does not have the agreement of two-thirds of the then-serving ACUP members will not be represented to be the consensus advice of the ACUP.

Motion failed 8 – 9 – 0

XXXIX. To further GAO recommendation # 1 regarding improvements to Model Minimum Uniform Crash Criteria, NHTSA should take additional steps to include both vehicle-related side underride crashes, and Vulnerable Road Users (VRU) side underride crashes in reporting of injuries and fatalities related to side underride guard crashes.

Motion carried 15 – 0 – 0

XL. NHTSA should assess risks associated with deflection into adjacent lanes associated with partial offset rear crashes as well as side underride crashes. Final results should be made public.

Motion carried 9 – 6 – 0

XLI. The ACUP shall recommend in its report that DOT explore the need for Federal weight limit weight-based exemption for side underride guards.

Motion carried 7– 6 – 2

XLII. The ACUP shall recommend in its report that NHTSA request that the Department of Transportation's Volpe Center evaluate the effectiveness of a side underride guard to determine if their effectiveness is similar or greater than Lateral Protective Devices in mitigating the severity of pedestrian, cyclist, and motorcyclist fatalities.

Motion carried 13 – 0 – 2

XLIII. NHTSA should work with the Federal Railroad Administration to conduct research on potential impacts of side underride guards during highway-rail grade crossings and that research be made publicly available.

Motion carried 15 – 0

XLIV. The ACUP shall recommend in its report that NHTSA create a field in the Fatality Analysis Reporting System to determine if an underride crash occurred involving a large truck and a pedestrian/cyclist.

Motion carried 15 – 0 – 0

XLV. Therefore it is resolved that any report from the ACUP to the Secretary that claims or purports to contain written consensus advice to the Secretary on underride protection to reduce underride crashes and fatalities relating to underride crashes will be provided in final form to all members of the ACUP at one week before such a report or advice is actually submitted to the Secretary so that those ACUP members who have dissenting or differing views may prepare their own submission to be submitted to the Secretary at the same time the report of the ACUP is submitted to the Secretary.

Motion carried 17– 0 – 0

XLVI. NHTSA should set deadlines for drafts of the majority and minority reports to be circulated, deadlines for comments to be submitted on each draft report, deadlines for revised drafts to be circulated, and deadlines for reports to be deemed final.

Withdrawn

XLVII. Moving forward, NHTSA should use an independent moderator to assist ACUP in executing Committee duties, covering all agenda items, and facilitating member discussion.

Withdrawn

XLVIII. NHTSA should investigate the potential for collision mitigation technologies for light and heavy-duty vehicles to prevent or reduce the risk associated with side underride crashes.

Motion carried 15 – 0 – 0

XLIX. The ACUP shall recommend that DOT disseminate educational material in addition to existing brochure for law enforcement to help them identify and record side underride crashes.

Motion carried 15 – 0 – 0

L. The ACUP report shall reflect whether each committee member concurs or does not concur with the report by allowing each member to make a statement of concurrence or non-concurrence with the report. The ACUP report include such documentation in an Appendix.

Motion carried 15 – 0 – 0

LI. Change the quorum requirement from 75% of ACUP Membership to 50+%, if By-Laws are subject to amendment (Note: they were not able to be amended)

Motion carried 11 – 6 – 0

B. Individual ACUP Member Reason Concurrence or Dissent

C. Technical briefings

a. Truck Rear Underride-by Matthew Brumbelow, IIHS

b. Rear Underride Prevention-by Aaron Kiefer, Collision Safety Consulting PLLC

c. Overview of 50 Years of Work on Rear Underride Prevention-by Marianne Karth, AnnaLeah and Mary for Truck Safety

d. An Alternative Estimate of the Lives that Could be Saved by a Side Underride Guard standard— by Matthew Brumbelow, IIHS

e. Underride Fatalities — by Eric Hein and letter with supporting data.

f. A History of Trailer Rear Impact Guards from Utility's Perspective — by Jeff Bennett, Utility Trailers

g. Missed Opportunities to Prevent Side Underride — by Marianne Karth, AnnaLeah and Mary for Truck Safety

h. Front Underride — By Keith Friedman, Friedman Research

i. Front Underride — by Marianne Karth, AnnaLeah and Mary for Truck Safety

j. Hydro Concept Rear Impact Guard (RIG) — by Malcolm Deighton, Hydro Aluminum Extrusions

k. Crash Avoidance Technology — by Wolfgang Hahn, ZF CV Systems North America

l. Jersey Barriers — by Doug Smith
m. Side Underride Data and Analyses — by Eric Heim

D. Quon Kwan Notarized Statement
*** Appendix: Quon Kwan's Statement**

Statement of Quon Kwan to the Advisory Committee on Underride Protection

My name is Quon Kwan. Prior to my retirement in May 2019, I worked as a general engineer at the U.S. Department of Transportation (U.S. DOT), where I rose to GS-14 in the Analysis, Research and Technology division of the Federal Motor Carrier Safety Administration (FMCSA).

In 2017, I proposed that my agency fund research to evaluate the synergistic effects of combining aerodynamic skirts with side guards on trucks, both single-unit trucks and tractor-trailers. The focus of the side guards was preventing fatalities of pedestrians and bicyclists, who as a group are called vulnerable road users. This is an important public safety concern because pedestrians and bicyclists have no protection whatsoever when they collide with or are struck by the sides of large commercial trucks. In a side collision with a moving truck, they get caught and are crushed to death beneath the rear axles. I wanted to know whether the protection offered to pedestrians and bicyclists could be combined with the fuel efficiency offered to a truck by aerodynamically designed side guards to achieve synergistic cost-effectiveness. My superiors reviewed and approved my research proposal, and it was funded with $200,000. I selected the Volpe National Transportation Systems Center (VNTSC or Volpe) in Cambridge, MA to perform the research because they had done previous research on standards for side guards on trucks. I composed an official Statement of Work for contract SA9PAI, which was agreed to by the Volpe Center, and I managed this project for FMCSA among several other heavy-duty truck safety research projects until my retirement.

The Statement of Work for this project specified key tasks including a (i) project plan; (ii) literature review of side guards domestically and internationally; (iii) a detailed examination of technical concerns such as how external parts of the truck, such as fuel tanks and fire extinguishers, would interact with a side guard, (iv) cost benefit analysis, (v) final report; and (vi) technology demonstration. While all of these were important, I regarded the cost benefit analysis to be the most critical task of this research project. This was critical because if side guards would both protect the safety of vulnerable road users while at the same time offer improved fuel efficiency and reduce fuel costs, the industry might adopt such side guards voluntarily. Voluntary adoption of standards is preferred to imposed government regulation under the National Technology Transfer and Advancement Act of 1996. Notwithstanding, cost benefit analysis is required for any government regulation by Executive Order (E.O.) 12866, which was issued in 1993 and remains in effect.

Over the period of performance by the Volpe Center, I regularly reviewed and provided comments on the Volpe research team's work. As the customer, my input on and interpretation of the task requirements were taken very seriously. The Volpe Center team worked efficiently and were performing all of the tasks I had required in the Statement of Work. In the drafts the team shared with me, the cost benefit analysis found that it was cost beneficial to equip trucks with aerodynamically efficient side protection guards and their adoption should be recommended across all the scenarios that were considered.

In late 2018, I was contacted by the American Trucking Associations (ATA) requesting that I provide them with a briefing on the research projects I was managing. I let my leadership know about their request and received approval. While not part of my formal job description, it was expected of me to speak publicly about my work. I had often traveled to the offices of ATA and made presentations, and this time was no different. I spoke to half a dozen ATA staff in their conference room about several projects, including this one. I was completely transparent with them and did not hold back any details.

During my presentation, one of the ATA staff reacted negatively when I told them that we were going to make a strong recommendation for side guards based on the cost benefit analysis. He said something like, "I don't see why truckers should have to pay for the unsafe practices of others," referring to pedestrians and bicyclists. He also didn't like our counter-intuitive finding that semi-trailers incurred as many crashes with vulnerable road users as single-unit trucks, even though semi-trailers are mostly driven on interstate highways. I believe I provided ATA with a copy of the draft report after that meeting because in my view they had technical expertise on the subject matter of the research done by Volpe. I regularly sought out peer review of the research that I managed. Normally, I obtained peer review from university professors and other neutral parties.

After that presentation, I know that my office director received a call from ATA because he called me into his office and said that ATA had expressed "some concerns" about the side guard study. He asked me if we could tone down the wording of the recommendation, making it less strong. This seemed like a reasonable request to wordsmith and tweak the language of the report. I thought I could tell Volpe to go stronger on voluntary adoption and to let go of any mention of rulemaking to require side guards. I did not think those changes would be consequential, because the critical finding that side guards providing both safety and aerodynamic fuel efficiency are cost effective would still stand and be validated. Anyone with integrity does not fool around with the data and analysis to predetermine a particular conclusion and I wasn't asked by my leadership to do that. I relayed these wordsmithing suggestions to the Volpe Center team, and they were amenable to making those changes.

In late winter 2018 or early spring 2019, I met with a section leader from the National Highway Traffic Safety Administration (NHTSA) of the U.S. DOT named Shashi Kuppa. She was in NHTSA's Office of Crashworthiness, and her areas of research sometimes overlapped with mine. In the meeting, Ms. Kuppa announced that she disagreed strongly with my project's cost benefit analysis for side guards and insisted that according to her own research, they were not cost effective. I was surprised by this because I had not shared my research on side guards with her or with anyone else at NHTSA. She strongly urged me not to release the side guard report. That surprised me too, since she was not in my chain of command and my report was funded by FMCSA, not NHTSA.

May 31, 2019 was my last day of government service. At the time I left U.S. DOT, this research on side guards was complete and all of the required tasks were performed. The only action left was for final review by the agency's leadership. I do not know who was designated by U.S. DOT to take over from me when I left. The published report FMCSA-RRR-19-004 was not released to the public until May 2020, about a year after I retired and more than a year after I received the final report DOT-VNTSC-FMCSA-19-01 from Volpe.

Since retiring I have pursued a master's degree in divinity and have learned two languages, Hebrew and Greek, and I now serve my church as a biblical counselor.

Recently when I read the published report FMCSA-RRR-19-004 on side guards that was posted on the U.S. DOT web site in May 2020, I was shocked and appalled by what I saw. The published report FMCSA-RRR-19-004 does not resemble the final report DOT-VNTSC-FMCSA-19-01 I had worked on when I departed from U.S. DOT. Moreover, the published report does not even fulfill the six required tasks in the official Statement of Work that U.S. DOT contracted with the Volpe Center to do. Most of the chapters, including the critical one on cost benefit

analysis, have been stripped out and the report now is nothing more than just a literature review. The published report also completely left out any discussion of aerodynamic side skirts, which of course was critical to the Statement of Work and benefit-cost analysis. This published report does not fulfill what I hired the Volpe Center to do. What is posted on the U.S. DOT public website as the published report on side guards defrauds the public because the Technical Report Documentation Page indicates that this is the final report of contract no. SA9PAI when clearly it is not; DOT-VNTSC-FMCSA-19-01 is the final report of contract SA9PAI.

I can only speculate how this happened. I do not believe that Volpe Center officials would have done this on their own. But someone at U.S. DOT could have ordered Volpe to "doctor" the final report on side guards and substitute it for the research they were originally hired to perform. Did Shashi Kuppa play a role? Notably, the published report doesn't contain the critical section on cost-benefit analysis that she vehemently opposed. After I retired, she was in a position to act herself or persuade senior officials in the U.S. DOT to quash the Volpe final report and replace it with the doctored, published report.

Suppressing this research was unacceptable and wrong. A new semitrailer costs tens of thousands of dollars, and adding a side guard to it costs mere pennies on the dollar to save an innocent victim's life. I would pay a penny for an engineering solution. The ATA didn't want to do that. The cost of their influence with officials in the U.S. DOT will be borne by many more innocent victims.

More than public safety was harmed. Since the published report does not meet the requirements of the Statement of Work, it was an unacceptable deliverable–it was a mere literature review with no analysis, let alone a critical cost-benefit analysis. U.S. taxpayers did not receive what they paid for. This constitutes waste, fraud, and abuse of taxpayer money. Furthermore, it is one thing to disagree with another professional, but to "doctor" the report of other professionals to suit one's own predetermined conclusion violates scientific integrity and could constitute misconduct.

I am submitting this statement to the Advisory Committee on Underride Protection in order to bring these hidden facts to light and help inform your work, which I understand is to assess the U.S. DOT's progress in advancing underride safety in a report to Congress and recommend policies to the Secretary to protect the public from underride death and injury. I am willing to testify to your committee and answer your questions.

I affirm that this statement is true and complete to the best of my recollection,

Quon Y. Kwan

Quon Kwan

04/11/2024

Date

Lisa Brenner

4/11/2024

LISA BRENNER
Notary Public - State of Maryland
Montgomery County
My Commission Expires Aug 14, 2027

E. Volpe Center Scope of Work -- "Truck Side Guards to Reduce Vulnerable Road User Fatalities

*** Appendix: Volpe Center Scope of Work**

Truck Side Guards to Reduce Vulnerable Road User Fatalities

SA9PA1

10/28/2016

Quon Kwan
Program Manager
Technology Division
(MC-RRT)
Federal Motor Carrier
Safety Administration

Date

David Arthur
Division Chief
Energy Analysis and
Sustainability (V-325)
Volpe Center

10/28/2016

Date

Truck Side Guards to Reduce Vulnerable Road User Fatalities

1.0. Statement of Work (SOW) Purpose

The purpose of this effort is to examine the safety benefits, costs, and feasibility of deployment of side guards on heavy-duty trucks to reduce fatalities from collisions of trucks with pedestrians and bicyclists, or other vulnerable road users (VRUs). Based on this research, this effort will develop actionable industry and policy recommendations in support of the Road-to-Zero FMCSA and USDOT commitment to eliminating traffic fatalities within 30 years.[1]

2.0. Statement of Work (SOW) Background

While large trucks comprise 4% of the U.S. vehicle fleet, they account for 11% of bicyclist and 7% of pedestrian fatalities nationally.[2] Urban truck involvement in these pedestrian and bicyclist fatalities is significantly higher, for example accounting for 32% of bicyclist fatalities and 12% of pedestrian fatalities in New York City.[3] The overrepresentation of trucks in these fatalities can be linked to inherent vehicle design challenges that both (1) limit the situational awareness of the operator by creating large blind spots, and (2) significantly decrease the probability of pedestrian and bicyclist survival following impact with a truck. Vulnerable road user survivability in truck collisions is between 8 and 78 times lower[4] than in light-duty car collisions. Also, in the U.S. about 50% of truck-involved bicyclist fatalities and 25% of pedestrian fatalities follow initial impact with the side of the truck and run-over by the wheels, a much higher rate than for light-duty vehicles.[5]

Truck side guards are devices designed to keep pedestrians and bicyclists from being run over by a large truck's rear wheels in side-impact collisions. Side guards have been required standard equipment since the 1980s in Europe and Japan, and more recently in Brazil.[6] They are also widely adopted in China, South America, and Australia. Based on studies in the United Kingdom (U.K.), side guards are an effective technology for reducing the number of fatalities and the severity of injuries: for example, bicyclist fatalities declined by 61% and pedestrian fatalities by 20% in side impact collisions with trucks after the U.K.'s 1986 side guard mandate.[7] Despite three decades of international experience and the rapid voluntary adoption of similar but non-rigid aerodynamic side skirts on U.S. trailers, the operational, cost-benefit, and regulatory aspects of requiring truck side guards in the U.S. has not been studied. The proposed research project will address this gap.

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[1] https://www.transportation.gov/briefing-room/us-dot-national-safety-council-launch-road-zero-coalition-end-roadway-fatalities "Working closely with our partners, both inside and outside the Department, we are committing significant resources to the serious effort being put forth to make the ambitious goal of zero deaths an eventual reality," said FMCSA Administrator T.F. Scott Darling III.

[2] NHTSA Fatality Analysis Reporting System (FARS)

[3] http://ntl.bts.gov/lib/54000/54700/54711/Truck_Sideguards_NYC.pdf

[4] http://ntl.bts.gov/lib/59000/59900/59997/DOT-VNTSC-SFMTA-16-01.pdf

[5] http://www.ntsb.gov/safety/safety-studies/Documents/SS1301.pdf

[6] http://ntl.bts.gov/lib/59000/59300/59356/Cambridge-Volpe_Safer_Truck_2016.pdf

[7] http://www.worldcat.org/title/integrated-safety-guards-and-spray-suppression-final-summary-report/oclc/84743321

The Federal Motor Carrier Safety Administration (FMCSA) is authorized to undertake this project under 49 USC 31108 [Section 4111 of SAFETEA-LU (P.L. 109-59)], "Motor Carrier Research and Technology Programs." Under 49 USC 31108, paragraph (a)(3)(C), FMCSA may fund research, development, and technology projects that improve the safety and efficiency of commercial motor vehicles through technological innovation and improvement.

Five key efforts are required in this project: (1) study interaction of a potential side guard with other truck parts and accessories (e.g., fuel tanks, fire extinguisher, exhaust system) and the implications for new Federal Motor Carrier Safety Regulations (FMCSRs), (2) investigate applicable international side guard standards, (3) perform preliminary cost-benefit analysis of truck side guard deployment, including safety, liability avoidance, and potential aerodynamic fuel savings,[8] (4) propose recommendations, and (5) propose means for voluntary adoption.

3.0. SOW Description/Technical Approach

The following are the tasks in this effort: (1) project plan, (2), literature review, (3) analysis of potential interaction of side guards with other truck parts and accessories, (4) cost-benefit analysis, (5) final report, and (6) technology demonstration. These tasks are discussed in detail below.

Task 1: Project Plan

Volpe shall submit a draft Project Plan with a milestone schedule showing deliverables and due dates (using the contract award date as the reference point). The draft Project Plan should be consistent with the Schedule of Deliverables shown in Section 4. Volpe staff shall travel to DOT Headquarters to present and discuss the draft Project Plan at a kick-off meeting within 14 calendar days of contract award for review and approval by the FMCSA Contracting Officer's Representative (COR). Volpe shall address any issues or comments on the draft Project Plan within one calendar week of receiving issues or comments from the FMCSA COR and submit the revised Project Plan to the FMCSA COR for approval.

Volpe will adhere to the approved final Project Plan during the period of performance. Delays are discouraged but may be permissible due to unforeseen circumstances beyond Volpe's control. Such a delay must be requested in writing (e-mail is permissible) by Volpe and approved by the COR. If the period of performance has to be extended, the Contracting Officer has to approve modification of the InterAgency Agreement (IAA) to extend the period of performance.

Task 2: Literature Review and Analysis

Volpe shall perform a search and review of the published literature to gather significant studies that have been done on the deployment of side guards on heavy-duty trucks. The literature

[8] Certain European and Canadian side guard models are already designed for aerodynamic drag reduction for fuel savings, so both aerodynamic and non-aerodynamic scenarios will be considered for cost-benefit analysis.

search shall also compile an annotated list of national and international standards for side guards applicable on heavy-duty trucks. Volpe shall also include studies on the effectiveness of side guards in reducing pedestrian fatalities in the literature search.

Volpe shall conclude the literature review with a draft report summarizing its findings, listing national and international standards, and summarizing any data on the (i) impact on reducing pedestrian and bicyclist fatalities and serious injuries and (ii) cost-benefits of side guards. Volpe shall submit to the FMCSA COR the draft literature review report in accordance with the schedule of milestones in the Project Plan. The COR will review the draft literature review report and present review comments to Volpe. Volpe shall address the COR's review comments, revise the draft literature review report, and submit a final literature review report in accordance with the schedule of milestones in the Project Plan.

Task 3: Analysis of Potential Interactions of Side Guards

Volpe shall perform an analysis of the potential interactions of side guard installation with other parts and accessories that are on selected common truck types, including for example a single-unit truck, tractor-trailer, a tanker truck, a dump truck, and a refuse truck. Examples of parts and accessories on these trucks shall include but not be limited to the following: fuel tanks, fire extinguisher, exhaust system, side marker lamps, and aerodynamic devices. The objective of the analysis is to determine whether there is a need to move parts or accessories, and the feasibility of moving any identified parts, to accommodate the installation of side guards. This task will include meeting with a truck manufacturer to discuss and document identified interaction issues and solutions for side guard installation. The cost and benefits of moving such parts and accessories shall be included in Task 4, 'Cost-Benefit Analysis."

Volpe shall conclude the analysis of potential interactions (including truck design, manufacture, and cost) of side guards with a draft report summarizing the findings and summarizing any impacts on safety. Volpe shall submit to the FMCSA COR the analysis of potential interactions of side guards report in accordance with the schedule of milestones in the Project Plan. The COR will review the analysis of potential interactions of side guards report and present review comments to Volpe. Volpe shall address the COR's review comments, revise the report, and submit a final analysis of the potential interactions of side guards report in accordance with the schedule of milestones in the Project Plan.

Task 4: Cost-Benefit Analysis

Volpe shall perform a cost-benefit analysis of retrofitting, operating, and maintaining side guards on existing heavy-duty trucks greater than 10,000 lbs. gross vehicle weight rating (GVWR). Volpe does not have to include all such heavy-duty trucks and may focus on only those types heavy-duty trucks with the highest risk of causing pedestrian/bicyclist fatalities, if possible to determine based on available data.[9] The costs shall include the capital costs of the side guards (including costs for retrofitting one or more baseline designs of side guards and moving any parts and accessories for accommodating the side guards). The operations and maintenance costs over

[9] The NHTSA FARS and GES systems, the Large Truck Crash Causation Study, and other data sources will be consulted for this determination.

the lifecycle of the side guards shall also be included in the analysis. The benefits shall include reduction in pedestrian fatalities and injuries, liability avoidance, and aerodynamic fuel economy. Additional considerations such as road spray suppression and wind stability may be considered if available data permit.

Volpe shall conclude the cost-benefit analysis with a draft report summarizing the findings and the return on investment for industry and society.[10] Volpe shall submit to the FMCSA COR the cost-benefit analysis report in accordance with the schedule of milestones in the Project Plan. The COR will review the cost-benefit analysis report and present review comments to Volpe. Volpe shall address the COR's review comments, revise the report, and submit a final cost-benefit analysis report in accordance with the schedule of milestones in the Project Plan.

Task 5: Final Report

Volpe will compile a draft final report based on the results of Tasks 2, 3, and 4, that is, literature review, analysis of potential interactions of side guards, and cost-benefit analysis reports. Based on consideration of all three reports (especially, if benefits exceed costs), Volpe shall compile a list of recommendations for FMCSRs addressing the retrofitting of side guards on existing trucks posing the highest risk of causing pedestrian fatalities. The draft final report must conform with FMCSA's template for final reports (see last paragraph of Task 5). Because FMCSA intends to publish the final report on its public-facing web site, the final report must also be 508-compliant.

Volpe shall submit to the FMCSA COR the draft final report in accordance with the schedule of milestones in the Project Plan. The COR will review the draft final report and present review comments to Volpe. Volpe shall address the COR's review comments, revise the draft final report, and submit a final report in accordance with the schedule of milestones in the Project Plan. Volpe shall also present a briefing on the final report to FMCSA senior management staff prior to the end of the period of performance.

The draft final report submitted as deliverable in the aforementioned tasks shall conform to FMCSA's template for final reports. This template is very similar to the Federal Highway Administration's (FHWA) *Communication Reference Guide* of May 2004, FHWA-RD-03-074 at http://www.fhwa.dot.gov/publications/research/general/03074/index.cfm The COR will provide the FMCSA template for final reports.

Task 6: Technology demonstration

Volpe will identify and partner with one or more key side guard stakeholders to conduct a demonstration of cost-effective side guard deployment on heavy-duty trucks greater than 10,000 pounds gross vehicle weight rating (GVWR). Potential stakeholders for this demonstration include, but are not limited to, local, state, and other jurisdictions; private truck fleets; truck manufacturers and suppliers; and industry associations such as the Truck Rental and Leasing Association, American Truck Association, and National Truck Equipment Association. The

[10] It is possible the benefits would most accrue to actors (e.g., other road users) different from the actors who have to invest (truck industry). If so, it would raise the issue of incentives and policy.

demonstration will build on recent and ongoing implementation of side guards in certain states, including New York and the District of Columbia, the nascent availability of side guards by OEMs and aftermarket suppliers, and voluntary adoption by large fleets. Volpe anticipates focusing demonstration activities on addressing actual and perceived cost barriers to users (e.g., via incentives) as well as the availability of side guards in the truck supply chain (e.g., by increasing awareness or requiring the technology). Volpe may engage FHWA's State Transportation Innovation Council (STIC) network and use this model to incentivize jurisdictions to demonstrate side guards and to provide operational and safety data to inform future adoption choices. Volpe will prepare a summary report based on the results of the demonstration. This activity is envisioned to be coordinated with a matching concurrent project to be funded by OST-R in support of side guard adoption outreach activity and communication.

4.0. Deliverables and Period of Performance

The period of performance is twenty-four (24) months from the date that the InterAgency Agreement (IAA) is executed and initial funding is provided.

Table 1 shows the initial deliverables and target dates.

Table 1 Deliverables and Target Dates

Task	Deliverable/Milestone/Activity	Target Date (months after IAA execution)
1	Project plan	1
2	Literature review draft report	6
3	Vehicle part interactions draft report	10
4	Cost-benefit analysis draft report	16
5	Final report	Draft 20 Final 21
6	Demonstration report	23
	Progress reports	15th of each month

The dates outlined in this section are the best estimates at the writing of this SOW. The Volpe Center will use reasonable, good faith efforts to complete the work, including procurements, in a timely and efficient manner to be able to meet the milestones in this SOW. The COR and the Volpe Center will discuss and jointly agree upon any significant changes to the schedule. If the project Period of Performance changes, the COR and the Volpe Center Project Manager will modify the IAA.

5.0. SOW Cost Estimates and Spend Plan:

Total estimated cost is $200,000, broken out in Table 2 below.

Table 2 Estimated Cost Breakout

Task	Cost (labor & other direct costs)
Project Management, including Project Management Plan and Status Reports	$15,000
Literature Review and Analysis Report	$40,000
Analysis of Potential Interactions of Side Guards	$40,000
Cost-Benefit Analysis	$60,000
Final Report	$25,000
Technology Demonstration	$20,000
TOTAL	**$200,000**

The Volpe Center Resource Plan is as follows:

Direct Labor - $ 174,000
Contracts – $10,000 (document proofing and 508 compliance)
Travel - $15,000 (two trips to IIHS,[11] NTEA,[12] SAE COMVEC, and/or NYC Fleet Safety Forum; one trip to a truck manufacturer; one or two to Washington, DC; two persons / trip)
Other - $1,000 (conference calls, web meetings)

Total - $200,000

The costs outlined in this section are the best estimates at the writing of this SOW. Resources may need to be re-allocated among the tasks as the project proceeds. Any significant reallocation of funds will be jointly agreed upon by the FMCSA PM and the Volpe Center PM and reflected in an updated PMP.

6.0 Assumptions and Constraints

1. An exhaustive analysis of all types of truck bodies, parts and accessories (Task 3) and of all potential costs and benefits (such as secondary effects due to reduced truck emissions or crash congestion) is out of scope, given schedule and budget.
2. Delays in FMCSA or third-party vendor activities will delay the Schedule of Milestones to be developed under Task 1 and may necessitate an extension of the period of performance of the interagency agreement.
3. Work is subject to available funding.

7.0. Terms and Conditions

1. The cost estimates in this agreement are based on information available at the time of writing the SOW. FMCSA and Volpe will discuss and jointly agree to any significant changes to

[11] Insurance Institute for Highway Safety; Volpe participated in the first Underride Roundtable at IIHS in May 2016.
[12] National Truck Equipment Association

these cost estimates or reallocation of funding among the tasks and will update the PMP accordingly. If the project scope is modified or expanded, FMCSA and the Volpe Center will modify the IAA/RA.

2. Volpe work shall be on a best effort basis (not fixed price) and charges will reflect only actual costs, without profit or fee.
3. At the technical close out of the project (when all deliverables have been completed and all charges have been recorded), Volpe will return any unexpended funds to the customer in a timely manner.
4. Volpe will use reasonable, good faith efforts to complete the work, including procurements, in a timely and efficient manner to be able to meet the milestones in this SOW. FMCSA and Volpe will discuss and jointly agree upon any significant changes to the schedule. If the project Period of Performance changes, FMCSA and Volpe will modify the IAA/RA.

F. Allegedly Suppressed Volpe Center Final Report -- "Truck Side Guards and Skirts to Reduce Vulnerable Road User Fatalities: Final Report on Net Benefits and Recommendations"
*** Appendix: Volpe Final Report**

Truck Side Guards and Skirts to Reduce Vulnerable Road User Fatalities: Final Report on Net Benefits and Recommendations

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

January 2019

FOREWORD

The authors wish to express their appreciation to Quon Kwan, Jeff Loftus, and Martin Walker of the Federal Motor Carrier Safety Administration for sponsorship of this report and to several individuals for their valuable input. The authors thank Coralie Cooper and Ryan Keefe at the U.S. DOT Volpe Center for advising the study team on data sources; John Knox White at the San Francisco Municipal Transportation Agency; Keith Kerman at the New York City Department of Administrative Services; Kristopher Karter at the City of Boston Mayor's Office of New Urban Mechanics for maintenance cost information; Eran Segev, Emily Lawless, and Emma Vinella Brusher for review, editing, and formatting; Ross Froat, Dan Horvath, and Bill Sullivan at the American Trucking Associations, Inc. for peer review, discussion, and feedback; and Volpe's Office of Communication and Knowledge Management for assistance with obtaining images.

NOTICE

Technical Report Documentation Page

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16. Abstract

This report summarizes a literature review of vulnerable road user (VRU) truck lateral protective device regulatory and technical standards, crash mitigation effectiveness, and U.S. implementation; an analysis of potential interactions between side guards and common truck parts—including aerodynamic skirts—and commercial vehicle safety inspections; and a benefit-cost analysis of deployment of side guards on the U.S. truck fleet.

The benefit-cost analysis relies on forecasts of vehicle miles traveled, fuel use, and vehicle registration to build a model of the U.S. truck fleet. Three scenarios of national side guard deployment are calculated, including sensitivity analysis for effectiveness of the technology, for the period 2020 to 2045. Two benefit categories are considered: (1) Safety benefits derived from reductions in crash costs for crashes between VRUs and trucks; (2) Aerodynamic benefits derived from fuel use reductions in vehicles that are side guard equipped. Results of the analysis indicate that side guard deployment on the U.S. truck fleet would produce net benefits. Improved aerodynamics provide a substantial portion of the total net benefits of side guards; however, consideration of aerodynamic skirts, which produce aerodynamic benefits but no assumed safety benefits, shows that side guards are still net beneficial at the incremental cost of reinforcing skirts to side guard strength. The report recommends and provides criteria for development of a new industry standard for side guards.

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

Acronym	Definition
ATRI	American Transportation Research Institute
BCA	benefit-cost analysis
BCR	benefit-cost ratio
BTS	Bureau of Transportation Statistics
CLOCS	Construction Logistics and Community Safety
CT	combination truck
EIA	Energy Information Agency
FARS	Fatality Analysis Reporting System database
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulations
FMVSS	Federal Motor Vehicle Safety Standard
FTA	Freight Transport Association (United Kingdom)
GES	General Estimation Survey database
GVWR	gross vehicle weight rating
HVCIS	Heavy Vehicle Crash Injury Study
KABCO	fatality (K), disabling injury (A), non-incapacitating injury (B), possible injury (C), and no injury (O)
kN	kilonewton
KSI	killed or seriously injured
LPD	lateral protective device
lb(s).	pound(s)
MAIS	Maximum Abbreviated Injury Scale
Mph	miles per hour
NACFE	North American Council for Freight Efficiency

Acronym	Definition
NTSB	National Transportation Safety Board
OEM	original equipment manufacturer
OMB	Office of Management and Budget
SUT	single-unit truck
TIFA	Trucks in Fatal Accidents (database)
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
U.S.	United States
U.S. DOT	United States Department of Transportation
VIUS	Vehicle Inventory Use Survey
VMT	vehicle miles traveled
Volpe	John A. Volpe National Transportation Systems Center
VRU(s)	vulnerable road user(s)
VRUMT	Vulnerable road user miles traveled
VSL	Value of Statistical Life

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EXECUTIVE SUMMARY

While large trucks comprise 4 percent of the United States (U.S.) vehicle fleet, they are associated with approximately 7 percent of pedestrian and bicyclist fatalities. The collision of a large truck with a vulnerable road user (VRU) such as a pedestrian, bicyclist, or scooter operator is more likely to result in death or serious injury than the collision of a large truck with another motor vehicle. The asymmetric mass ratio and the geometric incompatibility of the two crash partners—the VRU victim is typically overrun by a truck rather than thrust over the vehicle—make these collisions less survivable. Mitigation of truck crashes involving VRUs, rather than other motor vehicles, is the focus of this report.

Compared to VRU crashes with passenger vehicles, VRU crashes with trucks and trailers are also more likely to involve initial impact with the side of the vehicle. Lateral protective devices, or side guards, are vehicle-based safety devices intended to prevent pedestrians, bicyclists, and potentially motorcyclists from falling into the exposed space between the axles of trucks with high ground clearance[1] and being run over by the rear wheels. Side guards represent one of the available countermeasures intended to mitigate truck collisions with VRUs. However, side guards are distinct from most other available countermeasures in both their technological maturity and their passive operation, requiring no behavioral or operational changes, nor requiring the engagement or training of the vehicle operator.

The John A. Volpe National Transportation Systems Center (Volpe) has completed a review of the published literature on the usage and effectiveness of side guards on heavy-duty trucks throughout the United States (U.S.) and globally. The review included national and international standards for side guards applicable to heavy-duty trucks as well as studies of the effectiveness of side guards in reducing VRU fatalities and serious injuries. The review also included published costs associated with side guard installation and maintenance in various markets.

Regulations for side guards have existed since at least 1979, when Japan adopted *Safety Regulations for Road Vehicles: Pedestrian Protecting Side Guards* (Ministry of Land, Infrastructure, Transport, and Tourism, 1979).[2] An international side guard regulation, United Nations (UN) Regulation 73 (United Nations Economic Commission for Europe, 1995), covers 43 countries and the European Union, and has served as a model for other national and local regulations and standards alongside the specification from the United Kingdom (UK) Construction and Road Use Regulations of 1986 (The Parliament of the United Kingdom, 1986).[3] A number of published recommendations to improve or increase the stringency of these standards were identified. No national side guard regulations currently exist in the U.S.; however a side guard specification published by Volpe in 2016 has been implemented at the local level by city jurisdictions and private fleets, resulting in approximately 3,000 installations through mid-2018.

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[1] Defined as the height between the bottom of the vehicle body and the ground on a level surface.

[2] At least one secondary source references side guard designs from as early as 1912 (Walz, Strub, Baumann, & Marty, 1990).

[3] The UN Regulations were established by the UN Economic Commission for Europe but are referred to as "UN Regulations" due to the system's 1995 expansion beyond Europe.

Of over 50 publications reviewed for information on side guard effectiveness, 11 were found to contain quantitative data, a majority of which presented evidence that side guards are effective in mitigating crashes between heavy-duty vehicles and VRUs. Analysis of the effectiveness data in the context of exposure data (percent of all VRU crashes that are side guard-relevant) produced a generalized total mitigation potential expressed as a reduction in the percentage of fatal/serious injuries for all VRU crashes. This total mitigation potential ranged from 5-30 percent in studies specific to bicycle fatalities, <1-6 percent in studies specific to bicyclist serious injuries, 2-4 percent in studies specific to pedestrian fatalities, <1 percent in studies specific to pedestrian serious injuries, and as high as 20 percent for generic VRU fatalities and 25 percent for generic VRU serious injuries in studies that didn't specify the VRU category.

While side guards may offer benefits for mitigating other crash types, such as those involving motorcycles and light duty vehicles, those crashes are not the purpose of side guard technology considered in this study. Panel-type side guards (as opposed to rail-type side guards), however, can provide aerodynamic benefits that result in reductions in fuel use. The cost of side guard installation depends on whether the side guard is equipped pre-market, aftermarket, or as a strength reinforcement of aerodynamic underbody fairings, also known as aerodynamic skirts or aero skirts.

A model of the U.S. trucking fleet was developed for benefit-cost analysis, and three bounding scenarios of side guard deployment were analyzed using that model for 2020 through 2045:

1. **Full Deployment First Year** simulates a mandate to equip all large trucks with side guards by a given date.
2. **Gradual Deployment** tracks a linear path of deployment through the period of analysis, which is 2020–2045.
3. **Aero skirts Fully Deployed** similarly tracks a linear path of side guard deployment through the period of analysis, but assumes that all vehicles are equipped with aero skirts prior to side guard installation. Aero skirts are a comparable technology that provides the same aerodynamic benefits as panel-style side guards but not necessarily the safety benefits, and which can be reinforced to provide comparable safety benefits as side guards for a nominal cost. This scenario provides insight into the marginal impact of side guard safety benefits relative to aero skirts.

Two initial findings from the benefit-cost analysis are notable and perhaps counterintuitive. First, more combination trucks than single-unit trucks were involved in side-guard relevant VRU fatalities between 2005 and 2015. This challenges the perception that combination trucks have negligible exposure to VRUs (e.g., traveling only on limited access highways). Second, 40% of single-unit truck miles traveled were found to be highway miles, nearly equal to their 43% share of urban miles, as compared to 69% highway miles and 22% urban miles for combination trucks. This challenges the perception that single-unit trucks operate too slowly to accrue aerodynamic benefits from a panel-type side guard or a side skirt.

Sensitivity analysis was conducted on the effectiveness of side guards in achieving safety and aerodynamic benefits. A high-benefits scenario used the highest values of safety effectiveness in the literature and 100 percent of the fuel savings effectiveness, while a low-benefits scenario

used the lowest safety effectiveness values in the literature and 80 percent of the aerodynamic effectiveness.

The analysis shows that side guard deployment provides significant net benefits under the full range of scenarios. Table ES-1 shows the benefit cost ratio (BCR) and the discounted net benefits for each scenario and for each assumption about safety effectiveness. Benefits and costs are discounted at 7 percent per year to their present value and aggregated to give net benefits. The majority of the benefits of side guards stem from their aerodynamic properties. However, side guards show positive net benefits even when considering only the incremental costs and benefits of reinforcing aero skirts into side guards.

Table ES-1: Scenario Benefit Cost Ratio (BCR) and Net Benefits for 2020-2045 (Discounted at 7 percent/year)

Scenarios	BCR (High Benefits)	BCR (Low Benefits)	Total Net Benefits (High Benefits)	Total Net Benefits (Low Benefits)
Full Deployment First Year	4.65	3.53	$61.6 billion	$42.2 billion
Gradual Deployment	3.05	2.33	$23.5 billion	$15.3 billion
Aero skirt Fully Deployed	2.28	1.19	$2.70 billion	$0.40 billion

The present analysis provides a baseline set of results for FMCSA to consider in developing potential future policies related to side guard standardization and deployment.

This report recommends **development of an industry side guard standard** through a standards development organization, with FMCSA supporting current efforts by certain truck manufacturers and major truck fleets.[4] A **new side guard industry standard** should address, at a minimum:

- Side guard installation on new trucks and new trailers exceeding 10,000 pound GVWR
- Dimensional requirements and performance-based mechanical requirements, including the flexibility to use non-side guard truck parts and accessories to meet these requirements
- Acceptable methods to demonstrate installation and maintenance compliance
- Retrofitting of side guards on existing trucks and trailers

As part of this standard development, particular attention and potentially further research is recommended to achieve industry consensus on:

- Appropriate maximum side guard ground clearance for providing full safety benefit as well as maximum flexibility for vehicle operations; and
- A best practice approach for reinforcing aerodynamic skirt products to provide side guard safety performance while minimizing incremental cost and impact on aerodynamic performance.

[4] Examples of SDOs include, but are not limited to, the American Trucking Associations Technology and Maintenance Council (TMC) and the American National Standards Institute (ANSI).

The new industry standard could potentially establish two tiers of compliance: a minimum set of requirements for international harmonization, e.g., aligned with the UN Regulation 73, as well as a more stringent set of recommended, best practice criteria.

Recognizing geographic differences in VRU exposure, the industry standard should be suited for the environment, e.g., side guards may be exempted for trucks operating exclusively in rural and remote environments. Flexibility should also be considered for side guard clearance on vehicles that cross unimproved, low clearance railroad grade crossings.

This report finally recommends FMCSA and researchers focus on the following further areas of inquiry:

- Determine the extent to which lateral underride technologies will be deployed in the absence of federal intervention.
- Additional potential safety benefits of side guard technology that were not addressed in the current study and incorporating them into the model.

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1. INTRODUCTION

In the coming decades, the need to transport increasing amounts of freight to large urban areas could increase conflicts between freight vehicles and other road users, in particular vulnerable road users (VRUs) such as pedestrians, bicyclists, and other non-occupants of vehicles. Current megatrends that may increase the number of conflicts between VRUs and large trucks include an urbanizing population, growing urban freight volume (due in part to e-commerce growth), and the growth of walking, biking, and other two-wheeled transportation as reported in the United States Department of Transportation (U.S. DOT) Beyond Traffic 2045 synthesis (United States Department of Transportation, 2017).[5] In 2015, over 4,000 people including 410 VRUs were killed and more than 111,000 people were injured in crashes involving large trucks (United States Department of Transportation, 2017).

Large trucks are overrepresented in VRU fatalities. While large trucks comprise 4 percent of the United States (U.S.) vehicle fleet (Bureau of Transportation Statistics, 2017), they are associated with approximately 7 percent of pedestrian and bicyclist fatalities (National Transportation Safety Board, 2013) (National Transportation Safety Board, 2014), approximately 450 annually (see Table 1:) (Federal Motor Carrier Safety Administration, 2017). In urban areas, the overrepresentation is significantly greater. For example, trucks in New York City comprise 3.6 percent of registered vehicles but accounted for an average of 12 percent of pedestrian fatalities from 2002 to 2006 (New York City Department of Transportation, 2010) and 32 percent of bicyclist fatalities from 1996 to 2003 (New York City Departments of Health and Mental Hygiene, Parks and Recreation, Transportation, and the New York City Police Department, 1996-2005). Furthermore, truck and bus crashes are between three and eight times more likely to result in a pedestrian fatality than crashes involving passenger vehicles (New York City Department of Transportation, 2010) (San Francisco Municipal Transportation Agency, 2015). A review of crashes in London found the incidence of death to be 78 times higher in collisions between large trucks and bicyclists than between cars and bicyclists (Quilty-Harper, Burn-Murdoch, & Palmer, 2012).

Compared to VRU crashes involving light-duty vehicles, VRU collisions with large trucks are more likely to involve an impact with the side of the truck. Accordingly, side guards, also referred to as lateral protective devices, are required to be installed on certain motor vehicles, trailers, and semi-trailers in at least 32 countries that the John A. Volpe National Transportation Systems Center (Volpe) identified. As shown in Figure 1, side guards are intended to mitigate side impact crashes by shielding pedestrians, bicycles, and other two-wheelers from the open space between the axle groups of large trucks. To date, a number of U.S. cities and one state have also mandated requirements for side guards, as has at least one U.S. commercial vehicle insurer.

[5] According to one market study, the U.S. is projected to be the second highest growth market for motorcycles, mopeds, and scooters through 2020: http://www.strategyr.com/Marketresearch/Motorcycles_Scooters_and_Mopeds_Market_Trends.asp

Figure 1: A large truck (left) typically has an exposed space, represented by the vertical arrow and approximately 50 inches in height, between the axles. During a collision, vulnerable road users (VRUs) can fall into the exposed space and suffer fatal crushing injuries. Side guards (right) are designed to cover these exposed spaces. (Source: mechanic, Dan Barbalata/123rf.com)

Current federal regulations require rear impact guards for trailers and semi-trailers to reduce the number of deaths and serious injuries that occur when passenger vehicles crash into the backs of these vehicles. However, there are currently no federal regulations concerning side guards to protect pedestrians and bicyclists from the risk of falling under the sides of trucks and being caught under the wheels. No prior federal research appears to have been performed or published on the topic of truck side guards to mitigate collisions with VRUs.

This study in part supports the critical role of the Federal Motor Carrier Safety Administration (FMCSA) in advancing Road to Zero, the U.S. DOT initiative to eliminate all traffic fatalities within 30 years (Federal Motor Carrier Safety Administration, 2016). The focus of this study recognizes that the non-occupant fraction of all road users killed in the U.S. has increased from 20 percent in 1996-2000 to 32 percent in 2012-2015, as shown in Figure 2 (National Highway Traffic Safety Administration, 2016).

Table 1: VRUs killed in all large truck crashes in 2013-2016

Non-motorist Type	2013	2014	2015	2016
Total Non-motorist Fatalities	441	393	410	468
Pedestrian	339	308	334	364
Pedalcyclist	79	61	54	87
Other/ Unknown Non-motorist	23	24	22	17
Total Fatalities	**3,964**	**3,903**	**4,067**	**4,317**
Percent Non-motorist Fatalities	**11%**	**10%**	**10%**	**11%**

Note: Reprinted from *Pocket Guide to Large Truck and Bus Statistics*, by the Federal Motor Carrier Safety Administration, retrieved from https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/safety/data-and-statistics/413361/fmcsa-pocket-guide-2018-final-508-compliant.pdf by the United States Department of Transportation.

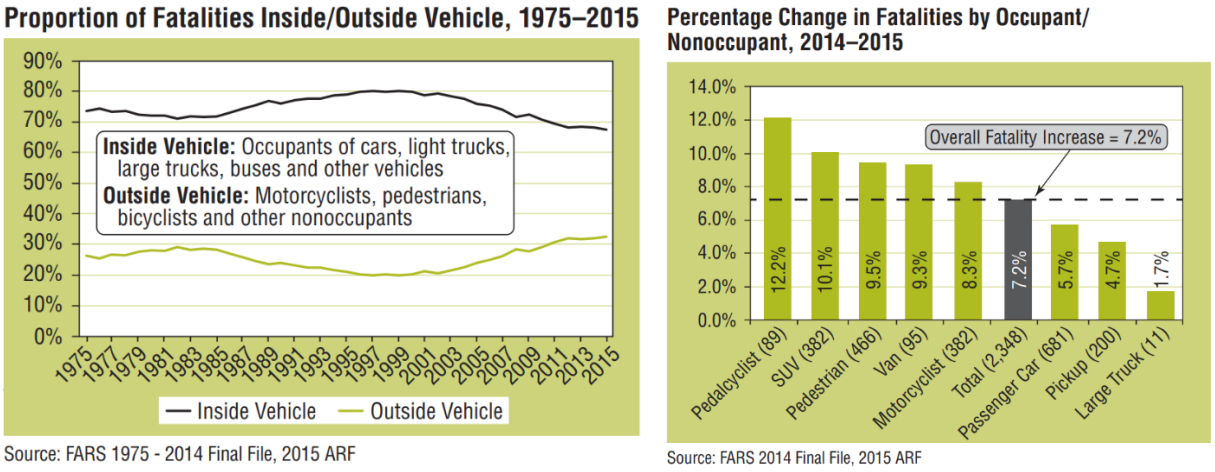

Figure 2: Nonoccupants' share of U.S. traffic fatalities has increased over the last 15 years (left), and the fatality shares of pedalcyclists and pedestrians outpaced overall fatality increases in 2015 (right) (National Highway Traffic Safety Administration, 2016).

It should be noted that **the focus of this study is on lightweight side guards (weighing tens of pounds) for protecting VRUs and not the significantly heavier (hundreds or thousands of pounds), more costly, and less widely commercialized side underride barriers that would be involved in protecting car occupants.** This study does not attempt to compare all crash avoidance and crash mitigation technologies for addressing truck-VRU fatalities and injuries. Lightweight side guards, the focus of this study, are a potentially cost-effective and near-term technology for protecting VRUs that is already mature and globally widespread and involves no behavioral modifications for truck drivers. The technology is also distinct from other potential alternatives in that it can offer both economic and environmental co-benefits if integrated as part of commercially available aerodynamic fairings, or integrated into industry-supported efforts such as the Department of Energy Vehicle Technologies Office 21st Century Truck Partnership.

In addition to the potential benefit for VRU safety and the fuel-saving potential co-benefit, other longer-term benefits of side guards may be considered—for example, improved sensing of trucks and trailers and thus collision avoidance by advanced driver assistance systems, road spray reduction and associated crash avoidance, and trailer wind stability. These issues have also not previously been considered together. The findings of this study will lay a foundation to inform potential future regulatory actions as well as best practices that the industry may voluntarily adopt.

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2. CURRENT SIDE GUARD REGULATIONS AND STANDARDS

Side guards are a mature technology. Volpe identified references to side guard designs from as early as 1912, while the first legislative requirements appeared in the 1970s. Japan and the United Kingdom (UK) led in requiring the use of side guards on large vehicles (in 1979 and 1986, respectively), and the United Nations (UN) and China have both maintained side guard regulations since 1988 and 1989, respectively, in various climatic, roadway, and urban conditions. Volpe also identified two countries in South America—Peru and Brazil—with established national side guard regulations.

In this section, side guard regulations and regulatory trends are reviewed, compared for applicability to vehicle types, and synthesized. Volpe leveraged its Massachusetts Institute of Technology Library partnership in support of this regulatory review, which included international regulations, foreign regulations, U.S. regulations and standards, and industry standards and recommended specifications. The most prolific source of specifications and standards proved to be international and foreign regulations, particularly those of the UN and the UK, with additional precedents identified from Brazil, China, Japan, and Peru. A non-exhaustive review of these sources along with online image searches identified at least 65 countries with widespread use of side guards either through regulations or other adoption methods (Table 2).

Table 2: Summary table of countries that may see widespread use of side guards (Source: Volpe)

Source	Number of Total Countries
Abides by UN Regulation 73	43
Independent national regulation	5*
Subnational regulation	3
Industry standard or recommended specification	3
Image search	14

*Includes the European Union

2.1 INTERNATIONAL REGULATIONS

Following independent regulations passed in Japan and the UK, a process of international harmonization began in 1988, with a proposal from the Netherlands and the UK to the United Nations Economic Commission for Europe (UNECE) to require "lateral protection devices" on vehicle classes N_2, N_3, O_3, and O_4 (as defined in the UNECE Consolidated Resolution on the Construction of Vehicles, RE3).[6] The regulation was added as Regulation 73 to the 1958 "Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be fitted and/or be used on Wheeled Vehicles and the Conditions

[6] Category N refers to motor vehicles with at least four wheels that are used for the carriage of goods (i.e., commercial trucks), and Category O refers to trailers.

for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions" (commonly referred to as "the 1958 Agreement").

Originally applicable only to European countries, the type approval system established in the 1958 Agreement—which allows a motor vehicle product approved by any authority party to the agreement to be accepted by other authorities applying the regulation—was expanded beyond Europe in a 1995 revision (GlobalAutoRegs, 2017). To reflect the broader coverage, the regulations annexed to the agreement are now widely referred to as "UN regulations" rather than "UNECE regulations." At the time of publication, Volpe is aware of 43 countries that have approved this regulation, suggesting widespread adoption of truck side guards in their respective nations (UNECE Inland Transport Committee, 2017) (See Figure 3, Table 18, and Figure 21).

A proposal was advanced in 2018 to amend UN Regulation 73. It would reduce the maximum allowable ground clearance (the height from the ground to the bottom edge of the side guard) to between 350 and 450 mm, versus 550 mm at present. The proposal would also increase the quasi-static force test to 3 kN from the existing 1 kN, with the intent of increasing protection for motorcyclists. (Economic Commission for Europe, 2018)

Figure 3: Images of UN Regulation 73 side guards in France (top), the Netherlands (middle), and Thailand (bottom) (Source: top and middle, Volpe; bottom, Nuttapong Wannavijid, 123rf.com)

Finally, the International Standards Organization maintains a typology to categorize all standards around the world, and for side guards, the relevant International Classification of Standards number appears to be 43.040.60 (International Organization for Standardization, n.d.).

2.2 REGUALTIONS IN FOREIGN COUNTRIES

Outside of the international UN Regulation 73, seven countries have taken steps to standardize side guard usage. The earliest national standard that Volpe found was Japan's "Pedestrian Protecting Side Guards," which made side guards a requirement in 1979 (Pedestrian Protecting Side Guards, Article 18-2, 1979). The United Kingdom followed with a 1983 amendment to the Road Vehicles (Construction and Use) Regulations to require the fitment of side guards to some new goods vehicles and some existing semitrailers; this regulation would eventually serve as the model for UN Regulation 73 (The Parliament of the United Kingdom, 1986). Additionally, side guard regulation has been implemented at the national scale in China (1989), Peru (2003), and Brazil (2009) (see Figure 4).

Two nations outside of the U.S. have also seen side guard programs on a local level, with the implementation of a side guard requirement for large vehicles in Mexico City in 2015 (Salvaguardas para Camiones Urbanos, 2015) and the implementation of side guards on city fleet vehicles in two Canadian jurisdictions: Saint-Laurent (Montréal), Quebec, in 2013 (The Jessica Campaign, 2016), and St. John's, Newfoundland and Labrador, in 2017 (Macdonald, 2016). Table 17 in Appendix A details the specifications of each national standard. Schematics and narrative descriptions follow, including the subnational regulations passed in Mexico and Canada.

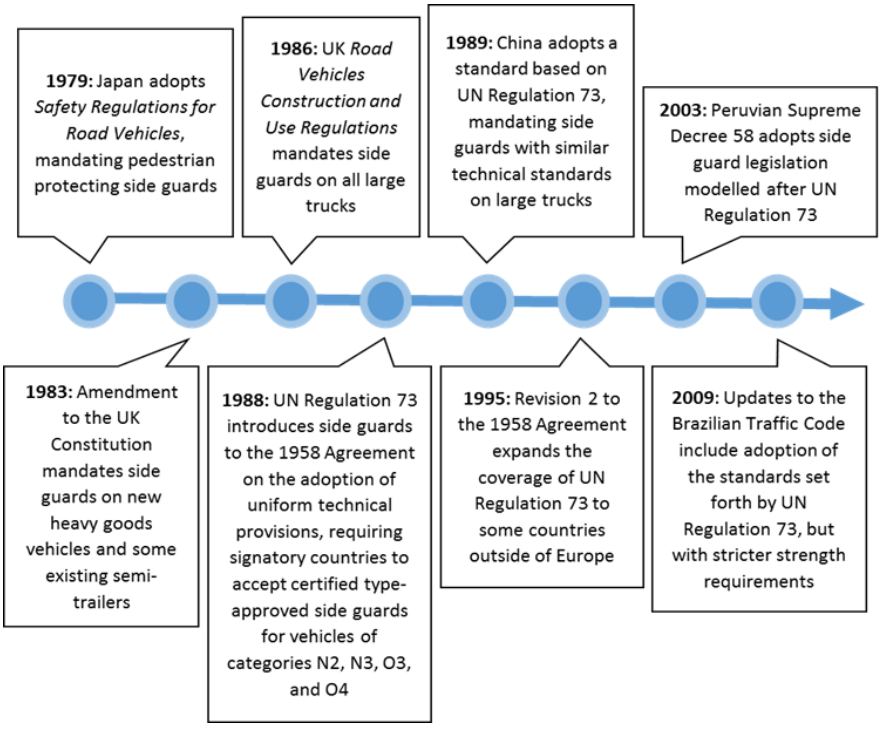

Figure 4: Timeline of national regulations relative to the passage and expansion of UN Regulation 73.

2.3 DOMESTIC REGULATIONS

2.3.1 Federal

Large truck design in the U.S. is regulated by Federal Motor Vehicle Safety Standards (FMVSS) and Federal Motor Carrier Safety Regulations (FMCSRs). FMVSS 223 applies to rear underride guards, which are intended to arrest light-duty vehicles that crash into the rear of a tractor trailer. No FMVSS or FMCSR currently requires or references side underride guards. The National Highway Traffic Safety Administration (NHTSA) rejected adding side underride guard requirements to the FMVSS in 1991. However, those requirements were proposed for a different purpose: protecting passenger car occupants rather than pedestrians and bicyclists (Padmanaban, 2013). Thus, the side guards considered at that time would have been significantly stronger, heavier, and costlier than the ones considered in this study, as they would have been designed to arrest or deflect a motor vehicle rather than a person. At the time of publication, no federal regulation or guidance focusing on VRU side underride mitigation appears to exist or to have been considered in past federal rulemakings.

2.3.2 State and Local

Although no national side guard regulations currently exist in the United States, there are at least seven municipal and state-level requirements that have either been implemented since 2008 or are pending. Washington, DC; New York, NY; the adjoining cities of Boston, Cambridge, and Somerville, MA; Seattle; San Francisco; Chicago; and Philadelphia have required side guards on a combination of municipal heavy-duty vehicles, city-regulated trucks (New York City, 2015), and all registered trucks in the District (Washington, DC, 2016). The Council of the District of Columbia passed a 2008 law requiring District-owned heavy duty vehicles to be equipped with side-underrun guards, but the law was not funded until 2014. Also in 2008, the City of Portland, OR, through a City Council resolution, implemented a pilot program on its municipal truck fleet, which resulted in about 12 vehicles being fitted with side guards (DePiero & Leader, 2012). In 2013, the City of Boston began retrofitting City vehicles with side guards, and in October 2014 it enacted the nation's first ordinance requiring side guards on City-contracted trucks (City of Boston Mayor's Office, 2014), followed by similar ordinances in Somerville, MA and Chicago. In 2015, the New York City Council enacted a local law requiring side guards on 10,000 trucks by 2024, including the City-owned fleet and the City-regulated commercial refuse fleet. In 2016, the 2008 District of Columbia law was amended to apply to all District-registered large trucks effective 2019 (Council of the District of Columbia, 2016), potentially making it the broadest implementation of side guards. In 2019, Massachusetts legislation advanced impacting state-owned and state contracted large trucks (Massachusetts, 2019). Volpe estimates that approximately 3,000 trucks have been equipped through mid-2018 under these local laws.

As of late 2018; Cambridge, MA; Seattle, WA; Philadelphia, PA; Portland, OR; and the Commonwealth of Massachusetts were in various stages of considering procurement laws that would require side guards on fleet vehicles under government contract. Additionally, the Massachusetts 2018 Strategic Highway Safety Plan includes side guards as a "high-leverage policy to reduce the frequency and severity of roadway fatalities." (Massachusetts DOT, 2018)

With the exception of Boston, these local laws have referenced and adopted the Volpe standard and are therefore generally consistent (see Figure 5 and Table 3). The City of Boston ordinance

preceded the Volpe specification and was instead modeled on the UN Regulation 73 specifications. The Boston ordinance is expected to eventually be revised to align with the Volpe specification (Carter K. , 2017).

Figure 5: Images of side guard-equipped trucks in Cambridge (top left), Boston (top right), New York City (middle left, middle right, and bottom left), and Chicago (bottom right) (Source for Chicago: Rosanne Ferrugia; Boston: Kristopher Carter; others: Volpe)

Table 3: Summary table of domestic regulations and their specifications

City	Date Enacted	Vehicles Covered	Vehicles Exempted	Strength Rqmt.	Maximum Ground Clearance	Maximum Gap between Guard and Wheels
Boston, MA	2014	Vehicles of weight 10,000 lbs. or higher.	- Agricultural trailers, - Fire engines, and - Trucks used exclusively for snow removal.	2 kN (440 lbs.)	21.5 in.[7]	11.8 in.
New York, NY	2015		- Street sweepers, - Fire engines, - Car carriers, and - Off-road construction vehicle types on which side guard installation is deemed impractical by the department.		350 mm (13.8 in.)	
Washington, DC	2016		None			
Somerville, MA [8]	2017		- Ambulance; - Fire apparatus; - Low-speed vehicle with maximum speed under 15 mph; - Agricultural tractor.			
Chicago, IL						

2.4 INDUSTRY STANDARDS AND RECOMMENDED SPECIFICATIONS

Several organizations, including Volpe and the Office of the Assistant Secretary for Research and Technology (OST-R), have developed side guard standards or guidelines to assist fleet operators who wish to implement side guards voluntarily. In some cases, as with the Australian Trucking Association standard and with the Volpe specification, these assist fleet operators in countries where there is no national side guard regulation. The Construction Logistics and Community Safety (CLOCS) Standard and Fleet Operator Recognition Scheme (FORS) are different, in that they assist UK fleet operators in implementing a stricter standard than exists nationally. Among these standards, Volpe's is the most stringent, with a strength requirement of 2 kN and a maximum ground clearance of 350 mm. The Australian Trucking Association standard ("Side Under Run Protection Technical Advisory Procedure"), which the group recommends to its members, is the most lenient, with a strength requirement of 1 kN and a maximum ground clearance of 550 mm (Australian Trucking Association, 2012). The CLOCS, FORS, and ATA standards are largely adopted by industry members, while the Volpe specification has been adopted by a mix of private fleets and U.S. cities and states (see Table 4).

[7] As of September 2017, the City of Boston was expected to revise the maximum clearance to 13.8 inches to align with other U.S. cities.

[8] As of January 2019, Cambridge, MA, was also expected to develop a similar ordinance.

Table 4: Summary table of other side guard standards in Australia, the United Kingdom, and the United States

Standard	Year Published	Adopters	Vehicles Covered	Strength Rqmt.	Maximum Ground Clearance	Maximum Gap Between Wheels and Guard
Australian Trucking Association (ATA) Standard	2012	Melbourne Metro	Vehicles of categories N_2, N_3, O_3, and O_4.	1 kN (225 lbs.)	550 mm (21.7 in)	Maximum of 300 mm (11.8 in.) behind the front tire and 300 mm (11.8 in.) in front of the rear tire
Construction Logistics and Community Safety (CLOCS) Standard for Construction Logistics; Fleet Operator Recognition Scheme (FORS)—United Kingdom	2015	London fleet managers (CLOCS) and fleet operators (FORS)	All rigid mixer, tipper and waste type vehicles over 3.5 tonnes gross vehicle weight that are exempt under the mandated UK standard	2 kN	550 mm (21.7 in)	300 mm (11.8 in.) between the back of the front wheel and the front of the side guard, 300 mm (11.8 in.) between the back of the side guard and the back tire
Volpe Standard—United States	2016	Boston Chicago New York City Wash., D.C. Somerville, MA San Francisco Seattle State of MA	Vehicles of weight 10,000 lbs. or higher	2 kN [9]	350 mm (13.8 inch) clearance	Should not exceed 300 mm (11.8 inches)

Additionally, six sets of recommended specifications for either standard establishment or standard improvement were reviewed (see Table 19 in Appendix A).

2.4.1 Volpe Specification Adopters

Volpe identified a wide range of adopters of the Volpe specification at the local (and, to a more limited extent, state) level in the U.S. and Canada. Additionally, Mexico City's 2015 side guard regulation is based on the Volpe specification. Table 5 summarizes known adoption of the Volpe specification among North American jurisdictions, insurers, and institutions. It does not include voluntary adoption by a growing range of private fleets in the freight and construction sectors.

[9] The Volpe specification is published in Imperial units, however it is summarized here in metric units for consistency with the other standards.

Table 5: Jurisdictions and other entities that have adopted the Volpe specification

Adopting Entity	Year of Adoption
Portland, OR *	2008
Montréal, QC *	2012
Boston, MA **	2014
Newton, MA *	2014
Fort Lauderdale, FL *	2015
Mexico City, Mexico	2015
New York, NY	2015
Orlando, FL *	2015
University of Washington	2015
San Francisco, CA	2016
Seattle, WA	2016
Washington, DC	2016
Cambridge, MA	2017
Chicago, IL	2017
Energi Insurance	2017
Greenville, NC	2017
Halifax, NS	2017
Harvard University	2017
Somerville, MA	2017
CEMEX	2018
Philadelphia, PA	2018
State of Massachusetts	2018
Madison, WI	2018
Acadia Insurance Group	2018

* Not known whether Volpe specification used.
** Not consistent with Volpe specification but revision expected to align.

2.5 EXISTING EXEMPTIONS

In contrast to light-duty vehicles, medium- and heavy-duty vehicles involve diverse body styles, dimensions, and uses. Certain truck types are more challenging to equip with side guards or may require side guard modifications. Volpe researched the existing vehicle exemptions in UN Regulation 73 and the UK Road Vehicles (Construction and Use) Regulations, and reviewed published assessments from a detailed 2004 TRL report (Smith & Knight, 2004) on the technical justifiability of the UK side guard exemptions—i.e., whether a unique physical configuration, unique operational requirements, or minimal exposure to pedestrians and bicyclists support exempting the vehicle. The UN and UK exemptions and Volpe's synthesis of the assessments of whether these existing exemptions are technically justified are summarized in Table 20 in Appendix A.

2.6 CONCLUSIONS

This review of national and local side guard regulations, research-based standards, and recommended specifications demonstrates both a global precedent for side guard adoption and a growing trend of subnational efforts in countries such as the U.S. where national adoption and standardization have not occurred.

A comparison of the key attributes of each confirmed national standard and the multinational UN Regulation 73 produces several findings. First, the UK standard applies to trucks of a lower gross vehicle weight (GVWR) rating than the Japan standard (3,500 kg or 7,716 lbs. compared to 8 tons or 16,000 lbs.), but it also exempts more vehicle types and has a higher ground clearance (550 mm or 21.7 in. compared to 450 mm or 17.7 in.). Compared to the Japan and UK regulations, the UN regulation maintains the more lenient minimum ground clearance of 550 mm (21.7 in.) used by the UK, and a lower minimum strength requirement of 1 kN versus 2 kN. China, Peru, and Brazil have each adopted the maximum ground clearance and wheel gap requirements of UN Regulation 73, and the first two have also adopted the same 1 kN strength requirement. The Brazil regulation, which is intended to address motorcyclist collision injuries and fatalities, has the highest strength requirement of any identified regulation, requiring side guards to withstand forces of 5 kN (Ministerio de Transportes y Comunicaciones, 2003).

Side guard regulations passed by municipalities tend to be modeled on UN Regulation 73 (e.g., in Canada) or on standards adopted by peer municipalities (e.g., Mexico City enacted a law based on one passed in New York City, which was based on the Volpe specification). Academic analyses of available side guard standards, meanwhile, have produced recommendations for more stringent specifications, i.e., higher strength requirements and lower ground clearances, and for fewer vehicle type exemptions.

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3. CRASH MITIGATION EFFECTIVENESS

Overall, about 50 publications were accessed and reviewed for this analysis. Section 3.1 describes the nature of the eleven publications that contained data specifically on the safety effectiveness of side guards for VRUs. Section 3.2 summarizes the data that these studies provide on VRU exposure to side guard relevant crashes, as well as the effectiveness that the side guards can have in such crashes.

3.1 OVERVIEW OF STUDIES

The majority of the studies on side guards present quantitative and/or qualitative evidence that side guards are effective at mitigating crashes with VRUs. A few of the findings were inconclusive, but no studies disproved side guard effectiveness. Most studies articulate that the type of side guards in common use (i.e., with ground clearance as high as 550 mm) are primarily effective for passing and overtaking maneuvers, in which the heavy vehicle travels roughly parallel with the VRU, with VRU impact on the passenger side of the vehicle ("nearside," in UK terminology). A number of studies present evidence supporting this. It appears that side guards—in particular more stringently designed side guards with lower ground clearance—can also be effective in crashes where the vehicle makes a turn to the passenger side, though the evidence to support this is less conclusive.

The studies summarized in this section fall into three categories: (1) field evaluation studies, which analyzed real-world crash data; (2) experimental studies, which conducted physical tests to assess side guard performance; and (3) simulation studies, which used computer models to simulate crash circumstances and outcomes. Some publications had multiple study components, and are thus cited in more than one section. A systematic review of the published findings is provided in Appendix B. The following is a summary of this review.

3.2 EFFECTIVENESS AND EXPOSURE: SUMMARY OF FINDINGS

While side guard effectiveness is the capacity to mitigate crash outcomes, exposure is the number of relevant crashes that side guards could mitigate. The overall benefit of side guard deployment—the number of fatalities and serious injuries mitigated—is a product of effectiveness and exposure. This section summarizes the available literature on the fraction of all crashes between trucks and VRUs that are likely to be side guard-relevant. The primary focus here is on exposure data for which there are corresponding effectiveness data.

The introduction of side guards globally over the past three decades was intended to prevent bicyclists and pedestrians from falling into the space between the axles of a passing large truck and being run over by the wheels. A definition of side guard-relevant crashes must at least involve an initial point of impact on the side. However, relevance likely also depends on the relative maneuvers of the truck and VRU during the collision. Glancing collisions while traveling in roughly parallel lines are most confidently side guard relevant. Turning collisions where a truck turns across the path of a bicyclist or pedestrian appear side guard relevant as well, though the effectiveness is of lower confidence based on the studies Volpe reviewed, and their

effectiveness may be more sensitive to side guard design, e.g., smooth panel versus rail construction, inboard distance from the side of the truck body, and ground clearance.

In the U.S., according to an NTSB analysis using Trucks in Fatal Accidents (TIFA) data from 2005-2009, **initial side-impact crashes represent 25-29 percent of pedestrian fatalities involving trucks and 44-55 percent of bicyclist fatalities involving trucks** (National Transportation Safety Board, 2013). These reported data do not provide the same degree of specificity as other studies on exposure, since they do not distinguish between various types of maneuvers.

3.2.1 Summary of Tables

Overall, there was much more information available for bicyclist fatalities than for any other category of VRU safety impact (bicyclist serious injuries, pedestrian fatalities, and pedestrian serious injuries).

Table 6 summarizes four UK studies that relied on "before and after" comparisons of national data to infer side guard benefit (Knight, 2005), (Smith, 2005), (Cookson, 2010), (Robinson, 2014). For ***bicycles***, across the three observation periods from 1980 to 2008, **the side guard-relevant crashes ranged from 10 to 22 percent of all crashes, and from 11 to 29 percent of serious crashes where the VRU was killed or seriously injured (KSI).** This only focuses on ***passenger side*** impacts with glancing type collisions, which the studies assume are the most relevant. **It is possible but less likely that glancing type collisions on the driver side may also be side guard-relevant, which would bring the total percentage of side guard relevant crashes up to as much as 45 percent of all crashes**. However, the studies do not provide exposure data for driver side bicycle crashes. In terms of pedestrians, the UK data show that "going ahead other" passenger side crashes in the first two observation periods (1980-1992) were **19-20 percent of all crashes and about 10-14 percent of all fatal crashes.** Broadening the focus to look at all passenger side crashes brings the total to **28-30 percent of all crashes and 17-23 percent of all fatal crashes.** Table 6 summarizes the key information from these studies in more detail.

Table 6: Summary table of four UK studies comparing nationwide data from 1980 to 2008

Safety impact	Exposure range (side guard relevant crashes as a percentage of all crashes)	Effectiveness range (reduction in fatality or serious injury as a proportion of all injuries)	Exposure × effectiveness (theoretical mitigation potential expressed in terms of all crashes)
Bicyclist fatalities	9-23%	55-75%	5-17%
Bicyclist serious injuries	12-35%	3-17%	<1-6%
Pedestrian fatalities	10-14%	20-27%	2-4%
Pedestrian serious injuries	19%	<1%	<1%

Table 7 shows data from two UK studies that took a different approach. These studies conducted detailed investigations of individual fatal crashes and assessed whether they could have been prevented by side guards. Finally, Table 8 summarizes other studies from Australia and the

Netherlands that show similar numbers for pedestrians and bicyclists (former) or do not differentiate (latter). The table also includes a UK study that provides a single combined effectiveness estimate for motorcycles, bicyclists, and pedestrians.

Table 7: Summary table of two UK studies predicting preventable bicyclist fatalities based on detailed investigations of individual crashes

Study	Guard implementation	Crash set	Exposure (side guard relevant crashes as a percentage of all crashes)	Effectiveness (reduction in fatality or serious injury as a proportion of all injuries)	Exposure times effectiveness (theoretical mitigation potential expressed in terms of all crashes)
Keigan09	UK regulatory requirement	Heavy vehicle changing lanes or turning left	24.2%	93.8%	22.7%
Keigan09	UK regulatory requirement	Cyclist lost control alongside vehicle	16.7%	45.5%	7.6%
Keigan09	UK regulatory requirement	Total of the two above	40.9%	74.1%	30.3%
Talbot14	UK regulatory requirement	Side crashes	100.0%	11.5%	11.5%
Talbot14	More stringent side guard dimensions to close gaps	Side crashes	100.0%	26.9%	26.9%

Another noteworthy resource is the UK's HVCIS fatal crash database. In this national database, available countermeasures are matched to each fatal crash along with an estimated probability that each countermeasure would have prevented the fatality. The probability estimation is based on review of evidence in the police crash report files as well as on published guidance about the efficacy of the various countermeasures (Cookson & Knight, 2010). Since side guards are already required in the UK, the estimated benefits related to side guard countermeasures in the HVCIS solely reflect incremental benefits associated with enhancing the existing requirement. Table 9 shows side guards along with some other possible countermeasures, for reference.

Table 8: Summary table of studies from Australia, the Netherlands, and the UK that show similar numbers for pedestrians and bicyclists (and, in the last case, motorcyclists)

Publication	Guard implementation	Crash set	Exposure (side guard relevant crashes as a percentage of all crashes)	Effectiveness (reduction in fatality or serious injury as a proportion of all injuries)	Exposure times effectiveness (theoretical mitigation potential expressed in terms of all crashes)
Rechnitzer93	Not specified	All fatal crashes	100.0%	20.0%	20.0%
Rechnitzer93	Not specified	All serious injury crashes	100.0%	25.0%	25.0%
VanKampen99	Bus as proxy for low-clearance guard condition	All passenger side turning maneuvers (rail-style side guard)	Not specified	25.0%	Not specified
VanKampen99	Bus as proxy for low-clearance guard condition	All passenger side turning maneuvers (smooth-style side guard)	Not specified	35.0%	Not specified
Riley81	Not specified	Side impacts for motorcyclists, bicyclists, and pedestrians	66.0%	24.0%	15.0%

This review of effectiveness studies relies heavily on references from the UK, in part due to the relative ease of accessing and reviewing publications in English. There are likely other effectiveness studies that this effort has not yet obtained, due to language limitations and other challenges associated with international research. The reviewed literature consistently shows that side guards are effective at mitigating fatalities and serious injuries for VRUs. Most studies focused on bicyclist fatalities, although there are several studies that address safety effectiveness for pedestrians and motorcyclists. According to the literature, side guards appear to be relevant for a significant fraction of crashes (9-40 percent of bicyclist crashes and 10-19 percent of pedestrian crashes) and effective in a significant proportion of these crashes.

Table 9: Relative influence and effectiveness of large truck safety countermeasures in preventing UK bicyclist-truck fatalities (Source: HVCIS fatal 1997-2006, via (Knight, et al., 2005))

Countermeasure	Total estimated lives that would have been saved by countermeasure (1997-2006)
Improve forward vision	8
Improve side vision	21
Install stronger and lower side guards*	13.25
Install aerodynamic side guards*	21
Provide bicycle lane	34.25
Other	9.75

*This is the **additional** projected benefit of **improved** side guards, not the overall benefit from side guards, since they are already required in the UK.

Multiplying effectiveness by exposure produces a generalized total mitigation potential expressed in terms of a reduction in the percentage of fatal/serious injuries for all crashes (not just side guard relevant ones).

- **Fatalities:** Looking across the studies specific to bicycle fatalities, this total mitigation potential ranged from 5 – 30 percent. For studies specific to pedestrian fatalities, the total mitigation potential ranged from 2 – 4 percent. For studies that presented generic estimates of effectiveness (not differentiating among VRU category), the total mitigation potential for fatalities ranged as high as 20 percent.
- **Serious injuries:** For the studies with data specific to bicycle serious injuries, the estimate of total mitigation potential ranged from <1 – 6 percent and for the one study with specific data on pedestrian serious injuries the estimate was <1 percent. For other studies that presented generic estimates of effectiveness (not differentiating among VRU category), the total mitigation potential for serious injuries ranged as high as 25 percent.

3.3 CONCLUSIONS

A variety of sources provide data on the safety effectiveness of side guards for VRUs, including field evaluation studies, which use real-world crash data; empirical studies, which involve physical tests to assess performance; and simulation-based studies, which use computer modeling to assess performance. Volpe reviewed over 50 publications for information on side guard effectiveness, 11 of which contained quantitative data on safety effectiveness for VRUs. The majority of these studies on side guards present quantitative and/or qualitative evidence that side guards are effective at mitigating crashes with VRUs. A few of the findings were inconclusive, but no studies disproved side guard effectiveness. Most studies articulate that the type of side guards in common use, with ground clearance up to and exceeding 550 mm, are primarily effective for passing/overtaking maneuvers, in which the heavy vehicle travels roughly parallel with the VRU, with VRU impact on the passenger side of the vehicle ("nearside," in UK terminology). A number of studies present evidence supporting this. Evidence was also identified indicating that side guards—in particular more stringently designed variants with decreased height between the bottom edge and the roadway—can be effective for crashes in which the vehicle turns toward the passenger side, though the evidence is less conclusive.

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4. BENEFIT-COST ANALYSIS

4.1 INTRODUCTION

Trucking plays a central role in freight and logistics and is an essential component of the U.S. economy. At the same time, crashes involving trucks and VRUs accounted for 468 fatalities in 2016, with societal costs of $4.5 billion,[10] a value that does not include the costs of non-fatal injuries. Truck side guards are an existing technology that has been widely deployed internationally for reducing fatal VRU crashes.

Separately, volatile fuel costs and environmental concerns have focused attention on fuel efficiency in the trucking sector. According to estimates from the Energy Information Administration (EIA), the trucking industry's total fuel expenses were $5.88 billion in 2015,[11] a value that does not include the societal costs of emissions from this consumed fuel. Both aerodynamic truck and trailer skirts and certain side guards that are designed to reduce aerodynamic drag have been developed as one way of producing fuel savings.

This section analyzes the benefits and costs of side guard deployment scenarios from a societal perspective. The goal is to understand whether the costs of side guard installation are justified by the potential safety and fuel efficiency benefits. The present analysis does not compare the net benefits of all the technologies that could potentially be used to produce similar benefits, but instead assesses the net benefits (or total societal benefit) of truck side guards as an available and technically mature countermeasure to reduce crash costs between heavy trucks and VRUs and to reduce fuel use in operation. The results of this report can, however, be used in future comparisons of the total net benefits of side guard deployment relative to alternative technologies that could address the same issues.

The analysis considers a technology closely related to side guards: aerodynamic truck and trailer skirts (aero skirts), which are installed in a way that makes them incompatible with also installing side guards.[12] Aero skirts provide similar fuel reduction benefits as certain side guards, but some may not be structurally reinforced to withstand crashes with VRUs and thus may not provide equivalent crash safety benefits. Aero skirts are already deployed on a significant portion of van and refrigerated trailers in the U.S. and are increasingly being deployed on new trucks and trailers or retrofitted onto older models. According to the North American Council for Freight Efficiency (NACFE) 2018 Annual Fleet Fuel Study, almost nine out of 10 recently purchased box-type trailers within the 20 participating fleets were equipped with aero skirts (Berg, 2018). Rapid aero skirt adoption has been driven in part by a 2010 California Air Resources Board

[10] Crash costs here represent the total cost to society rather than the cost to carriers alone. This was calculated using U.S. Department of Transportation (DOT) Value of Statistical Life (VSL) for 2016 of $9.6 million, and 468 fatalities occurred in crashes involving trucks and VRUs in 2016.

[11] Estimate built from American Transportation Research Institute (ATRI) estimate of fuel cost per mile ($0.21) and FHWA estimate of heavy-duty truck vehicle miles traveled (roughly 280 billion miles).

[12] Aero skirts can be structurally reinforced to garner the same safety benefits as side guards.

requirement as well as by EPA Greenhouse Gas Phase 2 Regulations for Medium- and Heavy-Duty Vehicles (Agency, 2018).

4.2 METHODOLOGY

4.2.1 Benefit-Cost Analysis Overview

Benefit-cost analysis (BCA) is an evaluation method that allows decision makers to compare alternative options by reframing the impacts of those options into commensurable terms, such as dollars. BCA considers the widest possible scope of who is impacted by a choice, yielding a full accounting of societal impacts. These impacts are broadly categorized into costs and benefits, and are further categorized by their cause or impact, e.g., benefits such as safety and costs such as installation. Impacts are determined for the present and for all relevant future years as determined by the lifecycle of the asset or program considered.

Impacts are converted from impact quantities (e.g., number of fatal crashes) into dollar values (e.g., a DOT-supplied cost of $9.2 million per fatality) for comparison. Impacts often occur over many years, and to account for the greater value of the present impacts versus those further in the future, the future impacts are discounted so that the values of all years are treated as present values.

Total benefits and costs from all years are summed, resulting in total net benefit, interpreted as the value of the option. Total net benefit may be positive or negative. Additionally, a benefit-cost ratio (BCR) can be calculated (total benefits divided by total costs) and used to categorize the option as being net beneficial (BCR>1), net neutral (BCR=1), or net negative (BCR<1). These two analysis outputs, net benefits and BCR, are used for comparative purposes.

The primary alternative of comparison is the case where no action is taken. Similarly, net benefits and BCR could be used in a comparison of all relevant alternatives (including the do-nothing case) to determine the most cost-effective option.

A net positive BCA is not a decisive reason for pursuing an option, as other considerations may make the option untenable, such as monetary or legal constraints.

4.2.2 Side Guard Benefit-Cost Analysis Methodology

This section provides an overview of the methodology for this side guard benefit-cost analysis. The impact categories considered are those for which the side guard is expected to deliver benefits or costs. Safety benefits are calculated as crash cost reductions in crashes between VRUs and side guard-equipped trucks. Fuel savings benefits (aerodynamic) are calculated from reductions in fuel use by side guard-equipped trucks. The costs considered are all costs associated with deploying side guards, which includes installation and maintenance.[13] The period

[13] Details about the method and cost of side guard maintenance can be found in Appendix D.

of analysis is from 2020 through 2045. Future values of each impact are discounted at 7 percent, consistent with the Office of Management and Budget's BCA guidelines (OMB, 2017).

A model of the trucking fleet was developed for the BCA analysis, and three alternative scenarios of deployment were considered to provide insight into the potential range of net benefits; all scenarios assume side guards achieve full deployment by 2045. These bounding scenarios were considered to account for the uncertainty of future regulatory and voluntary industry action.

4.2.2.1 Truck Assumptions

This analysis considers the full population of commercial trucks over 10,000 lbs., including the two categories of single unit trucks and combination trucks. Single-unit trucks are vehicles over 10,000 pounds that have a single frame, often with two axles, while combination trucks include a power unit (or tractor unit) that tows one or more trailer(s).

These two truck categories are further broken down by cargo body types (e.g., dump truck, flatbed, or van). The characteristics of cargo body types (such as truck length) were determined from the Vehicle Inventory and Use Survey (VIUS), part of the 2002 Economic Census. The VIUS dataset is considered the most reliable data on the U.S. truck fleet available at this time.

Estimates of the total size of the U.S. fleet by truck category are derived from the Bureau of Transportation Statistics' (BTS) vehicle registration data, which provide annual State-level registration data for all motor vehicles including heavy trucks. The proportion of cargo body types in each truck category is obtained from the VIUS dataset.

Side guards are directly deployed on single-unit trucks (SUT), but are indirectly deployed on combination trucks (CT) (tractor trailers) because they are deployed on the trailers and not the tractor. Trailers can be pulled by different truck tractors depending on operational needs or availability. Estimates of the number of trailers in the U.S. are provided in the Americas Commercial Transportation (ACT) Research Co.'s U.S. trailer factory shipment data (ACT Research Co., 2014), and annual sales growth of 1 percent was assumed.

To avoid excess complexity, the model presented here does not account for differences in fuel efficiency between tractor trailer engines and further does not associate the estimated vehicle miles traveled (VMT) with tractor types.

The remainder of this report does not distinguish between truck tractors and trailers, and uses "trucks" or "vehicles" to refer to all single-unit trucks and combination trucks (tractors with trailers).

Attempts were made to break out BCA-relevant information by cargo body type, but ultimately the most important distinction for calculating benefits and costs was between truck category (SUT or CT).

The trucking fleet model assumes that truck owners/operators of trucks with different body types are equally likely to deploy side guards, meaning that owners/operators of an SUT dump truck

are equally likely as owner/operators of other SUTs to deploy side guards. This assumption could be adjusted in the model if data about the likelihood of deployment by cargo body type were available.

4.2.2.2 Side Guard Assumptions

Three kinds of lateral underride protective equipment are relevant to this report:

1. **Aero skirts**, discussed above, are essentially un-reinforced side guards that provide aerodynamic benefits but not necessarily safety benefits.
2. **Rail side guards** are reinforced bars that provide safety but not aerodynamic benefits.
3. **Aero side guards** are essentially aero skirts that have been reinforced to prevent unintentional entry under the side of a truck and therefore provide both safety and aerodynamic benefits.

Both aerodynamic and safety benefits increase when the panel-style side guard maintains lower ground clearance. The photos shown in Figure 6 through Figure 9 illustrate SUT and CT trucks equipped with aero (panel-style) and rail-style side guards.

Figure 6: Photo of a Single-Unit Truck (SUT) with Rail Side Guard

Figure 7: Photo of a Combination Truck (CT) with Rail Side Guard

Figure 8: Photo of a Single-Unit Truck (SUT) with Aero Side Guard

Figure 9: Photo of a Combination Truck (CT) with Aero Side Guard

4.3 BENEFITS

4.3.1 Safety Benefits

4.3.1.1 Reductions in Crash Fatalities, Injuries, and Associated Costs

The key feature of side guards compared to other lateral devices on heavy trucks is their ability to withstand low force collisions,[14] preventing impacting objects from passing under the truck and incurring significantly more harm. Side guards provide this function when the object contacting the side guard collides with low force and is stopped from underriding. Compared to motor vehicles, VRUs have low mass and do not travel at high speeds, and therefore have lower acceleration on impact.

Side guards may also reduce truck crash costs involving motorcycles (also a VRU, but not for the purposes of this report) and other vehicles (passenger cars) if the acceleration of these vehicles on impact with a side guard-equipped truck is low enough.[15] This report does not calculate these potential benefits from truck-involved motorcycle or passenger vehicle crashes.

Safety benefits, or reductions in crash costs, can be produced by two means:

1. The crash event is avoided entirely so that the costs of the crash are avoided entirely
2. The crash severity is mitigated so that the severity of the injury is lessened, which reduces the costs

A crash's severity is defined by the injuries to a VRU's body or the damage sustained by trucks in the crash. Side guards are not intended to prevent crashes, but rather to reduce the severity of bodily injury in a crash. This reduction in severity primarily occurs because the side guard prevents VRUs from passing under the truck where they could be struck by the undercarriage or run over by the wheels. According to the HVCIS, aero side guards would mitigate a larger number of fatalities compared to rail side guards; however, the present analysis assumes equal crash severity reduction for rail and aero side guards (Knight, et al., 2005)).

Annual crash costs were calculated based on historical frequencies of crashes by truck category, type of VRU involved, severity of bodily injury, and the crash costs by severity (bodily injury). The resulting annual crash costs represent total annual safety benefits that could be realized from side guard deployment. Reductions in total annual crash costs are based on proportion of trucks side guards equipped in a given year. This methodology assumes that all trucks have an equal chance of being involved in a VRU crash.[16]

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[14] The guiding principle is that force equals mass times acceleration. Low-force collisions therefore can be low mass, low acceleration, or both low mass and low acceleration.

[15] The assumption here is about 20 mph for a car, 10 mph for a motorcycle due to the fact that motorcycle occupants are less protected than passenger vehicle occupants and would only see reductions in injuries in crashes at lower speeds.

[16] As previously, it also assumes that each vehicle type within SUT and CT is equally likely to deploy side guards.

No consideration was made for the effect of other technologies, such as automated or connected trucks on VMT, except those made by EIA in its fuel use forecasts or those made by the Federal Highway Administration (FHWA) in its VMT forecasts.

4.3.1.2 Relevant Crashes and Forecasts of Crashes

The projected frequency of side guard-relevant crashes can be broken down by truck category, VRU type (pedestrian or bicyclist), and bodily injury type. This report uses crash data to determine the number of side guard-relevant U.S. crashes, i.e., those which could have been mitigated by side guards based on the features of the crash.

Data on VRU- and truck-involved crashes are obtained from three sources: the General Estimates System (GES), the Fatality Analysis Reporting System (FARS), and Truck in Fatal Accidents (TIFA), which is a more detailed subset of the FARS database. These databases provide information about the first point of contact between the VRU and the truck in truck-VRU crashes.

The crashes included in this analysis were limited to those whose crash cost could conceivably be reduced if a side guard had been deployed on the truck. The FARS, GES, and TIFA databases used two methods of coding contact points: clock points and relative direction.

The majority of crashes were coded using the clock point system shown in Figure 10. Clock point 12 is the front of the truck, clock point 6 is the rear, and the hour hands in between mark the angle and point at which the truck encountered the VRU. Clock points 12 (front of truck) and 6 (rear of truck) were dropped from this analysis, as they could not conceivably be mitigated by side guards.

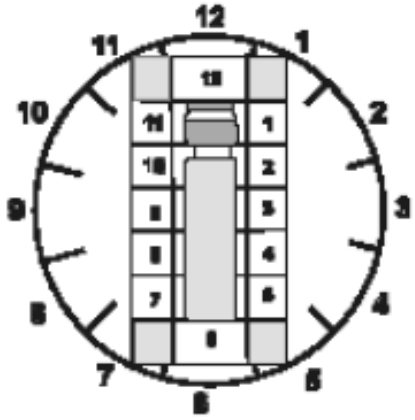

Figure 10: Clock Point Diagram (NHTSA, 2010)

Crashes were assigned a relative direction of impact as follows: left, left-front side, left-back side, right, right-front side, and right-back side. Crashes were dropped from the analysis if the first contact point was coded as a non-collision, an impact with the top of the truck, an impact with cargo/truck parts set in-motion, other objects set-in-motion, or an unreported or unknown impact area.

Figure 11 and Figure 12 depict the side guard-relevant truck-involved crashes with bicyclists and pedestrians, respectively, from 2005 to 2015 by truck category. The graphs show stability across

time in the number of crashes for both pedestrian- and bicycle-involved crashes with either SUTs or CTs.

The primary components of crash risk are the total vehicle miles traveled (VMT) by trucks and the total miles traveled by pedestrians and bicyclists (VRUMT). The expectation is that both of these measures increase over time. VMT for trucks has increased steadily over the 2005-2015 period. No measure of VRUMT exists, but a Census Bureau report on mode of commute shows marginal change in the number of workers who walk or bicycle (Mckenzie, 2015). The fraction of bicycling work commuters rose from 0.5 percent in 2006 to 0.6 in 2013, and the fraction of walking work commuters fell from 2.9 percent in 2006 to 2.8 in 2013. The number of commuters is an imperfect measure of VRUMT because it is not a measure of distance, which more closely approximates exposure, and because it does not account for non-commute and recreational trips.

The assumption of this report is that the change in crash rate in the past is a reasonable indication of the change in crash rate in the future without side guard deployment.

Figure 11: Side Guard-Relevant Bicyclist Fatalities by Truck Category from 2005 to 2015

Figure 12: Side Guard-Relevant Pedestrian Fatalities by Truck Category from 2005 to 2015

4.3.2 Aerodynamic Benefits

The second principal benefit of side guards addressed in this report is aerodynamics improvement. Side guards can reduce wind drag experienced by the vehicle at higher speeds, resulting in increased fuel efficiency. More fuel efficient vehicles use less fuel, and this reduction in fuel use is considered a reduction in real cost and, therefore, a benefit.

Fuel use in gallons was estimated using FHWA's forecasts of VMT multiplied by the EIA's forecast of gallons per mile (GPM) for new trucks. Aerodynamic benefits accrue from reductions in total fuel used by the proportion of side guard-equipped trucks and the fuel efficiency gained for an assumed speed on each functional class of VMT.

The aerodynamic benefit of aero skirts has been shown to be dependent on speed and on the vehicle category. A fuel efficiency improvement) by speed schedule was developed from this research for both SUTs and CTs (Cooper, 2003). For instance, approximately 20 percent of the fuel savings benefit achieved by CTs at 55 mph is still achieved at 20 mph; and, correspondingly, about 16.5 percent of the benefit achieved by SUTs at 55 mph is still achieved at 20 mph.

Table 10 shows the assumed speed on each functional class, percent of single-unit truck and combination truck VMT driven on each functional class, and the final VMT-weighted fuel efficiency percent gains from side guard use- by single-unit truck and combination truck vehicles for each functional class.[17] The fuel efficiency improvement values were summed by vehicle type and applied to the total annual combination truck and single-unit truck VMT values.

Table 10: Fuel Efficiency Improvement of Combination Trucks (CT) and Single-Unit Trucks (SUT) by VMT

Truck Type	Category	Interstate Rural	Interstate Urban	Other Arterial Rural	Other Rural	Other Urban
SUT and CT	Assumed Speed (MPH)	55	55	40	25	25
CT	Percent of VMT Driven	30%	21%	18%	9%	22%
	Fuel Efficiency (GPM) Percent Increase with Side Guard Deployed	1.4%	1.0%	0.7%	0.1%	0.3%
SUT	Percent of VMT Driven	10%	13%	17%	17%	43%
	Fuel Efficiency (GPM) Percent Increase with Side Guard Deployed	0.4%	0.6%	0.5%	0.2%	0.5%

The fuel efficiency percent gains meet expectations given the roadway type and the vehicle type characteristics. Side guard-equipped CTs travelling on Rural Interstates (30 percent of total CT VMT) show the largest gain in fuel efficiency. Side guard-equipped SUTs driven on Other Urban roads (43 percent of SUT VMT) show a much smaller gain in fuel efficiency commensurate with the lower speeds on those roadways compared to interstate speeds and with the reduced impact of side guards on SUT fuel efficiency compared to CTs.

[17] An assumption was made that the bodies of trucks, tractors, and trailers are in fairly good condition, with no major dents.

Given the light weight of side guards relative to the weight of the rest of the vehicle (between approximately 0.05 and 0.5 percent of the weight of the vehicle), there is no concern about reduced fuel efficiency from the added side guards' weight. However, if there were fuel efficiency reductions from weight, side guard testing for fuel efficiency would incorporate the impact of the weight of the side guards.

4.4 COSTS

To determine the cost of side guards, Volpe reviewed available literature, performed market research, and drew on data generated from prior engagement with the cities of New York, Boston, San Francisco, Chicago, and Cambridge in identifying side guard suppliers.

4.4.1 Global Cost Data

A 2006 Australian study quantified the unit costs of side guards based on data from two European manufacturers based in Sweden and also estimated the costs of equipping these European side guards on Australian vehicle types (Australian Government Department of Infrastructure, Transport, Regional Development and Local Government, 2009). The unit cost of the side guard device for each meter of vehicle length was reported to be $45.88 AD in 2005, including an assumed shipping cost to Australia equal to 20 percent of the cost of the product. Volpe excluded this Australian shipping cost to isolate the cost of the side guard device, and since the original values were reported in 2005 Euros and Australian dollars, Volpe converted unit and per-vehicle costs to 2017 U.S. dollars.[18] Volpe computed the side guard cost per vehicle meter length to be $36.27 in 2017 U.S. dollars.

When multiplied by the vehicle lengths for each Australian vehicle type, the per-vehicle costs of adding a side guard to both the left and right sides of the vehicle are as shown in Table 11 (Standards and International Vehicle Safety Branch, 2006). The cost of equipping a vehicle with side guards is found to be $453 for a single-unit truck, $689 for a semi-trailer, and between $907 and $1,941 for longer combination vehicles. Based on the reported distribution of truck and trailer types in Australia, the fleet-weighted average cost of side guards is $669 per vehicle. As noted, this estimate is for the product alone, as shipping cost can vary widely. Given the similarity between the Australian and U.S. truck fleet (Blower, 2012), this may be a generally transferable cost estimate for the U.S. context.

[18] The currency and inflation calculation for this table were performed using the following historical currency conversion and inflation calculators: http://www.xe.com/currencytables/; http://www.saving.org/inflation/

Table 11. Reported cost of rigid side guards for large trucks and trailers

Vehicle Type	Vehicle Length (m)	Cost (2017 USD)
3 axle semi-trailer	19	$689
5 axle semi-trailer	19	$689
6 axle semi-trailer	19	$689
7 axle B-Double	25	$907
8 axle B-Double	25	$907
9 axle B-Double	25	$907
Double Road Train	36.5	$1,324
Triple Road Train	53.5	$1,941
2 axle rigid commercial vehicle	12.5	$453
3 axle rigid commercial vehicle	12.5	$453
4 axle Twin-Steer rigid commercial vehicle	12.5	$453
2 axle rigid commercial vehicle with 2 axle dog trailer	19	$689
3 axle rigid commercial vehicle with 3 axle dog trailer	19	$689
Fleet average		**$669**

Volpe's review of a number of European side guard vendors corroborates that the typical cost of side guards in that mature market is in the hundreds of dollars per vehicle for rail-style side guards. On the low end, a pair of twin-rail 10-foot side guard kits from UK suppliers, including mounting hardware, can be purchased for about $300 plus shipping costs (Commercial Body Sideguard Systems, n.d.). These knock-down side guard kits can be mounted to the truck cargo bed on van or flatbed type bodies (Sideguard Legs- Pre-Assembled (Galvanized), n.d.) or bolted to the frame rail on tankers, cement mixers, etc.

4.4.2 Domestic Cost Data

The total cost of a side guard includes materials and installation labor, both of which decrease along a production curve. Since side guards are less widely available in the U.S. than in countries with side guard regulations, U.S. costs are currently higher. In 2013, Volpe was aware of only one manufacturer of side guards in North America. In 2018 there were at least nine side guard suppliers, including trailer skirt manufacturers, truck body builders, and part suppliers, as shown in Table 27 (Appendix). Several of these suppliers are also listed on the New York City Hunts Point Clean Truck Program side guard vendor list, which is periodically updated (Vendor Network- Side Guard Vendors, 2017).

More recent data obtained by Volpe from North American suppliers and fleets show per-vehicle prices as of 2017, following a number of local side guard pilot programs and laws, ranging approximately from $700 to $1,800 for rail-style designs and approximately from $1000 to

$2700 for panel style designs.[19] Variation in costs is attributable to costs of different designs, the quantity of product needed to fit different size vehicles, and the labor required for different types of installation. Increased side guard installation under a number of Vision Zero programs may be stimulating manufacturer interest, attracting new entrants, and reducing costs closer to the ranges documented in Europe.

4.4.3 Interaction with Truck Parts and Inspections

Volpe performed an analysis, detailed in Appendix C, of potential side guard interactions with common truck parts that could increase or reduce the cost of side guard implementation, as well as potential interactions of side guards with commercial vehicle safety inspections that could pose barriers or added costs.

Volpe identified typical parts and accessories present on the ten most common truck types in the U.S. truck fleet with a gross vehicle weight rating greater than 10,000 lbs. and assessed their potential interactions with side guards. These interactions vary in compatibility, which Volpe's analysis (described in Appendix C) designated as *synergistic*, *adaptation*, or *incompatible*. Certain truck parts were found to require pre-market or aftermarket adaptations to accommodate side guards, whereas several truck parts appear to be synergistic with side guards, i.e., these parts can serve as part of the side guard device. Table 12 summarizes potential added costs or cost savings associated with combining side guards and these truck parts and accessories on a vehicle. "Synergistic" truck parts present potential cost savings related to side guard implementation; "synergistic or adaptation" truck parts present minimal cost, no cost, or minimal cost savings; "adaptation" truck parts present low cost; incompatible truck parts present high cost. No "incompatible" truck parts were identified.

Aftermarket installation can incur costs related to relocating or replacing existing common truck parts and accessories that a manufacturer currently installs without consideration for side guard placement. However, if truck and trailer manufacturers were to install side guards pre-market, the coordinated placement of truck parts and accessories together with side guards could eliminate the costs of component repositioning and adaptation.

[19] Based on data provided by Airflow, Takler, Transtex, Allied Body, and Laydon/WABCO; NYC Department of Citywide Administrative Services Fleet and Boston Mayor's Office; and City of Cambridge side guard 2016 request for proposal bid results.

Table 12: Truck parts and associated implementation costs related to their compatibility with side guards.

Related Implementation Cost	Synergistic *(Potential Cost Savings)*	Synergistic or Adaptation *(Minimal Cost or Potential Cost Savings)*	Adaptation *(Low Cost)*	Incompatible *(High Cost)*
Aftermarket	• Wheels • Frame or chassis • Underbody toolbox • Side marker lamps • Air reservoir • Stairs • Stored spare tire • Tires • Lift axle	• Underbody fuel tank • Aerodynamic truck skirt • Ladder • Stabilizer leg	• Fire extinguishers	• None
Pre-market	• Wheels • Frame or chassis • Underbody toolbox • Fire extinguisher • Side marker lamps • Air reservoir • Stairs • Stored spare tire • Tires • Lift axle	• Underbody fuel tank • Aerodynamic truck skirt • Ladder • Stabilizer leg	• None	• None

Volpe's interview with the FMCSA Field Operations Office Director confirmed that the Level 1 inspection is preferable whenever possible. Level 1 inspections include the driver and his/her credentials, a vehicle walk-around, and the inspector physically entering underneath the vehicle. The interview also identified five available solutions for continuing to perform Level 1 inspections on commercial vehicles equipped with side guards:

- **Partial Level 1 inspections**: These inspections will check brakes without the inspector going underneath the vehicle;
- **Improved inspection facilities**: Inspection facilities with pits and ramps for Level 1 inspections;
- **Movable side guards**: Removable or hinged side guards that permit easy access;
- **Improved inspection techniques**: Inspectors perform Level 1 inspections with a "creeper" (a low-profile rolling cart) from the truck rear; and
- **Improved technology in inspections**: Anticipated transition to roadside wireless inspections in the future.

In summary, Volpe's analysis did not find that any of the required or common truck parts would be incompatible with side guards. While some truck parts may require pre-market or aftermarket adaptation, several parts are synergistic in that they can already act as a partial side guard, which can yield cost savings compared to installation of a larger, purpose-built side guard. Commercial

vehicle safety inspections of trucks with side guards can be addressed in five ways, some of which are currently common practice. Both findings indicate minimal additional vehicle adaptation costs incurred beyond the purchase, installation, and maintenance of side guards--as discussed in the following section—particularly if implemented as a factory-installed device.

4.4.4 Inputs to the Benefit-Cost Analysis

4.4.4.1 Installation

The principal cost of side guard deployment is the cost of purchasing and installing the equipment on the truck.

This analysis considers side guard installation cost factors that could be captured in the vehicle data available and that are relevant to installation costs. The primary installation cost factors are the method and timing of installation and the length of the truck. The categories of installation based on these factors are as follows:

- An aftermarket product on trucks without an aero skirt
- An aftermarket product on trucks with an aero skirt, through reinforcement of the aero skirt with bracing
- A factory-installed, pre-market product

The installation costs applied to pre-market installations are the average installation costs weighted by the share of vehicles of a given length. The percent of trucks by length were determined from the VIUS 2002 dataset. Pre-market rail and panel side guards are treated as having the same installation cost. Table 13 shows the cost of pre-market installation of side guards by cargo body type and length and the share of the vehicles of a given length by body type.

Table 13: Cost of Side Guard Pre-Market Installation by Truck Category and Length

Category	12.5 m	19 m	25 m	36.5 m	53.5 m	Total
SUT, Percent of Trucks	93.4%	6.5%	-	-	-	100%
SUT, Cost of Installation	$423	$689	-	-	-	$440
CT, Percentage of Trucks	-	95.7%	4.0%	0.17%	0.11%	100%
CT, Cost of Installation	-	$689	$907	$1,324	$1,941	$700

Aftermarket installation can increase upfitting costs related to relocating or replacing existing common truck parts and accessories, which most U.S. truck manufacturers currently install without consideration for side guard placement. As noted above, the cost of retrofitting a truck with side guards ranges in installation cost irrespective of vehicle size from $700-$1,800 for rail design and $1,000-$2,700 for full panel designs. The analysis used the median of these figures for each installation type: $1,250 for rail retrofit and $1,850 for panel.

Annual total cost of installation is the product of the number of vehicles deploying side guards of each deployment type each year and the cost of installation by deployment type.

4.4.4.2 Maintenance

Installation of new equipment is expected to produce recurring maintenance costs incurred by truck operators to maintain proper functioning of or reduce deterioration of the side guard.[20]

The per truck per year cost of maintenance of $7.27 used in this report is constructed from an estimate of time required to conduct maintenance on a side guard unit, and the mean hourly wage for bus and truck mechanics. The time required for side guard maintenance comes from interviews with jurisdictions that have installed side guards on some publicly owned and operated trucks (See Appendix D).

4.5 SCENARIOS AND RESULTS

This section provides context for the benefit-cost analysis scenarios that were computed, describes the purpose of each scenario, details the assumptions of each scenario, and discusses the results and findings of the analyses.

This report recognizes that there are many scenarios that could be selected. How deployment may progress in the real world is an open question, and at the present time many different scenarios are possible. Given the evidence of value from the benefit and cost components as discussed in sections 4.3 and 4.4, the business case for deployment of side guards by truck owners or operators appears relatively strong.

The intent of this report is to provide an understanding of the impacts of national-scale deployment of side guards, and it is still unclear what the entire fleet will actually experience. Owners have potentially many alternatives for capital investments to increase safety or reduce fuel costs. All three analyses assume full side guard deployment by 2045 or earlier.

While the scenarios are not necessarily realistic, and while they are not intended to predict how implementation would actually occur, they were chosen to bound the range of plausible results.

The fact that the timing and extent of deployment can significantly impact the costs and benefits accrued over the analysis period, as well as direct competition that side guards face from aero skirts for fuel efficiency improvements, are incorporated into these scenarios.

The scenarios were calculated with two different levels of side guard effectiveness: a low effectiveness, reported in each scenario section that follows and in the conclusion, and a high effectiveness, reported in the conclusion. The low-effectiveness assumption uses the lowest values of safety effectiveness found in the literature and only 80 percent effectiveness for the

[20] No additional maintenance costs to other parts of the trucks equipped with side guards were found.

fuel reduction benefits. The high-effectiveness scenario sets side guard safety effectiveness at the highest values in the range found in the literature, and sets fuel savings at literature values.

4.5.1 Scenario 1: Full Deployment First Year

The Full Deployment First Year scenario assumes that starting in 2020, all existing trucks without side guards will be retrofitted with side guards, and all new trucks in 2020 and thereafter will install side guards pre-market. The scenario assumes that 30 percent of existing single-unit trucks and combination trucks in the fleet have aero skirts deployed. Finally, the scenario assumes that all trucks will install full-panel or aero side guards and not rail side guards, and will therefore accrue all aerodynamics benefits. Evidence about whether rail or full-panel deployment is more likely to be deployed was not available.[21]

This deployment scenario is intended to mimic a mandatory deployment policy. It estimates the maximum benefits that could potentially accrue over the analysis period because all trucks accrue benefits for all years.

Figure 13 shows the annual costs and benefits for the analysis period 2020-2045 for the Full Deployment First Year scenario.[22] In 2020, all existing trucks are equipped with side guards, and the total cost of installation is near $12 billion. Total costs are marginal in the following years relative to 2020, as only new vehicles are equipped and maintenance costs are incurred. Safety benefits are marginally smaller than costs after 2020 and reach roughly one-quarter billion dollars in 2045. The aerodynamic benefits are substantial and rise from $3 billion in 2020 to more than $6 billion in 2045.

Figure 14 shows the same forecast of these same benefits discounted at 7 percent to their present values. Discounting overcomes the fuel use growth, leading to a decline in annual aerodynamic benefits.

[21] Regarding this assumption, it is worth noting that the ratio of deployed rail side guards to deployed panel aero side guards would have to be approximately 17 to 1 (for CTs) and 3 to 1 (for SUTs) before fuel savings benefits would no longer exceed the cost of deployment in a given year.

[22] This is not a summation of benefits.

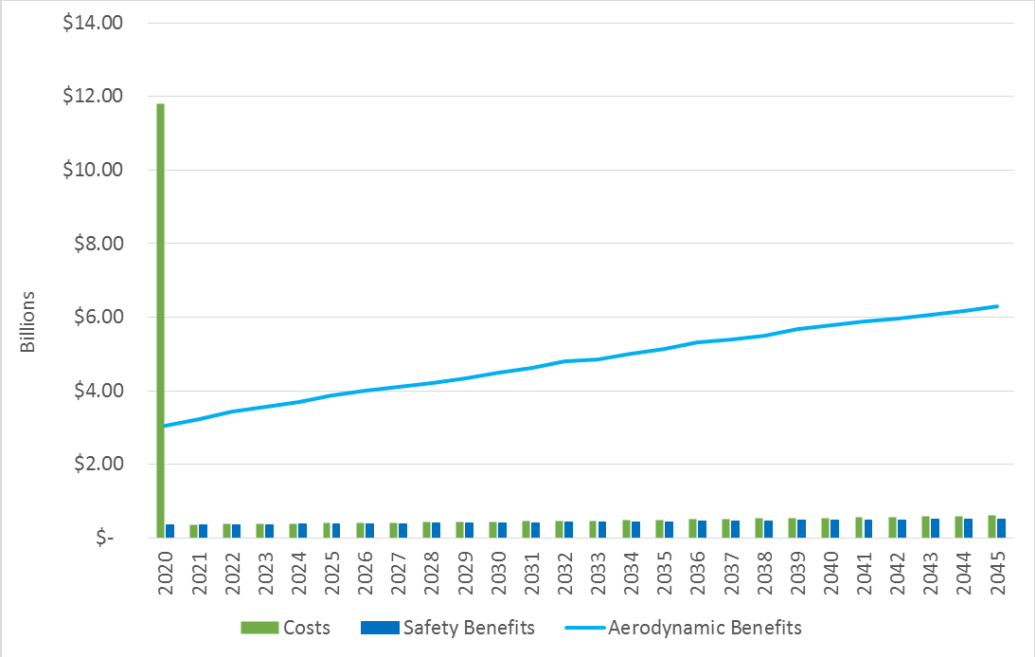

Figure 13: Undiscounted Benefits and Costs Occurring Each Year (2020-2045) for the Full Deployment First Year Scenario

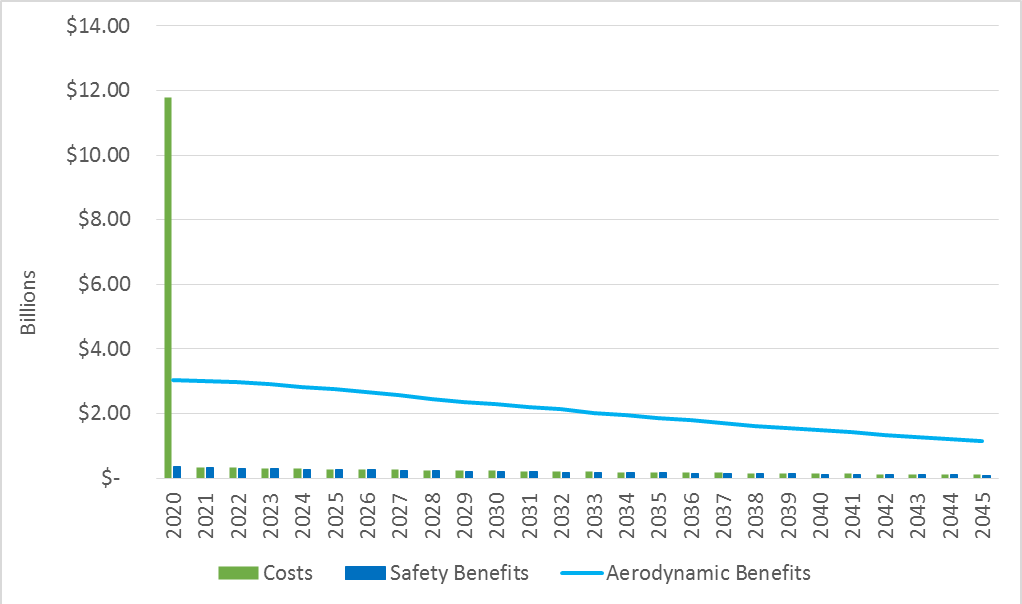

Figure 14: Discounted Benefits and Costs Occurring Each Year (2020-2045) for the Full Deployment First Year Scenario (7 percent)

4.5.2 Scenario 2: Gradual Deployment

The Gradual Deployment scenario assumes that 5 percent of existing trucks without side guards will be retrofitted with side guards each year until all existing trucks have been retrofitted with side guards. New vehicles in a given year that are equipped with a side guard are considered existing in following years. For new trucks, the scenario assumes that 5 percent will deploy pre-market side guards in 2020, and that the percent of new trucks deploying side guards will

increase by 5 percent each year until all new trucks deploy pre-market side guards in 2039. Aero skirts are estimated to be deployed on 15 percent of existing single-unit trucks (SUT) and combination trucks (CT) and 30 percent of new SUTs and CTs, which are retrofitted in later years. The scenario assumes that 5 percent of SUTs will be equipped with rail panel side guard and not rail side guards, and will therefore not accrue aerodynamic benefits.[23]

This scenario attempts to provide a more realistic rate of adoption among new and existing trucks by gradually rolling out deployment throughout the period of analysis. The realism of this gradual deployment depends on how quickly non-mandated deployment would reflect other adoption patterns, such as an S-curve where adoption rates gradual increase until half of all potential deployers have deployed, after which deployment rates slow.

Figure 15 shows the annual costs and benefits for the analysis period 2020-2045 for the Gradual Deployment scenario.[24] The annual cost of side guards rises from roughly $0.75 billion in year 2020 to roughly $1.5 billion in 2041, after which it drops to roughly $0.5 billion because all existing trucks have been equipped with side guards and only new trucks are installing side guards. Aerodynamic benefits rise from near marginal in 2020 to just under $5 billion in 2041, after which the rate of growth slows as only some portion of new vehicles are deploying side guards leading to a final annual benefit of $5.4 billion in 2045. The values of aerodynamic benefits in this scenario do not match the value in the previous scenario because not all vehicles with aero skirts deploy side guards. Figure 16 shows the same forecast of these same benefits discounted at 7 percent to their present value.

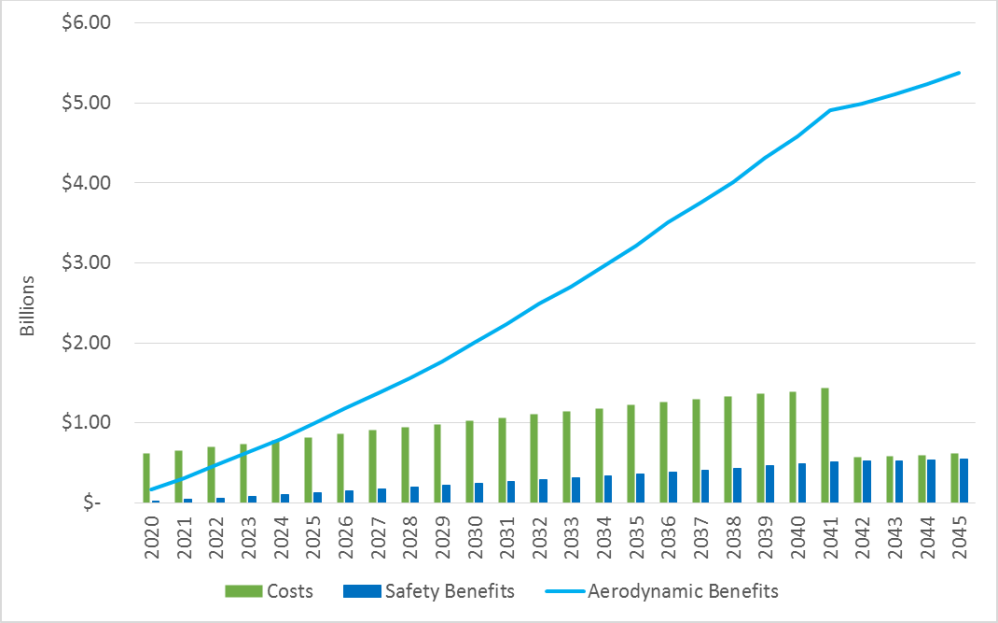

Figure 15: Undiscounted Benefits and Costs Each Year (2020-2045) for the Gradual Deployment Scenario

[23] Given the strong aerodynamic benefits for CTs, it seems unlikely that CT owners/operators would choose rail over panel side guards.

[24] This is not a summation of benefits.

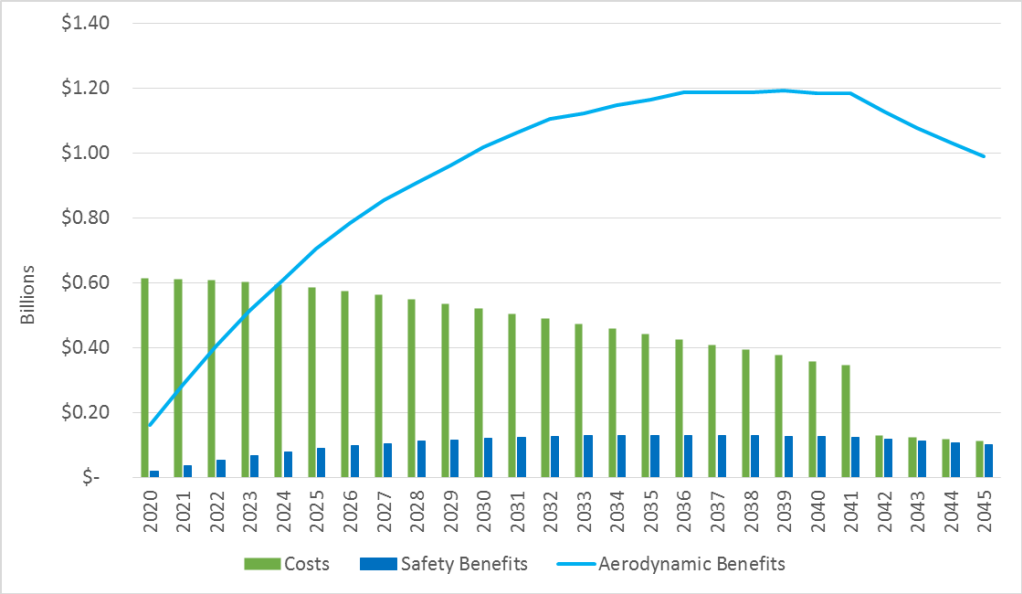

Figure 16: Discounted Benefits and Costs Each Year (2020-2045) for the Gradual Deployment Scenario

4.5.3 Scenario 3: Aero Skirts Fully Deployed

The Aero Skirts Fully Deployed scenario assumes that all trucks are equipped with aero skirts in 2020 and that all new trucks are pre-market equipped with aero skirts. Any side guard installed in this scenario is an adaptation of an aero skirt, which has a lower cost than a side guard retrofit install with no aerodynamic panel.[25] This scenario establishes the net benefits of only the safety benefits of side guards, by reinforcing aero skirts to be strong enough to produce safety benefits (i.e., strong enough to prevent VRUs from entering under the vehicle). This scenario assumes no fuel cost benefits ever accrue because fuel savings have already been achieved by the aero skirts.

Side guard deployment follows the same pattern in this scenario as in the gradual deployment scenario: 5 percent of existing trucks without side guards will be retrofitted with side guards each year until all existing trucks have been retrofitted with side guards. The maintenance costs are attributed to the side guards rather than the aero skirts. Further, the scenario assumes that 15 percent of new trucks do not upgrade aero skirts to side guards and thus do not attain the associated safety benefits.

Figure 17 shows the annual costs and benefits for the analysis period 2020-2045 for the aero skirt fully deployed scenario.[26] Aerodynamic benefits are zero in each year by construction because the scenario assumes that all vehicles have deployed aero skirts to which the aerodynamic benefits should accrue. Costs rise similarly to the gradual deployment scenario to a peak in 2040, when all existing vehicles have been retrofitted from aero skirts to side guards. Finally, the safety benefits rise from marginal in 2020 to more than $0.5 billion in 2045. Figure 18 shows the same forecast of these same benefits discounted at 7 percent to their present value. Figure 18 shows

[25] Maintenance costs are attributed to side guards and not to aeroskirts in this scenario. This is an accounting choice that may overestimate this cost.

[26] This is not a summation of benefits.

that discounting does not overcome safety benefit growth completely, leading to marginally increasing annual safety benefits.

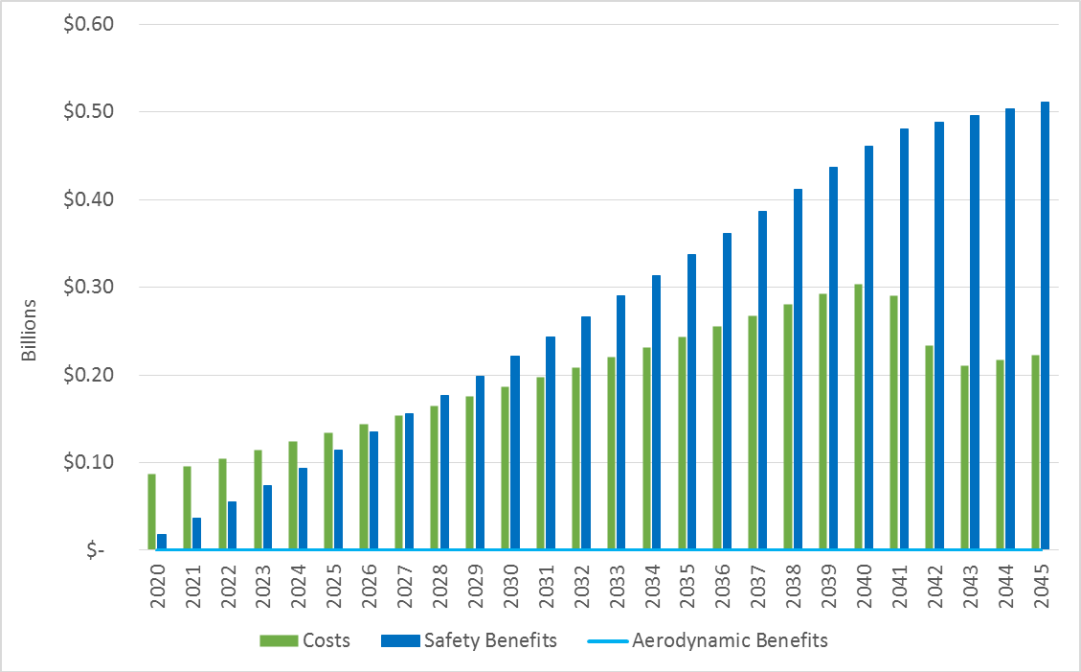

Figure 17: Undiscounted Benefits and Costs Occurring Each Year (2020-2045) for the Aero skirt Fully Deployed Scenario

Figure 18: Discounted Benefits and Costs Occurring Each Year (2020-2045) for the Aero skirt Fully Deployed Scenario

4.5.4 Benefit-Cost Conclusions

Each scenario of side guard deployment shows that the technology provides positive net benefits. Aerodynamic benefits represent a greater overall share of the total benefits than do safety

benefits, as aerodynamic benefits accrue whenever the vehicle is driven at medium or high speeds. In Scenario 3, however, where no additional aerodynamic benefits are accrued, the safety benefits alone still produce positive net benefits.

Given the relative share of fuel benefits and the lack of conflicting technologies to aero skirts and side guards, the deployments of full-panel side guards or aero skirts appears more likely than not for any given vehicle. The marginal safety benefit of reinforcing an aero skirt to a side guard is potentially high enough to cover the cost of retrofitting within a few years.

Table 14 shows the benefit-cost ratios (BCR) and net benefits for each scenario and each side guard effectiveness assumption. The low-effectiveness assumption uses the lowest values of safety effectiveness found in the literature and only 80 percent effectiveness for the fuel reduction benefits. The high-benefits scenario sets side guard safety effectiveness at the highest values in range found in the literature, and sets fuel savings at literature values.

Table 14: Scenario Benefit-Cost Ratio (BCR) Results (Discounted at 7 percent)

Scenarios	BCR (High Benefits)	BCR (Low Benefits)	Total Net Benefits (High Benefits)	Total Net Benefits (Low Benefits)
Full Deployment First Year	4.65	3.53	$61.6 billion	$42.2 billion
Gradual Deployment (5 Percent Annual Retrofit)	3.05	2.33	$23.5 billion	$15.3 billion
Aero skirt Fully Deployed	2.28	1.19	$2.70 billion	$0.40 billion

Table 15: Scenario Benefit-Cost Ratio (BCR) Results (Discounted at 3 percent)

Scenarios	BCR (High Benefits)	BCR (Low Benefits)	Total Net Benefits (High Benefits)	Total Net Benefits (Low Benefits)
Full Deployment First Year	6.12	4.65	$101 billion	$72 billion
Gradual Deployment (5 Percent Annual Retrofit)	3.59	2.76	$45.2 billion	$30.5 billion
Aero skirt Fully Deployed	2.52	1.31	$5.2 billion	$1.1 billion

The benefit-cost ratio provides some indication of the cost effectiveness of a particular side guard deployment scenario for achieving social benefit. The BCR is unitless and is useful for comparing alternative choices, but it does not provide the complete picture.

The overall level of net benefit is an important consideration as well**. For the low-benefits scenarios and discounted at 7 percent over the full period of analysis, the total net benefits are $42.2 billion, $15.3 billion, and $0.4 billion, respectively.** Given the strong impact on fuel efficiency, any given vehicle is able to recover the cost of side guard deployment within one to two years, depending on use, though the payback period for the fleet depends on when deployment occurs.

Table 16 lists the payback period for each deployment scenario and discount rate.

Table 16: Payback Period for Each Scenario and Discount Rate

	7 Percent Discount		3 Percent Discount	
Scenarios	***High Benefits***	***Low Benefits***	***High Benefits***	***Low Benefits***
Full Deployment First Year	3 years	4 years	3 years	4 years
Gradual Deployment	6 years	8 years	6 years	8 years
Aero skirt Fully Deployed	6 years	18 years	6 years	16 years

Figure 19 and Figure 20 show the cumulative benefits by year for the low- and high-benefits scenarios, respectively, discounted at 7 percent.

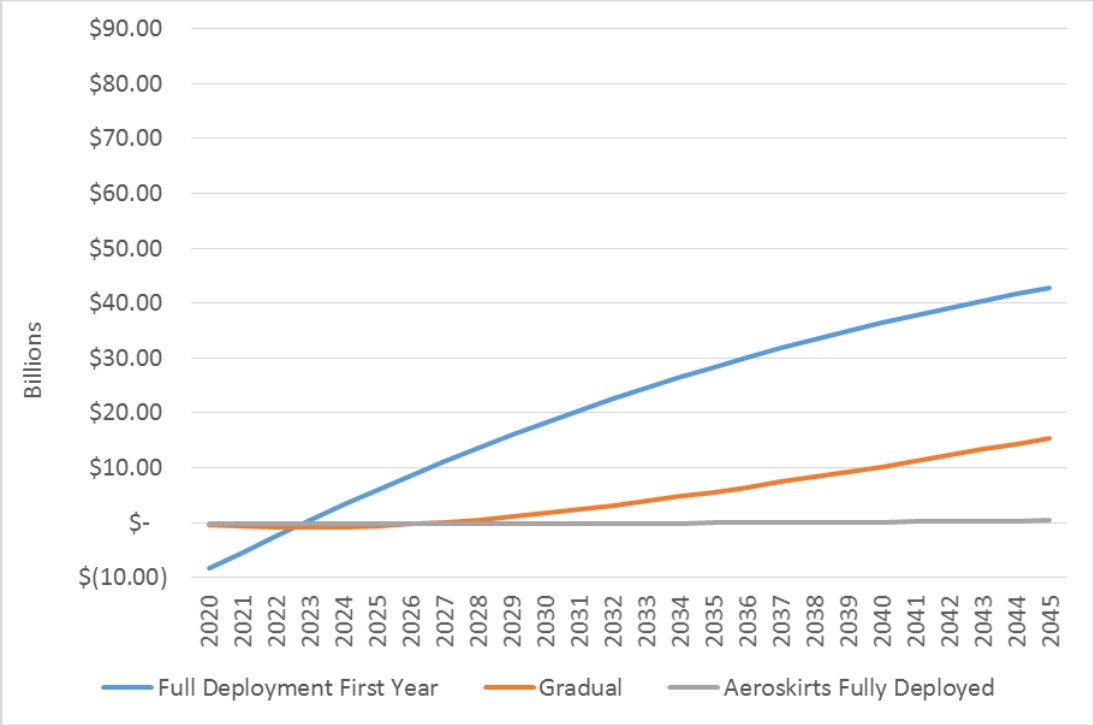

Figure 19: Discounted Cumulative Net Benefits of Each Scenario by Year (Low Benefits)

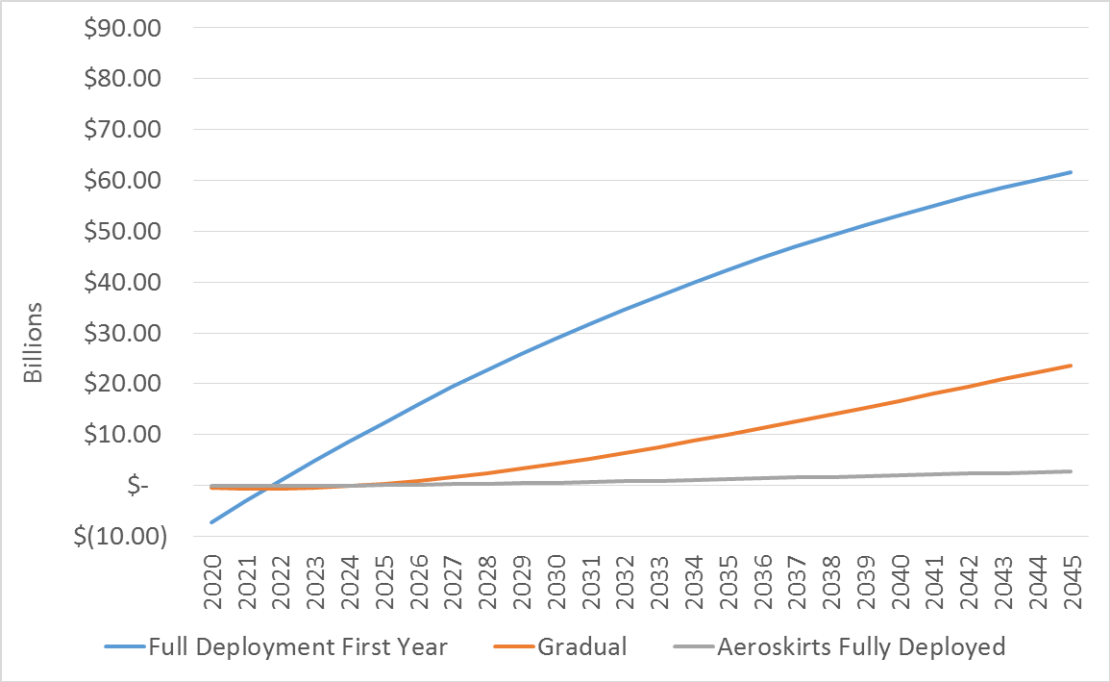

Figure 20: Discounted Cumulative Net Benefits of Each Scenario by Year (High Benefits)

With any analysis, it is important to understand how various assumptions have impacted the net benefits of the scenarios. The following is a partial listing of the assumptions highlighted in the report that are likely to overestimate or underestimate the net benefits:

- **Net Benefits Overestimated**
  - Dynamics between fuel savings and VMT. Increased VMT has many consequences that can be traced to some degree or another. The impact of increased truck VMT from reduced fuel use is beyond the scope of this study.
  - The analysis does not properly include scrappage of trucks and new sales. New sales are considered the difference in the total trucks from one year to another (data on truck sales is scarce), and this means that the model does not account for the retirement of trucks with side guards. It underestimates the number of trucks that will install side guards. This is a reduction in the total cost and therefore an overestimation of the net benefits.
- **Net Benefits Underestimated**
  - Maintenance costs may have been overstated as some side guard deployers reported having no additional maintenance costs for deploying side guards.
  - The analysis does not account for the potential ability of side guards to reduce crash costs for non-VRU truck-involved crashes, such as with motorcyclists, moped operators, and vehicle occupants.

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5. CONCLUSIONS

5.1 EXISTING SIDE GUARD REGULATIONS

There is global precedent for VRU-protecting side guard or lateral protective device adoption, as demonstrated by overseas national regulations spanning the previous 40 years, a multinational United Nations regulation for side guard type approval that has been adopted by 43 countries and the European Union, and the development of standards and local regulations in Australia and North America that appear to be catalyzing further adoption in comparable jurisdictions.

Specifications vary among the regulations and standards reviewed, but the approximate geometry and strength requirements remain relatively consistent. Most side guard standards require the guards to withstand 1-2 kN of quasi-static lateral force with limited deformation, enough to deflect a non-motorized VRU such as a pedestrian or a bicyclist in a collision. The Brazil standard, however, is also intended to protect motorcyclists and therefore has a greater strength requirement of 5 kN, and a 2018 proposal seeks to increase the UN regulation to 3 kN. (Economic Commission for Europe, 2018) Maximum ground clearances range from 350 mm (13.8 in.) to 550 mm (21.7 in.); a majority of regulations opt for the higher ground clearance, but academic studies and non-regulated standards (such as the specification developed by Volpe) recommend lower ground clearances, as does the 2018 proposed UN regulation amendment.

In contrast to the VRU-protecting side guards analyzed in the current study, side underride protection systems designed to arrest a passenger vehicle would require substantially heavier, stronger, and more costly construction. To avoid confusion between these two technologies and use cases, it is important to define clearly which population the side guard technology aims to protect, and to apply the proper context in any potential future U.S. standards or regulations.

5.2 EFFECTIVENESS AND EXPOSURE STUDIES

Volpe reviewed over 50 publications for information on side guard effectiveness and found 11 that contained quantitative data. A majority of the studies presented quantitative and/or qualitative evidence that side guards are effective at mitigating crashes with VRUs. Most studies focused on bicyclists as the crash target and demonstrated that side guards as currently designed (i.e., with ground clearance up to and exceeding 550 mm[27] or 21.7 in.) are effective for mitigating collisions between a VRU and a passing or overtaking truck. A smaller body of evidence is currently available to support the effectiveness of side guards in collisions between VRUs and a truck making a turn to the passenger side (i.e., right turns in the U.S. and left turns in the UK). A limited number of studies address and indicate that side guards further provide a level of effectiveness for crashes with pedestrians and motorcyclists.

[27] Maximum ground clearance of trailer side guards actually exceeds 550 mm once the trailer is attached.

Multiplying effectiveness (reduction in fatalities or serious injuries as a proportion of all side guard-relevant VRU crashes) by exposure (percent of all VRU crashes that are side guard-relevant) produces a generalized total mitigation potential expressed in terms of a reduction in the percentage of all fatal/serious injuries for all VRU crashes, not just side guard relevant crashes. This total mitigation potential ranges from 5 to 30 percent in studies specific to bicycle fatalities, <1-6 percent in studies specific to bicyclist serious injuries, 2-4 percent in studies specific to pedestrian fatalities, <1 percent in studies specific to pedestrian serious injuries, and as high as 20 percent for all VRU fatalities and 25 percent for all VRU serious injuries in studies that did not distinguish the VRU category.

5.3 BENEFIT-COST ANALYSIS

This report presents a broad benefit-cost analysis of deployment of side guards in the U.S. trucking fleet under various assumptions of deployment and effectiveness. The results under these scenarios show that side guard deployment would be an effective technology for generating net societal benefits in wide-scale U.S. deployment. Aerodynamics comprise a larger share of total benefits than safety benefits in the analysis,[28] but when isolated under one of the scenarios, safety benefits alone still produce net positive benefits.

As no consideration in this report has been made on the impact that other technologies may have on the benefits of side guard deployment, it is important for policy makers to further investigate how technologies may interact with one another in the field. Generally, technologies for aerodynamic benefits do not conflict, as they do not reduce the effectiveness of other fuel efficiency technologies. Technologies intended to produce safety benefits are sometimes not compounding in effect, i.e., they may not produce the same additional benefits when deployed together as when deployed separately. For example, automated vehicle technology is one technology that could reduce the number of truck-involved VRU crashes in the U.S. With fewer crashes to mitigate, the benefit of alternative safety mitigations such as side guards could, in principle, be reduced. However, the timeline and magnitude of any such reductions is unknown and challenging to predict. Moreover, as long as large trucks and VRUs continue to share street space, even sophisticated truck automation may offer limited benefit in side-impact crashes in which the VRU unexpectedly loses control.

[28] Compare Figure 50 and Figure 51 in Appendix A, which show the annual benefits by scenario and vehicle type for safety and aerodynamic benefits, respectively.

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6. RECOMMENDATIONS

The present analysis provides a baseline set of results for FMCSA to consider in developing potential future policies related to side guard standardization and deployment.

This report recommends **development of an industry side guard standard** through a standards development organization (SDO), with FMCSA supporting current efforts by certain truck manufacturers and major truck fleets.[29] A **new side guard industry standard** should address, at a minimum:

- Side guard installation on new trucks and new trailers exceeding 10,000 pound GVWR
- Dimensional requirements and performance-based mechanical requirements, including the flexibility to use non-side guard truck parts and accessories to meet these requirements
- Acceptable methods to demonstrate installation and maintenance compliance
- Retrofitting of side guards on existing trucks and trailers

As part of this standard development, particular attention and potentially further research is recommended to achieve industry consensus on:

- Appropriate maximum side guard ground clearance for providing full safety benefit as well as maximum flexibility for vehicle operations; and
- A best practice approach for reinforcing aerodynamic skirt products to provide side guard safety performance while minimizing incremental cost and impact on aerodynamic performance.

The new industry standard could potentially establish two tiers of compliance: a minimum set of requirements for international harmonization, e.g., aligned with the UN Regulation 73, as well as a more stringent set of recommended, best practice criteria.

Recognizing geographic differences in VRU exposure, the industry standard should be suited for the environment, e.g., side guards may be exempted for trucks operating exclusively in rural and remote environments. Flexibility should also be considered for side guard clearance on vehicles that cross unimproved, low clearance railroad grade crossings.

This report recommends FMCSA and researchers focus on the following further areas of inquiry:

- Determine the extent to which lateral underride technologies will be deployed in the absence of federal intervention. This may involve development of a more in-depth business case for owners that considers the payback period of equipping side guards given the vintage and use of the truck.

[29] Examples of SDOs include, but are not limited to, the American Trucking Associations Technology and Maintenance Council (TMC) and the American National Standards Institute (ANSI).

- For particular policy considerations, the model developed in this report should be expanded to incorporate dynamics of fuel use reductions on VMT and vehicle retirement.
- Additional potential safety benefits of side guard technology that were not addressed in the current study and incorporating them into the model (e.g., truck-involved crashes with automobiles at low speeds or equipped with ADAS and automation systems).

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APPENDIX A – SIDE GUARD REGULATIONS AND STANDARDS

Table 17: Summary table of national standards and their specifications (UN Regulation 73 included for comparison)

Country	Year Passed	Vehicles Covered	Vehicles Exempted	Strength	Maximum Ground Clearance	Maximum Gap Between Wheels and Guard
Japan [a]	1979	Ordinary-sized motor vehicles used for the transport of goods or ordinary-sized motor vehicle with a gross vehicle weight of 8 tons or more.	Motor vehicles with a passenger capacity of 11 persons or more and motor vehicles having a shape similar to the motor vehicles with a passenger capacity of 11 persons or more.[30]	Not available	450 mm (17.7 in.)[31]	Not available
United Kingdom	1983; expanded 1986	- A motor vehicle first used on or after April 1, 1984, with a weight that exceeds 3,500 kg (7,716 lbs.); - A trailer manufactured on or after May 1, 1983, with an unladen weight that exceeds 1,020 kg (2,249 lbs.); and, - A semi-trailer manufactured before May 1, 1983, that has a gross weight exceeding 26,000 kg (57,320 lbs.) and that forms a vehicle with a relevant train weight exceeding 32,520 kg (71,694 lbs.).	- A motor vehicle that has a maximum speed not exceeding 15 mph; - An agricultural trailer; - Engineering plant; - A fire engine; - Tipping trucks; - Military vehicles; - A vehicle without bodywork on its way to be checked/ fitted; - A refuse vehicle; - A specially designed vehicle carrier; - A motor car that forms part of an articulated vehicle; - A trailer with a load platform [with restrictions]; and - A trailer not from Great Britain.	2 kilonewtons (kN) (450 lbs.)	550 mm (21.7 in.)	300mm (11.8 in.)
United Nations [b]	1988; updated in 2007,	Vehicles of categories N_2, N_3, O_3, and O_4.[32]	- Tractors for semi-trailers, and - Vehicles designed and constructed for special purposes where it is not possible, for	1 kN (225 lbs.)	550 mm (21.7 in.)	300 mm (11.8 in.)

[30] This definition typically exempts buses.

[31] In practice, this clearance is typically only 380 to 400 mm (15-15.75 in.) on the largest articulated vehicles (Riley, Penoyre, & Bates, Protecting Car Occupants, Pedestrians, and Cyclists in Accidents Involving Heavy Goods Vehicles by Using Front Underrun Bumpers and Sideguards, 1985).

[32] N_2, N_3, O_3, and O_4 are vehicle categories defined in UNECE Consolidated Resolution on the Construction of Vehicles (R.E.3). Category N refers to motor vehicles with at least four wheels that are used for the carriage of goods (i.e., commercial trucks); Category O refers to trailers.

	2010, and 2016		practical reasons, to fit such lateral protection.			
China [a]	1989; updated in 1994, 2001	Vehicles of categories N_2, N_3, O_3, and O_4.	- Tractors; - Special purpose vehicles specially designed and manufactured for handling long goods that cannot be segmented, such as vehicles that transport timber, steel bars and other goods; and - Vehicles designed and manufactured for specialized purposes that cannot be fitted with side guards due to objective reasons.	1 kN (225 lbs.)	550 mm (21.7 in.)	300 mm (11.8 in.)
Peru	2003	Vehicles of categories N_2, N_3, O_3, and O_4.	All other vehicle categories.	Not available	550 mm (21.7 in.)	300mm (11.8 in.)
Brazil	2009	Trucks, trailers, and semi-trailers with a weight exceeding 3,500 kg (7,716 lbs.).	- Those made before 2011; - Tractor trucks; - Bodywork or load platforms that are up to 550 mm (21.7 in.) high in relation to the ground; - Vehicles designed and constructed for specific purposes where it is not possible to provide for the design of side shields; - Unfinished vehicles; - Vehicles and implements intended for export; - Military vehicles; and - Vehicles with sufficient defense built in.	5 kN (1,124 lbs.)	550 mm (21.7 in.)	300 mm (11.8 in.) behind the front wheels and 500 mm (19.7 in.) in front of the rear wheels.

[a] Primary source not available
[b] Included for comparison only

UN Regulation 73

Table 18: List of the 44 parties that have approved Regulation 73 (43 countries and the European Union)

UN Regulation 73 Contracting Parties			
Albania	European Union	Luxembourg	Russian Federation
Austria	Finland	Macedonia, Republic of	San Marino
Belarus	France	Malaysia	Serbia
Belgium	Georgia	Malta	Slovakia
Bulgaria	Germany	Moldova, Republic of	Slovenia
Croatia	Greece	Montenegro	Spain
Cyprus	Hungary	Netherlands	Sweden
Czech Republic	Ireland	Norway	Switzerland
Denmark	Italy	Poland	Turkey
Egypt	Latvia	Portugal	Ukraine
Estonia	Lithuania	Romania	United Kingdom

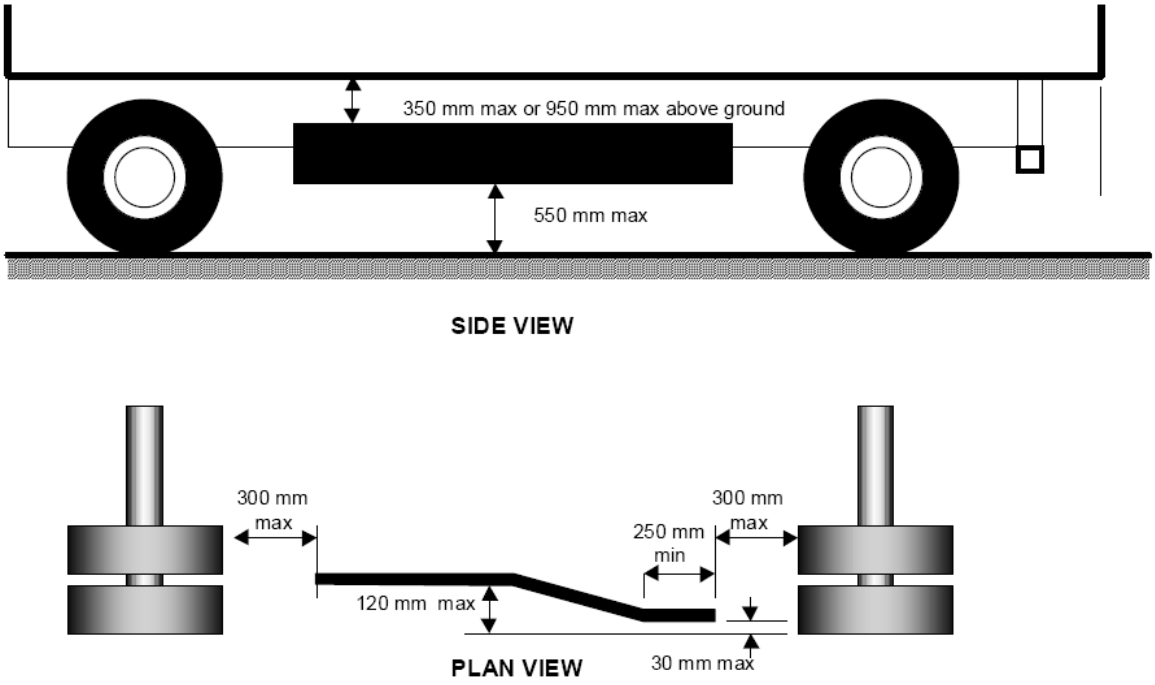


Figure 21: Schematic of the UN Regulation 73 side guard dimensional requirements (Source: UN Regulation 73).

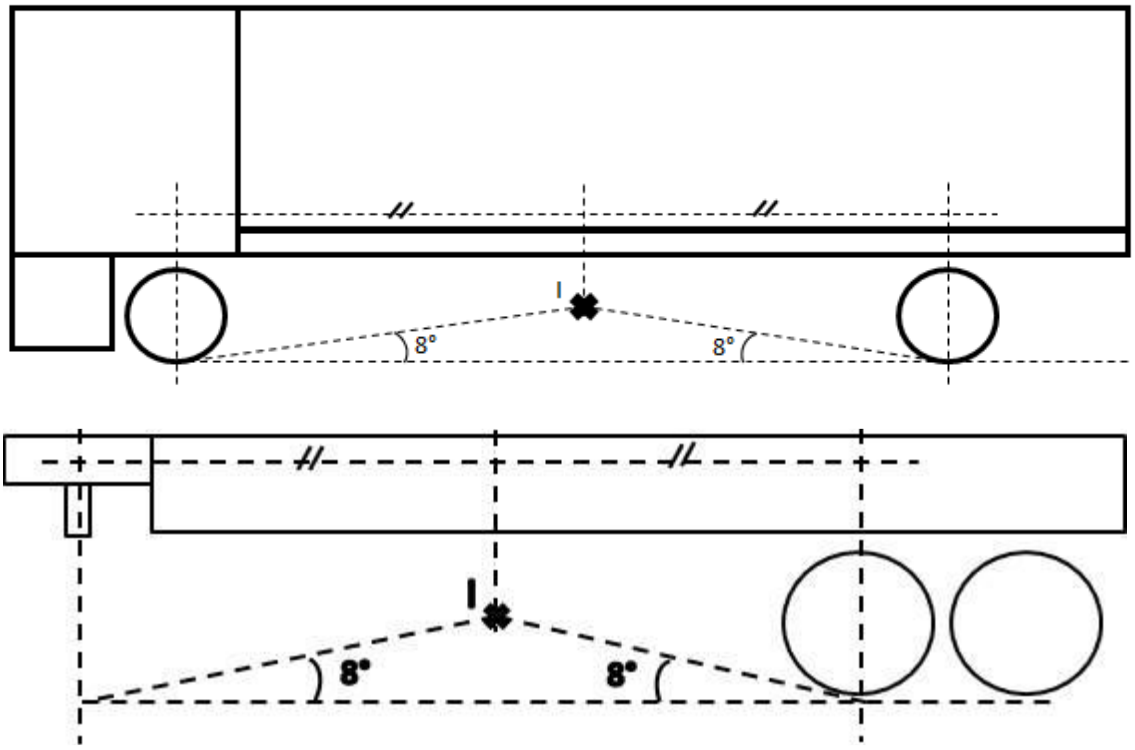


Figure 22. Schematic of 2018 proposed amendment to UN Regulation 73.

As shown in Figure 22, the 2018 proposed amendment to UN Regulation 73 would change the quasi-static force test to 3 kN while increasing the allowable elastic deflection as follows:

(a) **[90]** mm over the rearmost 250 mm of the device; and
(b) **[450]** mm over the remainder of the device.

The amendment would also reduce the allowable maximum ground clearance as follows, based on the wheelbase of the truck or trailer on which the side guard is installed:

(a) If $I \leq 350$ mm then the ground clearance can be 350 mm maximum;
(b) If 350 mm $< I \leq 450$ mm then the ground clearance is I;
(c) If 450 mm $< I$ then the ground clearance is 450 mm maximum;

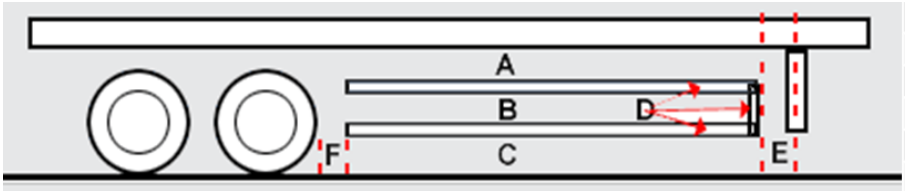
Japan

Instituted with the goal of protecting pedestrians, side guards became required in Japan in 1979, making Japan appear to be the first recorded country to mandate the use of side guards on heavy vehicles (Pedestrian Protecting Side Guards, Article 18-2, 1979). The maximum ground clearance under the Japanese regulation is 450 mm (17.7 in.), more stringent than the 550 mm (21.7 in.) maximum permitted in UN Regulation 73 and in other countries that have harmonized to the UN standard (see Figure 23). In practice, on the largest articulated vehicles this clearance is typically even lower: 380 to 400 mm (15 to 15.75 in.) (Riley, Penoyre, & Bates, Protecting Car Occupants, Pedestrians, and Cyclists in Accidents Involving Heavy Goods Vehicles by Using Front Underrun Bumpers and Sideguards, 1985).

Figure 23: Image showing a rail-style side guard on a truck in Japan (Source: Hirohito Takada, 123rf.com)

United Kingdom

Side guards were first mandated in the UK in 1983 for "new goods vehicles and trailers over certain weights and for some of the larger existing semitrailers" (Riley, Penoyre, & Bates, Protecting Car Occupants, Pedestrians, and Cyclists in Accidents Involving Heavy Goods Vehicles by Using Front Underrun Bumpers and Sideguards, 1985). In 1986, side guards were mandated on all large trucks by an Act of Parliament (The Parliament of the United Kingdom, 1986). In 1988, the UK also agreed to be bound to UN Regulation 73, which had a lower strength requirement and less specific exemptions (see Figure 24).



A	13.8 inches maximum
B	11.8 inches maximum
C	21.7 inches maximum
D	4 inches minimum
E	9.8 inches maximum
F	11.8 inches maximum

Figure 24: Technical specifications of the UK dimensional requirements for side guards on trailers (Adapted from Transports' Friend, n.d.)

China

Side guards first became mandatory in China in 1989 with the implementation of Standard GB 11567, a requirement largely aligned with the UN side guard regulation formulated the year

before (see Figure 25). This standard was updated in 1994 under "Requirements for side and rear lower protective devices for automobiles and trailers GB 11567-1994," and again in 2001 as GB 11567-2001 (Car and Trailer Side Protection, 2001).[33] The standard is applicable for vehicles of categories N_2, N_3, O_3, and O_4, with exemptions made for tractors and vehicles designed for a special purpose that cannot therefore be outfitted with side guards. A notable example of this exemption is logging vehicles, as the configuration to hold timber does not permit the installation of a guard. Regarding the design of the guard itself, the regulation specifies a maximum ground clearance of 550 mm (21.7 in.), as well as a strength requirement of 1 kilonewton (kN). Both solid and cross bar designs are allowed, with a maximum of 300 mm (11.8 in.) between cross bars on the guard. The regulation is similar to that put forward by the UN in its strength requirement and its applicability to vehicle types.

Figure 25: Image showing abandoned Chinese dump trucks with side guards (Source: Novyy Urengov, 123rf.com)

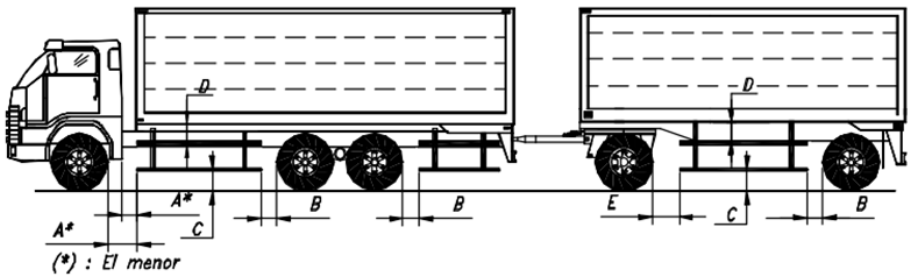
Peru

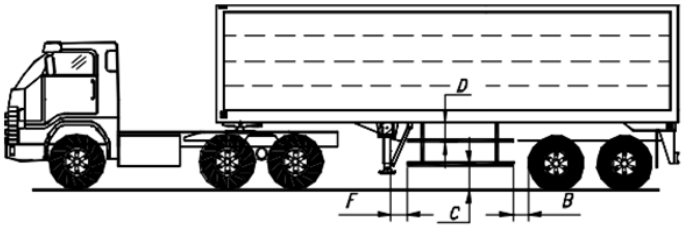
Side guards have been mandatory in Peru since the 2003 passage of Supreme Decree 58, which mandated that vehicles of categories N_2, N_3, O_3, and O_4 have lateral defenses for the protection of bicyclists, pedestrians, and motorcyclists (Ministerio de Transportes y Comunicaciones, 2003). Like UN Regulation 73, the maximum ground clearance allowed is 550 mm (21.7 in.), and the front and rear edges of the guard should be no more than 300 mm (11.8 in.) from the front and rear tires (see Figure 26 and Figure 27). Also specified in the Peru regulation is that the guards must be a maximum of 120 mm (4.7 in.) from the outer edge of the wheels or friction rail

[33] Primary source documentation could only be found for the 2011 standard, but secondary sources confirmed the existence of the original two standards (Riley, Penoyre, & Bates, 1985).

of the vehicle. Additionally, the regulation specifies that the side guard should have no sharp edges and smooth exterior surface. Unlike many of the other national regulations, there is no strength requirement specified for the guard.

Figure 26: Images of single-unit and combination tractor trailers equipped with side guards in Peru (Source: Volpe)





Cota	Descripción	Valor
A	Distancia desde la banda de rodamiento del neumático o borde posterior de cabina hasta el extremo delantero de la defensa	= 300 mm
B	Distancia desde la banda de rodamiento del neumático hasta el extremo posterior de la defensa	= 300 mm
C	Distancia desde el borde inferior de la defensa hasta el nivel de carretera	= 550 mm
D	Distancia desde el borde superior de la defensa hasta el borde inferior de la plataforma o carrocería .	= 350 mm
E	Distancia desde la banda de rodamiento del neumático hasta el extremo delantero de la defensa	= 500 mm

Figure 27: Technical specifications of the Peru standard (Ministerio de Transportes y Comunicaciones, 2003)

Brazil

With the passage of Resolution 323 to the Brazilian Traffic Code in 2009, trucks in Brazil are required to install side guards (see Figure 28), with the goal of protecting Brazil's large population of motorcyclists, as well as bicyclists and other operators of small vehicles (National Traffic Council, 2009). There are significant differences in the Brazil side guard regulation compared to others: it requires side guards to withstand a load of 5 kN while the UK and UN regulations only require side guards to withstand a load of 2 and 1 kN, respectively. The regulation requires trucks, trailers, and semi-trailers with a total gross weight of more than 3,500 kg, imported or made after 2011, to install side guards to be legally registered.

Similar to UN Regulation 73, the maximum ground clearance allowed is 550 mm (21.7 in.), and side guards must not extend beyond the plane corresponding to the width of the vehicle (see Figure 29). The upper bound of the side guard can be no more than 950 mm (37.4 in.) above the ground; the clearance between the front of the guard and the front wheel should be no more than 300 mm (11.8 in.), and the clearance between the back of the guard and the rear wheels should be no more than 500 mm (19.7 in.).

Figure 28: Image showing a side guard on a truck in Brazil (Source: Sergio Shumoff, 123rf.com)

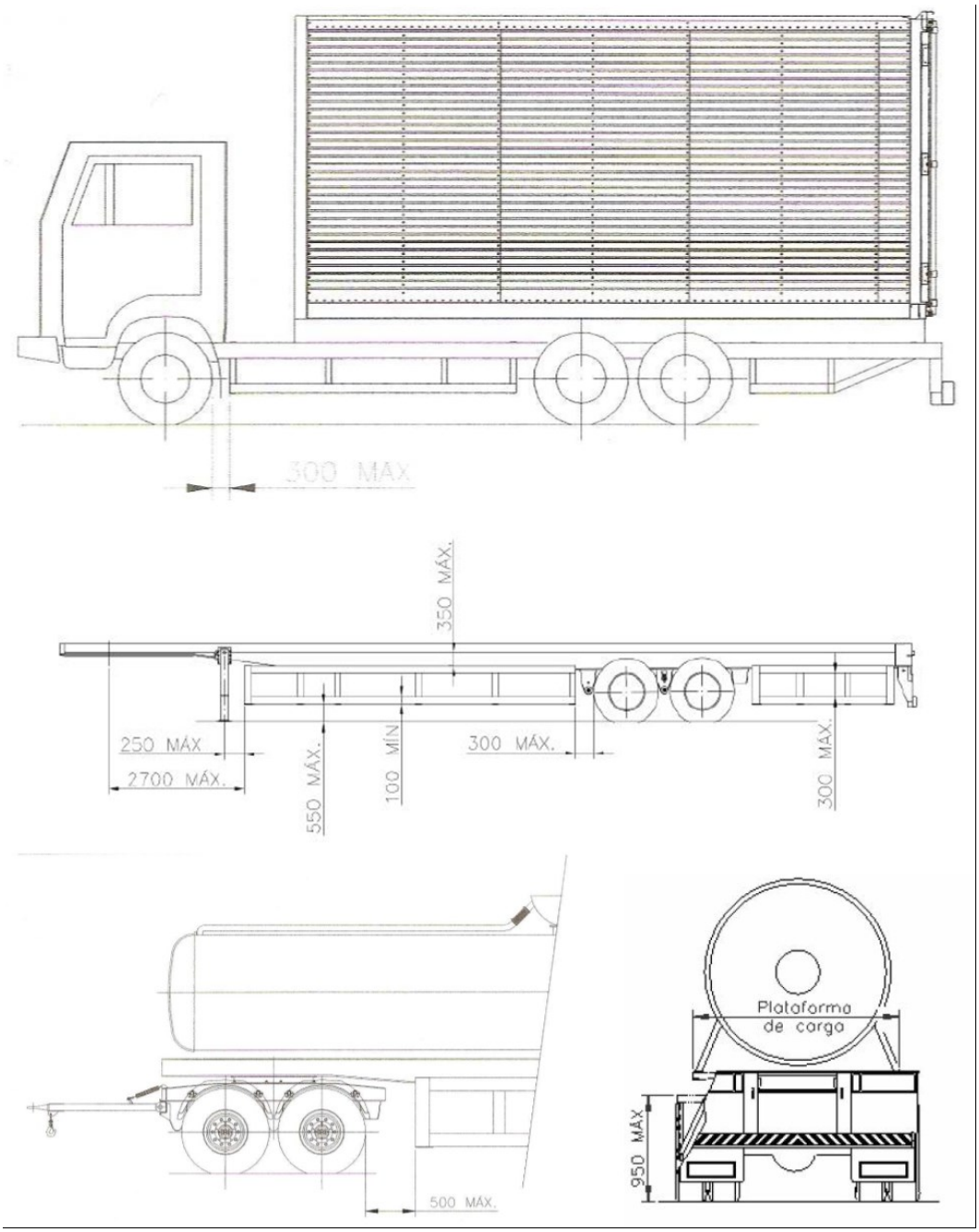


Figure 29: Technical specifications of the Brazil standard (all figures are in millimeters) (National Traffic Council, 2009)

Canada (Saint-Laurent and St. John's)

Pedestrian and bicyclist deaths due to collisions with large trucks and snow removal vehicles have spurred a public campaign for the adoption of side guards in Canada. The Borough of Saint-Laurent in Montréal, Quebec, began testing side guards in 2010, passed a resolution in 2012 to equip all new eligible fleet vehicles with side guards, and by 2014 had equipped 25 of the 33 eligible fleet trucks, with plans to fit all 33 by the end of 2015 (Buteau, 2014). As of 2017, the City of St. John's, Newfoundland and Labrador, has also implemented side guards on 43 fleet

vehicles. This addition is not prescribed by any law or regulation, but has instead been implemented as a show of good faith following a number of VRU deaths. In a similar manner, the City of Westmount, an enclave of Montréal, has also begun adding side guards to their snow plows (Macdonald, 2016).

Side guards have been debated on a national scale twice in Canada, first in 2009 and again in 2013. The issue was first brought to the Ministry of Transport by St. John's and the Federation of Canadian Municipalities. The resolution was tabled and reintroduced in 2013, this time with the support of the City of Montréal. At the time of publication, Volpe is not aware of any national regulation for side guards in Canada (The Jessica Campaign, 2016).

Mexico (Mexico City)

The "installation of a safety device designed to prevent pedestrians, cyclists and motorcyclists from being run over by the back wheels of a truck when a lateral collision occurs" became mandatory in Mexico City in 2015 with the implementation of Article 40 of the Federal District Transit Regulations (Salvaguardas para Camiones Urbanos, 2015). The regulation requirements were modeled on the New York City side guard standard (Santillan, 2015), which is consistent with the Volpe specification (see section 0, **Volpe Side Guard Specification**).

The standard applies to vehicles of more than 3.5 tons, with the exception of fire trucks, sweepers, and car carrier trailers. The maximum ground clearance is 350 mm (13.8 inches), lower than the maximum permitted in the national regulations that Volpe identified. The top edge must be no more than 350 mm (13.8 inches) below the truck platform or between 1.00 and 1.50 m (39.4 and 59 in.) above the level of the road. Additionally, the side guard must be able to withstand a force of 200 kg (2 kN) without deflecting more than 30 mm (1.2 inches) in the rearmost 0.25 m (11.8 inches) and 0.15 m (5.9 inches) along the remaining length (see Figure 30). This 2 kN strength specification is consistent with the UK standard, higher than UN Regulation 73, and lower than the Brazil standard.

In order to minimize the risk of injury to pedestrians or cyclists, the regulation includes several additional geometric requirements, and the regulation recommends—but does not require—a panel-style side guard instead of horizontal rails or bars. Finally, the regulation specifies that the side guard must be made of stainless steel.

From secondary sources, Volpe found that a national Mexican side guard standard may be in development as of 2015 by the Auto Parts Committee of the Mexican Institute of Normalization and Certification (Comité de Autopartes del Instituto Mexicano de Normalización y Certificación) under the National Standardization Program (Santillan, 2015).

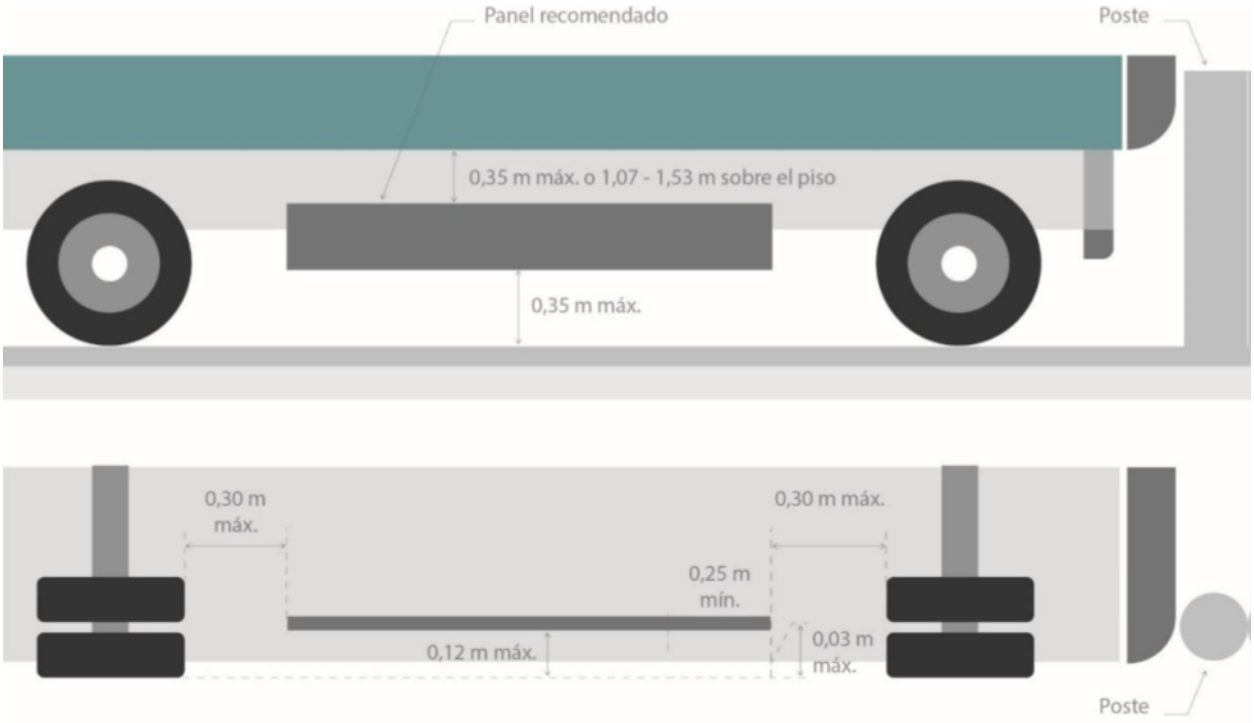


Figure 30: Specifications of the Mexico City standard (Salvaguardas para Camiones Urbanos, 2015)

Other Potential Side Guard Adoption in Foreign Countries

A non-exhaustive Volpe review of vehicle images indicates that up to and possibly more than 14 additional countries likely see relatively widespread adoption of side guards and may have implemented their own requirements or guidance.[34] When added to the 43 countries that abide by UN Regulation 73, the 4 unique countries identified previously as having national side guard regulations (i.e., not counting the UK, which is already counted in the list of countries that have adopted UN Regulation 73), and the 4 countries with sub-jurisdiction regulations or industry standards, **at least 65 countries appear to have widespread side guard usage**, whether or not actually required. While some of these countries may have implemented side guard standards and requirements, additional research would be needed to confirm the existence and details of any regulations in these countries.

Prior Recommendations for Side Guard Requirements

The first publication considered, from the National Transportation Safety Board, is included for completeness only, as its focus is on mitigating vehicular underride, not VRU underride, in collisions with trucks.

[34] Based on online image search results and news articles, countries that may have widespread adoption of truck side guards include the following: Cambodia, Colombia, India, Israel, Myanmar, New Zealand, Pakistan, the Philippines, South Korea, South Africa, Thailand, Tunisia, Uruguay, and Vietnam.

Table 19: Summary table of recommended specifications from studies conducted in Australia, the United Kingdom, and the United States

Published Recommendation		Year Published	Vehicles Covered	Strength Rqmt.	Maximum Ground Clearance	Maximum Gap Between Wheels and Guard
NTSB **(National Transportation Safety Board, 2014)**		2013, 2014	Single-unit trucks over 10,000 lbs., trailers over 10,000 lbs., truck tractors over 26,000 lbs.	Not specified	Not specified	Not specified
TRL studies	Protecting Car Occupants, Pedestrians, and Cyclists in Accidents Involving Heavy Goods Vehicles by Using Front Underrun Bumpers and Side guards (Riley, Penoyre, and Bates, 1985)	1985	Vehicles of categories N_2, N_3, O_3, and O_4.	Not specified	300 mm (11.8 in.) – 400 mm (15.7 in.)	300 mm (11.8 in.)
	Review of side and underrun guard regulations and exemptions (Smith & Knight, 2004)	2004	Vehicles of categories N_2, N_3, O_3, and O_4.	Not specified	300 mm (11.8 in.)	Not specified
	Integrated Safety Guards and Spray Suppression - Final Summary Report (Knight, et al., 2005)	2005	Vehicles of categories N_2, N_3, O_3, and O_4.	Not specified	300 mm (11.8 in.) – 550 mm (21.7 in.)	300 mm (11.8 in.)
Monash University		2002	Vehicles over 3 tons.	2 kN	350 mm (13.8 in.)	300 mm (11.8 in.)
University of Ontario Master's Thesis **(Galipeau-Belair, 2014)**		2014	Vehicles of categories N_2, N_3, O_3, and O_4.	Not specified	350 mm (13.8 in.) – 400 mm (15.7 in.)	Not specified

National Transportation Safety Board

The National Transportation Safety Board (NTSB) issued two related Safety Recommendations to NHTSA, in July 2013 and April 2014, for the development of national performance standards and for requiring the installation of heavy-duty side underride guards on single-unit trucks over 10,000 lbs. gross vehicle weight rating (GVWR), trailers over 10,000 lbs., and truck tractors over 26,000 lbs., with the objective of stopping motor vehicles from intruding under the sides of the large truck or trailer (National Transportation Safety Board, 2014).

It is important to note that the NTSB recommendations focus on far heavier, more expensive, and less commercially available devices designed to arrest a motor vehicle at high speed instead of a VRU at low speed. Although side guards consistent with such a standard could also mitigate crashes involving VRUs, such heavy-duty equipment would be massively overdesigned for this type of crash. Hundreds of times more kinetic energy must be managed to stop a high-speed passenger vehicle as compared to a low-speed VRU.[35] Therefore, while the authors reference the NTSB recommendations for completeness, **it is critical to separate the lightweight VRU side guards considered in this study and the concept of heavy-duty vehicle-arresting side underride guards for any potential future regulatory or standard-setting action.**

Transport Research Laboratory (TRL)

Three reports—drafted in 1985, 2004, and 2005—prepared by TRL for the UK Department for Transport detail recommendations for the design and usage of side guards in the UK (Riley, Penoyre, & Bates, Protecting Car Occupants, Pedestrians, and Cyclists in Accidents Involving Heavy Goods Vehicles by Using Front Underrun Bumpers and Sideguards, 1985). Included are recommendations for the reduction of exemptions from UK side guard legislation, suggesting that adjustable side guards be considered before ruling vehicle types exempt. One report advises a ground clearance of 300 mm (11.8 in.), citing a UK crash database and suggesting that reducing the clearance will reduce the incidence of bicyclists being run over when they fall onto the truck side (Smith & Knight, 2004).

Monash University

A study done by Monash University in 2002 also provided recommendations for vehicles over three tons (Lambert & Rechnitzer, 2002). Researchers focused on the impact of side guards on pedestrians and cyclists, finding that the usage of flat panels is preferable as it limits the chance of rails catching on pedestrians and cyclists. The study also found that a strength of 2 kN is ideal for testing, and that the ground clearance of 350 mm (13.7 in.) is preferred to one of 550 mm (21.7 in.), where a pedestrian or cyclist may not be protected from the vehicle wheel path. Lastly, researchers noted that most buses and car-carriers would not need side guards due to their low ground clearance.

University of Ontario Master's Thesis

A 2014 University of Ontario Master's Thesis titled Design and Development of Side Underride Protection Devices (SUPD) for Heavy Vehicles focused on the design and implementation of side guards to prevent fatalities from crashes involving large trucks. While much of the research focused on preventing crashes between small cars and trucks, the author made some recommendations as to side guard design that could reduce pedestrian and bicyclist deaths (Galipeau-Belair, 2014). Advocating for side guard usage on vehicles of categories N_2, N_3, O_3, and O_4, the author agreed with the UK standard of applicability. Additionally, the recommended

[35] Kinetic energy E = ½*mass*velocity^2. A light duty vehicle weighing 4,000 pounds and traveling 30 mph possesses *240* times the kinetic energy of a 200 pound VRU traveling at 10 mph.

ground clearance was between 350 mm (13.7 in.) and 400 mm (15.7 in.), a value higher than that recommended by the TRL studies but lower than that required by the UN Regulation 73.

Industry Standards

Australian Trucking Association Standard

The Australian Trucking Association standard was developed with the desired goal of providing guidelines and instructions for truck and trailer manufacturers as well as truck operators in Australia to comply with UN Regulation 73 side guard standards (Australian Trucking Association, 2012). The standard is in the form of a Technical Advisory Procedure developed by the Australian Trucking Association Industry Technical Council and endorsed by the Australian Trucking Association General Council that provides general construction guidelines for a lateral protection device. The Australian Trucking Association standard provides trailer and truck body builders with off-the-shelf designs that would be deemed to comply with the requirements of UN Regulation 73, for which it maps European and Australian vehicle category designations. The designs provided cover three materials: steel, aluminum, and a fiber composite panel material. According to the Technical Advisory Procedure, "the fiber composite panel material design is low weight and may be designed to improve dynamic airflows around trailers offering potential to achieve safety and efficiency gains" (Australian Trucking Association, 2012). The technical specifications are equivalent to those required in UN Regulation 73, with two exceptions that make it somewhat more stringent: first, the Australian Trucking Association standard additionally specifies side guards rearward of the axle group; second, it recommends, though does not require, a lower maximum ground clearance of 525 mm (20.7 in.) (see Figure 31). In Australia, the Melbourne Metro Rail Authority is requiring all trucks involved in the construction of a metro system project starting in 2017 to be fitted with side guards (Carey, 2017), and some amount of adoption of the standard was identified (Bikes and trucks, 2017).

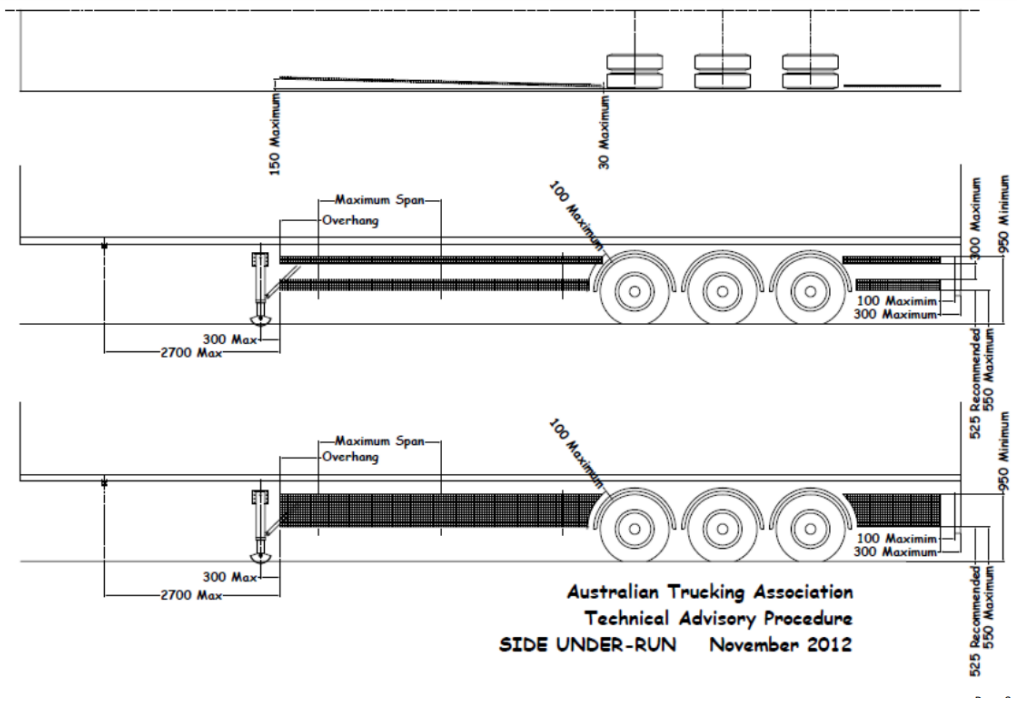


Figure 31: Technical specifications of the ATA standard (Australian Trucking Association, 2012)

Construction Logistics and Cyclist Safety (CLOCS) and Fleet Operators Recognition Scheme (FORS) Standards

The Construction Logistics and Cyclist Safety (CLOCS)[36] Standard for Construction Logistics and the Fleet Operator Recognition Scheme (FORS) are industry standards used initially in London and more recently throughout the UK. Implemented by construction clients through contracts, CLOCS provides a way for owners to manage road risks in a standardized way (Construction Logistics and Community Safety (CLOCS), 2015). To comply with CLOCS, clients must fit side guards to all vehicles that are currently exempt from side guard use under the Road Vehicles Construction and Use Regulations of 1986, including mixer and tipper (dump) vehicles over 3.5 tons in weight.

FORS is an accreditation that demonstrates fleet operators' compliance with CLOCS standards, and it represents the fleet-facing side of the same requirements. Adopters include the City of London, the borough of Camden, and over 400 UK industry members (referred to as "Champions") of the program (London Cycling Campaign, 2017).

Volpe Side Guard Specification

In 2016, Volpe and the Office of the Assistant Secretary for Research and Technology developed and published "Truck Side Guard Technical Specifications: Recommended Standard DOT-

[36] CLOCS was recently renamed Construction Logistics and Community Safety, though the original terminology still appears in the published standard.

VNTSC-OSTR-16-05" for side guards in the U.S. The origin and basis of the standard included Volpe's initial review of international precedents, published recommendations from the Transport Research Laboratory (TRL) and Monash University (as discussed later in this section), and fleet feedback from side guard operational pilots in the cities of Boston, Cambridge, New York, and San Francisco. The Volpe specification was published in U.S. customary units based on the 350 mm maximum ground clearance recommended by TRL and Monash and the 2 kN force test criteria (see Figure 32). Volpe recommended the stronger 2 kN standard (identical to the UK standard) to provide a larger safety margin and to account for the heavier average weight of people today compared to when the first side guard requirements were developed more than 30 years ago (Volpe National Transportation Systems Center, 2014).

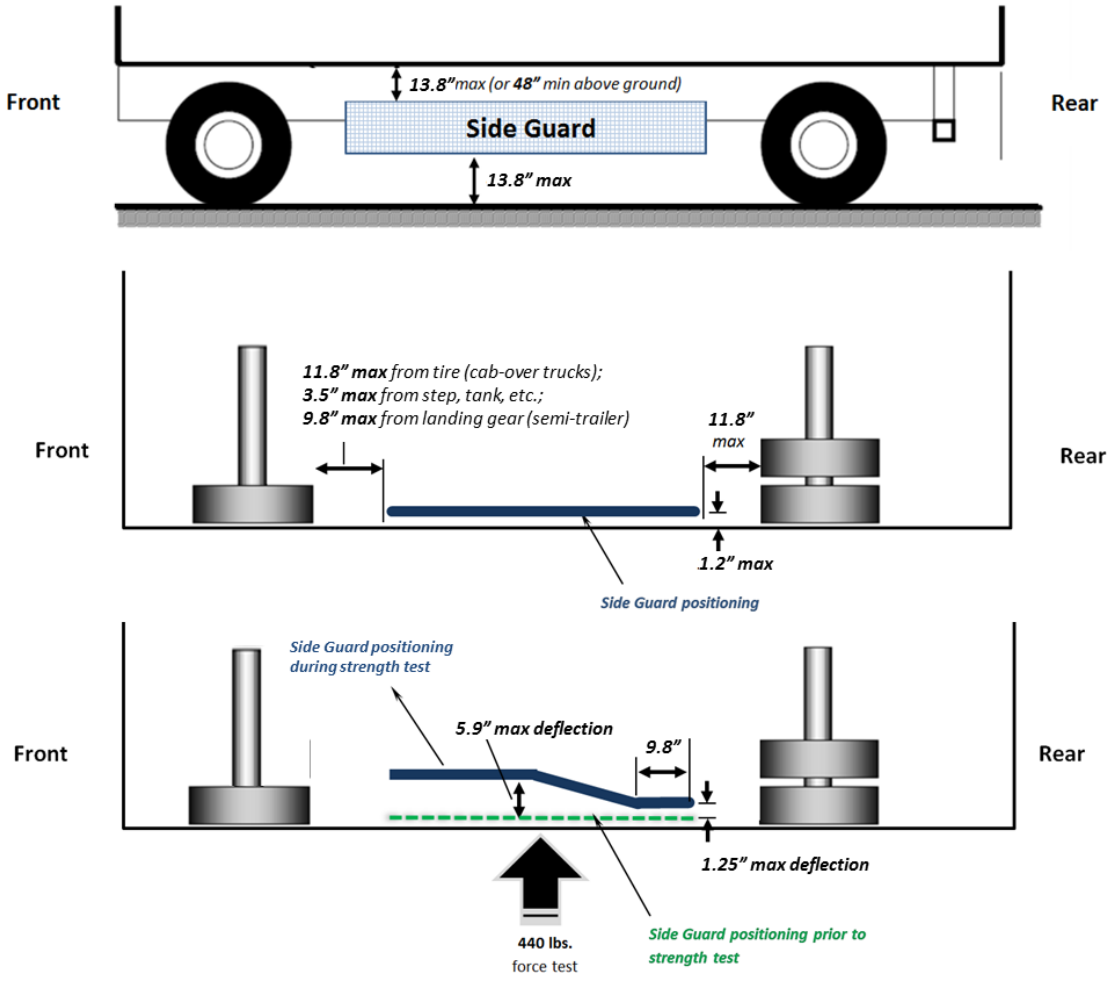


Figure 32: Technical criteria of the Volpe specification (Source: Volpe)

Figure 33: Private sector rail and panel style side guards in the Boston and New York City (NYC) metro areas (Source: Volpe)

Private Sector Installations

Whether complying with local laws or doing so voluntarily, a growing number of private sector U.S. fleets operating in urban areas have been installing side guards. In the Boston area, these have included Save That Stuff, Sunrise Scavenger, Capitol Waste, EarthWorm, and Harvard University; in New York City, these have included FreshDirect, Action Carting, New York Post, and Coca-Cola; and in Seattle, the University of Washington. Additionally, U-Haul has implemented and markets aerodynamic side skirts that may also function as side guards on 26' box trucks, as shown in Figure 33.

Existing Exemptions

Volpe research showed that the UK Construction and Use regulation, which predates UN Regulation 73, includes a substantially larger number of vehicle exemptions. These exemptions have been gradually reduced (Hammond, 2013) in recognition that a large fraction of VRU fatalities in London have involved side guard-exempted vehicles (Transport for London , 2014).

The UN Regulation 73 side guard regulation does not apply to tractors for semi-trailers, trailers designed and constructed for transporting "very long loads of indivisible length, such as timber, steel bars etc.," and vehicles designed and constructed for special purposes where it is not possible to fit lateral protection.

Also, there are four specific derogations in the UN Regulation 73 language:

- An *extendable trailer* shall comply with all the dimensional and strength requirements when closed to its minimum length; when the trailer is extended, however, the gap between the side guards and either the forward or rear tire can be greater than normal.

- *Cargo tank* trucks provided with hose or pipe connections for loading or unloading must be fitted with side guards "which comply so far as is practicable with all the [dimensional and strength] requirements of paragraph 7; strict compliance may be waived only where operational requirements make this necessary."

- On a vehicle that has *extendable legs*—e.g., a crane—to provide additional stability during loading, unloading or other operations, the side guard can have additional gaps to permit extension of the legs.

- On a vehicle equipped with anchorage points for *roll-on/roll-off* transport, gaps are permitted within the side guard for tie down points for ropes used to cover loads.

Due to flexibility in the language of the regulations, if the sides of the as-built vehicle or a combination of appropriately located toolboxes, fuel tanks, etc., already meet the dimensional and strength requirements of side guards, they are regarded as replacing the side guards.

Street sweepers are among the UK exempt vehicles, due to their "ancillary equipment" and possibly due to their low top speed. The TRL report is ambivalent about whether sweepers should be exempted or whether they should have removable guards, though the report acknowledges the added complexity associated with removable guards.

The TRL report is definitive, however, in its assessment that refuse collection trucks are not a technically justified exemption (Smith & Knight, 2004). The off-road capability of collection trucks is generally limited and existing devices and structures mounted under the body typically limit the ground clearance between the wheels, so there is no ground clearance justification for an exemption.

Exempted trucks have been found to be overrepresented in VRU fatalities. The predicted benefits of ending the exemptions from the UK side guard regulations have been estimated by TRL as preventing about 6 percent of bicyclist fatalities and close to 1 percent of pedestrian fatalities (Knight, et al., 2005).

Brazil's regulation does not apply to tractor trucks, those with load platforms up to 550 mm (21.7 in.) above the ground, vehicles intended for export, unfinished vehicles, military vehicles, those whose design is sufficient to meet the requirement, and those constructed for specific purposes where, for technical reasons, lateral protection cannot be installed.

Table 20: Summary table of vehicle types exempted from side guard fitment under UN or UK regulations and technical justification based on published assessments

Vehicle Type	UN / UK Exemptions	TRL Study Findings	Exemption Technically Justified?
Tractor for semi-trailer	Exempt from UN standard	Fuel tanks and other structures often fill the space between axles, but there is no real reason to maintain exemption. Flat panel side guards would be beneficial.	No
Special purpose vehicle where side protection is impractical	Exempt from UN standard	This catch-all category is too open to subjective interpretation.	Unclear
Trailer designed for very long loads	Previous UN exemption has been repealed; UK exemption remains	Continued exemption is warranted when distance between axles is extremely long. These vehicles also move at low speed, often with a police escort.	Yes
Low-speed vehicle (max. 15 mph)	Exempt from UN standard	Exemption is not warranted based on speed alone (as distinct from vehicle type).	No
Tipping / dump truck	Additional UK exemption	Exemption is generally not warranted. Side guards do not interfere with hydraulics and vehicles seldom require extreme off-road capabilities. Ground clearance is already limited by other vehicle components.	No
Refuse / collection truck	Additional UK exemption	Exemption is generally not warranted. Ground clearance is already limited by bodywork and equipment, so side guards do not pose an issue and are generally compatible with operation.	No
Street sweeper	Additional UK exemption	Fitting side guards could interfere with operations, though a stowable side guard could work.	Unclear
Military vehicle	Additional UK exemption	Continued exemption is warranted given the range of use for these vehicles, even though not always technically justified.	Yes
Fire engine	Additional UK exemption	Typical design meets dimensional requirements. In cases where it does not, side guards are indicated except when used off-road.	Unclear
Car carrier	Additional UK exemption	Vehicle design generally already has very low ground clearance.	Unclear

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APPENDIX B – SYSTEMATIC REVIEW OF EFFECTIVENESS STUDIES

Field evaluation studies

Several UK studies have demonstrated the safety effectiveness of side guards on large trucks, showing decreases in pedestrian and bicyclist injury severity for the most side guard-relevant crash types after the UK mandated side guards for most heavy duty vehicles (Patten & Tabra, 2010). A 2005 UK TRL study (Knight, et al., 2005) compared 1980-1982 ("before") data with 1990-1992 ("after") data, and a 2010 TRL study (Cookson & Knight, 2010) compared 1980-1982 ("before") data with 2006-2008 ("after") data. According to both studies, the most relevant crashes for side guards are passenger side ("nearside") impacts where the heavy vehicle was traveling straight ahead and passing the VRU (i.e., passing/overtaking crashes). In the UK crash databases these are classified as "going ahead other" (2005 and 2010 TRL studies) and "overtaking moving vehicle" (2010 TRL study).

The TRL 2005 study results (Knight, et al., 2005) show that the bicycle injury distributions for the passing/overtaking crash category before and after the nationwide installation of side guards changed substantially and favorably. In contrast, the before and after data did not show any appreciable change in the injury distribution for "passenger side turning maneuver" crashes, or for any other crash categories. Based on this, the authors conclude that the primary safety impact of side guards is in passing/overtaking crashes, where the heavy vehicle is moving straight ahead. Figure 35 depicts these same results in a different way, showing a 61 percent reduction in the proportion of bicyclist fatalities in the passing/overtaking crash category. This was reported in the 2005 TRL report (Knight, et al., 2005) and cited by National Research Council Canada in a 2010 study (Patten & Tabra, 2010).

The 2010 TRL report (Cookson & Knight, 2010) comparing crash data from 2006-2008 also showed lower bicyclist and fatality and serious injury rates for side guard-relevant crashes when compared to the pre-side guard 1980-1982 period.

Before and after data from the 2005 TRL study revealed there was a greater reduction in the proportion of severe injuries and deaths for bicyclists than for pedestrians. Still, **the fraction of fatal pedestrian casualties in the passing/overtaking passenger side-impact crash type decreased 20 percent,** compared to the 61 percent observed for bicyclists. More detail on this is available in a companion TRL report (Smith, Neale, & Knight, 2005). Case studies from the Heavy Vehicle Crash Injury Study (HVCIS) and the Truck Crash Injury Study (TCIS) databases in the UK suggested that the reason for this difference might be that the crash mechanisms are different; according to these data sources, pedestrians more commonly walked into the side of vehicles rather than falling against them (Knight, et al., 2005).

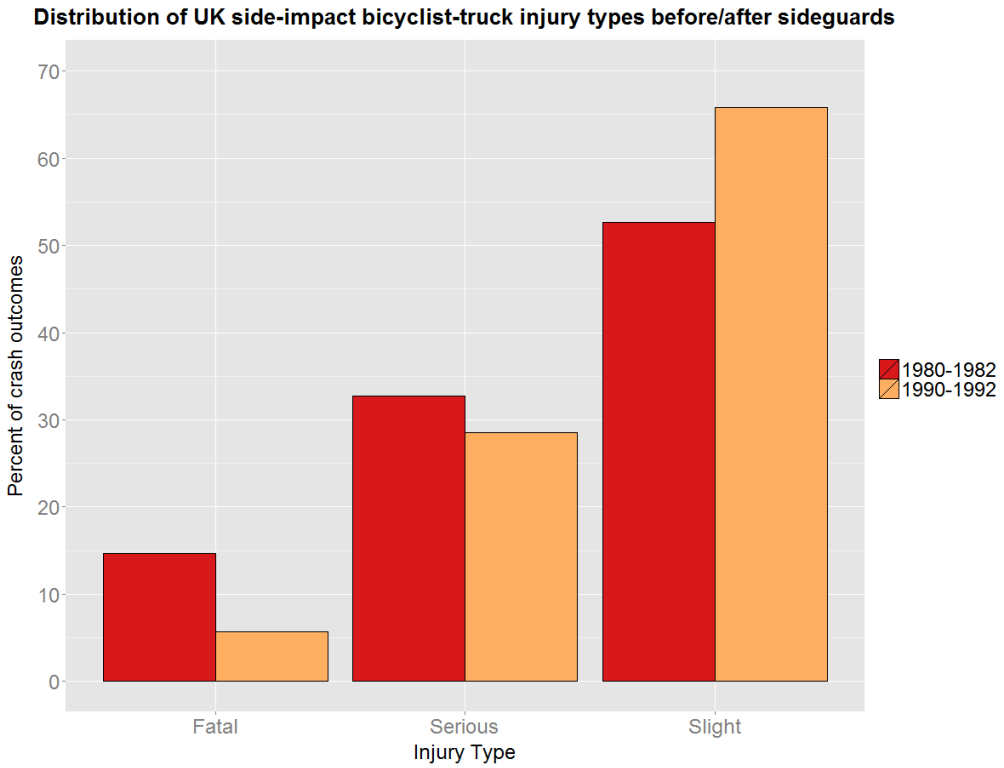

Figure 34: Fatality and injury distribution of bicyclists in passing/overtaking side impacts with trucks 4-6 years before and 4-6 years after the mandatory introduction of side guards in the UK (74 crashes in 1980-82 and 66 crashes in 1990-92) (Volpe National Transportation Systems Center, 2014)

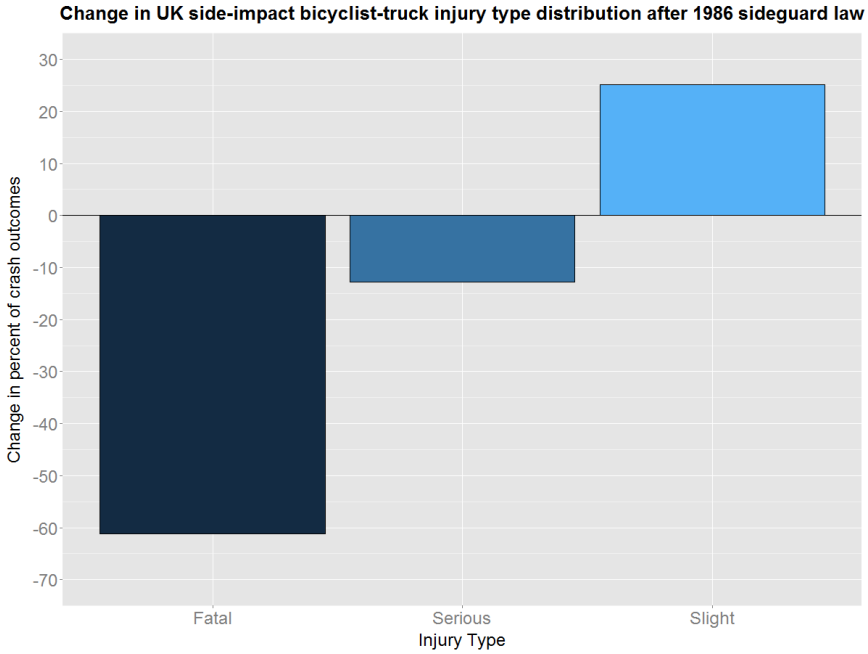

Figure 35: Decrease in fatality and serious injury rates for bicyclists in passing/overtaking crashes following side guard implementation in the UK (74 crashes in 1980-82 and 66 crashes in 1990-92)

It is possible that other confounding factors may have changed from the before to the after measurement periods, and some may question the extent to which these uncontrolled factors, whether known or unknown, may have distorted the apparent side guard effectiveness in either direction. While confounding factors can never be ruled out entirely in real-world experiments, all of the knowledge that we have suggests that any confounding factors would only have influenced the ***frequency*** of crashes (e.g. ***preventative*** countermeasures such as mirrors, safety education campaigns, etc.), but would not have influenced the ***severity*** of crashes in the way that a ***mitigating*** countermeasure, like a side guard would. For this reason, the TRL reports focus their analyses on the changes in severity (the injury distribution).

Even if there were other unexplained factors arising in the "after" observation periods with a significant impact on crash severity, we would expect them to affect crash severity in multiple categories, and not just the side guard-relevant categories. However, according to the 2005 TRL report, "in the non-side guard-relevant crash types the proportion of killed or seriously injured (KSI) cyclists and pedestrians were broadly similar before and after side guard introduction, or even increased slightly." This further supports the hypothesis that side guards were a primary factor reducing crash severity in the "after" period.

In addition to comparing crash outcomes from two different time periods (before and after the side guard phase-in), the 2005 TRL report also compared crash outcomes in the same time period (after phase-in), for trucks that were exempt and non-exempt from the side guard regulation.[37] The results were consistent with the before and after results, again suggesting that side guards effectively mitigated crash severity in the passing/overtaking crash category. Exempt vehicles had a higher proportion of the most severe crashes (killed or seriously injured) and were overrepresented in those serious crashes when compared to non-exempt vehicles, and the differences were statistically significant. Table 21 shows the comparison of exempt and non-exempt vehicle crash outcomes for 1990-1992.

The 2010 TRL report performed a similar comparison of exempt and non-exempt vehicles in 2006-2008, and Table 22 shows that the results for the passing/overtaking crashes were consistent with the 2005 exempt/non-exempt comparison and with the before and after comparisons for both studies. **All of these results support the hypothesis that side guards helped reduce the severity of crashes.** The 2010 TRL report also added a separate comparison of exempt and non-exempt crash data for passenger side turning maneuvers. These results were unexpected, because they show that exempt vehicles were more likely to have crashes in these maneuvers, and also had a higher proportion of more severe crashes. The before and after data, by contrast, only showed a minor change in the injury distribution for this crash type, which was not statistically significant. The authors note that other factors could explain these conflicting results, such as the

[37] An advantage of this comparison is that it considers crashes over the same time period, eliminating potential confounding factors that may have changed from the before to the after period. A different confounding factor could exist, however, if exempt vehicles were inherently more fatal in side-impact crashes for unknown reasons that are not related to the presence of side guards. However, both the time-series and the exempt/not exempt safety analyses are consistent and show reduced fatality rates among side guard-equipped large trucks.

use of these vehicles in different environments, driver behavior, or field of view (e.g. close proximity mirrors required as of 2006).

Table 21: 1990-1992 crash severity distribution in truck-bicycle passing/overtaking crashes in the UK when the truck was either exempt or not exempt from side guard installation (KSI = killed or seriously injured) (Knight, et al., 2005)

	Fatal	Serious	Slight	% fatal	% KSI
Exempt (no side guards)	6	18	22	**13%**	**52%**
Not exempt (equipped with side guards)	5	34	103	**4%**	**27%**

Table 22: 2006-2008 crash severity distribution in truck-bicycle passing/overtaking crashes in the UK when the truck was either exempt or not exempt from side guard installation. (KSI = killed or seriously injured) (Cookson & Knight, 2010)

	Fatal	Serious	Slight	% fatal	% KSI
Exempt (no side guards)	4	11	15	**14%**	**52%**
Not exempt (equipped with side guards)	3	23	43	**4%**	**37%**

A 2014 TRL report revisited the data from the prior TRL reports, and suggested extrapolating from the results. The authors of the TRL report pointed out that **the before and after comparisons from the prior studies likely underestimated the effectiveness of side guards, since the "after" period did not have universal side guard fitment.** Instead, the authors estimate that only 74 – 89.5 percent of heavy vehicles were actually equipped. The remaining vehicles were exempt. Thus, assuming a linear dose-response relationship, the authors suggest a proportional amplification of the observed reductions in fatalities and severe injuries in order to estimate the actual effectiveness of side guards. So, for example**, for the 2010 TRL results, this would translate to an estimated reduction in bicyclist fatalities of 61.7 - 74.6 percent. For the 2005 TRL results this would result in an estimated reduction in bicyclist fatalities of 68.4 – 82.7 percent, and an estimated reduction in pedestrian fatalities of 22.7 – 27.4 percent** (Robinson & Cuerden, 2014)**.**

A study performed by the Dutch Road Safety Research Institute (SWOV) on behalf of Transport and Logistics Netherlands (TLN) analyzed crash and exposure data and then completed cost-benefit assessments for certain safety measures, including side guards. The study used buses as a proxy for side guard-equipped trucks, since the side of a bus presents a smooth surface that extends very close to the ground (often lower than most side guards), whereas trucks without side guards typically have gaps in the side of the vehicle. With this difference in mind, the study compares the severity of VRU crashes for buses turning right (passenger side) and trucks turning right, from 1989-1997, noting that **serious injuries are 50 percent less likely in a bus side-impact crash with a VRU (defined in the study as a pedestrian, bicyclist, or moped rider)**

than in a comparable truck crash.[38] This is calculated based on "deaths or hospital admissions as a percentage of all injuries." In contrast, there was little difference in injury severity for left-hand (driver's side) crashes. The study draws a distinction between "open" side guards (i.e. rail-style) versus "closed" side guards (i.e. smooth-style), and assigns a different effectiveness to each. The study assigns an effectiveness of 35 percent to "closed"/smooth-style side guards, based on the above analysis, and assigns a slightly lower (and admittedly arbitrary) effectiveness of 25 percent to "open"/smooth-style side guards. The study lists four scenarios of side guard adoption and assigns cost-benefit estimates to each (estimate of number of lives saved per guilders invested) (Van Kampen & Schoon, 1999).

Some studies used a hybrid qualitative/quantitative approach to assess the relevance of side guards. These studies reviewed fatal crash data for which detailed "case study" information was available, such as: reports by experts, diagrams showing pre-impact trajectories and post impact positions, photographs of the scene and vehicles involved, transcriptions of interviews with drivers and witnesses, and detailed injury and trauma assessments. Unfortunately, since the data sets for these case studies are limited to fatal crashes, the studies were not able to analyze the instances where a side guard prevented a fatality. Instead, for vehicles that did not have side guards fitted, they judged whether a side guard would have potentially mitigated the fatal injuries, based on the data and expert input available. For fatal crashes where the vehicles had side guards fitted, they noted how the side guard performed, and why it did not save the VRU.

- One study had a sample size of n>300 fatal crashes, and estimated that side guards would have prevented fatal injuries to over 15 percent of the bicyclists, motorcyclists, and pedestrians that were killed. Approximately two-thirds of the 300 crashes were side impact crashes, meaning that the effectiveness percentage specific to side impact crashes was about 24 percent (Riley, Chinn, & Bates, An analysis of fatalities in heavy goods vehicle accidents, 1981).

- Another study had a sample size of n=27 relevant fatal crashes, including n=16 "type A" crashes, in which the vehicle made contact with the cyclist by turning left or changing lanes, and n=11 "type B" crashes, in which the cyclist lost control or wobbled while alongside the vehicle. **Researchers determined that 20 of these 27 could have been prevented had the heavy duty vehicle been fitted with a side guard** (or if it had been a side guard with more rigorous technical specifications). This included 15 out of 16 "type A" crashes and 5 out of 11 "type B" crashes (Keigan, Cuerden, & Wheeler, 2009).

- Another study had a sample size of n= 24, including front and side fatal collisions of all types (not limited to side guard relevant crashes). It found that all of the fatally injured cyclists were already on the ground before any side guard interaction could have occurred. Since the UK side guard requirement allows a gap of up to 550 mm from the bottom of the side guard to the road surface, this was large enough to pass over a person already completely prone on the ground, and side guards were not seen to be effective in

[38] It is not completely clear from the translation whether the study is truly only analyzing turning maneuvers, or whether it is analyzing all side-impact crashes (including the passing/overtaking maneuvers deemed most relevant by the UK studies).

this sample. The authors note that this is not to say that they are not effective; the data from the study were insufficient to prove or disprove their effectiveness, given the circumstances of the crashes in this sample (Thomas, Talbot, Reed, Barnes, & Christie, 2015).

- Another study had a sample size of n=4 fatal rear wheel run-over crashes with side guards fitted, and n=8 fatal rear wheel run-over crashes without side guards fitted. In the four cases where side guard were fitted, they were not effective in preventing the bicyclist from going under the truck, for two reasons: (1) in two cases, the cyclist passed through a gap in the side guard in the vicinity of the fuel tank, and (2) in the remaining two cases, the cyclist was already on the ground and went underneath the side guard, as described in the study above. **For the crashes where the vehicle was not fitted with a side guard, the researchers estimated that a side guard may have prevented the bicyclist from going under the vehicle in three out of eight cases** (Talbot, Reed, Barnes, & Thomas)**.**

An Australian study estimated that side guards would convert 20 percent of all fatalities to injuries and 25 percent of all serious injuries to minor injuries for both pedestrians and bicyclists. In contrast to other studies, this "effectiveness" percentage is expressed as a percentage of all fatalities and serious injuries, rather than as a percentage of the side guard-relevant crashes. The author determined these percentages by combining the benefit estimates derived from the Australian crash investigations with European estimates from cited references. However, the author of this Australian study did not explain the details of this combination and derivation, so the assumptions and rationale are not explicit (Rechnitzer, 1993). The European estimates are from two other studies cited in this section (Hogstrom & Swensson, 1986) (Riley, Chinn, & Bates, 1981).

Empirical Studies

A 1985 UK study used a crash dummy on a bicycle to test the effectiveness of a side guard for the typical side guard-relevant crash, where a heavy duty vehicle overtakes a bicyclist at low speed and the bicyclist falls into the path of the rear wheels. Researchers began by testing a side guard with the maximum allowable gaps and inset under the UK regulation, and then tested improved side guards with smaller horizontal and vertical gaps and reduced inset (i.e., surpassing contemporary UK regulatory requirements). The minimum legal side guard reduced the likelihood of running over the bicyclist by 60 percent, from 100 percent to 40 percent of the test runs. An improved guard with lower ground clearance, less inset, and smaller gap between the guard and the rear wheels reduced the incidence to near zero. Based on the tests, researchers recommended changes to side guard specifications to improve effectiveness (Riley, Penoyre, & Bates, Protecting Car Occupants, Pedestrians, and Cyclists in Accidents Involving Heavy Goods Vehicles by Using Front Underrun Bumpers and Sideguards, 1985).

A 1986 Swedish study by the Volvo truck manufacturing company carried out a number of tests and experiments with a crash dummy on a moped in order to assess the effectiveness of a side guard for protecting a motorcyclist or bicyclist. The study concluded that a side guard would have a positive (mitigating) influence in 35 percent of accidents (Hogstrom & Swensson, 1986).

A 2012 Canadian study conducted a performance test to see how aerodynamic side skirts would perform when impacted by a loaded bicycle. Although they were not originally designed for preventing side underride, all three side skirts prevented the loaded bicycles from entering under the trailer. Their performance differed in terms of the amount of deformation, rebound, energy absorption, and permanent skirt damage after the test, but none of the side skirts were damaged to the point where they could become hazardous to other motorists if the trailer were to continue driving after an impact with a bicycle (Patten, Lalonde, Mayda, & Poole, 2012). This research only tested the strength and behavior of the side skirt and did not attempt to understand what would happen to the human rider in terms of injury severity. Nevertheless, this experiment suggests that the side skirts already employed on some trucks for fuel efficiency reasons could provide some amount of ancillary safety benefit.

Simulation-based studies

A 2005 UK study used computer simulation supplemented by accident analysis to estimate the incremental safety benefit of fitting a smooth-style side guard rather than a rail-style side guard. In the simulated experiment, both side guard designs were effective at preventing the upper body of the VRU from being run over by the rear wheels but the smooth side guard was more effective at reducing overall injury risk, especially for head impacts. Replacing rail with smooth style side guards would result in an incremental additional reduction in bicyclist fatalities of 0.65 to 5 percent and a reduction in serious pedestrian casualties of 0 to 3.9 percent. The study also noted that evidence from crash studies supports the findings of the computer simulation. According to the author, estimates of casualty reduction potential (of replacing "rail" with "smooth" style side guards) are conservative because they “exclude a number of possible benefits from other maneuvers not evaluated and a number of simulated differences to body loads for which there is no known translation to probability of injury risk.” Also, based on the results, the author concludes that a pedestrian falling against the side of a vehicle is even more likely to be benefitted by a side guard than a bicyclist falling against the side of a vehicle; however, pedestrians have less exposure to this type of accident, so the overall benefit is less. The author posits that a pedestrian more commonly walks into the side of a vehicle rather than falling against it (Smith, Neale, & Knight, 2005).

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APPENDIX C: TRUCK PART AND INSPECTION INTERACTIONS

This section examines potential installation and operational interactions between the U.S. truck fleet's most common cargo body types, vehicle components, and the installation of factory-installed as well as aftermarket side guards. The report also examines potential interactions between side guards—whether aftermarket or premarket—and FMCSA commercial vehicle safety inspections. The analysis identifies potential incompatibilities (costs) as well as potential synergies (avoided costs) between side guards and specific truck parts, which are categorized in this report as synergistic, adaptable, re-positioned, or potentially incompatible; incompatible truck parts are defined as parts that conflict with truck side guard installation and cannot be adapted or re-positioned.

Methodology

The analysis of potential interactions between side guards and truck components used three distinct methodologies. First, Volpe performed a quantitative and qualitative analysis of the results of the 2002 Vehicle Inventory Use Survey (VIUS) to determine the suitability of the most prevalent truck types in the U.S. fleet with GVWR greater than 10,000 pounds for aftermarket installation of side guards. Second, Volpe itemized truck parts and components associated with the identified truck types, assessed potential interactions and compatibilities between aftermarket side guards and each component, and estimated whether there would be a cost associated with mitigating any conflicting interactions and/or taking advantage of any potentially positive or synergistic interactions. This second analysis was a systematic tabulation based on online research and visual assessments of specific truck parts. Finally, Volpe conducted interviews with the Acting Director for the FMCSA Field Operations Office and with select truck and truck part manufacturers to identify and examine potential interactions related to commercial vehicle safety inspections, along with any other potential interactions not revealed through the analysis of individual components.

Common Truck Types

Truck fleet composition data for this report originated from the Vehicle Inventory and Use Survey (VIUS), a part of the 2002 Economic Census. This survey, still considered the most complete census of the U.S. truck fleet,[39] is based on a sample of 136,113 private and commercial trucks registered in the United States. Commercial vehicles relevant for side guards' installation and subject to FMCSA regulation are principally those with gross vehicle weight rating (GVWR) greater than 10,000 lbs. Of the 85 million trucks of all weight ranges estimated by VIUS, 6.4% (5,415,200) were estimated to exceed 10,000 lbs.

[39] Per interviews with the National Truck Equipment Association and with the FleetDNA project team (Kenneth Kelly, Kevin Walkowicz, and Adam Duran) at the Department of Energy National Renewable Energy Laboratory.

The 2002 VIUS's Table 3a, "Trucks, Truck Miles, and Average Annual Miles for Trucks, Excluding Pickups, Minivans, Other Light Vans, and Sport Utilities: 2002 and 1997," includes the number of trucks by truck type.

Table 23 below is based on Table 3a from the 2002 VIUS and shows ten of the most common truck types listed in the 2002 VIUS.[40] These ten most common truck types include designations of single-unit and tractor-trailer. Single-unit trucks include a single frame, often with two axles, and tractor-trailer trucks include a power unit that tows one or more trailer(s). The total of these ten types account for approximately 80% of the total fleet, and their compatibility with side guards is considered in the following chapters. The remaining light-heavy, medium, and heavy-heavy vehicles include other body types (United States Census Bureau, 2017)

The 2002 VIUS excludes vehicles owned by federal, state, and local governments; ambulances; buses; motor homes; farm tractors; trailer units; and trucks reported to have been disposed of prior to January 1, 2002. Trailer unit information is important in quantifying the potential costs and benefits of side guards because these additional trailers could impact the costs associated with side guard installation and the benefits of crash mitigation and aerodynamic fuel efficiency. Americas Commercial Transportation (ACT) Research Co. documents U.S. trailer factory shipment data that can be used to fill in this knowledge gap. Using ACT data, the total population of truck trailers was estimated to be approximately 2.3 million in 2011. Forecasts of truck trailers in future years include a one percent sale growth rate, based on 2012 sales that increased by 244,186 trailers. These sale shipments are further broken down into categories such as Dry Van, Refrigerated, Container Chassis, Flatbed, Tank, Other On-Highway, and Off-Highway (ACT Research Co., 2014).

Conclusion

Using the 2002 VIUS data, Volpe has identified the top 10 most common truck types by calculating the highest percentages of truck types in the U.S. truck fleet over 10,000 pounds. These truck types include: Flatbed, Stake, or Platform (Single-Unit); Dump (Single-Unit); Van Basic Enclosed (Tractor Trailer); Van Basic Enclosed (Single-Unit); Van, step, walk-in or multistep; Service, utility or other (Single-Unit); Flatbed, Stake, or Platform (Tractor-Trailer); Van, open top (Single-Unit); Tank, liquids or gases (Single-Unit); and Dump (Tractor-Trailer). The total of these truck types account for approximately 80% of the fleet, and each individual truck type ranges from 2% to 17% of the fleet. The distribution of these truck types dictates the distribution of their associated, commonly installed parts and accessories. These parts and accessories may interact with side guard installation differently: some parts and accessories may be less costly to accommodate, while others may require more costly adaptations or alternatives.

Truck Parts and Accessories

This section examines different truck body components, both those required by FMCSA safety regulations and those commonly installed for vocational applications, and their potential

[40] The category "Service, Other" was omitted due to the wide range of included cargo body types.

interactions with side guards. This section considers each truck part's expected compatibility with side guards, the types of fleets impacted by this interaction, and whether there is a potential added cost associated with this interaction. Several different sources informed this analysis, including the U.S. Federal Motor Carrier Safety Administration (FMCSA) Regulations Part 393 ("Parts and Accessories Necessary for Safe Operation") and the 2010 Side guard Compliance Guide published by the United Kingdom's Freight Transport Association. Table 24 presents these truck parts and is followed by figures that illustrate the points of potential interaction.

Volpe's analysis assumes that side guards would be installed as either aftermarket products on trucks and trailers, mirroring early adopter U.S. fleets that have been retrofitting their vehicles, or as factory-installed, pre-market products. Aftermarket installation can increase upfitting costs related to relocating or replacing existing common truck parts and accessories, which truck manufacturers currently install without consideration for side guard placement.

Original equipment manufacturers, which produce the chassis and cab, appear to be unlikely candidates for factory installing side guards in the U.S. Final manufacturers, or "body builders," perform extensive modifications to the chassis when they install cargo bodies on the chassis.[41] Therefore, these final manufacturers as well as trailer manufacturers can—and a number already do[42]—install side guards pre-market. If this were the predominant way that side guards became implemented in the U.S., the coordinated pre-market placement of truck parts and accessories with side guards could be expected to avoid the costs of part repositioning or adaptation. This scenario is included in Table 2.

Conclusion

Referencing the Federal Motor Carrier Safety Regulations Part 393, "Parts and Accessories Necessary for Safe Operation" and considering truck parts often present on the ten most common truck types, Volpe has assessed the potential for added-cost interactions between these truck parts and either pre-market or aftermarket side guards. As summarized in Table 24, if truck and trailer manufacturers installed side guards pre-market, the coordinated placement of truck parts and accessories with side guards could potentially avoid the costs of part repositioning and adaptation. Aftermarket side guards introduce more uncertainty about added cost due to their varying compatibility with typical parts and accessories. Truck components with such uncertainty have been categorized in this analysis as "synergistic or adaptation," and they include underbody fuel tanks, aerodynamic skirts, and ladders. Some components can result in cost savings for side guard fitment when they already cover the same underbody space as the side guard. These parts include wheels (including lift axles), underbody toolboxes, air reservoirs, stored spare tires, underbody fuel tanks, aerodynamic truck skirts, and ladders. Truck parts that may require adaptation or repositioning for compatibility with side guards include fire extinguishers, which may be stored in the cab, and side marker lamps. No truck parts were categorized as incompatible with side guards, meaning that no truck parts would conflict with the installation of truck side guards in a way that adapting or re-positioning those parts could not solve.

[41] Interviews with John Stuart (Mack Trucks) and Skip Yeakel (Volvo North America), August 31, 2017; and with Paul Jarossy and Corby Stover, Morgan Corporation, September 25, 2017.

[42] For example, Morgan Corporation (https://www.morgancorp.com/news/morgan-offers-customers-improved-step-toolbox-and-side-guard-protection-options) and McNeilus.

Inspection Considerations

In addition to side guards' potential interaction with required and common truck components, Volpe assessed side guards' potential interaction with roadside commercial motor vehicle safety inspections. Vehicle inspections are categorized into eight levels, only some of which may be impacted by side guards. Levels 1 through 3 are considered the most common and are detailed below (CVSA, 2017):

- **Level 1 – North American Standard Inspection**: This inspection is the most comprehensive inspection level. This inspection includes mainly three components: (1) inspection of driver and credentials, involving the driver's license, Medical Examiner's Certificate and Skill Performance Evaluation Certificate (if applicable), alcohol and drugs, driver's record of duty status (as required), hours of service, seat belt, vehicle inspection report(s); (2) a vehicle walk-around inspection; and (3) an inspection of some underbody truck components, which requires the inspector to physically go underneath the commercial vehicle to examine and measure the brakes, check for cracks in the frame, and observe other components.

- **Level 2 – Walk-Around Driver/Vehicle Inspection**: This inspection includes the same inspection activities as Level 1, but does not require the inspector to climb underneath the vehicle.

- **Level 3 – Driver/Credential Inspection**: This inspection must include, where required and/or applicable, the examination of the driver's license, Medical Examiner's Certificate and Skill Performance Evaluation (SPE) Certificate, driver's record of duty status, hours of service, seat belt, and vehicle inspection report(s).

Limiting the ability of inspectors to perform Level 1 inspections on the entire fleet due to side guard implementation could be a potential concern. However, several existing inspection practices and precedents would still permit proper inspection of trucks that have side guards.

Trucks and trailers with low-boy, car carrier, or other low ground clearance cargo body types, as well as motor coaches, can receive Level 1 inspections at inspection facilities with pits or ramps. At other inspection locations, these vehicle types typically receive Level 2 inspections. These vehicle types commonly present ground clearances from 8 to 10 inches, and some present ground clearances as low as 6 inches due to their construction.[43] FMCSA permits these vehicle types to receive a Level 2 inspection in most cases when inspection facilities do not have pits or ramps (Yessen, 2017).

Trailers with aerodynamic side skirts also have a low ground clearance on the sides of the trailers but do not restrict access to the underbody in the front or rear. Most aerodynamic side skirts are not easily removable or foldable for inspection and are commonly installed with 4 to 12 inch ground clearance.[44] When side skirts are installed, an inspector cannot easily go underneath the

[43] Interview with Rick Farris, Trail King Industries, September 26, 2017.

[44] For example: https://www.windyne.com/ and: https://www.wabashcomposites.com/docs/default-source/ctp-warranty-pdfs-and-files/duraplate-aeroskirt-data-sheet.pdf?sfvrsn=2

trailer from the side. However, the inspector can still slide beneath the vehicle on a "creeper", or a low, rolling cart, from the rear to conduct a Level 1 inspection.

By comparison, a number of U.S. jurisdictions and fleets have implemented a 13.8-inch maximum ground clearance for side guards, which may permit an inspector to enter from the side. Non-removable side guard designs that are installed lower would still permit access from the rear, similar to aerodynamic side skirts.

In the U.S., relatively few vehicles are equipped with side guards for the purpose of protecting VRUs, therefore direct knowledge about the experience of inspecting them is limited.[45] However, common side guard designs include hinges or pins to permit removal or opening of the device for access underneath the vehicle from the side. Such designs are unlikely to interfere with Level 1 roadside safety inspections. For side guard designs that are non-removable and are permanently installed, the inspection experience with aerodynamic side skirts, which have been widely deployed and are geometrically similar to side guards, provides several solutions.

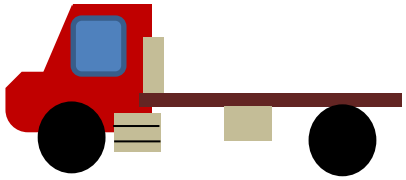
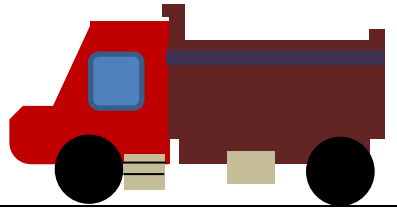
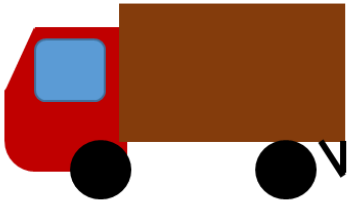
Conclusion

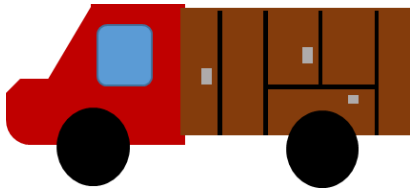
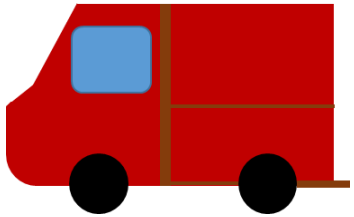
The interview with FMCSA's Field Operations Office Acting Director identified side guards' potential interaction with roadside commercial motor vehicle safety inspections. Level 1 is the most comprehensive inspection and includes the inspector physically getting underneath the commercial vehicle to see and measure the brakes, check for cracks in the frame, and observe other components. Level 1 inspections can be performed on a national fleet installed with side guards, using adaptations, some of which are already implemented in the field:

- Partial Level 1 inspections that check brakes without the inspector going underneath the vehicle
- Inspection facilities with pits and ramps for Level 1 inspections
- Removable or hinged side guards that permit regular access
- Inspectors perform Level 1 inspections with a "creeper" or low, rolling cart from the truck rear
- Anticipated transition to roadside wireless inspections in the future

[45] Volpe estimates that between 1,500 and 2,000 U.S. trucks with side guards are in service as of August, 2017.

Table 23: Top ten common truck types, common elements, and representative images.

Truck Type	% of Fleet	Description of Truck	Common Elements	Diagram	Image
Flatbed, Stake, or Platform (Single-Unit)	17%	A flatbed, single-unit truck that has a cargo body type without sides or a roof, with or without readily removable stakes which may be tied together with chains, slats or panels. This includes "stake body" trucks.	Underbody toolbox, flat bed extending backwards, stakes, entrance steps, fuel tanks.		 Source: City of Seattle
Dump (Single-Unit)	13%	Has a cargo body type that tilts to discharge its load by gravity. This category can include “belly dump” trailers that discharge a load through the lifting of the bed, or those with body type of "grain, chips or gravel" that discharge the load through a gate in the bottom without tilting.	Entrance steps, underbody toolbox, underbody fuel tanks.		 Source: Alexander Epstein, Volpe
Van, basic enclosed (Tractor-Trailer)	11%	Has a cargo body type with an enclosed body integral to the frame of the motor vehicle or trailer. This category may apply to both enclosed trailers and cargo vans. This is the most common cargo body type for trailers.	Underbody tool box, stored spare tire, landing gear, rear underride guard.		 Source: Alexander Epstein, Volpe
Van, basic enclosed (Single-Unit)	10%	Has a cargo body type having an enclosed body integral to the frame of the motor vehicle or trailer. It applies to both enclosed trailers and cargo vans. As a single-unit truck the cargo carrying capability of the vehicle is integral to the body of the vehicle.	Rear guard. Less common but still found on some vehicles: entrance steps, underbody tool box.		 Source: Alexander Epstein, Volpe

Truck Type	% of Fleet	Description of Truck	Common Elements	Diagram	Image
Service, utility or other (Single-Unit)	9%	A vehicle designed for usage by utility or other service companies. A single-unit vehicle, the back of the truck is specially designed for the storage and transportation of tools, composed of separate compartments. There is a high level of variation in design type for these vehicles.	Entrance step, enclosed compartments. Less common but still found on some vehicles: raised arm for utility line work, electrical line storage.		 Source: City of New York
Van, step, walk-in or multistep	7%	A medium-duty truck designed for usage that includes multiple stops or deliveries. The height of a walk-in or multistep van is typically higher than that of a regular van.	A sliding or open door, extremely low clearance, and a step-in that is incorporated inside the vehicle body.		 Source: City of New York
Flatbed, Stake, or Platform (Tractor-Trailer)	4%	Has a cargo body type without sides or a roof, with or without readily removable stakes which may be tied together with chains, slats or panels. This would include "stake body" trucks. As a tractor-trailer truck these have a separate trailer that is not integral to the operation of the vehicle.	Underbody fuel tanks, underbody tool box, spare tire, extended flatbed. Less common: rear underrun guards, entrance step, landing gear.		 Source: Alexander Epstein, Volpe

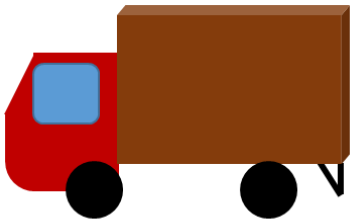
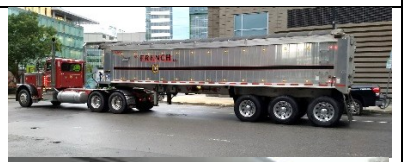
Truck Type	% of Fleet	Description of Truck	Common Elements	Diagram	Image
Van, open top (Single-Unit)	3%	Has a cargo body type having a mostly enclosed body integral to the frame of the motor vehicle or trailer. A variation of the enclosed van, this body type has all sides covered but the top open. This allows for cargo that may be higher than the height of the truck.	Rear guard. Less common but still found on some vehicles: entrance steps, underbody tool box.		 Source: Alexander Epstein, Volpe
Tank, liquids or gases (Single-Unit)	3%	Has a cargo body type with an enclosed tank that contains liquids or gases; this body is integral to the frame of the motor vehicle or trailer. Due to the wide variety of liquids that can be transported, a high level of variation exists, including insulated, non-insulated, pressurized, non-pressurized, single-load design, multiple loads with internal divisions in the tank, and more.	Underbody fuel tank and underbody tool box. Less common but still found on some vehicles: entrance steps, lift axle, rear underride guard.		 Source: Alexander Epstein, Volpe
Dump (Tractor-Trailer)	2%	Has a cargo body type that tilts to discharge its load by gravity. Unlike the single-unit dump truck, this vehicle has its dumping functionality on an attached trailer. Live-bottom trailers (bottom image at right) have a similar cargo body but use a conveyor belt instead of gravity to discharge the load.	Underbody fuel tank, underbody tool box, rear underride guard. Less common but still found on some vehicles: entrance steps.		  Source: Alexander Epstein, Volpe
Source for "Description of Truck" and "Common Elements": (United States Census Bureau, 2017); (NCHRP, 2017); (FMCSA, Vehicle Configuration and Cargo Body Types, 2017) Source for "Diagram": United States Department of Transportation, Volpe Center					

Table 24: Truck parts and their associated conflicts, compatibility, and costs

Truck Part	Side Guard Interaction (Yes/No)	Side Guard Interaction Details	Compatibility (Synergistic, Re-position, Adaptation, Incompatible)	Compatibility Details	Likely Fleet(s) Impacted	Potential Added Costs (Yes/No)
Fuel Systems						
Underbody fuel tanks *-liquid fuel tank* *-compressed natural gas* *-liquefied petroleum gas*	Yes, see Figure 36	The position of fuel tanks can vary, but these components tend to be located below the cab or along the body of the vehicle, which is where the fuel tank may interact with the side guard.	Synergistic or Adaptation	Fuel tanks can be placed along the bottom edge of the body with an adjacent side guard attachment or the side guard can be continuous, covering the fuel tank.	All	Pre-market: No Aftermarket: Yes
Cargo Securement						
Steel strapping	No					
Chain	No					
Webbing	No					
Wire rope	No					
Cordage	No					
Bolster	No, see Figure 37					
Winch	No					
Bunks	No, see Figure 3					
Stakes	No, see Figure 3					
Frames, Cab, and Body Components						
Wheels	Yes, see Figure 39	Wheels may be located adjacent to side guards.	Synergistic	Similar to side guards, tires may also act as a barrier between VRUs and the exposed space beneath the truck body.	All	Pre-market: No Aftermarket: No
Frame or chassis	Yes, see Figure 40	The chassis or the truck body frame is the truck part where many side guards are fastened.	Synergistic	The chassis is often used synergistically for side guard attachment.	All	Pre-market: No Aftermarket: No
Cab and body components	No					
Suspension system: axles	No					
Suspension system: springs	No					
Suspension system: torsion bar	No					

Suspension system: air pressure regulator	No					
Suspension system: exhaust controls	No					
Steering wheel systems	No					
Additional Parts or Accessories						
Underbody toolbox	Yes, see Figure 7	The position of the underbody toolbox can vary, but they are often located along the underbody of the body of the vehicle.	Synergistic	Underbody toolboxes can be placed along the bottom edge of the body with an adjacent side guard attachment.	Flatbed, Stake, or Platform (Single-Unit); Van, basic enclosed (Tractor-Trailer); Van, basic enclosed (Single-Unit); Tank, liquids or gases (Single-Unit); Dump (Tractor-Trailer)	Pre-market: No Aftermarket: No
Fire Extinguisher	Yes, see Figure 8	Power units of trucks are required to have fire extinguishers. Fire extinguishers are sometimes stored along the underbody of the truck.	Adaptation	Fire extinguishers can be placed inside of the truck cab or they can be placed behind the side guard, but still accessible; this is accomplished by adapting the side guard to allow access to the fire extinguisher.	All	Pre-market: No Aftermarket: Yes
Exhaust System	No					
Side marker lamps	No, see Figure 9					
Aerodynamic truck skirt	Yes, see Figure 45	Aerodynamic truck skirts are attached along the underbody of the truck, where a side guard is attached.	Synergistic or Adaptation	Aerodynamic truck skirts can be used synergistically to have the same effect as a side guard or they can be adapted to have a safety impact like side guards.	Flatbed, Stake, or Platform (Single-Unit); Dump (Single-Unit); Van, basic enclosed (Tractor-Trailer); Van, basic enclosed (Single-Unit); Dump (Tractor-Trailer); Flatbed, Stake, or Platform (Tractor-Trailer); Van, open top (Single-Unit); Tank, liquids or gases (Single-Unit)	Pre-market: No Aftermarket: Yes
Air reservoir	No					
Load platform	No					

Landing Gear	No, see Figure 5					
Stabilizer Leg	Yes, see Figure 6	Stabilizer leg, used to brace or balance the truck's body (often with a crane or an aerial device), sometimes have components that extend past the bottom of the truck's body.	Synergistic or Adaptation	Adaptations to side guards, such as a longitudinal gap, may be needed to allow for the use of the stabilizer leg. On new vehicles, the placement of stabilizer legs may be appropriate at the rear of the truck.	Flatbed, Stake, or Platform (Tractor-Trailer)	Pre-market: No Aftermarket: No
Ladder	Yes, see Figure 11	Ladders may be positioned along the body of the vehicle.	Synergistic or Adaptation	Ladders can be designed to be a barrier between VRUs and the area below the body of the truck.	Flatbed, Stake, or Platform (Single-Unit); Dump (Single-Unit); Flatbed, Stake, or Platform (Tractor-Trailer); Tank, liquids or gases (Single-Unit); Tank, liquids or gases (Single-Unit); Dump (Tractor-Trailer)	Pre-market: No Aftermarket: Yes
Stored spare tire	Yes, see Figure 12	The position of the stored spare tire can vary, but they tend to be along the body of the vehicle.	Synergistic	Stored spare tires can be designed to be a barrier between VRUs and the area below the body of the truck; alternatively, the side guard could be removable to allow access when the spare tire is needed.	Van, basic enclosed (Tractor-Trailer); Flatbed, Stake, or Platform (Tractor-Trailer)	Pre-market: No Aftermarket: No
Tires	Yes, see Figure 4	Tires may be located adjacent to side guards.	Synergistic	Similar to side guards, tires may also act as a barrier between VRUs and the exposed space beneath the truck body.	All	Pre-market: No Aftermarket: No
Lift axle	Yes, Figure 13	Lift axles are used to carry additional weight and can be raised off the ground when they are not needed. Lift axels are installed ahead of or behind the driving tandem axles.	Synergistic	Lift axles may also act similarly to side guards, as a barrier between VRUs and the exposed space beneath the truck body.	Flatbed, Stake, or Platform (Single-Unit); Dump (Single-Unit); Van, basic enclosed (Tractor-Trailer); Flatbed, Stake, or Platform (Tractor-Trailer); Tank, liquids or gases (Single-Unit); Dump (Tractor-Trailer)	Pre-market: No Aftermarket: No
Sleeper berths	No					
Heaters	No					

Windshield wiping and washing systems	No					
Windshield defrosting and defogging systems	No					
Rear-vision mirrors	No					
Horn	No					
Speedometer	No					
Exhaust systems	No					
Floors	No					
Rear impact guards and rear end protection	No					
Warning flags on projecting loads	No					
Television receivers	No					
Buses, driveshaft protection	No					
Buses, standee line or bar	No					
Buses, aisle seats prohibited	No					
Seats, seat belt assemblies, and seat belt assembly anchorages	No					
Interior noise levels in power units	No					
Sources: (FMCSA, FMCSA Regulations Part 393, 2017); (FTA, Freight Transportation Association, 2017); (FMCSA, Driver's Handbook on Cargo Securement, 2017)						

Figure 36: Truck with underbody fuel tank. (Source: Volpe)

Figure 37: Truck trailer with bolsters (vertical posts). (Source: FMCSA)

Figure 38: Truck trailer with bunks (horizontal structure) and stakes (vertical structures). (Source: Taina Sohlman, 123rf.com)

Figure 39: Truck with wheels and tires. (Source: Rob Wilson, 123rf.com)

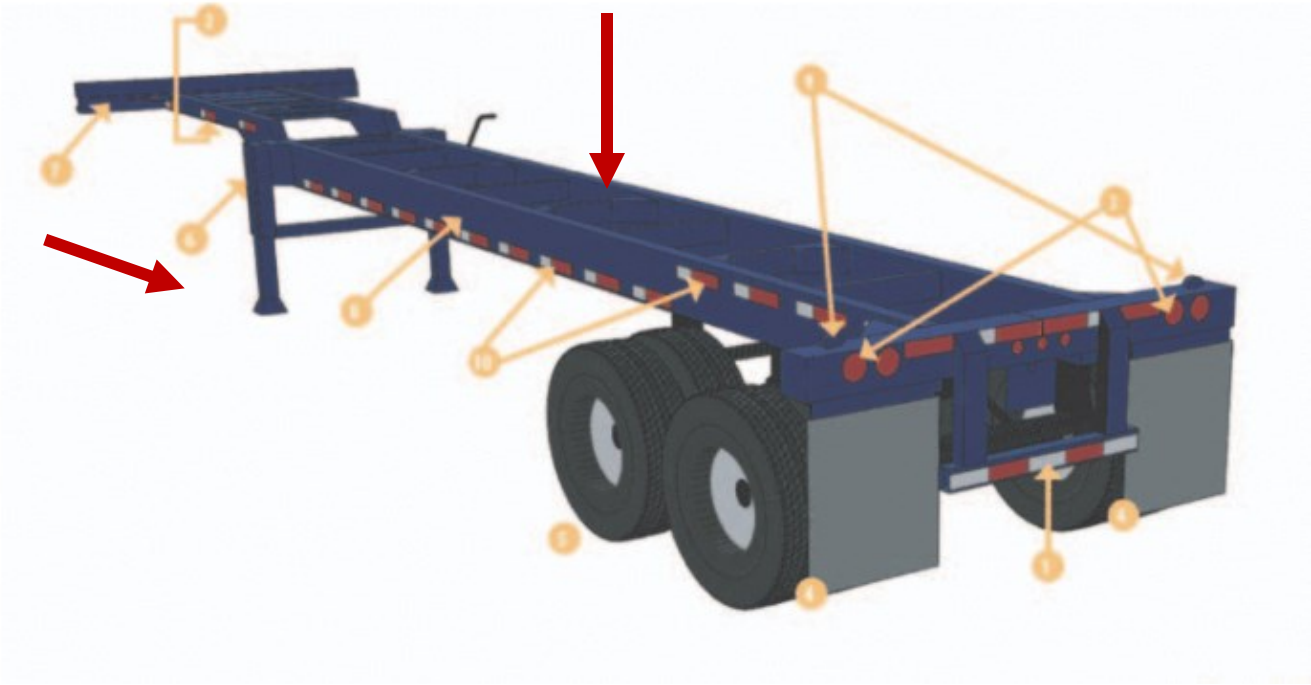


Figure 40: Diagram of truck trailer chassis and truck landing gear. (Source: NCHRP)

Figure 41: Truck with a crane and stabilizer leg. (Source: Volpe)

Figure 42: A truck with an underbody toolbox. (Source: FMCSA)

Figure 43: Truck with fire extinguisher behind side guard (Source: Nuttapong Wannavijid, 123rf.com)

Figure 44: Truck with side lamps. (Source: Sergio Shumoff, 123rf.com)

Figure 45: Truck with aerodynamic skirt. (Source: Vitpho, 123rf.com)

Figure 46: Truck with ladder. (Source: Сергей Сергеев, 123rf.com)

Figure 47: Truck with a stored spare tire. (Source: Volpe)

Figure 48: Truck with a lift axle. (Source: Volpe)

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APPENDIX D: ADDITIONAL BENEFIT-COST ASSUMPTIONS AND PROJECTIONS

Structural and Data Limitations

The following is a discussion of the structural and data limitations of the analysis. Structural limitations are those limitations in the methodology that fail to account for real-world features or dynamics.

The trucking fleet model assumes no dynamic relationship between aerodynamic benefits (fuel efficiency) and VMT. However, in the real world, as the cost of driving per mile is reduced from reduced fuel use, the price of driving is expected to decrease. In a competitive market, the reduction in cost per mile for carriers would lead to an outward shift in the supply curve—suppliers competing for consumers would offer lower prices and this shift in the supply curve would induce more demand in truck VMT. Estimates of the rebound effect on fuel efficiency range from 2 to 10 percent. A conservative estimate would then reduce the fuel savings benefits by 10 percent, though this is not explicitly incorporated into the results of the analysis.

The fleet trucking model does not incorporate scrappage of trucks. Some portion of trucks that are equipped with side guards will be scrapped each year. This gap in the analysis is partially offset by the fact that newer trucks are driven more than older trucks, and the model assumes that trucks of all model years drive at the same levels.

Data limitations are those gaps that were identified but were not possible to include because the data were not available. Many of these limitations were related to the fact that relevant information is not available by specific cargo body type. In particular, the model does not use unique gallons per mile (GPM) for SUT cargo body types (such as box or dump trucks) and for CT trailer types (such as box, or low boy).

Finally, the light-weight side guards considered in this report may produce other benefits not accounted for in the methodology, particularly safety benefits that accrue from reduced crash costs of crashes not involving vulnerable road users (VRUs):

- Crash cost reduction for truck crashes involving motorized two-wheelers, i.e., motorcycles, mopeds, etc.
- Crash cost reduction related to improved wind stability for side guard-equipped trucks.
- Crash cost reductions from reduced road spray from side guard-equipped trucks and trailers.

- Improved automotive collision avoidance sensor detection of trucks/trailer[46]

No evidence at this time suggests that side guards are likely to increase the occurrence or severity of accidents in the above list. Therefore, the above list can be seen as evidence that the net benefits computed in this report are likely an underestimate.

Crash Cost

Crash costs are determined by the severity of the injury. There are two primary injury classification taxonomies used in the U.S.:

1. **The Maximum Abbreviated Injury Scale (MAIS)** defines 6 categories of injury, which are defined by the type, location on the body of the injury, and severity of the injury. For benefit-cost analysis, USDOT's recommended monetary values are based on these MAIS levels.

2. **The KABCO injury scale,** named for the letter categories used in its classification system, places injuries in the following severity levels: fatality (K), disabling injury (A), non-incapacitating injury (B), possible injury (C), and no injury (O). This scale is typically used by emergency responders to assess crash outcomes, as it is more readily assessed on-scene than the more fine-grained MAIS levels.

Although the KABCO scale is in widespread use, on-scene assessment does not always correctly predict the actual severity of injuries on the more medically precise MAIS scale. Based on prior research that tracked the correspondence between KABCO and MAIS levels for a sample of crashes, it is possible to convert injury data from KABCO to MAIS using conversion factors. For instance, a KABCO injury rating of O, "no injury," has a roughly 7 percent chance of actually being an MAIS level one injury, and a roughly 2 percent chance of being an MAIS level two injury (U.S. DOT, 2017). The U.S. Department of Transportation (U.S. DOT) provides a conversion between KABCO-rated injuries and the probability distribution of MAIS for more accurate costing of injury.

This report uses the KABCO scale because it is consistent with the reporting of injury severity in the available crash data (GES, FARS, and TIFA), but converts the KABCO values to their appropriate MAIS figures for consistency with USDOT's recommended monetary values.[47]

The cost of each bodily injury category is represented by the fraction of the cost of that injury crash to the cost of a fatal crash. While no value can be put on a human life, in order to conduct a

[46] For example, if side guards had been deployed on the tractor trailer involved in the 2016 fatal Florida Tesla crash, the truck may have been more easily detected by the vehicle's forward sensors: https://www.ntsb.gov/news/press-releases/Pages/PR20170912.aspx

[47] This report assumes that there is no cost of damage to the truck in VRU and truck-involved crashes, and only considers the cost of injury to the VRU.

benefit-cost analysis that accounts for prevented fatalities, some monetization of these avoided fatalities must be provided.

Economists resolve this valuation issue by using a measure called the Value of Statistical Life (VSL). VSL is essentially a measure of the amount that a group of individuals would be willing to pay to reduce their risk of dying in a crash. U.S. DOT sets this value at $9.6 million. Table 25 provides the schedule of KABCO severity categories, the fraction of VSL, and the unit value in U.S. dollars (U.S. DOT, 2017).

Table 25: KABCO Schedule of Injury Severity and Cost (in 2016 dollars) (U.S. DOT, 2017)

KABCO Level	KABCO Severity Description	Fraction of VSL	Unit value ($2016)
O	No Injury	0.0003	$ ……..3,200.00
C	Possible injury	0.007	$ 63,900.00
B	Non-Incapacitating Injury - Minor Injury	0.013	$ 125,000.00
A	Incapacitating Injury - Serious Injury	0.048	$ 459,100.00
K	Not Survivable	1	$ 9,600,000.00
U	Injured, Severity Unknown	0.018	$ 174,000.00

Effectiveness of Side Guard Crash Reduction

The final assumption of safety benefits is how effective side guards are at reducing crash costs. The *Truck Side Guards to Reduce Vulnerable Road User Fatalities* report in this series reviewed various studies that reported on the effectiveness of side guards to reduce the proportion of fatalities and serious crashes as a share of total injury crash types. Crash costs can be reduced through two means: Crash costs can be avoided entirely because the potential crash entities do not make contact, or they can be mitigated through a reduction in the severity of the impact. Side guards do not provide crash avoidance but rather provide crash mitigation by preventing VRUs from entering under the truck and being struck by the underside of the vehicle or run over by the vehicle.

Therefore, as with the studies reviewed in *Truck Side Guards to Reduce Vulnerable Road User Fatalities* the crash cost effectiveness in this report is mitigation, or reducing the crash severity from more severe to less severe.

Side guards are assumed to be able to mitigate some injuries and not others. KABCO crashes rated as level O (No Injury) are considered not mitigatable by side guards because there is essentially no injury. For all other injury severities, the analysis assumes that the injury severity is reduced to a fixed minimum injury severity. A study of injury crashes in the UK converted crashes rated as slight in the UK scale (with limited exceptions) as level one crashes in the MAIS scale (Morris, Welsh, Barnes, & Chambers-Smith, 2006). The dollar value of MAIS level one is 0.003 percent of VSL, or $28,800.00 (distinct from KABCO crash type O), which was then treated as the minimum cost of an injury crash with a VRU. The safety benefit accrued by side guards then is the difference in value between the MAIS level one crash cost of $28,000 and the KABCO value of the crash cost.

Table 26 provides the range of effectiveness of side guards at mitigating crash severity. These effectiveness figures are the reduction in fatal or serious injuries as proportion of all injury crashes.

Table 26: Side Guard Effectiveness from Four UK Studies Comparing National Data 1980-2008

Crash Type Mitigated by Side Guards	Range of Effectiveness in Reducing Given Crash Type to MAIS Minor Crash
Bicyclist fatalities	55-75%
Bicyclist serious injuries	3-17%
Pedestrian fatalities	20-27%
Pedestrian serious injuries	<1%

Liability

Crash cost values provided by FHWA are the total social cost of crashes and include medical costs, costs of repair or loss of truck, loss of revenue in the case of commercial trucks, among others. Consistent with benefit-cost analysis, the crash cost reductions in this report are framed as total social costs of crashes. They represent the total cost of a fatality or bodily injury to society as a whole and are not just the costs incurred by truck operators. However, a rough value of the estimate of safety benefits that accrue for truck operators caused by the deployment of side guards as a safety countermeasure for crashes involving VRUs can be constructed.

Assuming for the purposes of simplicity that insurance premiums perfectly capture the expected value of crash costs for heavy-duty vehicles and VRUs in addition to expected crash costs from non-VRU- and truck-involved crashes, then in principle a reduction in the risk of high crash cost from deploying crash-cost-mitigating side guards would reduce insurance premiums. If insurers recognized the side guard's potential safety mitigation to reduce the costs of crashes with VRUs, then trucks equipped with side guards would, in principle, be charged a lower premium.

A report by the U.S. DOT Volpe Center reviewed the current federal insurance requirements for commercial motor vehicles, which require motor carriers to carry a minimum level of insurance (Hymel, Lee, Pearlman, Pritchard, & Rainville, 2012). The report provides the average insurance premium per truck in 2009 of $6,449 ($2016). Using this value, the insurance premium savings for side guard-equipped vehicles can be constructed.

As the *Truck Side Guards to Reduce Vulnerable Road User Fatalities* report states, "in 2015, over 4,000 people including 410 VRUs were killed and more than 111,000 people were injured in crashes involving large trucks (United States Department of Transportation, 2017)." Therefore, the share of VRU-involved fatalities in 2015 is roughly 10 percent. The risk premium value of side guard deployment would be 10 percent of the insurance premium multiplied by the

effectiveness of the side guard at reducing crash costs.[48] The annual cost savings for side guard-equipped trucks would be roughly $665.

This figure cannot be incorporated into a benefit-cost analysis because a reduction in insurance premiums would be considered a transfer.[49] However, it is helpful in considering the business case for a truck owner or operator. This rough estimate of cost savings would cover the cost of installing side guards on a truck in no more than four years.

Domestic supplier and cost data

Table 27: Example North American side guard aftermarket suppliers identified by market research

Company	Headquarters	Design type
Air Flow Deflector	Quebec	Panel
Laydon/WABCO*	Ontario	Panel/aero skirt
Transtex	Ontario	Panel/aero skirt
Walker Blocker	Washington	Panel
Shu-Pak Corporation	Ontario	Rail-style
Takler USA	New Jersey	Rail-style
Duragard	New Jersey	Rail-style
McNeilus	Minnesota	Rail-style
American Road Machinery Company	Ohio	Rail-style

As early data points shown in Table 28, the City of Boston's 2013-2014 pilot installations cost $1,200-$1,800 per vehicle; New York City (NYC) pilot installations cost about $2,000-3,000 per vehicle, including approximately $1,500 in materials; and Portland's installations, which were among the first in the U.S. and involved a combination of custom panels and toolboxes, cost an average of $2,500 per vehicle. The University of Washington paid ~$3,000 per truck in 2015.

Table 28: Example North American side guard retrofit reported costs

U.S. city	Reported approximate cost per vehicle	Side guard type
Boston (Mayor's Office, 2015)	$1,200-1,800	Steel rail; fiberglass panel
Cambridge (Witts, 2016)	$1,800	Steel and aluminum rails
New York City (Mayor's Office, 2015)	$3,000 / $2,000	Fiberglass panel; steel rail; aluminum rail
Portland (DePiero & Leader, 2012)	$1,000 small trucks - $4,000 trailers; $200-$250 per toolbox	Metal panel and toolbox

New York City's Vision Zero Side Guard Incentive Program was established in 2016 and has awarded grants up to $2,000 per truck for 88 trucks to date, reflecting an upper bound for

[48] Assume the risk premium does not consider the risk of non-fatal bodily injury for simplicity.

[49] In BCA when the result of an action is a transfer of goods from one part to another with no creation or loss of real value it is called a transfer, and for the purposes of BCA does not impact the net benefits of the action. No transfers are proposed as part of scenarios considered in the report.

reasonable cost (NYC Business Integrity Commission, NYC Department of Transportation, and NYC Department of Citywide Administrative Services, 2016).

Another indication that, at larger volume, side guard costs in the U.S. could approximate the costs illustrated in Table 11 is provided by a U.S. Department of Commerce National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP) Supplier Scouting analysis completed in May-June 2016. On request from Volpe and the San Francisco Municipal Transportation Agency, the nationwide network of MEP Centers, with coordination from NIST MEP, performed Supplier Scouting for domestic manufacturing capabilities and capacity for the production of side guards. The Opportunity Synopsis, essentially a Request for Information, provided for a wide range of trucks and trailers over 10,000 pounds found in the San Francisco City Fleet and set a maximum purchase price of $1,000. The results of this Supplier Scouting analysis were as follows:

- MEP Supplier Scouting identified **21 U.S. manufacturers as potential matches**.
- **19 of the manufacturers identified were confirmed by NIST MEP to currently have the capability, capacity, and interest** in producing the items being sought. These domestic manufacturers are located in California, Iowa, Kentucky, Louisiana, and West Virginia.
- Additionally, two manufacturers were separately identified by NIST MEP that appear to currently produce a similar item and currently have capability and capacity to produce the side guard items.
- The 19 U.S. manufacturers identified as potential matches indicated that they are interested in pursuing the business opportunity to produce the needed items for supply to the appropriate projects.

As many truck manufacturers are multinational, companies such as Daimler or Volvo already outfit trucks with side guards in many world markets outside of North America (see example in Figure 49). As a result, either the original equipment manufacturer (OEM)[50] or final manufacturer ("body builder")[51] paths to side guard inclusion may be more cost-effective than the aftermarket path, given the efficiency of reduced costs of integration with vehicle layouts that may not otherwise be optimized for inclusion of side guards.

[50] For tractors and trailers
[51] For single-unit trucks

Figure 49: Images of Volvo side guard-equipped vehicles currently manufactured for non-U.S. markets (Source: Alf van Beem and Raymondo166, Wikimedia Commons)

Maintenance cost interview data

- The City of Portland, Oregon, reported no increase in maintenance cost on trucks with side guards installed since 2008 (DePiero & Leader, 2012).
- Boston Public Works reported there were no increases in maintenance costs for the 160 trucks that had side guards installed since 2013 (Carter K. , 2016).
- The New York City director of Fleet Services reported that side guards did not result in any additional maintenance costs on the 2,000 trucks equipped since 2015, but noted that side guard inspection would be added to the maintenance checklist. The estimated maintenance check will require 15 minutes of staff time per truck annually (Graczyk, 2016).

Side guards lack any moving parts and, therefore, like other underride installations like tool boxes, are not expected to increase maintenance costs. However, in line with New York City's director of Fleet Services, this report assumes that there will be some ongoing maintenance cost associated with side guards, specifically that it will take a single mechanic 15 minutes to inspect one side guard per year. Given the current evidence of the potential cost of maintenance from these other sources, this estimate may overstate the maintenance costs by 100 percent, since all claim (per the interviews) that there have been no side guard-associated maintenance costs. The report assumes there is no difference in maintenance cost depending on truck type, cargo body type, or side guard type.

The total annual cost of maintenance is computed by multiplying the number of side guard-equipped trucks and annual maintenance cost per truck.

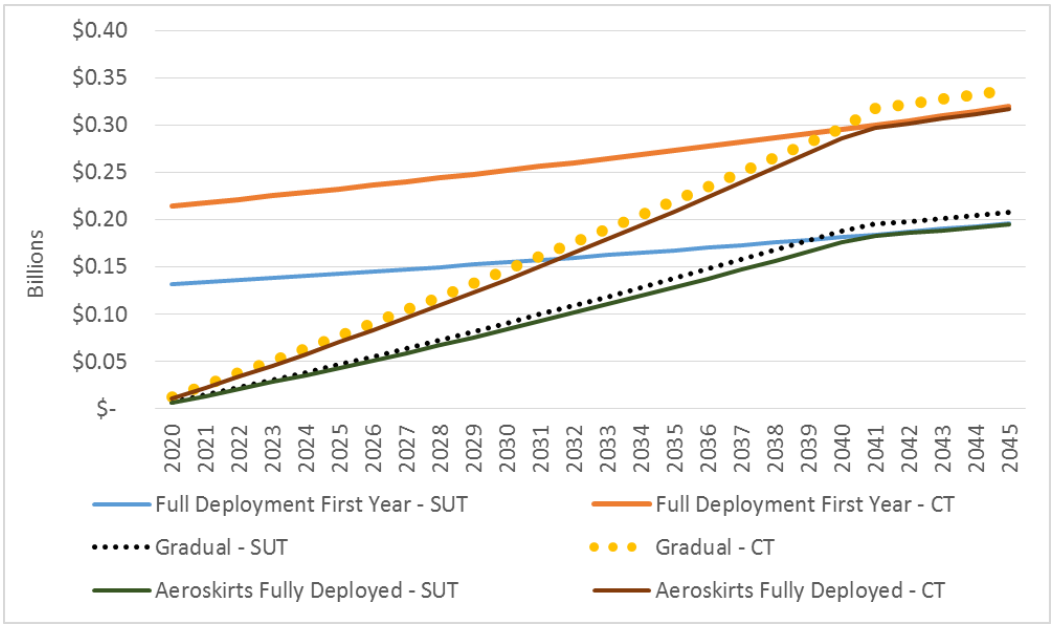

Figure 50: Safety Benefits Each Year by Scenario and Vehicle Type (Low Effectiveness)

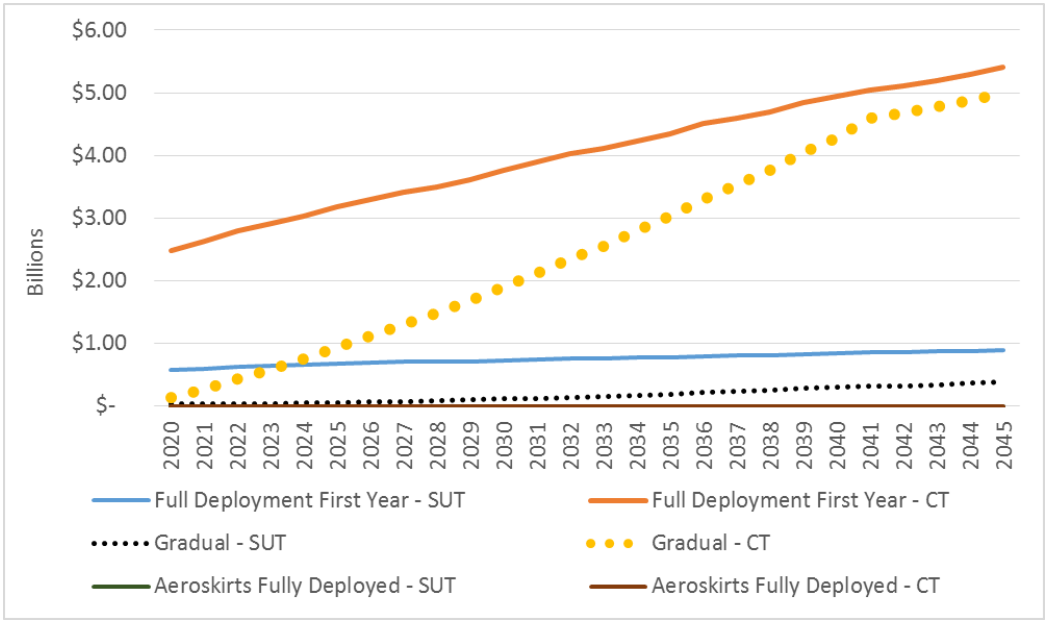

Figure 51: Aerodynamic Benefits Each Year by Scenario and Vehicle Type (Low Effectiveness)

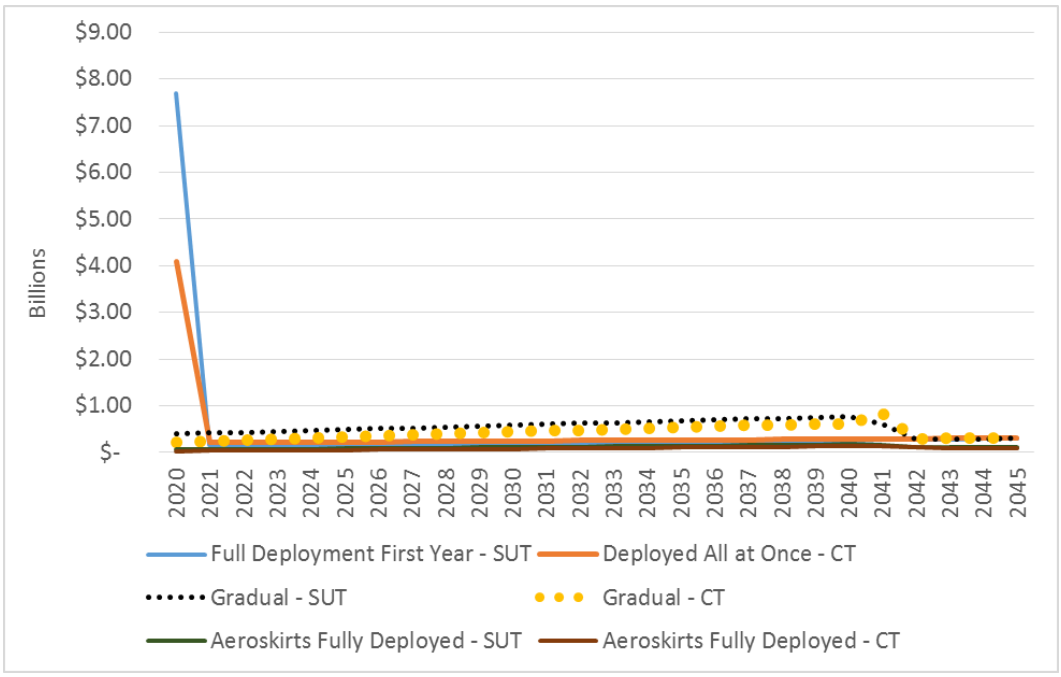

Figure 52: Costs of Side Guards Each Year by Scenario and Vehicle Type (Low Effectiveness)

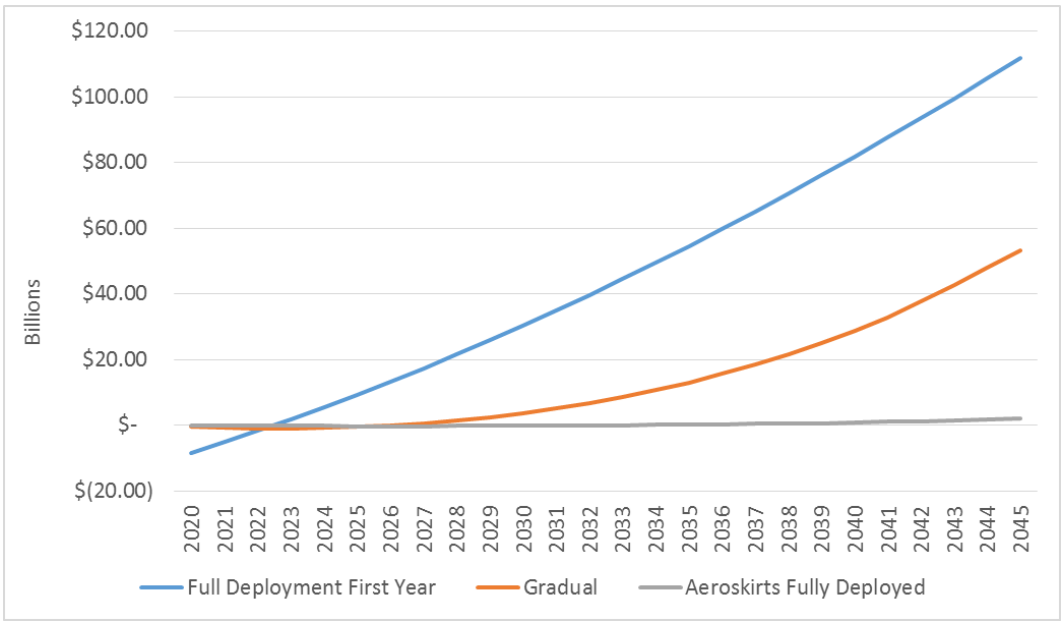

Figure 53: Undiscounted Cumulative Net Benefits of Each Scenario by Year (Low Effectiveness)

Table 31: FMCSA Financial Responsibility Study Total Operating and Insurance Costs Per Truck Per Year (Hymel, Lee, Pearlman, Pritchard, & Rainville, 2012)

Motor Freight Transportation and Warehousing Survey 1994 Trucking, Except Local (SIC 4213)			
Year	Operating Expense per Year per Truck	Insurance Cost per Year per Truck	Share
1990	$70,965	$2,808	4.0%
1991	$70,828	$2,834	4.0%
1992	$75,061	$2,819	3.8%
1993	$78,716	$2,945	3.7%
1994	$87,078	$3,251	3.7%
Transportation Annual Survey 1997 Trucking, Except Local (SIC 4213)			
Year	Operating Expense per Year per Truck	Insurance Cost per Year per Truck	Share
1993	$77,568	$2,932	3.8%
1994	$84,682	$3,214	3.8%
1995	$88,061	$3,286	3.7%
1996	94,390	$3,465	3.7%
1997	$98,570	$3,278	3.3%
ICF/Edwards Study (2003)			
Year	Operating Expense per Year per Truck	Insurance Cost per Year per Truck	Share
2000	$106,482	$4,081	4.1%
2001	$109,672	$6,744	6.0%
Service Annual Survey Trucking (NAICS)			
Year	Operating Expense per Year per Truck	Insurance Cost per Year per Truck	Share
2004	$164,907	$7,226	4.4%
2005	$188,206	$6,688	3.6%
2006	$201,617	$7,207	3.6%
2007	$208,773	$7,242	3.5%
2008	$212,844	$6,778	3.2%
2009	$169,161	$5,789	3.4%
ATRI Update (2011)			
Year	Cost Per Hour	Insurance Premiums	Share
2008	$2.45	$2.22	3.3%
2009	$58.00	$2.15	3.7%
2010	$59.60	$2.06	3.5%
Freight Rate Index			
Year	Cost per Hour	Insurance Premiums	Share
2012	$2.45	$0.12	4.8%

Table 29: ATRI Cost of Trucking Report Operating Expense per VMT (Hooper & Murray, 2017)

Motor Carrier Costs	2008	2009	2010	2011	2012	2013	2014	2015	2016
Vehicle-based									
Fuel Costs	$0.63	$0.41	$0.49	$0.59	$0.64	$0.65	$0.58	$0.40	$0.34
Truck/Trailer Lease or Purchase Payments	$0.21	$0.26	$0.18	$0.19	$0.17	$0.16	$0.22	$0.23	$0.26
Repair & Maintenance	$0.10	$0.12	$0.12	$0.15	$0.14	$0.15	$0.16	$0.16	$0.17
Truck Insurance Premiums	**$0.06**	**$0.05**	**$0.06**	**$0.07**	**$0.06**	**$0.06**	**$0.07**	**$0.07**	**$0.08**
Permits and Licenses	$0.02	$0.03	$0.04	$0.04	$0.02	$0.03	$0.02	$0.02	$0.02
Tires	$0.03	$0.03	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04
Tolls	$0.02	$0.02	$0.01	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02
Driver-based									
Driver Wages	$0.44	$0.40	$0.45	$0.46	$0.42	$0.44	$0.46	$0.50	$0.52
Driver Benefits	$0.14	$0.13	$0.16	$0.15	$0.12	$0.13	$0.13	$0.13	$0.16
TOTAL	**$1.65**	**$1.45**	**$1.55**	**$1.71**	**$1.63**	**$1.68**	**$1.70**	**$1.58**	**$1.59**

G. NHTSA Petition under the Administrative Procedure Act re: FARS filed by Eric Hein

*** Appendix Eric Hein's Petition**

April 21, 2023

Pete Buttigieg, Secretary
U.S. Department of Transportation
1200 New Jersey Avenue SE
Washington, DC 20590-0001

Ann Carlson, Acting Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE
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Barbara Rhea, Chief
State Data Reporting Systems Division
National Highway Traffic Safety Administration
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PETITION under the Administrative Procedure Act

Dear Secretary Buttigieg:

In accordance with Administrative Procedure Act (APA), I hereby petition the U.S. Department of Transportation (USDOT) and the National Highway Traffic Safety Administration (NHTSA) to promptly issue, amend, modify, or repeal the relevant regulations or guidance documents (49 CFR 5.3; 5 U.S.C. §553(e)) in order to:

1. Update the Fatality Analysis Reporting System (FARS) analytical user's manual (NCSA 2023), the 2021 FARS/CRSS Coding and Validation Manual (NHTSA 2023), the Model Minimum Uniform Crash Criteria (MMUCC; NHTSA 2023a) and other guidance documents to provide a standardized definition of underride (NHTSA 2022a) and override crashes for the required underride/override data element (see Appendices);

2. Modify the existing underride FARS data element, which is already required to be reported by each State, in the FARS analytical user's manual (NCSA 2023), the 2021 FARS/CRSS Coding and Validation Manual (NHTSA 2023), the MMUCC (NHTSA 2023a), and other guidance documents, to differentiate and collect data on rear underride, side underride, and front override crashes (see Appendices);

3. Require an Underride/Override "Checkbox" and mandatory reporting of this data element on State Police Crash Report Forms when States upgrade and standardize their electronically reported State crash data systems to enable electronic real-or near real-time uploading of crash data; and

4. Provide training and information to State FARS analysts and State and local police departments on how to identify and record underride and override crashes.

The critical issue of underride crash fatalities is personal for me. I am a truck safety advocate and began in 2015, after my 16-year-old son Riley Eric Hein was tragically killed due to the lack of a side underride guard on a 2016 semitrailer produced by Utility Trailer Manufacturing Company. I am also on the Board of Directors of the Institute for Safer Trucking, a nonprofit organization focused on educating the public on truck safety issues and the data-driven solutions to address them.

Background

This petition seeks to modify interpretive rules and general policy statements of procedure, and practice within the USDOT and NHTSA. In addition to rulemakings and exemptions, the USDOT procedures, as amended, explicitly provide for the public to petition for retrospective reviews of existing rules and the *modification or rescission of guidance documents* (USDOT 2021; 86 FR 17293), which are interpretive rules and general policy statements of agency organization, procedure, and practice. This aligns with the Administrative Procedure Act's (APA) definition of rule, which is broad and covers a variety of agency actions, including several types of actions that are not subject to the APA's notice-and-comment rulemaking procedures. An agency statement will qualify as a "rule" under the APA definition if it: 1) is "of general or particular applicability," (2) has "future effect," and (3) is "designed to implement, interpret, or prescribe law or policy.

NHTSA is authorized by 49 U.S.C. 30182 and 23 U.S.C. 403 to collect data on motor vehicle traffic crashes to aid in the identification of issues and the development, implementation, and evaluation of motor vehicle and highway safety countermeasures to reduce fatalities and the property damage associated with motor vehicle crashes. Using this authority, NHTSA established the FARS, which collects data on fatal motor vehicle crashes. Among other things, the information aids in the establishment and enforcement of motor vehicle regulations and highway safety programs. The FARS collects data from all 50 States, the District of Columbia, and Puerto Rico. NHTSA established cooperative agreements with the 50 States, the District of Columbia and Puerto Rico to report a standard set of data on each fatal crash within their jurisdictions. As fatal crashes occur, the State employee (FARS Analyst) extracts and codes the required information (data elements) in the FARS records-based system (NHTSA 2022; 87 FR 19573).

FARS is an on-going data acquisition system with annual reviews determining whether annual changes are needed in the acquired and coded data. The FARS manuals are updated annually. State FARS analysts must use the manual appropriate to the current program year (NHTSA 2018). In the past, the FARS was a voluntary information collection of fatal motor vehicle traffic crashes; however, State participation and data collection in FARS is now mandatory (with the exception of American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the United States Virgin Islands; 23 U.S.C. 02(b)(1)(F)(vi); NHTSA 2023b; 88 FR 7780).

Petitioned Actions

Petitioned Action 1: *Update FARS User's and Coding Manuals, the Model Minimum Uniform Crash Criteria, and other guidance documents to provide a standardized definition of underride and override crashes*

This petitioned action could use NHTSA's existing procedure and practice to annually modify and change the FARS analytical user's manual (NCSA 2023), change the 2021 FARS/CRSS Coding and Validation Manual (NHTSA 2023), change the draft MMUCC (NHTSA 2023a) and change any other guidance documents to provide a consistent and standardized definition of underride and override crashes (see Appendices). These changes would not affect the reporting burden of the individual States because the underride/override data element is already required to be coded and reported. In fact, the petitioned changes would ease extraction and coding by the State's FARS analysts.

The Government Accounting Office (GAO 2019) reported that NHTSA had previously identified anomalous patterns in underride crash data in FARS. The main reason for these anomalies has been varying definitions of this crash type, as reporting officers have many interpretations of what constitutes an underride crash. Including a standard definition of an underride and override crash would provide greater assurance that these crashes are accurately recorded.

The underreporting of underride and override crashes and fatalities due to variability in the data collection process limits NHTSA's ability to accurately determine the frequency of such crashes (GAO 2019). As demonstrated NHTSA's recent Advance notice of proposed rulemaking (ANPRM), underreporting of side underride crashes is coming in FARS. The petitioned action would help resolve the underreporting issue by providing additional information and clarity on how to identify and code underride and override crashes, to increase the reporting accuracy of the underride data element in FARS. These improvements would enable NHTSA to better identify and support rulemakings and research efforts on underride crashes (GAO 2019).

Petitioned Action 2: *Modify the existing FARS underride data element to differentiate and collect data on rear underride, side underride, and front override crashes*

This petitioned action would remove ambiguity on the procedure and practice of collecting and reporting of the underride/override FARS data element that currently codes the underride/override data element identical for rear underride, side underride, and front override crashes. This petitioned action requests that the USDOT and NHTSA modify the required underride/override data element in the FARS analytical user's manual (NCSA 2023), the 2021 FARS/CRSS coding and validation manual (NHTSA 2023), the draft MMUCC (NHTSA 2023a) and any other guidance documents to differentiate between and independently code rear underride, side underride, and front override crashes. This would enable more precise data capture and reporting and the resulting analyses of underride and override crashes to permit tracking of the differing regulatory categories that are important to evaluate countermeasure effectiveness, tracking crash outcomes, and to support NHTSA and FMCSA rulemaking

activities. In fact, NHTSA (2023c) used side impact, sideswipe, and angled crashes between the passenger vehicles and tractor-trailers to estimate side underride crashes because the underride/override FARS data element does not currently differentiate between rear or side underride crashes. The petitioned changes would also align with one of the important uses of FARS data to "…estimate the potential effectiveness of new technology", which could include side underride guards for semitrailers NHTSA (2016; 2023c).

Many researchers and organizations, including NHTSA, have reported the poor quality of NHTSA's underride crash data (NHTSA 2023c). For example, IIHS representatives compared underride crash cases in FARS and in NHTSA's and FMCSA's Large Truck Crash Causation Study and identified cases that involved underride crashes but were not categorized correctly in FARS (GAO 2019). Additionally, the University of Michigan's Transportation Research Institute reported that it can be difficult or impossible to identify underride in available computerized crash data files, such as FARS (GAO 2019).

NHTSA has a cooperative agreement with an agency in each State's government to report and populate FARS information for all qualifying fatal crashes in exchange for payments. The FARS is a mutually beneficial data collection effort which requires fiscal support to sustain the cost of the data acquisition (i.e., all manual and electronic methods of reporting). NHTSA (2021) provides funding for up to fifty-two non-competitive Cooperative Agreements to support the States to collect police-reported fatal crashes involving all motor vehicles, pedestrians, and cyclists. These cooperative agreements are a flexible instrument designed to provide money to support a public purpose, including fulfilling the required reporting requirements (2 CFR § 182.620, § 183.25). While States have their own procedure and practice to develop and use paper State Police Crash Report Forms, clearly differentiating and clearly defining rear underride, side underride, and front override would encourage greater uniformity of underride/override crash data.

Petitioned Action 3: *Require an Underride/Override "Checkbox" on State Police Crash Report Forms when States upgrade and standardize their electronically reported State crash data systems*

This petitioned action would require the inclusion of a checkbox for the mandatory reporting of the underride/override data element on all State electronic crash data systems. The inclusion of an underride/override checkbox would increase the timely and accurate reporting of the underride/override data element. This action also aligns with USDOT's (2022) National Roadway Safety Strategy and could easily be completed through the funding agreement for each State grant to collect electronic data which was established by NHTSA under the Infrastructure Investment and Jobs Act ("IIJA", 2021 P.L. 117-58; NHTSA 2022b; 87 FR 25565). This grant program enables the States to electronically transfer their motor vehicle crash data, which will increase the timely and accurate reporting of the underride/override data element and other crash information to the FARS database. The adoption of electronic crash reporting by State law enforcement agencies would standardize State crash data to align with the latest MMUCC.

Petitioned Action 4: *Provide annual training and information to State FARS analysts* and S*tate and local police departments on how to identify and record underride crashes*

This petitioned action would train the FARS analysts during the annual system-wide FARS meeting and reinforce uniform data coding procedures and practices for rear underride, side underride, and front override information. In this annual FARS meeting, NHTSA could provide information such as a PowerPoint presentation or a training video for the States to share with state and local police departments on how to identify and record underride/override crashes (e.g., see GAO 2019). Additionally, during each State's annual FARS Cooperative Agreement coordination meetings, NHTSA could train state and local police departments on how to identify and record underride and override crashes (e.g., an e-learning underride training module).

The USDOT and NHTSA can complete the petitioned actions quickly without time-consuming rulemaking and should do so promptly. For the reasons discussed above, I urge the USDOT and NHTSA to grant this petition. Thank you for your prompt attention to this petition.

Sincerely,

Eric Hein

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Literature Cited

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Appendix 1
(NCSA 2023, replace page 142)

V31 Vehicle Underride/Override

Definition: This data element identifies whether this vehicle experienced an underride or override with another vehicle during the crash. An underride refers to a crash in which any portion of a passenger vehicle slides under the body of a larger truck or trailer. An override refers to this motor vehicle riding up over another motor vehicle. Either can occur with a parked motor vehicle.

- **Rear underride –** when the crash impact between a passenger vehicle and truck/trailer occurs at the rear and slides under the truck/trailer.

- **Side underride –** when the crash impact between a passenger vehicle and truck/trailer occurs on the side and slides under the truck/trailer.

- **Front override –** when a truck collides with a vehicle in front of it and rides over that vehicle.

Additional Information: This data element also appears in the Parkwork data file as PUNDEROVERRIDE.

Note the striking vehicle, not the vehicle struck, determines the underride/override condition. Law enforcement should use any available mechanism in their reporting systems to carefully describe the relative location of the striking vehicle with respect to the struck vehicle and to accurately report rear or side underride crash data in individual crash reports, whether or not underride crash data fields are included in the crash form or in the event that officers use diagrams and narrative information.

SAS Name: UNDEROVERRIDE

Attribute Codes

2022-Later

0 No Underride or Override
1 Rear Underride (Compartment Intrusion)
2 Rear Underride (No Compartment Intrusion)
3 Rear Underride (Compartment Intrusion Unknown)
4 Side Underride (Compartment Intrusion)
5 Side Underride (No Compartment Intrusion)
6 Side Underride (Compartment Intrusion Unknown)
7 Front Override
8 Not Applicable
9 Not Reported
10 Reported as Unknown

Appendix 2
(NCSA 2023, replace page 345)

V31 Vehicle Underride/Override

Definition: This element indicates whether this vehicle experienced an underride or override with another vehicle during the crash. An underride refers to a crash in which any portion of a passenger vehicle slides under the body of a larger truck or trailer. An override refers to this motor vehicle riding up over another motor vehicle. Either can occur with a parked motor vehicle.

- **Rear underride –** when the crash impact between a passenger vehicle and truck/trailer occurs at the rear and slides under the truck/trailer.

- **Side underride –** when the crash impact between a passenger vehicle and truck/trailer occurs on the side and slides under the truck/trailer.

- **Front override –** when a truck collides with a vehicle in front of it and rides over that vehicle.

Additional Information:

SAS Name: PUNDEROVERRIDE

Attribute Codes

2022-Later

0 No Underride or Override
1 Rear Underride (Compartment Intrusion)
2 Rear Underride (No Compartment Intrusion)
3 Rear Underride (Compartment Intrusion Unknown)
4 Side Underride (Compartment Intrusion)
5 Side Underride (No Compartment Intrusion)
6 Side Underride (Compartment Intrusion Unknown)
7 Front Override
8 Not Applicable
9 Not Reported
10 Reported as Unknown

Appendix 3
(NHTSA 2023, replace pages 356-357)

Vehicle Underride/Override **V31**

V31 – *Vehicle* Underride/Override

FORMAT: *1 numeric*
SAS NAME: *Vehicle.UNDEROVERRIDE, Parkwork.PUNDEROVERRIDE*
ELEMENT VALUES:

Codes	*Attributes*
0	*No Underride or Override Noted*
1	*Rear Underride a Motor Vehicle In-Transport (Compartment Intrusion)*
2	*Rear Underride a Motor Vehicle In-Transport (No Compartment Intrusion)*
3	*Rear Underride a Motor Vehicle In-Transport (Compartment Intrusion Unknown)*
4	*Side Underride a Motor Vehicle In-Transport (Compartment Intrusion)*
5	*Side Underride a Motor Vehicle In-Transport (No Compartment Intrusion)*
6	*Side Underride a Motor Vehicle In-Transport (Compartment Intrusion Unknown)*
7	*Front Override*
8	*Not Applicable*
9	*Not Reported*
10	*Reported as Unknown*

Definition: This element indicates whether this vehicle experienced an underride or override with another vehicle during the crash.

An underride refers to a crash in which any portion of a passenger vehicle slides under the body of a larger truck or trailer. An override refers to this motor vehicle riding up over another motor vehicle. Either can occur with a parked motor vehicle.

- ***Rear underride – when the crash impact between a passenger vehicle and truck/trailer occurs at the rear and slides under the truck/trailer.***

- ***Side underride – when the crash impact between a passenger vehicle and truck/trailer occurs on the side and slides under the truck/trailer.***

- ***Front override – when a truck collides with a vehicle in front of it and rides over that vehicle.***

Vehicle Underride/Override V31

Rationale: Needed to identify crashes in which an underride or override occurs to support NHTSA rulemaking activities.

Remarks: When coding this element, try to assess the outcome for each vehicle in a vehicle-to-vehicle collision—if this vehicle slid under the body of a larger truck or trailer during the events of the crash, then this vehicle is coded as UNDERRIDE while the other vehicle is coded as OVERRIDE.

In vehicle-to-vehicle collisions, a vehicle is either overriding another vehicle while the other vehicle is underriding, or a vehicle is neither overriding nor underriding, or the vehicle-to-vehicle collision is not applicable because it involves a motorcycle, ATV/ATC, or snowmobile.

Law enforcement should use any available mechanism in their reporting systems to carefully describe the relative location of the striking vehicle with respect to the struck vehicle and to accurately report rear or side underride crash data in individual crash reports, whether or not underride crash data fields are included in the crash form or in the event that officers use diagrams and narrative information.

HIERARCHY FOR VEHICLES WITH MULTIPLE COLLISIONS WITH OTHER MOTOR VEHICLES:
If this vehicle is involved in more than one collision with another vehicle, then code underride/override based on the following priority:

1. ***Events involving an underride and override.***
2. ***Events where underride/override are Reported as Unknown.***
3. ***Events where underride/override are Not Reported.***
4. ***Events where it can be determined that No underride or override apply.***
5. ***Events for which underride/override are Not Applicable.***

0 (No Underride or Override) is used when it can be determined from the case material that neither underride nor override occurred for this vehicle.

1-3 (Rear Underride) is used when this vehicle traveled or was pushed under the rear of another vehicle (including a parked vehicle) during the crash. These codes are also used for this vehicle when another passes over it.

4-6 (Side Underride) is used when the crash impact between a passenger vehicle and truck/trailer occurs on the side and slides under the truck/trailer.

The classic example is an automobile striking the rear end or side of a tractor-trailer and coming to a stop under back or side of the trailer. In these examples, the automobile is the underriding vehicle, and the tractor-trailer is overriding. Indications that an underride occurred can include crash descriptions in the narrative. Example statements may include

Vehicle Underride/Override V31

descriptions such as "passed under," "struck and wedged beneath/under," "struck and went/slid under," "slid below/under after impact," etc.

Underride events can occur at any plane of contact and at any angle. It is possible in an underride of a trailer for a vehicle to pass under the trailer and emerge from the other side.

7 (Override) is used when this vehicle rode up over another vehicle (including a parked vehicle) during the crash. This code is also used for this vehicle when another vehicle passed under it. The classic example is a truck striking the front end or rear end of an automobile and coming to a stop on top of it. In this example, the truck is the overriding vehicle, and the automobile is the underriding vehicle. Indications that an override occurred can include crash descriptions in the narrative. Example statements may include descriptions such as "drove up on to," "struck and traveled over," "struck and went/slid over," "ended up on top," etc.

8 (Not Applicable) is populated by the data entry system for single vehicle crashes (i.e., underride or override events require two vehicles), for any vehicle in a multi-vehicle crash that has no vehicle-to-vehicle collision events (e.g., 12, 14, 45, or 55), and for all vehicle-to-vehicle collisions involving motor vehicle types for which this data is not collected—specifically, motorcycles, all-terrain cycles, and snowmobiles, but excluding "autocycles."

9 (Not Reported) If a State's crash report manual instructs to leave blank data blocks that are not applicable, then a blank in those data blocks is NOT considered "Not Reported."

Code 9 (Not Reported) in these two situations:

1. ***No field or coding block exists on the State's crash report to provide the information to code this element, AND no other information is available to code the element (e.g., narrative, diagram, case material); or***
2. ***A field or coding block exists on the State's crash report that would provide the information needed to code this element, but it has been left blank, AND no other information is available to code the element (e.g., narrative, diagram, case material).***

10 (Reported as Unknown) is used when the case material reports that it is unknown if an underride or override occurred AND no other information is available to code the element.

We distinguish between those underriding vehicles with compartment intrusion versus those with no compartment intrusion.

- ***Compartment intrusion indicates a breach of the passenger compartment of this underriding (striking) vehicle. For example, damage to the windshield or glass area.***

Vehicle Underride/Override **V31**

- ***No compartment intrusion means that the underridden vehicle (struck vehicle) did not directly enter the passenger compartment of this vehicle (for example, damage to the hood or front bumper).***

Compartment Intrusion Guidelines:

Compartment Intrusion Codes "1" or "4" are used when the police crash report indicates that the passenger compartment of the underriding vehicle has been damaged. Sources of this information can be the police crash report narrative and/or the vehicle damage scale. If the top of the vehicle is damaged, as noted by the vehicle damage scale, codes "1" or "4" would apply.

No Compartment Intrusion Codes "2" or "5" are used when a portion of the vehicle is under another and it is known that there is no passenger compartment intrusion.

Compartment Intrusion Unknown Codes "3" or "6" are used when it is unknown if there is passenger compartment intrusion.

Appendix 4
(NHTSA 2023a, replace page 139)

V42. Underride / Override

V42. Vehicle Underride / Override

Element Definition:

An underride refers to a crash in which any portion of a passenger vehicle slides under the body of a larger truck or trailer. An override refers to this motor vehicle riding up over another motor vehicle. Either can occur with a parked motor vehicle.

Attribute Values:

Select 1

- Not Applicable
- No Underride or Override
- Rear Underride
- Side Underride
- Front Override
- Unknown

Remarks:

Complete this element for all motor vehicles. The information it provides can be important in helping NHTSA and FMCSA make decisions on regulatory strategies for different types of underride/override crashes.

- **Rear underride –** when the crash impact between a passenger vehicle and truck/trailer occurs at the rear and slides under the truck/trailer.

- **Side underride –** when the crash impact between a passenger vehicle and truck/trailer occurs on the side and slides under the truck/trailer.

- **Front override –** when a truck collides with a vehicle in front of it and rides over that vehicle.

Highway Safety Rationale:

This element is important to evaluate countermeasure effectiveness, tracking crash outcomes, and to support NHTSA and FMCSA rulemaking activities.

Implementation Suggestions:

- Law enforcement should use any available mechanism in their reporting systems to carefully describe the relative location of the striking vehicle with respect to the struck vehicle and to accurately report rear or side underride crash data in individual crash reports, whether or not underride crash data fields are included in the crash form or in the event that officers use diagrams and narrative information.

Validation Rules:

- None

Alignment Rules for VEHICLE UNDERRIDE/OVERRIDE:

- None

Appendix 5
(NHTSA 2023a, replace term on page 259)

Glossary of Terms

Glossary of Terms

VEHICLE UNDERRIDE/OVERRIDE - An underride refers to a crash in which any portion of a passenger vehicle slides under the rear or side body of a larger truck or trailer. A front override refers to this motor vehicle riding up over another motor vehicle. Either can occur with a parked vehicle.

H. Membership of the ACUP

Section 23011(d)(2)(B) required that DOT choose two representatives from each of the following categories of stakeholders to comprise the ACUP's membership. Several slots remained vacant.

Stakeholder per Section 23011(d)(2)(B)	Representative member of ACUP
Truck and trailer manufacturers	Jeff Bennett, Utility Trailer; Kristen Glazner, Wabash National Corp.
Motor carriers, including independent owner-operators	Doug Smith, OOIDA; Dan Horvath, American Trucking Associations
Law enforcement	Thomas Mrozinski, Frisco Police Department, Frisco TX - Traffic Unit; *vacant*
Motor vehicle engineers	John Freiler, Truck Trailer Manufacturers Association; Jeff Zawacki, Hendrickson International
Motor vehicle crash investigators	Lee Jackson, Traffic Crash Reconstruction; Aaron Kiefer Collision Safety Consultants PLLC
Truck safety organizations	Jennifer Tierney, Truck Safety Coalition; Harry Adler, Institute for Safer Trucking
Insurance industry	Claire Mules, Assurance Resources Inc.; Matthew Brumbelow, Insurance Institute for Highway Safety
Emergency medical service providers	Melinda Carter, Virginia Department of Health; Dr. Theodore Richard Delbridge, Maryland Institute for Emergency Medical Services Systems
Families of underride crash victims	Marianne Karth; Jane Mathis
Labor organizations	Daniel McKisson, ILWU; *vacant*

I. Meeting Dates & Minutes

The ACUP met six times on the following dates: May 25, 2023, November 15, 2023, February 8, 2024, March 13, 2024, April 24, 2024, May 22, 2024. Meeting minutes are attached.

05.25.2023 Meeting Minutes

Time and Location

The meeting was held May 25, 2023, at 12:30 – 4:30 p.m. ET. It was a virtual meeting conducted via Zoom for Government webinar.

Participants

National Highway Traffic Safety Administration (NHTSA)

Ann Carlson, *Chief Counsel*
Shonda Humphrey, *Attorney*
James Myers, *Designated Federal Officer*
Lina Valivullah, *Alternate Designated Federal Officer*
Kai Bean-Pittman, *Administrative Support*

Committee Members

Daniel McKisson, *Labor Organizations*
Jane Mathis, *Families of Underride Crash Victims*
Marianne Karth, *Families of Underride Crash Victims*
Claire Mules, *Insurance Industry*
Matthew Brumbelow, *Insurance Industry*
Jennifer Tierney, *Truck Safety Organizations*
Harry Adler, *Truck Safety Organizations*
Aaron Kiefer, *Motor Vehicle Crash Investigators*
Lee Jackson, *Motor Vehicle Crash Investigators*
Jeff Zawacki, *Motor Vehicle Engineers*
Jeff Bennett, *Motor Vehicle Engineers*
Adrienne Gildea, *Law Enforcement*
Doug Smith, *Motor Carriers*
Dan Horvath, *Motor Carriers*
Kristin Glazner, *Truck and Trailer Manufacturers*
John Freiler, *Truck and Trailer Manufacturers*

Welcome & Overview

Designated Federal Officer James Myers welcomed everyone to the meeting. He noted that the meeting was being recorded and that the recording would be made available online.

Opening Remarks by Ann Carlson

Chief Counsel Ann Carlson provided opening remarks on roadway safety and the importance of the Committee. She described the National Roadway Safety Strategy, reviewed the duties of the Committee, and emphasized that NHTSA is seeking all available approaches to mitigate and eliminate underride crashes. She thanked the Committee members, especially family members of underride crash victims, for serving on the Committee.

Agenda Overview

James Myers provided an overview of the meeting agenda and introduced others assisting with the Committee. He noted that NHTSA is still seeking category representatives for the remaining spots on the Committee.

Federal Advisory Committee Act and Ethics Briefing

Shonda Humphrey provided an overview of the Federal Advisory Committee Act. She noted that Committee members are to avoid conflicts of interest and misuse of position, or the appearance thereof, and are subject to the ACUP Code of Conduct. Committee members were provided the opportunity to ask questions following the presentation; there were none.

Committee Member Self-Introductions

James Myers facilitated introductions of the Committee members in the order listed above. Each member introduced themselves, their background and experience, and the viewpoints they bring to the Committee. Any members interested in serving as the Committee Chair were also able to state their interest. Some members suggested that the Committee Chair should be as neutral as possible.

Robert's Rules

James Myers provided more information on how the Committee will operate, including the use of a reduced set of Robert's Rules of Order. He noted that the quorum for the Committee is 75 percent of the current Committee members must be present to conduct meetings rather than a simple majority. Future meetings will follow the general format outlined by Robert's Rules.

Election of Chair

Five members were interested in serving as Chair. Committee members agreed to elect the Chair using two rounds of voting, an initial round and a "run off" round. In response to a question, James Myers noted that a NHTSA representative cannot be the Committee Chair.
Voting was held using online polls. The candidates and the number of votes they received are listed below. Adrienne Gildea was elected as Committee Chair with a majority of votes.

Round One

Claire Mules 1
Harry Adler 1
Lee Jackson 6
Jeff Bennett 1
Adrienne Gildea 7

Round Two

Lee Jackson 7
Adrienne Gildea 9

Suggestions for Future Meetings

Committee members provided suggestions for future meetings and topics they would like to discuss.
Jane Mathis – Suggested in-person committee meetings.
Marianne Karth – Suggested committee submit a request for information from NHTSA, get briefings from technical experts on underride studies, not have all committee meetings in-person so the meetings can occur more frequently, have committee witness crash tests, and have working groups to review information provided to the Committee by NHTSA.
Jennifer Tierney – Also requested discussing information from NHTSA and to have in-person meetings.
Kristin Glazner – Suggested additional information on April 2023 NHTSA documents would be beneficial, recommended a technical briefing on advanced driver assistance systems.
Matthew Brumbelow – Discuss Side underride Guard ANPRM Cost Benefit Analysis.

Claire Mules – Go to conferences and shows to disseminate information on underride.
Adrienne Gildea – Discuss ground rules, code of conduct, how the committee will operate.
Harry Adler – Quantify if discussions are specific to one type of underride protection.
Jennifer Tierney – Review conspicuity (visibility) and anything else that may help solve underride.
John Freiler – Determine what can be done to improve underride data collected.
Dan Horvath – Review comments submitted to side underride ANPRM.
Marianne Karth – Discuss whether to have a working group on alternatives to guards for underride protection.
Doug Smith – Mentioned potential increase in speed differential between semitrucks with trailers and other vehicles due to speed limiters. Also asked if committee could visit a railroad grade crossing with low clearance.
Adrienne Gildea – Put all topics on the table and then add timeline and prioritize, process on how to discuss, then work through all the committee wants to discuss.
Dan McKisson – Follow up to Mr. Smith's comments about railroad crossings, getting stuck on sharp up/down grades, determine if there is a database drivers can use to know when they are approaching a low railroad grade crossing.
Doug Smith – Noted that some crossings are marked and others are not. Drivers need to see the hazard and react appropriately.
Marianne Karth – Stated she has a PowerPoint about problematic railroad grade crossings and that there is a Federal Railroad Administration database on railroad crossings.
Harry Adler – There is a need for better data. Compare states with a field for underride vs. those states without. Look at what other types of accidents are preventable or mitigated by guards.
Jeff Bennett – Mentioned ground level docks also create clearance issues, there are a lot of driveways and angles ramps, consider improving education and crash avoidance.
Harry Adler – Recommended that the Committee consider other vulnerable road users.

Closing

James Myers closed the meeting by thanking participants and reviewed contact information (XXX@dot.gov). The DFO and Chair will determine the agenda for the next meeting. Once a meeting date and talking points are approved, a date will be made public. Committee information will be submitted to the FACA Database for public access.

11.15.2023 Meeting Minutes

NHTSA did not make minutes available from this meeting to the ACUP.

02.08.2024 Meeting Minutes

Time and Location

The meeting was held February 8, 2024, from 12:30 to 4:30 p.m. ET. It was a virtual meeting conducted via Zoom for Government webinar.

Participants

National Highway Traffic Safety Administration (NHTSA)
James Myers, *Designated Federal Officer*

Lina Valivullah

Committee Members

Aaron Kiefer, *Motor Vehicle Crash Investigators*

Claire Mules, *Insurance Industry*

Dan Horvath, *Motor Carriers*

Doug Smith, *Motor Carriers*

Harry Adler, *Truck Safety Organizations*

Jeff Bennett, *Motor Vehicle Engineers*

Jeff Zawacki, *Motor Vehicle Engineers*

Jennifer Tierney, *Truck Safety Organizations*

John Freiler, *Truck and Trailer Manufacturers*

Kristin Glazner, *Truck and Trailer Manufacturers*

Lee Jackson, *Motor Vehicle Crash Investigators*

Marianne Karth, *Families of Underride Crash Victims*

Matthew Brumbelow, *Insurance Industry*

Mindy Carter, *Emergency Medical Service Providers*

Ted Delbridge, *Emergency Medical Service Providers*

Thomas Mrozinski, Jr., *Law Enforcement*

Invited Presenters

Malcolm Deighton

Wolfgang Hahn

Welcome and Call to Order

James Myers, Designated Federal Officer, welcomed everyone to the meeting.

The meeting began with roll call to verify the presence of a quorum. Sixteen members were present. Labor Organizations representative Daniel McKisson and Families of Underride Crash Victims representative Jane Mathis were unable to attend the meeting.

James Myers asked if there were any amendments or objections to the meeting minutes from the second meeting; there were none.

Since the previous Chairperson resigned from the Committee before the meeting, the Committee elected a new Chair. Two members were nominated and willing to serve. Lee Jackson won the election with 9 votes while Jeff Bennett received 5 votes.

The next point of discussion was the definition of a consensus, which was not defined in the establishment of the Committee. Some members expressed a preference for a simple majority of 51 percent, while others believed it should be 75 percent to better represent the full Committee. Jennifer Tierney made a motion for consensus to be 51 percent and Dan Horvath made a motion for 75 percent. The committee voted on the first motion, which passed with 9 votes, setting consensus as 51 percent and rendering the second motion moot.

Overview of Rulemaking Process

Lina Valivullah of NHTSA presented an overview of the rulemaking process, including the agency's rulemaking authority, governing acts and executive orders, and specific requirements for Federal Motor Vehicle Safety Standards. She described the steps of the rulemaking process and provided an example of a rulemaking as well as a link to a federal website[36] with additional information on government regulations and the rulemaking process. There were a few questions from Committee members regarding public petitions and how the Committee can best support its recommendations.

Presentations

The focus for the meeting was rear underride crashes, including prevention and mitigation technologies and relevant recommendations.

Jeff Bennett began with a presentation on rear impact guard history and Utility Trailer's guards. He showed pictures of Utility equipment, including a guard with an increased 7-inch cross-section that received the TOUGHGUARD award. He stated that such guards can have unintended consequences whereby the passenger car striking the end of the guard spins out into the adjacent travel lane and causes a secondary crash. Harry Adler asked if unintended consequences of secondary crashes have been an issue and stated that crashes between two passenger vehicles are more survivable than underrides.

Matthew Brumbelow presented information on the incidence of rear impact fatalities and undercounting of underride in crash databases. He presented an overview of the Insurance Institute for Highway Safety (IIHS) TOUGHGUARD testing and noted that 9 manufacturers have guards that pass the IIHS tests. He criticized the estimations that NHTSA used to support rulemaking actions and suggested upgrading requirements for semitrailers and single unit trucks. There was additional discussion on whether secondary crashes are a concern and agreement that underreporting of underride in FARS should be addressed.

Malcolm Deighton of Hydro Extrusion presented his work on Sapa's aluminum rear impact guard designs. Sapa was manufacturing energy absorbing crash alloys that they used to create rear impact guards with similar weight and greater strength than a typical steel guard. He stated that Sapa performed successful crash tests of their guards up to 40 mph and that NHTSA conducted quasi-static testing of the guards in 2018 with the guard strength exceeding the load capabilities of the test equipment. He acknowledged that trailer integration is also a significant factor in real world performance of rear impact guards. Jeff Bennett commented that Utility uses crash alloys for other parts of their trailers but that the guards would have to be notched to fit dock locks.

Wolfgang Hahn of ZF Commercial Vehicle Solutions presented on collision avoidance and mitigation systems. He discussed crash configurations using data from FARS and stated that many fatalities occur at high speeds with vehicles in the same travel lane. He stated that technologies such as automatic emergency braking (AEB) can prevent collisions and reduce contact speeds, reducing injury severity and preventing fatalities. There was some discussion of AEB as a crash mitigation technology on heavy trucks and on passenger vehicles.

[36] https://www.reginfo.gov/public/reginfo/Regmap/index.myjsp

Jennifer Tierney showed pictures of underride crash victims, referenced the Committee's purpose, and asked that Committee members act in good faith. Lee Jackson presented a list of recommendations to consider, including NHTSA issuing additional requirements for rear guards, AEB, and conspicuity tape, and conducting additional research. Kristin Glazner noted that data is important for rulemaking and agreed that the Committee should discuss research recommendations. Some Committee members expressed opposing views on AEB requirements. There was also some discussion of how the Committee should operate, including voting on motions in the next meeting and sharing documents online.

Marianne Karth presented pictures of her daughters and the crash scene as well as the FARS report to show that it's not always accurate. She reviewed the history of underride regulations and the recent rulemaking actions. She stated that Stoughton reduced the weight of the trailer to compensate for the increased weight of their rear guard and that NHTSA should have included the Stoughton guard in its rulemaking analysis. She said that two manufacturers with TOUGHGUARD awards do not offer those guards as standard and NHTSA should require TOUGHGUARD-level performance. She also proposed the creation of a working group to develop voluntary consensus standards.

Aaron Kiefer presented information on rear guard force requirements and weights, stating that there is plenty of data available, and likewise noting that the 1970 rear guard proposal had higher outboard strength requirements than the final rule. He stated that modifying rear guard geometry would allow for increased strength with reduced weight and that even his retrofit solutions do not add much weight. There was some discussion regarding guard engineering, survivability of high-speed crashes, and the potential of AEB to mitigate crash severity.

Discussion

After the presentations, the Committee proceeded to general discussion. Marianne Karth made several motions, including requesting establishment of a working subgroup, requesting a closed meeting to review deliberative information, and recommending that NHTSA amend the rear impact guard final rule. Other members of the Committee expressed concerns about subgroups and closed meetings. Lee Jackson suggested holding motions until the next meeting and the Committee agreed, expressing a need for more time to understand the recommendations and relevant information. The Committee discussed how to organize documents and emails. Harry Adler inquired whether the Committee is allowed to use a shared document or drive for its work; NHTSA will verify and respond. Jeff Bennett expressed dissatisfaction with the Committee consensus being a simple majority. Others stated that dissenting opinions can be included in the report to represent additional viewpoints.

Wrap Up

The Committee agreed to communicate proposed motions via email. General discussion continued through the scheduled end time of the meeting, then the Committee adjourned.

03.13.2024 Meeting Minutes

Time and Location

The meeting was held March 13, 2024, from 12:30 to 4:30 p.m. ET. It was a virtual meeting conducted via Zoom for Government webinar. The meeting was recorded.

Participants

National Highway Traffic Safety Administration (NHTSA)

Mr. James Myers, *Designated Federal Officer*

Committee Members

Mr. Aaron Kiefer, *Motor Vehicle Crash Investigators*

Ms. Claire Mules, *Insurance Industry*

Mr. Dan Horvath, *Motor Carriers*

Mr. Dan McKisson, *Labor Organizations*

Mr. Doug Smith, *Motor Carriers*

Mr. Harry Adler, *Truck Safety Organizations*

Ms. Jane Mathis, *Families of Underride Crash Victims*

Mr. Jeff Bennett, *Motor Vehicle Engineers*

Mr. Jeff Zawacki, *Motor Vehicle Engineers*

Ms. Jennifer Tierney, *Truck Safety Organizations*

Mr. John Freiler, *Truck and Trailer Manufacturers*

Ms. Kristin Glazner, *Truck and Trailer Manufacturers*

Mr. Lee Jackson, *Motor Vehicle Crash Investigators*

Ms. Marianne Karth, *Families of Underride Crash Victims*

Mr. Matthew Brumbelow, *Insurance Industry*

Ms. Mindy Carter, *Emergency Medical Service Providers*

Dr. Ted Delbridge, *Emergency Medical Service Providers*

Mr. Thomas Mrozinski, Jr., *Law Enforcement*

Welcome and Call to Order

Mr. Myers welcomed everyone to the meeting. The meeting began with roll call to verify the presence of a quorum. Seventeen members were present at the time. Emergency Medical Service Providers representative Dr. Delbridge joined the meeting after roll call was complete. A few other members excused themselves for some portion of the meeting, but quorum was maintained throughout.

Mr. Myers asked if there were any amendments or objections to the meeting minutes from the third meeting. Mr. Smith said that his statement on FHWA changing the design of Jersey barriers to prevent rebound accidents should be included. Mr. Myers asked Mr. Smith to provide supporting information and noted that the corrected minutes would be resent and posted to the FACA database.

Committee Chair Mr. Jackson provided opening remarks. He cited the Committee's purpose to reduce underride crashes and fatalities and asked for meetings to remain orderly. He referenced the letter submitted by Mr. Eric Hein, encouraged others to talk to Mr. Hein, and asked members to share news of any planned crash tests so others can attend. He said he would support submission of a dissenting report, as suggested. In response to a consensus motion submitted by Mr. Bennett, Mr. Jackson cited Robert's Rules, stating that someone who voted for the previous motion must reconsider. Mr. Jackson invited Committee members to speak with him individually, and Mr. Myers noted that discussions outside of Committee meetings cannot be about Committee matters. Mr. Jackson also thanked Ms.

Karth for her apology and asked members not to take actions that may undermine others' trust. He expressed disappointment in NHTSA's decision not to provide deliberative materials, noted the expiration date of the Committee Charter in June 2024, and said if they are granted an extension, the Committee should be able to complete a report by October.

Mr. Jackson made a motion to amend the Bylaws to require a simple majority of members for quorum instead of 75%, citing the time constraints and saying that the Committee needs to maintain an aggressive meeting schedule. Mr. Adler seconded the motion. Mr. Bennett disagreed, saying that only having fifty percent of members present when deciding motions detracts from the Committee's credibility. Mr. Smith also disagreed with the motion. Mr. Horvath suggested that proxies should be allowed and disagreed with changing quorum. Mr. Adler said that proxies would be a good compromise and asked about amending the Bylaws to allow proxies. Mr. Jackson disagreed with amending the current motion, stating that proxies should be a separate motion. Ms. Tierney said that the Committee needs to act urgently to save lives and should adopt the motion. Mr. Freiler expressed concern over the possibility of motions being passed by only a quarter of all members if quorum is a simple majority. The Committee voted on the motion, which passed with 11 YES votes and 6 NO votes.

There was some discussion about additional motions. Mr. Adler suggested a combined motion to request an extension and allow proxies, but Mr. Jackson said it should be two separate motions. Mr. Myers noted that there is an existing list of motions and Mr. Jackson agreed that new motions should be added at the end.

Motions

The Committee proceeded to discussion and voting on a list of motions compiled after the last meeting as agreed.

Motion I was Mr. Bennett's motion to change consensus to two-thirds. Mr. Jackson reiterated that per Robert's Rules, someone who voted for the original motion would have to reconsider. Mr. Smith said he reconsidered, so the motion will be brought in the next meeting.

Motion II was to recommend that NHTSA conduct comprehensive research on underride crash characteristics, including the frequency of 30 percent overlap crashes. Ms. Tierney said that enough studying has been done and it is time for action. Mr. Freiler said that he is in favor of studies on 30 percent overlap crashes because FARS lacks that information. Ms. Karth said that a 2010 NHTSA study found that severe passenger compartment intrusion is more prevalent in corner impacts than in center impacts. Mr. Bennett asked that the study also include information on car rotation. Ms. Glazner, who brought the motion, referenced NHTSA's previous comment that data is important and stated that new, comprehensive research is needed. Mr. Adler agreed that there is a need for better data on underride crashes and said that there is undercounting of underride. Ms. Karth stated that car rotation does not determine fatalities and asked if the recommendation is for the research to be completed before changing regulations. Ms. Glazner reiterated that NHTSA makes data-based decisions and that the research is necessary for NHTSA to take action. Mr. Freiler asked if this is a motion to include a consensus report recommendation for more data. Ms. Glazner said yes, and that she is calling for an update to the UMTRI data. Mr. Brumbelow said that prior research was not very good but if the recommendation is for photographic-based research, he could support it. Mr. Jackson stated that he is

against the motion because more research is not needed. Mr. Adler asked if this is additional research and Ms. Glazner said yes, this should be a robust update to the old UMTRI data. Mr. Freiler requested amending the motion to say the research should include all available information, including photographs as Mr. Brumbelow mentioned, and that the recommendation will be in the Committee's report. Ms. Glazner seconded the amendment. Mr. Brumbelow also said he's in favor of the motion though NHTSA should have to get photographs. The Committee voted and the motion passed with 13 YES votes and 4 NO votes. Mr. Myers asked to clarify the language of the motion as amended. Ms. Glazner stated that the recommendation in the report will include analysis with photographs, incorporating both Mr. Freiler's and Mr. Brumbelow's comments. Mr. Kiefer noted that Ms. Glazner and Mr. Brumbelow should agree on the verbiage for the final report. Ms. Karth asked what the protocol is for conflicts of interest. Mr. Jackson asked if anyone had a conflict of interest. Mr. Freiler said the Charter requires that they don't vote if they have a conflict of interest. Ms. Karth asked if manufacturers that don't include 'TOUGHGUARD' guards as standard have a conflict of interest. Mr. Jackson stated that everyone has to decide for themselves whether they have a conflict of interest.

Motion III was to conduct an in-person meeting. Mr. Jackson withdrew the motion because it is only feasible if the Committee Charter is extended.

Motion IV was to request an extension and was also brought by Mr. Jackson. Mr. Adler seconded the motion. Mr. Bennett said that they do not need to ask for an extension and should be discussing the actual issues. The Committee voted and the motion passed with 13 YES votes, 4 NO votes, and 1 abstaining. There were a few questions on the timeline with an extension and Mr. Jackson reiterated that he wants to wrap up the report in October.

Motion V, brought by Ms. Karth, was to include a recommendation for the 2022 rear guard rule to be amended to require all new trailers to meet the 'TOUGHGUARD' protocol. Mr. Bennett asked what the test protocol is and whether this was addressed by Motion II; Mr. Jackson said this is different. Mr. Freiler suggested an amendment to say 'or equivalent' rather than specifying a brand name. Ms. Karth said that the test protocol is on the IIHS website, and Mr. Brumbelow said the manufacturers would be assessing the guards themselves but agreed to the amendment. Ms. Glazner said the Committee has not discussed the force and energy requirements in the standard and suggested that Mr. Brumbelow present on the requirements to inform the Committee. Mr. Smith said more data needs to be collected before applying this requirement, and Mr. Bennett agreed. Ms. Karth said that there is plenty of information and the manufacturers have already shown that it can be done. Mr. Adler echoed that this is a concrete recommendation with sufficient supporting information. Ms. Tierney said people are delaying and the Committee should think of their loved ones dying in an underride crash. Mr. Bennett said the design is on their trailers, but the data is necessary. Ms. Mules stated that the motion is too broad to vote on. Mr. Freiler noted that changes to the standards are implemented as a new rulemaking, not an amendment, per the regulatory process. Mr. Kiefer said that IIHS research is comprehensive and is available online. Mr. Horvath said that the GAO already looked into the matter and determined there is a lack of data. The Committee voted and the motion passed with 10 YES votes, 1 NO vote, and 6 abstaining. Ms. Mathis asked if Mr. Myers was recording names with the votes. Mr. Adler noted that the meeting is being recorded and said the proper way to track voting would be to call roll. Mr. Jackson asked Mr. Myers to review the recording to include names with the votes.

Motion VI was to include a recommendation to update FMVSS 223 and 224 within five years in response to technological advancements. The Committee voted and the motion passed with 13 YES votes, 0 NO votes, and 3 abstaining.

Motion VII was to include an assessment of NHTSA's performance as inadequate. Ms. Karth withdrew the motion on the condition that it is discussed with other assessment motions at a later date.

Motion VIII was to request all NHTSA/DOT scoping documents and discussions between NHTSA and Elemance regarding rear impact work from 2018 to 2024. Mr. Bennett said that the Committee won't be able to review all that information. Mr. Adler said this is exactly what the Committee should be reviewing and discussing. Mr. Freiler asked the relevance of discussions with Elemance. Mr. Kiefer, who brought Motions VIII and IX, said he was surprised by what work was done and what can be expected. Motion IX was to request all documents related to DOT testing completed by Karco or other contractors between 2016 and 2024. Mr. Kiefer said he was unaware of data from Karco testing and wanted to know what was scoped and what the findings were. Ms. Tierney agreed that the Committee should obtain and review every piece of information. Mr. Bennett said they need more real-world statistics, not laboratory data; Mr. Kiefer said it's not more data so much as information about what the research was for and what it means. Mr. Myers reminded the Committee that deliberative information will not be provided and that the compliance data is already available. Mr. Adler said that the Committee can still vote to request information and suggested combining Motions VIII and IX into one; Mr. Kiefer agreed. Ms. Karth stated that NHTSA's response to the letter from Professor Oswald was insufficient. As a point of order, Mr. Freiler asked that people keep their cameras on to ensure quorum. Ms. Tierney stated that some people are at home, not in an office, and have to turn their camera off at times. Mr. Myers asked for cameras to be turned on for voting. The Committee voted on the combined Motions VIII and IX, and the motion passed with 12 YES votes, 3 NO votes, and 1 abstaining.

Motion X was for DOT to produce all documents related to rear guard standards between 1970 and 1998. This motion was also brought by Mr. Kiefer and was seconded by Ms. Karth. Mr. Bennett asked if the historical information is necessary, stating that reviewing it again is not the best use of time. Mr. Kiefer stated that it will enable them to understand how the current, insufficient standards came about after the original proposed rule was stronger. Ms. Tierney said that every piece of information should be requested and reviewed, and Mr. Adler agreed. The Committee voted and the motion passed with 10 YES votes, 6 NO votes, and 0 abstaining.

Motion XI was for the Committee to include a recommendation for all trailers manufactured since 1998 to be retrofitted to provide 'TOUGHGUARD' equivalent performance. Mr. Kiefer brought this motion but stated that he would abstain from voting because he sells retrofit products. Mr. Bennett said cost-benefit analysis and rationale is needed and the motion should be amended to say 'mitigate' rather than 'prevent underride.' Mr. Kiefer agreed to amend the motion to refer to mitigation of PCI. Mr. Smith said that 1998 is too long ago as most trailers are only on the road for about 10 years, so it should be since 2014. Mr. Jackson stated that he sees older trailers and suggested removing the date entirely. Mr. Adler said that all trailers should be retrofitted and 1998 is appropriate. There were questions on conflicts of interest, abstaining, and whether hand raise votes would show in the video recording. Some members abstained due to potential conflicts. The Committee voted and Motion XI passed with 8 YES votes, 1 NO vote, and 6 abstaining.

Motion XII was for the Committee to recommend regulating Single Unit Trucks (SUTs) with the same rear impact guard standards as semitrailers. Mr. Bennett asked if there is information on SUTs available to consider. Mr. Jackson said there are underride crashes with SUTs as well. Mr. Smith said there would be a lot of exemptions for special purpose trucks and the motion is too broad. Mr. Adler said the requirements should be broadened to include conspicuity tape as well and it's up to NHTSA to do the rulemaking part. Mr. Brumbelow said they don't know how many underride crashes there are but there are about 150 fatalities in a year involving the rear of SUTs and IIHS has asked for this regulation in the past. Ms. Tierney said this is a necessary recommendation to prevent deaths and injuries. Ms. Mules said this is crossing over to ambulances and delivery trucks. Mr. Adler said the Committee work does include all commercial trucks, not only 18 wheelers. The Committee voted and the motion passed with 9 YES votes, 2 NO votes, and 4 abstaining.

Motion XIII was to recommend that NHTSA require performance standards to withstand 30% overlap crashes at 35 mph as directed by IIJA. There was confusion over the language of this motion. Mr. Bennett asked if this was already required. Ms. Karth stated that it is not already required. Nobody claimed or seconded this motion so it was tabled.

Motion XIV was to recommend NHTSA testing at "highway speeds" up to 65 mph as directed by IIJA. Mr. Kiefer said that it is reasonable and passenger vehicles are safer every year. Mr. Bennett questioned if this is required by IIJA and if it is reasonable. Ms. Karth said it is required by IIJA and is the Elemance research. Mr. Kiefer said this can be simulations and does not need to be live testing. The Committee voted and the motion passed with 9 YES votes, 5 NO votes, and 1 abstaining.

Ms. Tierney realized that Motion XIII was her motion and asked to return to it because lives lost in low overlap crashes are important. Ms. Mathis seconded the motion. Ms. Karth asked if Motion XIII is the same as Motion V. Ms. Tierney noted that she prefers the 30% overlap language, but it is the same, so she withdrew Motion XIII.

Motion XV was for a recommendation for NHTSA to "expeditiously complete" the Heavy Vehicle Automatic Emergency Braking rulemaking. Ms. Tierney said it is her motion and the recommendation is to complete the rulemaking as soon as possible. Ms. Mules asked what the rule says. Mr. Adler stated that the proposed rule has not been published and the motion is asking NHTSA to complete it quickly. Mr. Smith said the technology is not ready yet. Mr. Adler disagreed and said AEB is effective. Mr. Myers clarified that the NPRM has been published but the final rule has not been issued. Mr. Jackson said this motion is essentially to endorse the AEB rule. Ms. Mules asked if this is from the front and if it has to do with rear underride. Mr. Adler said AEB is relevant to preventing underride crashes, and Mr. Jackson and Mr. Freiler agreed. The Committee voted and the motion passed with 15 YES votes, which was all present.

Motion XVI was for a recommendation to conduct a study on the change in survivability rates with AEB on passenger vehicles. Mr. Bennett said it should be for all crashes not just rear underride. Mr. Freiler requested amending the motion to say AEB on all vehicles. Ms. Tierney agreed but asked if that is within Committee scope. Mr. Adler agreed that AEB should be on all vehicles, and noted that they can emphasize the ability of AEB to reduce crash speeds, which was echoed by Ms. Karth. Mr. Freiler stated that the Committee is not limited to suggestions for commercial motor vehicles. Mr. Brumbelow clarified that the motion is research-based and is about studying the changes in survivability. Ms. Tierney agreed. The Committee voted and the motion passed with 15 YES votes, which was all present.

Motion XVII was to recommend stronger conspicuity requirements and replace conspicuity tape every 5 years. Mr. Jackson, who brought the motion, said the tape is never replaced on most trailers but the tape wears over time and loses reflectivity. Ms. Tierney agreed and she has seen trailers with ragged tape. Mr. Bennett said this is already required by DOT. Mr. Jackson said the requirement is only at time of manufacture, not on the vehicle. Mr. Freiler questioned what the inspection requirements are. Mr. Jackson said it only needs to be clean and it doesn't matter if it is worn. Mr. Horvath asked why the suggestion is for a time requirement, not a reflectivity requirement, and Mr. Jackson responded that the reflectivity meters are very expensive. Mr. Horvath asked if there is data on the tape lifespan. Mr. Jackson said with a 5 year requirement, they would only need to replace the tape once in a 10 year lifespan. Mr. Bennett agreed that conspicuity is important and pointed out that this would fall under FMCSA's authority, so the motion was amended to say FMCSA rather than NHTSA. Mr. Kiefer agreed that there should be a 5 year maintenance requirement. Mr. Smith said that all tape is not the same quality and the manufacturing timestamp doesn't say when it was applied. Ms. Glazner also expressed support for conspicuity tape. Mr. Zawacki suggested that the requirement should be for performance or age. Ms. Tierney said a simple 5 years is best. Mr. Freiler said the 5 year rule will encourage cheap tape and the requirement should be for measured reflectivity. Mr. Horvath pointed out that lighting solutions are often better than conspicuity tape. Mr. Jackson said that will be discussed with a later motion. The Committee voted and the motion passed with 11 YES votes, 4 NO votes, and 1 abstaining.

Motion XVIII was to recommend a requirement for SUTs to meet conspicuity requirements and rear impact guard requirements as well. Mr. Adler stated strong support and said it is cost beneficial and recommended by the NTSB. Mr. Bennett asked about the cost-benefit analysis. Mr. Adler said his organization did the analysis based on the withdrawn ANPRM. Mr. Bennett said NHTSA should finish its work but the Committee needs the facts. Ms. Mules asked if they're discussing tape or rear impact guards and suggested splitting the motion. Mr. Adler was referring to the cost of tape. Ms. Tierney said this is her motion and that the Committee should focus on saving lives and does not need to consider cost. Ms. Mules said it is relevant and needs to be considered. Mr. Jackson noted that the Committee already voted on rear guards for SUTs and suggested amending the motion to only pertain to conspicuity. The Committee voted on the amended motion and it passed with 15 YES votes, 0 NO votes, and 1 abstaining.

Motion XIX was to recommend research on enhanced rear signaling systems for better visibility. Mr. Bennett stated that NHTSA does not allow installation of an existing flashing brake light product. Mr. Jackson said the motion is to conduct research on how to enhance lighting. Mr. Horvath agreed with research but said the existing requirements prohibit this technology. Mr. Jackson said human factors is complex and there will need to be a lot of research. Mr. Adler said there is an existing exemption for the product mentioned and they should have some information available. Mr. Freiler said that DOT does have research on these factors but there is disagreement within DOT. Mr. Jackson agreed to amend the motion to say 'DOT' rather than 'NHTSA.' The Committee voted and the motion passed with 16 YES votes (all present).

Motion XX was to recommend research into high visibility clearance lamps for all commercial motor vehicles. Mr. Jackson said the current lights are too small. Ms. Tierney agreed that enhancing visibility is important. Mr. Freiler said that they are ID lamps, not clearance lamps, and suggested amending the motion. Mr. Jackson agreed to amend the motion to 'ID lamps' and also to make the recommendation to DOT as a whole. Mr. Smith suggested that the ID lamps may confuse people. Mr. Jackson responded

that the recommendation is for research to see what works the best. The Committee voted on the motion and it passed with 14 YES votes, 1 NO vote, and 1 abstaining.

Motion XXI was to recommend research into efficacious methods of reducing distracted driving. Mr. Freiler suggested minor amendments to the wording and Mr. Jackson agreed. Mr. Bennett suggested saying 'such as flashing lamps,' and Ms. Tierney, who brought the motion, agreed to the amendment. The Committee voted and the motion passed with 16 YES votes (all present).

Motion XXII was to recommend working with State law enforcement and other stakeholders to issue rear impact guard citations and encourage maximum fines for all violations. Ms. Tierney brought the motion. Mr. Bennett said enforcement of existing law is not the Committee's purpose. Mr. Adler stated support but suggested amending the motion to include education of law enforcement on underride, and Ms. Tierney agreed to the amendment. Mr. Freiler said the label requirement should be excluded because it doesn't affect the guard performance, but he is otherwise in support. Mr. Horvath agreed. Ms. Tierney asked for Mr. Jackson's input, and he suggested a slight amendment. Mr. Bennett said there are other nitpicky requirements in addition to the label. Ms. Tierney agreed to amending the motion to say 'violations affecting safety' rather than 'all violations.' The Committee voted and the motion passed with 14 YES votes, 1 NO vote, and no abstentions.

Motion XXIII was for NHTSA to provide a writer. Ms. Tierney withdrew this motion.

Motion XXIV was to include a history of underride crashes in the report to Congress. Mr. Bennett said other items should be prioritized. Mr. Horvath stated that if a history is submitted, it should be comprehensive, and that work may bog down the group. Ms. Tierney disagreed. Ms. Karth suggested prioritizing the report recommendations. Mr. Freiler said an entire history is excessive with the limited time of the Committee. The Committee voted and the motion passed with 7 YES votes, 4 NO votes, and 4 abstaining.

Motion XXV was a duplicate of Motion IV.

The last motion was for a minority report to accompany the Committee report. The Committee voted without additional discussion due to the time constraint and the motion passed with 15 YES votes (all present).

Mr. Adler requested to vote on the motion for proxies but there was not enough time. Ms. Karth asked if the agenda will continue in the next meeting and Mr. Myers confirmed.

Wrap Up

Discussion and voting for the motions continued through the end of the meeting. The scheduled presentations and discussion on topics relating to side underride crashes were postponed to a later meeting.

04.24.2024 Meeting Minutes

Time and Location

The meeting was held April 24, 2024, from 12:30 to 4:30 p.m. ET. It was a virtual meeting conducted via Zoom for Government webinar. The meeting was recorded.

Participants

National Highway Traffic Safety Administration (NHTSA)

Mr. James Myers, *Designated Federal Officer*

Committee Members

Mr. Aaron Kiefer, *Motor Vehicle Crash Investigators*

Ms. Claire Mules, *Insurance Industry*

Mr. Dan Horvath, *Motor Carriers*

Mr. Dan McKisson, *Labor Organizations*

Mr. Doug Smith, *Motor Carriers*

Mr. Harry Adler, *Truck Safety Organizations*

Ms. Jane Mathis, *Families of Underride Crash Victims*

Mr. Jeff Bennett, *Motor Vehicle Engineers*

Mr. Jeff Zawacki, *Motor Vehicle Engineers*

Ms. Jennifer Tierney, *Truck Safety Organizations*

Mr. John Freiler, *Truck and Trailer Manufacturers*

Ms. Kristin Glazner, *Truck and Trailer Manufacturers*

Mr. Lee Jackson, *Motor Vehicle Crash Investigators*

Ms. Marianne Karth, *Families of Underride Crash Victims*

Mr. Matthew Brumbelow, *Insurance Industry*

Ms. Mindy Carter, *Emergency Medical Service Providers*

Dr. Ted Delbridge, *Emergency Medical Service Providers*

Mr. Thomas Mrozinski, Jr., *Law Enforcement*

Invited Speakers

Mr. Eric Hein, *bereaved father of Riley Hein*

Mr. Keith Friedman, *Friedman Research Corporation*

Mr. Dennis Lombardi, *Institute of International Container Lessors (IICL)*

Welcome and Call to Order

Mr. Myers opened the meeting with roll call and confirmed the presence of a quorum. Sixteen members were present at the time; Dr. Delbridge and Ms. Mules joined later.

Mr. Jackson, Committee Chair, thanked everyone for joining and verified that there were no objections to the March meeting minutes. Mr. Jackson revisited the March 13 discussion on conspicuity tape and his recommendation for a requirement to replace the tape every 5 years. He was unaware that conspicuity tape is required to meet the reflectivity standard while in use but still supports a 5-year replacement requirement. He reiterated that reflectivity meters are expensive so very few inspectors have them. Mr. Freiler said that enforcement of the existing requirement may need to be addressed but

adding a requirement to replace the tape every 5 years will result in people installing lower quality tape. Mr. Smith stated that the tape is very difficult to remove for replacement. Mr. Jackson suggested placing the new tape on top of the old tape. Mr. Smith responded that the tape needs to be applied to a good surface. Mr. Jackson also stated that increased knowledge of the existing requirements will result in significant changes to enforcement.

Mr. Jackson proceeded to discussion of the Committee report(s). He said that he will produce the majority report and others can send him text to include. Ms. Glazner inquired whether it will be one or two reports and Mr. Jackson clarified that it will be one report containing both positions. Mr. Myers encouraged the Committee to address disagreements in the report. Mr. Jackson asked about the deadline and Mr. Myers suggested delivering the report by June 28. Mr. Adler asked how the report might be formatted. Mr. Jackson suggested that the report would be in two sections, one for the majority opinion and one for the minority opinion. Mr. Freiler asked about circulating the drafts and Mr. Jackson noted that the Committee may not have time to discuss them because there is no meeting scheduled for June. Mr. Bennett suggested appointing a timekeeper for the current meeting, so Mr. Jackson asked Mr. Bennett to fill that role.

Presentations

The first presentation was by Mr. Eric Hein, the bereaved father of 16-year-old Riley Hein who died in a side underride crash in 2015. Mr. Hein presented side underride data and analyses that he previously submitted to NHTSA. He used NHTSA's FIRST online tool to query FARS data for side underride crashes from 2007 to 2020. Including undercount correction factors and vulnerable road user fatalities, he estimated the annual baseline cost of side underride serious injuries and fatalities to be $4.0 to $5.9 billion. He noted that NHTSA used 2013 estimates for the number of trailers instead of more recent data from manufacturers. He also said that Wabash estimated a cost of $896 for a side underride guard in 2018, which is $1,084 adjusted for 2023, while NHTSA used an estimated AngelWing cost of $2,990 but stated there would be reduced costs due to economies of scale and competition. He estimated an annual benefit of side underride guards for semitrailers of $540 million to $1.4 billion. He also stated that fuel savings from the addition of aerodynamic skirts to side guards would increase the benefits. His recommendation to ACUP was to question the accuracy of NHTSA's cost benefit analysis, stating that the agency ignored the 2022 survey data, inflated the number of semitrailers, ignored benefits to vulnerable road users, and truncated benefits, leading to erroneous conclusions. He concluded that the benefits of side underride guards outweigh the costs.

Mr. Bennett commented that many groups have tested side guards and that existing guards have only been shown to work in specific crash scenarios. Mr. Hein said the effectiveness numbers are not his own conclusions and that he obtained them from research reports by NHTSA and others, which said that side guards are effective up to 50 mph. Mr. Kiefer said he has successfully tested his guard toward the rear of the trailer at 35 mph. Mr. Bennett responded that the AngelWing sheared off in a 45-degree crash test and Mr. Kiefer said it was a partial shear of an old trailer and the guard provided mitigation. Mr. Kiefer said it's possible to create crash compatibility, and Mr. Bennett agreed, but said that such side guards are not currently available. Mr. Kiefer said his guard is for sale, with two of them in use, but it is not well understood by industry. Mr. Bennett said he will buy one. Mr. Freiler asked if Mr. Hein's comments have been submitted to the docket because it is still an open rulemaking, and Mr. Hein said that they have been submitted but he has not heard a response. Mr. Hein wanted to demonstrate that NHTSA did not use the best available information for the ANPRM.

The second presentation, by Ms. Karth, was on missed opportunities to prevent side underride fatalities. She showed pictures of her daughters and others who died in rear and side crashes with trucks. She stated that NTSB issued recommendations to NHTSA in 2014 for side underride protection and commented on the 2023 ANPRM expressing concern about underestimated benefits. She also said that TTMA drafted side impact guard practices, though Mr. Freiler of TTMA stated that no such document was developed. Ms. Karth stated that the ANPRM was wrong and should be withdrawn. She said NHTSA should complete a new side impact guard analysis and rulemaking that includes vulnerable road users. Ms. Karth showed a video from Lois Durso, whose daughter Roya died in a side underride crash, and another video from a 2024 side underride crash that was similar but without a fatality. Ms. Tierney commented that the committee's purpose is to make safety recommendations to reduce underride crashes and fatalities and it is a waste of time to nitpick different situations. Ms. Karth also showed a crash test video of Mr. Kiefer's guard. Mr. Smith asked how long it takes to disassemble the guard to change a tire and noted that a blown tire could tear the webbing off. Mr. Kiefer said it has two winch ratchets and a clamping plate, and it will probably take 2-5 minutes, or 10 minutes for a total replacement of the webbing. Mr. Jackson asked Mr. Smith if he was saying 10 minutes wasn't worth saving lives, and Mr. Smith responded that it is more time sitting on the side of the road where accidents tend to occur.

The third scheduled presenter was Mohammad Atarod, on the subject of injuries in underride crashes, but he was not in attendance.

Moving to the topic of front underride/override, Mr. Jackson encouraged the Committee to review the email from Ex-Guard with videos of their truck guards.

Ms. Karth then presented on front underride. She noted that there are international requirements and that Australian and European trucks have front protection. She referred to an UMTRI study from 2002 showing that front protection can increase crash compatibility and said that NTSB investigated a crash that determined the front bumper of the truck was higher than the passenger vehicle bumpers and overrode the vehicle. NTSB said in 2013 that collisions involving the front of trucks were the most common and passenger compartment intrusion (PCI) is common, and that there is a strong relationship between front truck bumper height and underride, and EU has required them since 2003. She also showed a petition for rulemaking on front override she filed that was granted. She stated that DOT is supposed to harmonize with global regulations and referred to presentations she shared with ACUP the previous week. She proposed recommendations for NHTSA to issue an ANPRM for front override protection and harmonize with global front override regulations.

Dan Horvath asked if there are any US manufacturers that put front protection on their trucks now, and Marianne said there are international manufacturers that are also in the US, and she doesn't know if they put any in the US. Lee Jackson said Ex-Guard makes front guards. Marianne Karth said Iain Knight said the Ex-Guard should be tested for energy absorption. Dan Horvath said that CMV AEB could mitigate rear end crashes and Marianne said it should be both/and to maximize survivability. John Freiler asked if her motions are being brought later and Marianne confirmed. Harry Adler suggested looking at international truck manufacturer websites showing front underride protection. Marianne Karth noted that Western Star trucks are made in the US with front underride protection and shipped to Australia. Aaron Kiefer said that Peterbilt trucks have low frontal structure and he wants to know more about their design. Jeff Zawacki said most OEMs have large brackets on the front to support large radiators to meet EPA regulations.

Mr. Keith Friedman of Friedman Research Corporation presented on heavy truck front underride protection that they have done. He stated that far more passenger vehicle fatalities and injuries occur involving the front of heavy trucks than the rear or sides, and that manufacturers want a level playing field as created by regulations requiring safety improvements. He said that front impact prevention and mitigation should include collision detection, AEB, improved braking, and front underride protection devices. Front protection is mandated in Europe. He showed images of a simulated impact with an airbag on the front of a heavy truck to mitigate frontal collisions and said HT airbag technology can mitigate crashes. Lee Jackson asked him to send videos showing the airbags in collisions to ACUP. John Freiler asked if this is an existing product or development. Keith said this was testing for industry

Mr. Smith presented on concrete Jersey barriers, saying that secondary crashes are important. He said that the barriers were introduced in 1955 and that the original design has been changed over time. He showed the current F type as well as a new Test Level 5 barrier being made in Austria. He showed continuous slope barriers. He said that secondary accidents are important and should not be discounted. Lee Jackson asked if there is data on car rotation accidents. Doug Smith cited Utility trailer testing. Marianne Karth asked if he is saying underride should be allowed to prevent secondary accidents, and Doug Smith said other people should not die due to increased secondary crashes. Harry Adler said they need data on secondary accidents to consider them and that anecdotal evidence is not sufficient to show that those externalities will outweigh the benefits of the guards. Doug Smith said the car will either be smashed or deflect. Lee Jackson said the idea is that a potential secondary crash is not as bad as a certain rear underride. Jeff Bennett said that in the Hein accident, the car rode up the Jersey barrier which caught the fuel line and caused the fire, and that unintended consequences are a valid concern. Dan Horvath said that data is necessary for all recommendations and he has a motion for research on the secondary crash concern. Marianne Karth said there is a difference between spinning and slight rotation. Jeff Bennett said it was a 90 degree rotation and they shouldn't be playing god. Marianne asked Matt Brumbelow to weigh in on rotation. Matt Brumbelow said only 5% of fatalities are coded as a different harmful event than striking the truck, and most are one passenger vehicle striking one large truck and no other vehicles. John Freiler asked about his citation of FARS and Matthew Brumbelow clarified he does not take issue with total fatality counts in FARS. Harry Adler said that some items such as travel speed are not very accurate in FARS but the number of vehicles involved is much stronger data.

Mr. Dennis Lombardi, the President of IICL, presented on side underride guards and intermodal chassis. He discussed the comments they've submitted to NHTSA that IIJA directed NHTSA to consider intermodal chassis in the side underride analysis and NHTSA did not complete any research on them. He said side underride guards on intermodal chassis would lead to supply chain disruptions and increase the number of trucks on the road. The cost in the ANPRM also does not include costs of inefficiencies, repair, etc. for intermodal chassis, and that current side underride guards are not suitable for intermodal chassis.

Lee Jackson showed a picture of stacked intermodal chassis to demonstrate that it is possible. Dennis Lombardi responded that they haven't seen how they could be implemented and there are other challenges, such as telescoping, generators, etc. Jeff Zawacki asked if IICL can provide recommendations on how to address underride without impacting operations, noting that the chassis has not been redesigned for many years. Dennis said anything limited stacking would create problems. Aaron Kiefer asked if IICL has any research funding. Dennis said they do not but they could consider it. Doug Smith

said increasing weight will reduce payload capacity and there are stacking limitations. John Freiler asked if the guards shown were side underride guards or VRU guards or aerodynamic mounts. Lee Jackson said he is unsure but showed the picture to demonstrate what can be done. John Freiler said they are happy to use demonstrated technology and perhaps they should consider a more tailored requirement. Lee Jackson said the requirement is necessary for someone to develop one. Marianne Karth showed a Strick trailer intermodal side guard and noted that what Lee showed is probably an LPD for VRUs. Marianne asked how IICL handles LPDs in other countries where they're required. She also said NHTSA asked for intermodal information in the ANPRM. She said industry members have the opportunity to apply for an exemption to requirements. Lee Jackson said there was no time for further discussion.

Dan McKisson said there is a lot of contention in the committee and requested that they work on more of a consensus report. Lee Jackson stated that the committee's limited time is part of the issue.

Motions

The Committee proceeded to discussion and voting on a list of motions compiled after the last meeting as agreed.

The Committee proceeded with discussion and voting on the motions. The first motion was from Jeff Bennett to define consensus as two-thirds, and he agreed to combine it with Doug's motion. Lee Jackson said there is no reason to vote on the consensus motion. Doug's motion is motion 15 so it will be discussed at that time.

Motion 2, brought by Jennifer Tierney, was that NHTSA should withdraw the ANPRM or reissue a revised ANPRM and cost-benefit analysis. Dan Horvath said withdrawing the ANPRM does not make sense and would only move things backward, and that the next step is an NPRM, not a new ANPRM. Jennifer disagreed that it should be changed, and Marianne agreed that withdrawing means acknowledging that the analysis is inaccurate. Harry Adler agreed that reissuing an ANPRM would be a delay but they want acknowledgement that the calculation was inadequate so perhaps they can modify the motion. Jeff Bennett said many trailers already have side skirts so the side guards can't claim that benefit. Marianne asked if Jennifer would be willing to combine the motion with hers. Jennifer said she wants to bring attention to what was missing in the ANPRM but she is fine with changing the motion as Harry said. Lee Jackson said they don't have time for much discussion of amendments. Jeff Bennett said they've received complaints that side guards damage the side skirts. The Committee voted and the motion passed with 7 YES votes, 6 NO votes, 4 abstaining.

Motion 3 was to say NHTSA must account for difficult or impossible to quantify benefits. The motion passed with 9 YES votes, 2 NO votes, 6 abstaining.

Motion 4, brought by Marianne Karth, was to say that NHTSA underestimated the number of preventable side underride deaths by 90% and the ANPRM should be withdrawn. Lee Jackson suggested removing the 90% number due to uncertainty. Jeff Bennett said that they need more data on effectiveness. Harry Adler asked if the motion is moot due to motion 2. Lee Jackson said they don't have time to combine/edit motions. The vote on the motion was a tie, with 7 YES votes, 7 NO votes, and 3 abstaining, which means the motion did not carry.

Motion 5 was for NHTSA to complete a new side impact guard analysis including VRUs. Jeff Bennett said the committee is on underride crashes, which are cars, not pedestrians. Marianne said they are talking about people dying under trucks. Jeff said they may die from the impact of a guard so they don't know if

it would prevent fatalities. John Freiler said the comments have been added to the ANPRM docket and that the motion should be to complete the rulemaking, including addressing all comments. Dan Horvath noted that the side guards for vehicles and VRUs are different and both should be addressed but are different. Harry Adler said there is a difference between a head on collision and off-tracking on a turn, and it's not to say all fatalities can be prevented by side guards, but NHTSA should reevaluate their analysis to count all potential benefits. Dan McKisson said the committee's job is to make NHTSA consider everything. Aaron Kiefer said he's doing research on side guards and VRUs. Jeff Bennett said they need the data and can't lead with the conclusion. Jeff Bennett said they sell pedestrian guards on their vans in Mexico. Lee Jackson said a guard could work for vehicles and pedestrians. Doug Smith asked about the pedestrian guards. Jeff responded they put a brace on the end of the skirt for the pedestrian protection. Dan Horvath said IIJA defined underride as vehicles and VRUs are another matter and they should discuss them separately from vehicles. Jennifer Tierney said VRUs are killed in underride crashes and they need to be counted to save lives. The Committee voted and the motion passed with 12 YES votes, 5 NO votes, none abstaining.

Motion 6 was for NHTSA to issue an ANPRM on front impact guards. Harry Adler stated support as it means collecting data on the matter. Lee Jackson agreed. The Committee voted and the motion passed with 11 YES votes, 1 NO vote, 5 abstaining.

Motion 7 was for NHTSA to harmonize with global front override regulations. Doug Smith said there is a difference between American and international trucks/trailers. Marianne Karth said Australia has both kinds of trailers and they have front override guards. Dan Horvath said this motion is moot because of motion 6. Marianne Karth said IIJA directs NHTSA to harmonize but Dan Horvath said it's a mischaracterization. Dan McKisson suggested an amendment to say "may" instead of "should" and Aaron Kiefer agreed that there should be some flexibility. Marianne Karth accepted the change. They voted on the motion and it passed with 11 YES votes, 1 NO vote, and 5 abstaining.

Motion 8 was for the creation of a Presidential Advisory Committee on Integrity of Underride Research. Lee Jackson disagreed that they need another committee for the same thing. Marianne said the Committee may not continue and does not have access to a lot of information. Jeff Bennett said there are many other deaths and there's no reason for this topic to take priority. Marianne Karth said the committee would specifically review all underride related research, which ACUP has been unable to do. The Committee voted and the motion did not carry, with 1 YES vote, 12 NO votes, 4 abstaining.

Motion 9, from Aaron Kiefer, was for all new semitrailers and SUTs with open spaces along to side to be equipped with side guards capable of preventing PCI with a midsize vehicle at any angle and closing speeds up to 40 mph. Jeff Bennett said current guards have not been shown capable of that, and Harry Adler said the committee is not making the rules, just recommending actions. Jennifer Tierney said it's about reducing crashes and fatalities, even if it won't save everyone. Doug Smith asked if this is mandating something that has not been created yet, and Lee Jackson disagreed. Dan McKisson asked if new semitrailers includes chassis. Aaron Kiefer said that's up to NHTSA. John Freiler said there's an open rulemaking on side guards so he's unsure what this is saying. Aaron Kiefer said 40 mph is an important target because that's survivable in modern vehicles. John Freiler said this should be suggested as part of the current rulemaking so as to not delay something that's already in progress. The Committee voted and the motion passed with 11 YES votes, 6 NO votes, and none abstaining.

Motion 10 was for all semitrailers and SUTs manufactured after 1998 to be retrofit with side guards. Jeff Bennett questioned the motive for this motion. Doug Smith said that retrofitting is expensive. Marianne Karth said that people shouldn't assume others' motives. Jennifer Tierney said that nobody should be discussing cost and that shouldn't be discussed. Jeff Bennett said that NHTSA must consider cost so it needs to be considered. Aaron Kiefer said the intent is for trailers in use. John Freiler said it's about prioritizing the best solutions. The Committee voted and the motion passed with 8 YES votes, 6 NO votes, and 3 abstaining.

Motion 11, brought by Aaron Kiefer, was for the side guards in the previous two motions to also prevent VRUs from passing under the vehicle. Jeff Bennett questioned if side guards would also protect VRUs. Aaron Kiefer said he doesn't see a reason why side guards can't also protect VRUs. Doug Smith said it's too broad. They voted on the motion and it passed with 9 YES votes and 8 NO votes, none abstaining.

Motion 12 was for NHTSA to conduct a cost analysis of the total cost of a fatal side underride crash including lost productivity, court costs, etc. based on data from crashes such as that of Riley Hein. Jeff Bennett said the reference is to a follow on crash. Harry Adler said the death was due to the car being lodged under the trailer, and that NHTSA's analyses should be updated and looked at in depth. Harry Adler suggested modifying the suggestion. Aaron Kiefer agreed to withdraw the motion but stated that a lot of costs were not captured in the ANPRM.

Motion 13, brought by John Freiler, was to replace the 5 year tape recommendation with a recommendation to conduct a study of conspicuity tape in service and actual rates of compliance. Lee Jackson agreed with the study but not with removing the 5 year requirement because the reflectivity meters are so expensive and everyone will not have them regardless. John Freiler agreed to amend the motion to remove the reference to the 5 year recommendation and just request a study. Thomas Mrozinski said the meters are too expensive for all the vehicle inspectors to carry. Doug Smith asked why they can't use human eye. Lee Jackson responded it needs to be quantified so it's not subjective. The Committee voted and the motion carried with 16 YES votes, 1 NO vote, none abstaining.

Motion 14, brought by Jeff Bennett, was for the ACUP report of consensus advice be provided to the committee at least 3 weeks before submission so everyone has time to include their views. Lee Jackson said time is tight and suggested amending to 1 week. Jeff Bennett agreed to the amendment. Dan Horvath said that the committee needs to commit a chunk of time in the next meeting for the report. Marianne Karth asked if they will be allowed to discuss matters via email and Jim said no. Harry Adler asked if they can email. Jim said they can email information but cannot discuss the matters. The Committee voted and the motion passed with 17 YES votes (all present).

Motion 15, brought by Kristin Glazner, was for NHTSA to set deadlines for report drafts, but she withdrew her motion.

Motion 16, brought by Doug Smith, was for consensus to mean two-thirds of all members. Lee Jackson disagreed with voting on this motion based on Doug and Jeff having already voted against the existing definition of consensus. Lee Jackson said this would undo all the settled votes for recommendations that passed with a simple majority. The Committee voted and the motion did not pass, with 8 YES votes, 9 NO votes, none abstaining.

Wrap Up

Discussion and voting for the motions continued through the end of the meeting. The scheduled presentations and discussion on topics relating to side underride crashes were postponed to a later meeting.

05.22.2024 Meeting Minutes

Time and Location

The meeting was held May 22, 2024, from 12:30 to 4:30 p.m. ET. It was a virtual meeting conducted via Zoom for Government webinar. The meeting was not recorded.

Participants

National Highway Traffic Safety Administration (NHTSA)

Mr. James Myers, *Designated Federal Officer*

Committee Members

Mr. Aaron Kiefer, *Motor Vehicle Crash Investigators*

Ms. Claire Mules, *Insurance Industry*

Mr. Dan Horvath, *Motor Carriers*

Mr. Doug Smith, *Motor Carriers*

Mr. Harry Adler, *Truck Safety Organizations*

Mr. Jeff Bennett, *Motor Vehicle Engineers*

Ms. Jennifer Tierney, *Truck Safety Organizations*

Mr. John Freiler, *Truck and Trailer Manufacturers*

Ms. Kristin Glazner, *Truck and Trailer Manufacturers*

Mr. Lee Jackson, *Motor Vehicle Crash Investigators*

Ms. Marianne Karth, *Families of Underride Crash Victims*

Mr. Matthew Brumbelow, *Insurance Industry*

Ms. Mindy Carter, *Emergency Medical Service Providers*

Dr. Ted Delbridge, *Emergency Medical Service Providers*

Mr. Thomas Mrozinski, Jr., *Law Enforcement*

Invited Speaker

Mr. Eric Hein, *bereaved father of Riley Hein*

Welcome and Call to Order

Mr. Myers opened the meeting with roll call and confirmed the presence of a quorum. Ms. Jane Mathis, Mr. Dan McKisson, and Mr. Jeff Zawacki were unable to attend the meeting. There were no objections to the April meeting minutes.

Mr. Jackson, Committee Chair, thanked everyone for their participation in the Committee and noted that there were no further meetings scheduled. Mr. Jackson asked the Committee members to provide

their statements for the report ahead of the submission deadline on June 30. Mr. Horvath asked for clarification on the timeline and report. Additional discussion on the report occurred later in the meeting.

Motions[37]

The Committee proceeded to discussion and voting on the list of motions that remained from the previous meeting. Motion 17, brought by Mr. Smith, was for NHTSA to provide an independent moderator for the Committee. Mr. Smith withdrew his motion because it was no longer pertinent. Motion 18, brought by Mr. Horvath, was for NHTSA to work with the Federal Railroad Administration to conduct research on potential impacts of side underride guards during highway-rail grade crossings. Mr. Kiefer suggested amending the motion to ensure that any such research is made public, and Mr. Horvath agreed to the amendment. Ms. Tierney stated support for research but not as a prerequisite for a side guard requirement. Mr. Bennett said that the research should not be limited to railroad crossings, noting that loading docks and other grades of 10 degrees or more create similar concerns. Mr. Horvath agreed that loading docks are a concern but said they should be kept separate. The Committee voted on the motion and it passed with 15 YES votes, which was all present.

Motion 19, brought by Mr. Horvath, was for NHTSA to include vulnerable road users (VRUs) in crash reporting, and for vehicles and VRUs to be addressed separately. Ms. Karth said that side guards can be designed to protect both VRUs and occupants of passenger vehicles and they should be protected together; Ms. Tierney agreed. Mr. Horvath said that some cities have VRU guards and that the collisions are different types of events. Mr. Adler agreed that they are different, that both need to be addressed, and that VRUs should be included in the Model Minimum Uniform Crash Criteria (MMUCC). Mr. Horvath noted that the Volpe center studied the issue and created a standard that was specific to VRUs. Mr. Adler said that Volpe looked at lateral protective devices (LPDs) and did not consider side underride guards. Mr. Horvath agreed to amend his motion to remove the statement of separation, and Ms. Karth expressed support for that amendment. Mr. Myers suggested that the Committee use different terms to distinguish between types of side guards that are designed for VRUs and for passenger vehicles. Ms. Karth said that 'LPD+' can be used in reference to a combination guard. Mr. Freiler said that the motion is about people, not guards. The Committee voted on the motion and it passed with 14 YES votes, which was all present at the time.

Motion 20, brought by Mr. Horvath, was for NHTSA to investigate the potential for collision mitigation technologies to prevent or reduce the risk associated with side underride crashes. Ms. Tierney suggested adding driver assistance technologies for heavy trucks as well as passenger vehicles. Mr. Horvath replied that those technologies are included in his statement and that his motion was broad, not limited to specific technologies. Ms. Tierney suggested adding "all" to the motion; Mr. Smith disagreed. Mr. Freiler suggested amending the motion to add "for light and heavy-duty vehicles" to address Ms. Tierney's concern, and Ms. Tierney agreed with his suggestion. Mr. Horvath amended the motion as suggested by Mr. Freiler. The Committee voted and the motion passed with 15 YES votes, which was all present.

[37] These meeting minutes capture committee member discussions from the May 22, 2024, ACUP meeting. No attempt has been made to correct inaccuracies spoken during the meeting. No attempt has been made to interpret or add explanation for the words spoken by committee members.

Motion 21, brought by Mr. Horvath, was for NHTSA to address risks associated with deflection into adjacent lanes in partial offset rear crashes and side underride crashes. Mr. Horvath noted that the subject has been raised as a concern in Committee discussions. Ms. Karth suggested an amendment to add an assessment of the risks in comparison to the underride crashes that are mitigated by the guards. Mr. Smith stated that people not part of the initial impact should not have to be involved in a crash. Ms. Tierney said that approach is contrary to Vision Zero and the National Roadway Safety Strategy. Mr. Kiefer stated that the implementation of highway guardrails included assessment of secondary crashes but that it does not make sense to study secondary crashes in a vacuum. Mr. Adler agreed that effects of possible secondary crashes should be framed within the context of prevented underride crashes. Mr. Smith stated that NHTSA has shown concern over secondary collisions. Mr. Freiler suggested an amendment to make the research public; Mr. Jackson questioned whether such a request would require NHTSA to do so. Mr. Horvath agreed with Mr. Freiler's amendment. Ms. Karth reiterated that secondary collisions should be compared to the injuries and fatalities that are prevented. Mr. Kiefer stated that secondary crashes are a straw man argument because the probability of such crashes is very low. Mr. Brumbelow agreed with Ms. Karth and Mr. Kiefer, stating that the most severe crashes should be prevented, and that passenger vehicle safety has improved. Mr. Bennett said that they know FARS undercounts underride so saying that the FARS data does not show high incidence of secondary crashes is hypocritical. Mr. Horvath said the intent of his motions as a whole is to address the primary concerns that have been raised in Committee meetings and in response to rulemaking. Mr. Horvath also said that motions should be kept simple but agreed with amending the motion to say results should be made public. Mr. Myers noted that the agency does publish final results. The Committee voted and the motion passed with 9 YES votes, 6 NO votes, and none abstaining.

Motion 22, brought by Mr. Adler, was for the Committee to recommend that NHTSA advance rulemaking mandating side underride guards on all applicable new semitrailers. Mr. Horvath asked if the Committee already voted on a similar motion, and Mr. Jackson agreed that it sounded familiar. Mr. Adler agreed to withdraw Motion 22 as well as Motion 23, which was to require retrofitting side guards, as they were very similar to the motions brought by Mr. Kiefer that were already discussed and passed by the Committee. Motion 24 was to require side guards on single unit trucks. Others again stated that the subject had been voted on, so Mr. Adler also withdrew Motion 24.

Motion 25, brought by Mr. Adler, was for NHTSA to examine the need for weight-based exemptions for side underride guards to address weight concerns. Mr. Myers asked Mr. Adler if he was referring to weight limits set by each State. Mr. Adler stated that Congress sets the weight limits for trucks. Ms. Tierney said that heavier trucks are associated with more severe and frequent crashes, and that DOT should not be trading one safety concern for another. Mr. Freiler said the recommendation should be to Congress and suggested an amendment to the motion to also request a study. Mr. Adler agreed with the amendment, saying that the issue should be explored to hopefully show that the added weight is not a significant concern. Mr. Bennett stated that the nation's infrastructure cannot handle greater vehicle weight. Ms. Mules said that trucks aren't weighed before leaving the yard. Mr. Smith said that weight costs are passed onto consumers. Ms. Karth noted that the motion is merely for a study and suggested that NHTSA may not be the correct agency to address. Mr. Adler agreed to amend the motion to make the recommendation to DOT. Mr. Adler also reiterated that the motion is not recommending an exemption to the vehicle weight limit, but rather is requesting a study to address vehicle weight concerns. Ms. Tierney said that a 2016 study showed that most trucks cube out before they weigh out and reiterated that truck weights should not be increased for any reason. Mr. Kiefer

noted that his side guard weighs around 500 to 700 pounds. The Committee voted and the motion passed with 7 YES votes, 6 NO votes, and 2 abstaining.

Motion 26, brought by Mr. Adler, was to recommend that NHTSA request DOT's Volpe center to evaluate the effectiveness of side underride guards to determine if they have similar or greater effectiveness than LPDs in mitigating the severity of collisions with VRUs. Mr. Kiefer stated agreement with the motion. There was no further discussion. The Committee voted and the motion passed with 13 YES votes, 1 NO vote, and 1 abstaining.

Motion 27, brought by Mr. Adler, was to recommend that NHTSA create a field in FARS to determine if an underride crash occurred involving a large truck and a pedestrian or cyclist. There were no comments. The Committee voted and the motion passed with 13 YES votes, 0 NO votes, and 2 abstaining.

Motion 28, brought by Mr. Adler, was to recommend that NHTSA disseminate educational material for law enforcement to help them identify and record side underride crashes accurately. Ms. Karth suggested an amendment to say that the material is in addition to existing material, and Mr. Adler agreed with that amendment. Mr. Freiler suggested further amending the motion to say DOT rather than NHTSA, and Mr. Adler agreed. The Committee voted on the amended motion, and it passed with 15 YES votes, which was all present.

Motion 29, brought by Ms. Glazner, was for the Committee report to reflect whether each member agrees with the content of the report by means of a statement of concurrence or non-concurrence. Ms. Glazner said that the statements would provide clarity on each member's position, especially for earlier motions when individual votes were not recorded. Mr. Jackson asked if the statements would be provided as an appendix and in place of a minority report. Ms. Glazner said it could work that way. Mr. Horvath, Mr. Adler, and Mr. Jackson stated support for the motion, noting that the statements may be a good way to express individual opinions. The Committee voted and the motion passed with 15 YES votes, which was all present.

There were no new motions.

Presentations

The first scheduled presentation was by Mr. Bennett on crash tests of side underride guards. He stated that IIHS tested the AngelWing side guard in 2017, but that the trailer was lightly loaded on a smooth floor and that they did not test other impact locations or angles. Mr. Bennett said that the AngelWing had three safety deficiencies, which were rigid bracing similar to bracing that has resulted in DOT safety recalls, violating regulations on air brake lines, and reduced breakover angle under 10 degrees, which leads to damage. He said that Utility ran the same test protocol on their similar side underride guard design with a greater payload, and it was effective in the full overlap test but failed in a low overlap test, even with reinforcement at the end of the guard. Mr. Bennett also showed pictures of a 45-degree impact test in April 2023 where the AngelWing detached from the trailer and resulted in underride. He stated that impacts toward the end of the guard at an angle are a common crash configuration. He also said the AngelWing does not meet the current FMVSS load requirements for rear guards and has only been shown to work in specific situations. Mr. Bennett said that the Committee's advice should be supported by field evidence and that the increased cost of side underride guards would add $10 billion in cost that would be passed onto consumers. Mr. Kiefer noted that the AngelWing is not the only

product on the market as his guard is also available, asked about other tests, and stated that the old trailer used for the AngelWing test failed due to corrosion. Mr. Bennett responded that he asked for pricing of Mr. Kiefer's guards, noted that Utility facilities have proprietary content, and stated that they need to know the actual effectiveness of the guards. Mr. Smith asked the weight of side underride guards; Mr. Bennett replied that the Utility guard was around 900 pounds, and they are working on lighter versions. Ms. Karth said that the AngelWing was reduced to 600 pounds in 2017.

The second presentation, by Ms. Karth, was on underride data collection. Ms. Karth stated that underride crashes occur every day and are underreported. She cited an underride crash study conducted by IIHS, provided examples of underride fatalities that were not coded accurately, and showed a graphic from the Institute for Safer Trucking demonstrating that some states do not include a field for underride on crash reports. Ms. Karth said she contacted state highway patrols in 2023 and obtained information about FARS coding. She said that the FARS contractor has not made changes to improve underride data and that NHTSA filters the FARS data, which alters the results, as shown by the IIHS analysis. Ms. Karth said that FARS accuracy is necessary but insufficient because the data is filtered.

The third presentation was by Mr. Kiefer on side underride crash testing conducted in 2023. He showed a successful 40 mph crash at 45 degrees with the AngelWing guard and stated that the trailer structure itself makes a difference in the outcome. Mr. Kiefer also showed a SafetySkirt test behind the rear axles of a trailer at 36 mph that prevented PCI, as well as a successful 45-degree impact into the center of the guard. He then showed a test with no side guard at 37 mph and 45 degrees for comparison. Mr. Kiefer stated that the polyester webbing of his SafetySkirt design absorbs energy by stretching but does not tear easily, providing crash mitigation. He also showed a successful 43.5 mph test into the side of the trailer with a SafetySkirt. Mr. Bennett asked for additional information on the guards and testing, especially collisions at the ends of the guard. Mr. Kiefer said he is unaware of other AngelWing tests but knows there have been changes to the guard, and he stated that the trailer in his tests was loaded with water. Mr. Smith asked about reefer trailer structure and what gauge steel is used for the rigid guards. Mr. Kiefer responded that he added more anchor points for reefer trailers and that it is better to have some give as with the SafetySkirt rather than having a rigid structure. Mr. Bennett stated that the AngelWing and Utility's version of the side guard are both made with 3/16" and 1/4" tubing, and that Utility attaches their guard to the side rails of the trailer.

The last presentation was by Mr. Eric Hein, the bereaved father of Riley Hein, on a petition under the Administrative Procedure Act to improve NHTSA's FARS underride data. He stated that NHTSA provides funding to states for FARS and that the user manuals are updated annually. Mr. Hein said that many researchers have documented underreporting of underride since the 1990s, that NHTSA did not adequately address GAO's recommendations, and that he petitioned DOT to amend the FARS guidance in 2023. His petition was for DOT to update the manuals and MMUCC to provide standardized definitions of underride and override, modify the existing FARS data element to differentiate rear and side underride crashes, require states to include an underride/override checkbox, and provide annual training and information to state analysts and police departments. Mr. Hein made a recommendation to the Committee that they recommend NHTSA grant his petition and address underreporting in the 2025 update of the FARS coding and manuals. Ms. Karth said she would like to include that recommendation in the ACUP report and Mr. Jackson said it would be included. Mr. Bennett questioned what changes may result from more accurate data. Ms. Mules said that police reports are completed at the time of the accident and many people pass at the hospital. She also stated that insurance

companies could provide lower premiums for trucks with side guards. Mr. Jackson noted that in Texas, at least, later deaths are to be reported up to 30 days after the crash. Mr. Freiler asked for clarification on the petition; Mr. Hein replied that he submitted the petition in 2023 and it was not a petition for rulemaking. Mr. Freiler expressed support for the petition.

Report Discussion and Wrap Up

The Committee proceeded to discussion of the report and the ending of the Committee. Mr. Adler asked how the report writing would be completed. Mr. Jackson stated that he would disseminate a draft report by June 18 and that anyone on the Committee could send him content to include in the report. Mr. Smith and Mr. Bennett volunteered to write the minority report and asked if they are allowed to communicate separately. Ms. Karth inquired about the Charter extension; Mr. Jackson responded that the extension has not been granted and there are no more meetings though the Committee did not meet for nearly a year. Mr. Horvath asked for clarification on the extension response and report writing. Mr. Myers clarified that there has not been a response, that emails should include all Committee members, and that discussions cannot be held via email. Mr. Horvath and Ms. Karth verified that the individual concurrence forms will be included with the report. Mr. Adler asked for verification that all motions that have been passed will be included in the majority report, and Mr. Jackson confirmed. Mr. Adler also asked for a list of all motions that have been voted on, particularly regarding front override; Ms. Karth noted which motion addressed front override. Ms. Glazner stated that she would create the concurrence/non-concurrence form for everyone to complete after the report is circulated. Mr. Smith also asked for Mr. Myers to provide a list of the motions. Mr. Myers responded that the previous meetings' motions have already been sent and confirmed that he will also provide the file from the current meeting. Mr. Jackson asked if there was any final business before the Committee adjourned. Several members of the Committee thanked Mr. Jackson for serving as the Committee Chair. Ms. Karth noted that Mr. Kiefer is planning future crash tests and asked others to consider attending. As there was no further business raised, the meeting adjourned early.

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	**Aaron Kiefer**
Voting Member Organization	**Collision Safety Consulting, PLLC**
Stakeholder Representation	**Accident Reconstruction**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report, Section I ("Majority Report"), as written**

   Voting Member Signature  **Date: 6/26/2024**

2. **Concur with the Final Report, Section II ("Minority Report"), as written**

   Voting Member Signature _____ Date: _____

3. **Concur with the Final Report,**
   ☒ Section I ("Majority Report"),
   ☐ Section II ("Minority Report"),
   as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

Please see enclosure.

   Voting Member Signature _____ Date: _____

4. **Non-Concur with both Sections I and II of the Final Report as written. Letter of Dissent must be provided.**

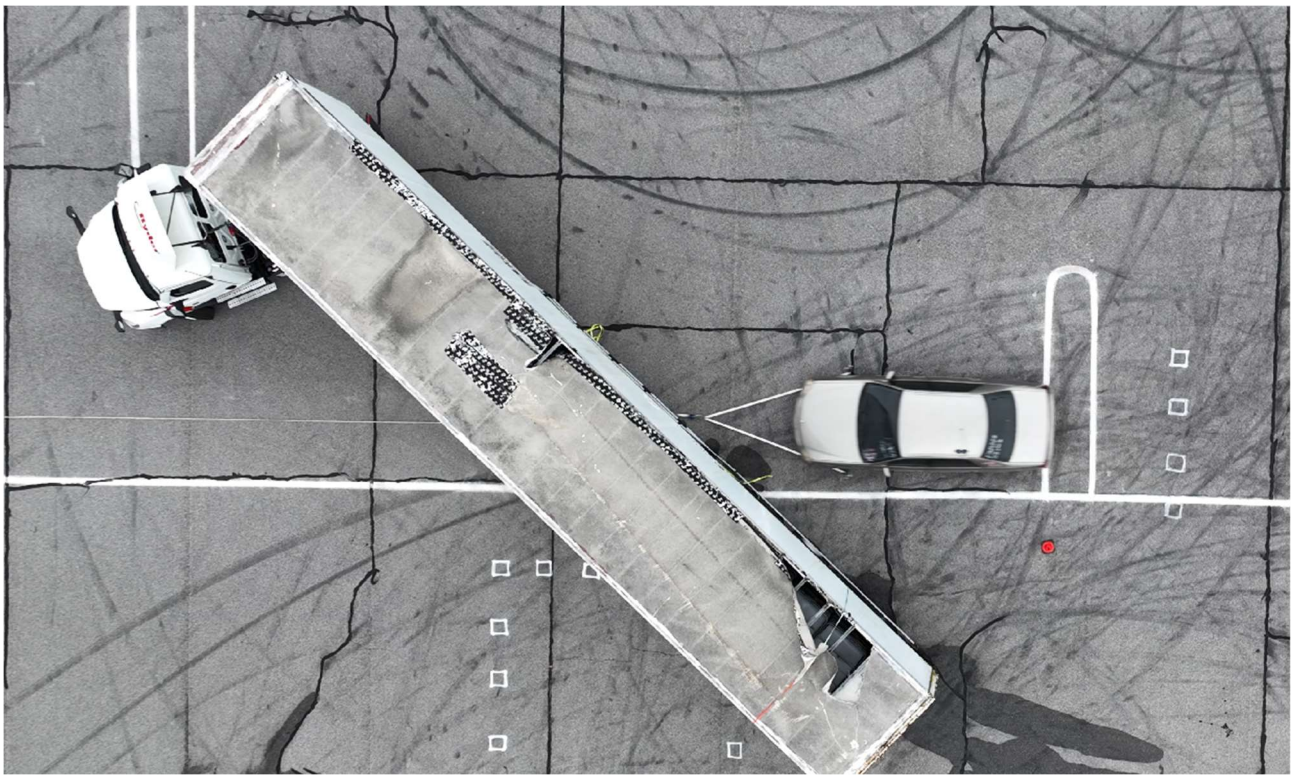
   Voting Member Signature _____ Date: _____

I am enclosing a photos of three SafetySkirt systems as well as screen captures from recent crash testing that I personally conducted in support of the majority report. Side underride guards have been validated extensively via live crash testing and proven to prevent underride and to protect occupants and vulnerable road users from underride harm. Furthermore, the Angelwing and SafetySkirt guards have also been used without issue in freight carrying operation by commercial carriers. Crash test videos are available at www.Trailerguards.com.


STOP
UNDERRIDES

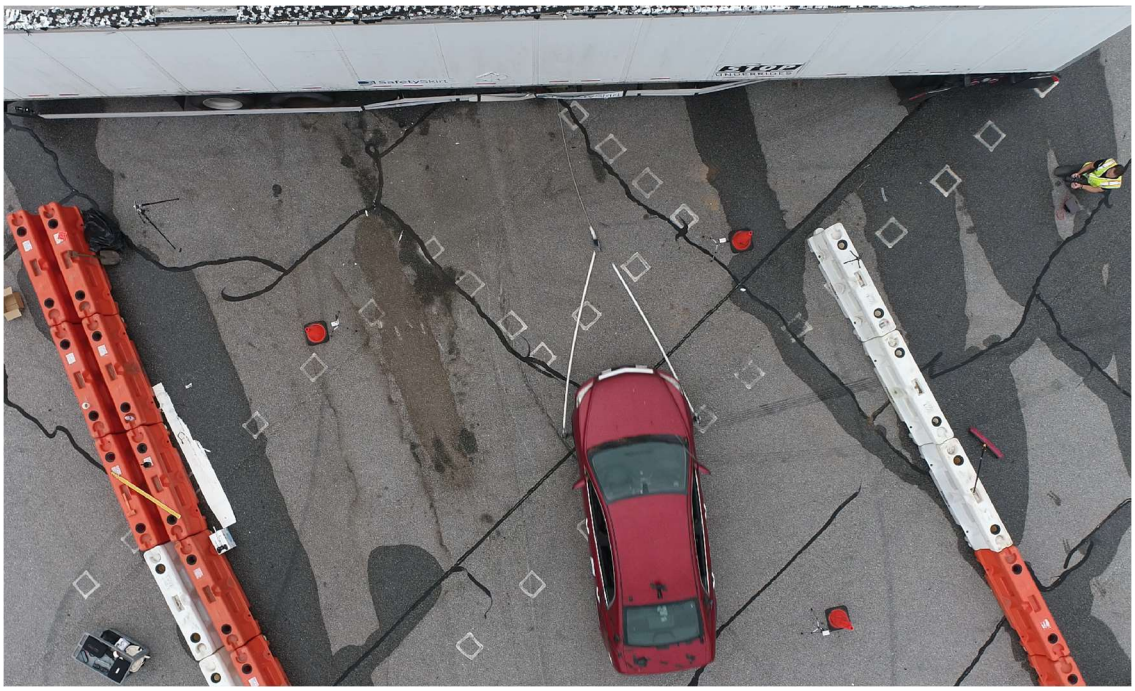

STOP UNDERRIDE CRASHES
www.TrailerGuards.com

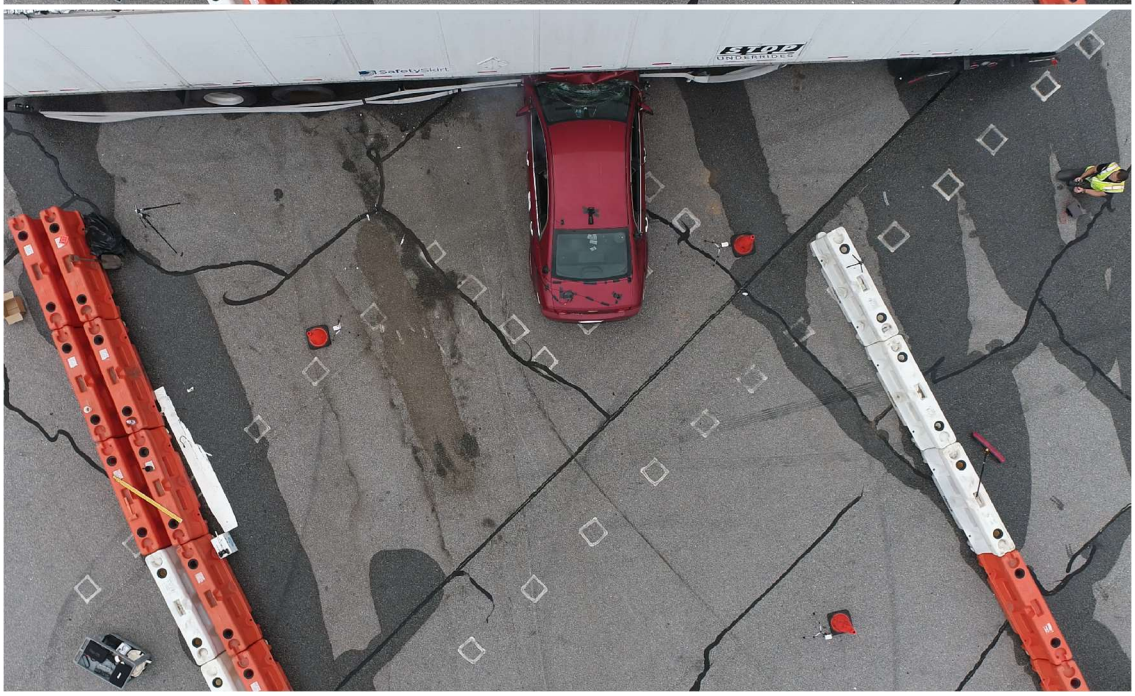
45 Degree Angle Test, Cadillac Deville, 35 mph, SafetySkirt Side Guard, 11/2023



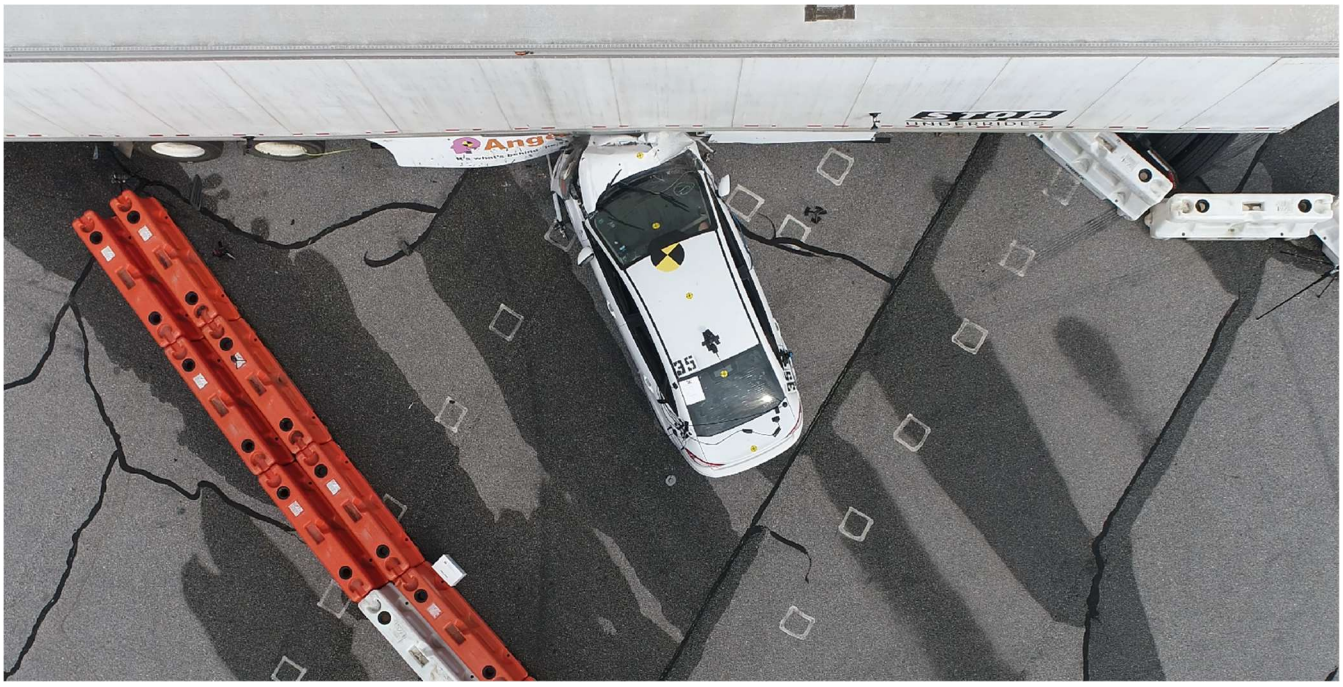
90 Degree Angle Behind Axles Test, Chevrolet Malibu, 35 mph, SafetySkirt Side Guard, 8/2023

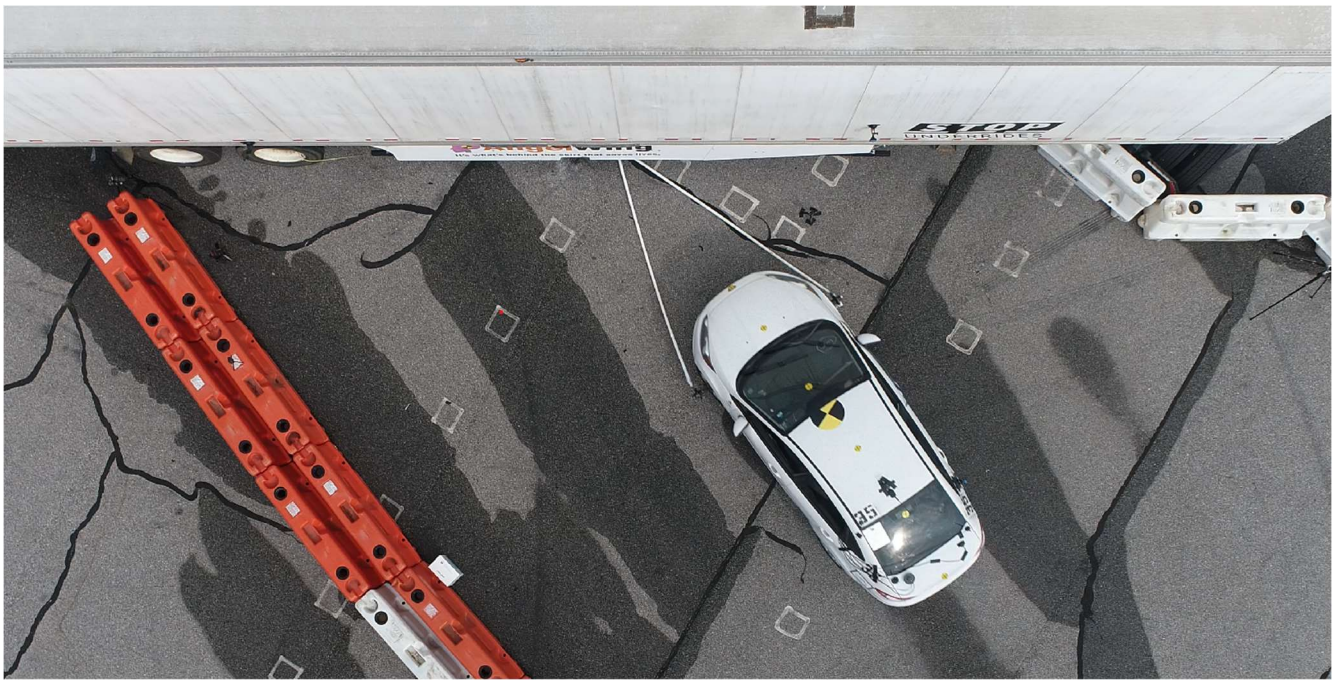
90 Degree Angle Test, Chevrolet Malibu, 44 mph, SafetySkirt Side Guard, 8/2023



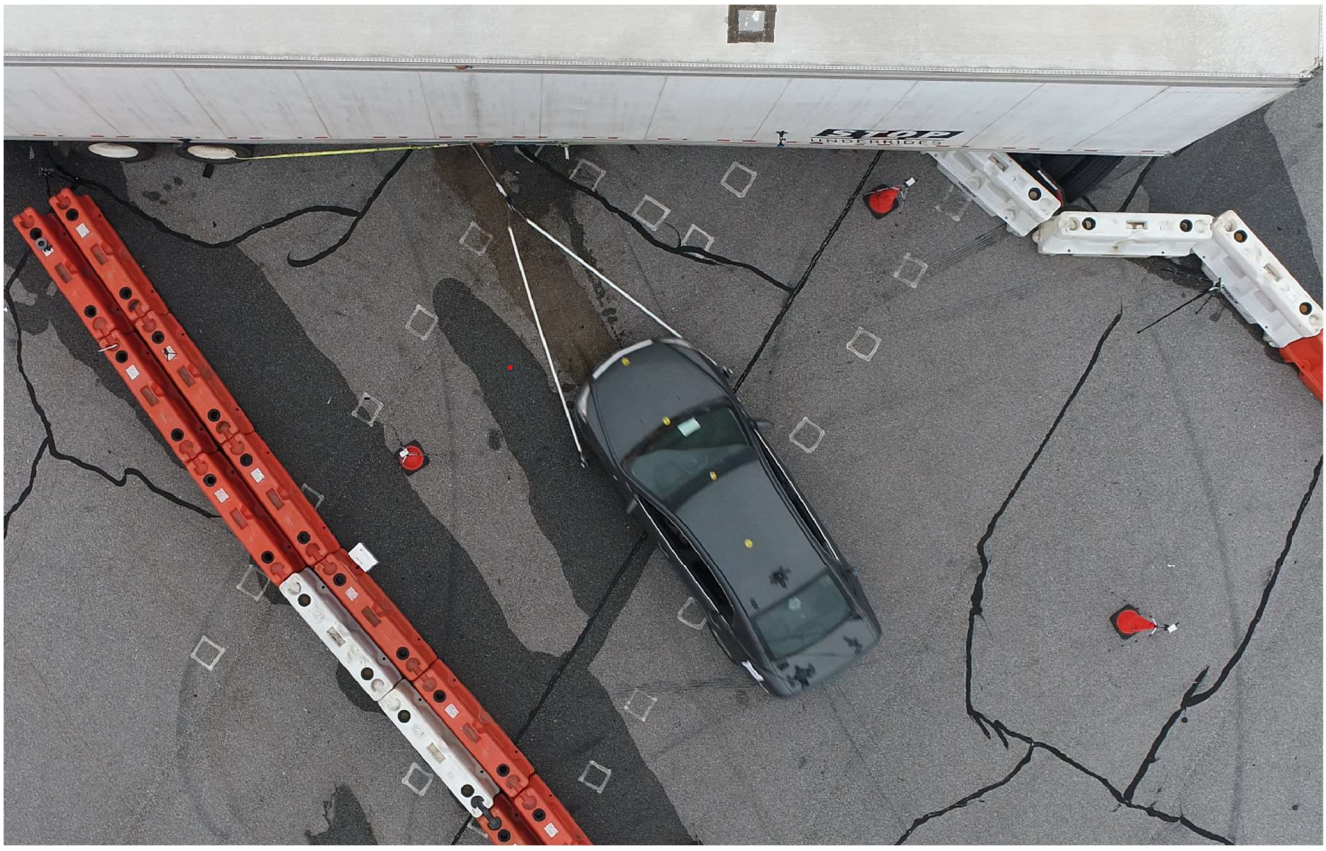


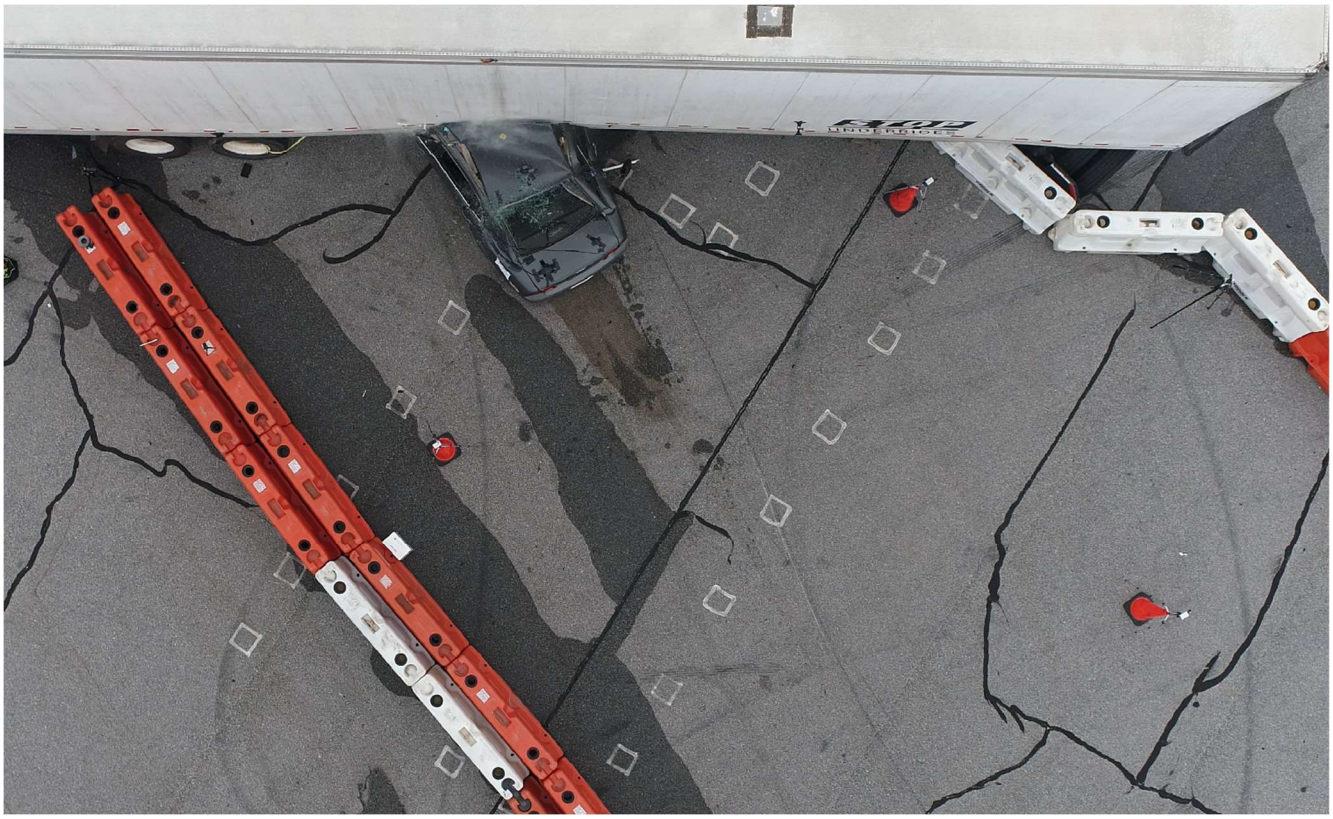
45 Degree Angle Test, Ford Fiesta, 40 mph, Angelwing Side Guard, 8/2023





45 Degree Angle Test, Chevrolet Malibu, 37 mph, Unguarded, 8/2023





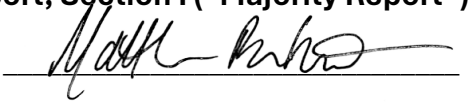
ADVISORY COMMITTEE ON UNDERRIDE PROTECTION (ACUP)

Statement of Concurrence / Non-Concurrence

Voting Member Name	**Matthew Brumbelow**
Voting Member Organization	**Insurance Institute for Highway Safety**
Stakeholder Representation	**Insurance industry**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report, Section I ("Majority Report"), as written**

   Voting Member Signature  **Date:** 26 June 2024

2. **Concur with the Final Report, Section II ("Minority Report"), as written**

   Voting Member Signature _____ **Date:** _____

3. **Concur with the Final Report,**

   ☐ Section I ("Majority Report"),

   ☐ Section II ("Minority Report"),

   as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature _____ **Date:** _____

4. **Non-Concur with both Sections I and II of the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	Melinda Carter
Voting Member Organization	NASEMSO - Trauma Mgrs. Council
Stakeholder Representation	Emergency Medical Service Providers

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report, Section I ("Majority Report"), as written**

   Voting Member Signature Melinda Carter **Date:** 6-27-24

2. **Concur with the Final Report, Section II ("Minority Report"), as written**

   Voting Member Signature _____ **Date:**

3. **Concur with the Final Report,**
   ☐ **Section I ("Majority Report"),**
   ☐ **Section II ("Minority Report"),**
   as written with the following exception(s): **(Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)**

Voting Member Signature _____ **Date:** _____

4. **Non-Concur with both Sections I and II of the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____

ADVISORY COMMITTEE ON UNDERRIDE PROTECTION (ACUP)

Statement of Concurrence / Non-Concurrence

Voting Member Name	Claire Mules
Voting Member Organization	Assurance Resources, Inc.
Stakeholder Representation	Insurance Industry

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report as written**

   Voting Member Signature _____ **Date:** _____

2. **Concur with the Final Report as written with the following exception(s):** (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature _____ **Date:** 6/26/2024

Quon Kwon report should not be taken into account as the committee have had zero discussions around him or his findings.

3. **Non-Concur with the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____

ADVISORY COMMITTEE ON UNDERRIDE PROTECTION (ACUP)

Statement of Concurrence / Non-Concurrence

Voting Member Name	Dan Horvath
Voting Member Organization	American Trucking Associations
Stakeholder Representation	Motor Carriers

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the ACUP Final Report and make the following declaration regarding the Report:

1. Concur with the Final Report as written

   Voting Member Signature _____ Date: _____

2. Concur with the Final Report as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature Dan Horvath Date: 6/27/24

Except as otherwise noted, I do NOT concur with the majority report included in the final report, and have outlined in the attached document my reasons why. I concur ONLY with section II, Minority report as drafted.

3. Non-Concur with the Final Report as written. Letter of Dissent must be provided.

   Voting Member Signature _____ Date: _____

I, Dan Horvath, representing Motor Carriers on the Advisory Committee on Underride Protection (ACUP), do not concur with certain provisions of the *final majority report* dated June 18, 2024, submitted to the U.S. Secretary of Transportation.[1] While there are certain provisions in the final report I agree with (including both *majority* and *minority* reports), I have included an outline of my dissent below.

As a primary matter, the definition of "consensus" was debated numerous times throughout the initial ACUP meetings, and a narrowly passed motion defined consensus as "51%" voting in favor of a motion. Because of this artificial definition of "consensus," the majority report is not in any meaningful sense a true reflection of the "consensus advice" of the Committee that the ACUP Charter demanded of the group. Instead, the bulk of that report simply represents the views of a bare majority of the Committee. The ACUP charter limited membership to "no more than 20 members." However, throughout the ACUP meetings, many committee slots were left vacant, including a law enforcement representative with valuable safety expertise, with the maximum number of members never exceeding 18 members. During committee votes in which all 18 members were present, any motion introduced required a mere 9-10 members, depending on attendance, to vote in favor of a motion to pass. While I recognize these votes reflect recommendations to the Secretary, rather than a solidified plan of action, I urge the Secretary and his staff to strongly consider *both* the majority and minority views included in this report when reviewing the recommendations. The minority report outlines several motions that passed with meaningful consensus approval rather than bare majorities.

Opposition to Motions Passed:

Motion #2: NHTSA should withdraw its previously submitted ANPRM or reissue a revised ANPRM and cost-benefit analysis that acknowledges and accommodates critiques made by commenters that the cost-benefit approach taken artificially constrained the number of lives saved and also failed to account for cost-savings (such as fuel efficiency gains provided by side underride guards). Motion passed 7 to 6 with 4 abstaining.

I oppose the recommendation that NHTSA's ANPRM should be withdrawn. The ANPRM presented a cost-benefit analysis indicating a net-negative benefit of $1 Billion if side underride guards are mandated. While I recognize several members of the ACUP disputed NHTSA's cost-benefit analysis and I fundamentally support efforts to ensure accuracy in any cost-benefit analysis, I do not support a "withdrawal" of the ANPRM as this will only further delay any meaningful action related to side underride guards. Unfortunately, seven ACUP committee members disagreed with this assessment and requested NHTSA start from scratch. During this discussion, I raised the fact that an ANPRM is *advance* notice. Any disputes to the cost-benefit analysis therefore should have been conveyed during the public comment process, and NHTSA would have the opportunity to respond to those concerns in a Supplemental Notice of Proposed Rulemaking or Notice of Proposed Rulemaking. I urged ACUP members that a withdrawal of the ANPRM would seriously delay the rulemaking process, as compared to addressing data discrepancies during the rulemaking process. For these reasons, I oppose the motion.

[1] Note: ACUP majority report was submitted to ACUP members on June 18, 2024 as a final document, however, minor typographical errors were made thereafter. All references in this non-concurrence submission are referring to the original June 18, 2024 report.

Motion #5: NHTSA should complete a new side impact guard cost-benefit analysis and rulemaking that counts previously omitted underride victim categories, including pedestrians, bicyclists, and motorcyclists. Motion passed 12 to 5.

In comments I co-authored on behalf of the American Trucking Associations in response to NHTSA's ANPRM, I highlighted numerous operational requirements for commercial vehicles that side underride protection designs will need to meet. Side underride crashes involving vehicles and vulnerable road users (VRU), such as pedestrians and cyclists, are both serious issues, however, they present very different engineering challenges. The DOT's research through Volpe has shown that addressing side underride crashes involving VRU via lateral protection devices (LPD) would use very different designs. Volpe's research has shown that LPD designs, which only need to withstand 450 pounds of force, could address pedestrian and cyclist underrides. While vehicular underride protection could also address VRU underride, LPD would likely offer a significantly better cost-benefit for addressing these types of underride crashes. The designs for LPD weigh less and need to withstand less forceful impacts, meaning they can have more flexibility in design and implementation, which offers promise for meeting operational requirements. Importantly, LPD can be *targeted* to cities and locations where pedestrian and cyclist underride are more prevalent, in turn reducing use cases and vehicle designs which present challenges for side underride protection. NHTSA should consider solutions to vehicular and VRU side underride separately to determine whether there are more cost-effective ways to address those involving VRU than vehicle-specific designs.

Motion #9: To require all new semitrailers, and single-unit trucks that have crash-incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph. Motion passed 8 to 6 with 3 abstentions.

I oppose the recommendation to require all new semitrailers and single-unit trucks to include side guards, as numerous operational requirements and unintended consequences associated with the equipment have not been addressed and therefore a mandate of side underride guards would be premature. As I outlined in comments filed on behalf of the American Trucking Associations in response to NHTSA's 2023 ANPRM, the methods available to mitigate the consequences of side underride crashes involving commercial vehicle trailers are extremely limited. As NHTSA noted in the analysis provided in their ANPRM, only one product is commercially available and has only been tested on crashes involving speeds up to 40 mph. Other designs are either in development or have no public testing data on which to base an analysis to determine effectiveness at scale and for various crash types. NHTSA correctly focused only on products that are available and have public cost and crash test data for analysis. NHTSA also correctly applied this data, as it would be inappropriate to make assumptions about performance beyond what testing has shown. Furthermore, NHTSA's estimate that current commercially available designs for vehicular side underride protection could prevent 17 fatalities and 69 serious injuries involving cars annually is reasonable based on the data available.

NHTSA should recognize the need for additional testing of underride guards to determine feasibility and unintended consequences in a real-world setting. Closed-course testing has shown that side underride guards can successfully stop a passenger vehicle traveling up to 40 mph from penetrating perpendicularly underneath the side of a stationary 53-foot dry van

trailer—one of many configurations of commercial vehicles—within a controlled test environment. However, that testing has not been replicated to demonstrate the impacts of a realistic highway scenario—with factors including both vehicles moving at highway speeds, a moving truck or tractor-trailer, other traffic present, the impact at different points on the trailer, and/or the crash occurring at a non-perpendicular angle. For example, although a side underride guard may successfully prevent a passenger vehicle from going underneath a trailer in some scenarios, the passenger vehicle may instead deflect off the trailer and strike other vehicles. The engineering challenge of mitigating a side underride event differs significantly from a rear underride event, and NHTSA should not make assumptions about side underride guard performance based on rear underride guard performance. Rear underride guards are 8 feet wide, have been standard for nearly 70 years, and are designed to address a specific and common type of crash scenario. Side underride guards are approximately 40 feet long and would be subjected to a wide variety of crash scenarios but have only limited testing data to show utility in one specific scenario. NHTSA should neither ignore these potentially dangerous scenarios nor move forward with a side underride guard mandate that attempts to solve a problem with an unproven solution with a high potential for unintended consequences.

As a guiding principle, efforts to decrease and eliminate side underride crashes should be focused on preventing the crash from occurring in the first place. Members of the ACUP agreed with this—to some extent—when discussing the need to address conspicuity reflective tape. The mitigation method proposed by the majority would force the trucking industry to expend its limited resources on unproven designs with limited potential benefits when we could instead focus efforts on proven mechanisms to reduce the likelihood of crashes occurring altogether. The transportation industry's focus should be on crash avoidance achieved by advanced driver assistance systems (ADAS), such as automatic emergency braking, as well as behavioral factors including distracted and impaired driving prevention.

The trucking industry continues to invest in these safety technologies, such as those included in ADAS – not because they are required to, but because they believe it is the right thing to do. A study conducted by the American Trucking Associations indicated that trucking companies invested $14 Billion to bolster safety on an annual basis.[2]

Motion #10: To require semitrailers, and single-unit trucks manufactured after 1998 that have crash-incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph. Motion passed 8 to 6 with 3 abstentions.

I oppose the recommendation made in Motion 10, which was passed by a margin of two votes, as it demonstrates a significant lack of understanding about the effects of a retrofit requirement on the trucking industry and of the industry more broadly. Previous congressional testimony[3] and 2012 data reported by the Federal Highway Administration on this very topic attested to the 11.7 million registered trailers in existence.[4] Using this figure, equipping the 11.7 million trailers

[2] https://www.trucking.org/news-insights/new-study-underlines-trucking-industrys-commitment-safety.
[3]Testimony, Under Pressure: The State of Trucking in America, Committee on Transportation and Infrastructure, House of Representatives. June 12, 2019; https://www.congress.gov/event/116th-congress/house-event/LC64735/text.
[4] https://www.fhwa.dot.gov/policyinformation/statistics/2012/mv11.cfm .

with a side underride guard costing approximately $2,900[5] would equate to approximately $33.9 billion spent on underride guards by the industry. When combined with the expected cost of labor in installing these guards, the mandate would exceed the industry's annual net revenue. Even if the cost of this unproven technology was phased in over a few years, it would indisputably divert a significant amount of NHTSA and industry resources away from important crash avoidance technologies – those proven to show wide-ranging benefits in all types of crashes – to focus on a singular, narrow type of crash and specific countermeasure unproven in real-world applications.

Motion #11: To require the side guards referenced in motions 9 & 10 above to also prevent a vulnerable road user (VRU) from passing underneath the guarded vehicle in an interaction with the side of the vehicle. Motion passed 9 to 8.

As noted above, designs for LPD to address VRU are very different from vehicular designs. NHTSA should consider solutions for addressing VRU separately to see if/how they can meet operational requirements or mitigate unintended consequences where vehicular designs may not. The different engineering requirements associated with LPD may allow more flexibility for meeting these requirements and better cost-benefit analyses than using vehicular designs to address VRU crashes.

<u>Opposition to Miscellaneous Statements Made in Majority Report:</u>

Page 12-22 "ACUP's Assessment" of Rear, Side, Front Underride Guards, Automatic Emergency Braking, and Allegations of Suppression of Underride Research Received by the ACUP.

This section contains numerous assertions made by the authors of the majority report that do not reflect motions discussed and passed by ACUP – much less the viewpoints of all ACUP members.

Concerning the evaluation of costs of side underride protection, I believe NHTSA made reasonable estimates using uncertain data to weigh costs and benefits. The result of NHTSA's analysis is a staggering net negative annual benefit of almost $1 billion and is a reasonable estimate of the costs that would be imposed by the requirement given operational limitations. That calculation is consistent with previous calculations that a mandate for side underride guards on *all* trailers in service would cost approximately $33.9 billion. Injuries and fatalities related to side underride crashes are undoubtedly tragic events that the industry and DOT should work towards addressing and preventing. However, side underride guards as discussed in NHTSA's ANPRM do not appear to be effective. In addition, these cost estimates do not include numerous operational factors that have been raised by industry groups.

Furthermore, ACUP members represented in the majority report have concluded that NHTSA's cost-benefit analysis is incorrect. While I believe their cost-benefit analysis was accurate to the extent of the information they had available, the analysis failed to include – as did the majority report submitted on behalf of ACUP – numerous operational concerns that were continually dismissed by select ACUP members. Reflecting on NHTSA's ANPRM, they acknowledge additional concerns raised by industry groups that were not addressed in the ANPRM. I reiterate

[5] Cost based on discussions during ACUP meetings.

the need to consider the impacts and potential impacts on the cost-benefit analysis based on the following:

> *Routing: The ACUP majority report failed to include an additional 5% estimate in vehicle miles traveled to avoid high-grade rail crossings or other roadway features that could present safety hazards if side guards are installed.*
>
> *Docking: NHTSA's analysis of routing to avoid infrastructure that is non-conducive to side-underride guards did not account for private property. ACUP reviewed presentations that discussed "high-centering" events at loading docks. Motor carrier industry members discussed not being able to install fuel fairings due to where they are making deliveries. The ACUP majority report should have also asked NHTSA for an advanced analysis of these concerns that were often dismissed. For example, one ACUP member stated that the number of rail-truck collisions at grade crossings is minimal. On the contrary, the Federal Railroad Administration (FRA) indicated that truck-trailers accounted for 22% of crashes at these locations each year from 2019-2022. If side guards were to be required, these numbers would undoubtedly increase.*
>
> *Maintenance: NHTSA's cost-benefit analysis factored in labor for installation but did not include ongoing maintenance costs. The ACUP majority report should have included information related to these additional maintenance costs.*

The majority report also states that Automatic Emergency Braking (AEB) represents an incomplete response "to the societal harm caused by underride crashes". This statement is misleading. It is true that the passenger car AEB rule does not include a performance test related to commercial vehicles or commercial vehicle trailers. While the performance of AEB for passenger vehicles in this scenario is not being tested, it would still be expected to provide some benefit and could prevent or mitigate a large portion of these crashes. Regarding front underride, the heavy-duty AEB rulemaking does propose a performance test in which a passenger car is slowed or stopped in front of the truck. This is the specific scenario in which a front underride crash could occur. The heavy-duty AEB rulemaking, while not final, proposes a performance requirement that would specifically and directly address this kind of underride event. NHTSA research has shown that a significant portion of vehicle crashes can be traced to human error, which could be directly addressed by ADAS technologies such as AEB.[6] AEB, undoubtedly, has the potential to reduce the number and severity of CMV-involved crashes including underride crashes.

Finally, the ACUP majority report incorrectly cites opinion, rather than fact, about DOT actions on underride crashes as it states that "very little has changed regarding side underride guard advancements in the last 50 years and no substantial progress has been made by DOT to prevent these horrific crashes and fatalities and injuries."[7] While I acknowledge that DOT's actions in the last 50 years are by no means complete, I disagree that no substantial progress has been made and in the last three years alone, DOT has taken the following actions:

- **November 9, 2021:** FMCSA published a final rule regarding rear underride guard inspection and labeling requirements, effective December 9th, 2021. The final rule

[6] 82 Fed. Reg. 8391 (Jan. 25, 2017).

[7] Biennial Report to Congress and the Secretary of the Advisory Committee on Underride Protection (Jun. 18, 2024).

adds rear underride guards to the list of items that are required to be inspected during an annual inspection.

- **June 30, 2022:** NHTSA issued a final rule for rear underride protection in conjunction with announcing the ACUP. The final rule established strengthening standards for the rear guard. NHTSA further announced additional research on rear impact guard designs and standards to better protect occupants in passenger vehicle crashes.

- **August 2, 2022:** NHTSA and FMCSA published educational materials for state and local police officers on how to identify and record underride crashes. This action was taken to fulfill Government Accountability Office recommendations related to suggested inaccuracies in reporting underride crashes.[8]

- **February 2, 2023:** NHTSA published a Federal Register notice proposing revisions to the Model Minimum Uniform Crash Criteria (MMUCC) to include a definition of underride and included underride as a recommended data field to be collected. The MMUCC was subsequently updated in early January 2024.[9]

For the reasons outlined above, I submit this letter of non-concurrence.

[8] https://www.gao.gov/products/gao-19-264.
[9] Ibid.

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	**Doug Smith**
Voting Member Organization	**Ralph Smith Co./Owner-Operator Independent Drivers Association (OOIDA)**
Stakeholder Representation	**Motor Carriers, Including Independent owner-operators**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report as written**

   Voting Member Signature _____ **Date:** _____

2. **Concur with the Final Report as written with the following exception(s):** (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature _____ **Date:** _____

3. **Non-Concur with the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature Doug Smith **Date:** 6/27/2024

I concur with the Minority Report and have included my personal views on ACUP proceedings and findings in the enclosed letter of dissent to the Majority Report.

June 27, 2024

The Honorable Pete Buttigieg
Secretary
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, D.C. 20590

Re: Advisory Committee on Underride Protection Majority Report Letter of Dissent

Dear Secretary Buttigieg,

My name is Doug Smith. I am a professional truck driver with over 50 years of experience. I am the Owner of Ralph Smith Trucking based in Bountiful, Utah, a family-owned and operated business that specializes in heavy civil construction, including demolition, flatbed, stepdeck, and heavy-haul services. Since 2017, I have served as a Board Member for the Owner-Operator Independent Drivers Association (OOIDA). OOIDA is the largest trade association representing the views of small-business truckers and professional truck drivers with approximately 150,000 members located in all fifty states that collectively own and operate more than 240,000 individual heavy-duty trucks.

Over the last year or so, I have served on the National Highway Traffic Safety Administration's (NHTSA) Advisory Committee on Underride Protection (ACUP) representing motor carriers, including independent owner-operators. I have appreciated the opportunity to represent the nation's professional drivers, including small-business truckers, in this advisory capacity. However, I do not believe the views I shared during ACUP meetings have been particularly reflected in the Committee's majority report. For this and other reasons, I do not concur with ACUP's majority report.

Section 23011 of the Infrastructure Investment and Jobs Act (Public Law 117-58) directed the U.S. Department of Transportation (USDOT) to establish ACUP. Beginning in May 2023, ACUP conducted a series of public meetings on various underride topics with the goal of providing consensus written advice and recommendations on safety regulations that can reduce underride injuries and fatalities. I believe all ACUP Members share a dedication to improving highway safety, saving lives, and reducing underride fatalities, but our meetings clearly exposed disagreements about the most practical policies to achieve such objectives. Unfortunately, ACUP lost its commitment to working in a collaborative and consensus manner over the course of these discussions.

Safety advocacy representatives manipulated their numerical advantage in Committee membership and the departure of an impartial Chairperson beginning in February 2024 to minimize opposing viewpoints of ACUP participants. These representatives approved a motion over the objections of industry to define "consensus" as a simple majority.

After this unjustified redefinition of "consensus", ACUP adopted dozens of proposed motions that merited substantive opposition. These finalized motions contradict the duties of a Committee

designed to identify recommendations that garnered broad agreement. Instead, ACUP advanced numerous policies that were supported by a slim margin of Committee members. The move that transformed "consensus" into a simple majority has now produced a final report that lacks any shred of legitimacy.

Cost versus Benefit Analyses

Many of the recommendations included in the majority report will only serve to increase costs for truckers, especially small-business operations that are the most experienced and safest in the industry. In their most recent cost-benefit analysis, NHTSA estimated total discounted annual cost of equipping new trailers and semitrailers with side underride guards between $970 million and $1.2 billion. NHTSA went on to mention that these costs on a per trailer basis are six to eight times more than the corresponding estimated safety benefits.

There was significant discussion within ACUP that USDOT, NHTSA, and law enforcement reporting mechanisms do not accurately count total underride crashes and fatalities. There was consensus among ACUP members that data collection for underride crashes and fatalities should be improved and I supported various motions to help accomplish that objective. However, there was little acknowledgment that NHTSA has omitted a number of operational costs beyond just installing and equipping new trailers and semitrailers with side underride guards, such as consideration of the long-term maintenance and durability of underride protection systems. NHTSA's 2023 Advance Notice of Proposed Rulemaking (ANPRM) on Side Underride Guards (RIN: 2127-AM54) did not account for the following:

- Any potential effects of side underride guards on port and loading dock operations and freight capacity, and on increased greenhouse gases and other pollutants resulting from increased fuel consumption;
- The effects of side underride guards on port and loading dock operations and freight capacity, and the practicability and feasibility of side underride guards in intermodal operations;
- Any costs associated with reinforcing trailers to accommodate the side underride guards and any associated changes to trailer loading patterns;
- Additional costs that accrue due to incremental wear and tear on equipped trailers; and
- Any costs and weight of strengthening the beams, frame rails, and floor of the trailer to accommodate side underride guards.

If NHTSA acts on any approved motions that recommend amending previous underride cost-benefit analyses, then all of these costs must be fully considered. I would also point out a few motions that needlessly place additional cost burdens on the agency that were approved by a slim majority of ACUP Members rather than a consensus:

- Motion: NHTSA should withdraw its previously submitted ANPRM or reissue a revised ANPRM and cost-benefit analysis that acknowledges and accommodates critiques made by commenters that the cost-benefit approach taken artificially constrained the number of lives saved and also failed to account for cost-savings (such as fuel efficiency gains provided by side-underride guards).

- Response: The report claims side guards will offer fuel efficiency benefits but does not provide empirical data or studies that quantify these savings. There is a reliance on theoretical aerodynamic improvements, without concrete evidence from real-world applications. Statements like "fuel efficiency gains provided by side underride guards" are made without specifying how these savings were calculated or validated.

- Motion: To require semitrailers, and single unit trucks manufactured after 1998 that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (PCI) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.
  - Response: The recommendation to retrofit all trailers manufactured after 1998 with side guards would impose significant financial burdens on small operators, and there is no detailed consideration of retrofit costs versus the economic capabilities of small businesses. If the 1998 retrofit date were adopted, the cost would be greater than 26 times the annual estimated cost which doesn't include the real-world annual costs. These retrofit costs would be approximately 30% higher than new equipment costs with equipment manufacturer's economies of scale. Costs for retrofitting, downtime, and maintenance are not evaluated against the financial constraints of small motor carriers. Small-business truckers comprise 96 percent of registered motor carriers in the United States, making them a key component of the nation's supply chain.

- Motion: NHTSA/USDOT should produce all documents related to rear guard standards including test data, contracts, studies, scoping documents, analyses, reports, memoranda, and/or other communications or references related to trailer and/or straight truck rear guard strength, design, quasi static or dynamic testing, and/or test protocols between 1970 and 1998.
  - Response: It's unclear how this information, some of which will be close to 60 years old, will help inform and facilitate the development of policies that are relevant to current conditions.

Operational and Safety Concerns

In addition to considering practical cost-benefit studies, NHTSA should be aware of operational and safety issues associated with underride equipment. There are a number of factors that USDOT must comprehensively consider, analyze, and test before promulgating new or amending existing underride standards. NHTSA cannot move forward with any side underride rulemaking without fully considering the practicability and feasibility the equipment has on trailer and semitrailer operations as there are numerous concerns limiting the real-world effectiveness of these devices. I specifically highlighted rail-crossings, loading docks, low ground clearances, jersey barriers, and deflected vehicles in ACUP presentations.

In 2022, there were more than 2,000 highway-rail crossing collisions in the U.S. and more than 30,000 reports of blocked crossings submitted to the Federal Railroad Administration's public

complaint portal. When commercial motor vehicles (CMVs) get grounded on highway-rail crossings, there are obvious safety concerns that can lead to collisions, injuries, and fatalities. Furthermore, these events cause equipment damage and other expenses.

There are potential maintenance concerns resulting in damage from curbs, roundabouts, raised humps on roads, speed bumps in parking lots, loading dock ramps, and other highway features that the equipment would undoubtedly encounter. These interactions would damage the side underride guards, forcing additional repair and possibly replacement costs. These damages could also force a driver out-of-service that would result in additional downtime costs. It's unclear if any of these costs would be covered by vehicle insurance policies or equipment warranties. These escalating costs would all have harmful safety outcomes as motor carriers/drivers would have less funding for routine maintenance and other vehicle-related upkeep.

Additionally, more real-world research and testing is warranted before quantifying possible benefits of side impact guards in crashes at speeds above 40 mph. The report advocates for side guards and underride protection technologies but does not provide robust, independent evidence supporting their effectiveness in real-world conditions for the variety of scenarios truckers encounter. Claims about the efficacy of side guards in preventing PCI in various crash scenarios lack supporting field data.

I fully support the following motions recommending conducting more review and analysis on these varying factors impacting underride safety.

- Motion: NHTSA should work with the Federal Railroad Administration to conduct research to examine potential impacts the installation of side underride guards would have during highway-rail grade crossings.

- Motion: NHTSA should investigate the potential for collision mitigation technologies for light and heavy-duty vehicles to prevent or reduce the risk associated with side underride crashes.

- Motion: NHTSA should assess risks associated with deflection into adjacent lanes associated with partial offset rear crashes as well as side underride crashes. Final results should be made public.

Recommendations that would prevent passenger vehicles from interacting with trucks in the first place are noticeably absent from the majority report. There are mentions of automatic emergency braking systems, distracted driving, and driver education, but the onus always falls on commercial drivers. Potential factors that would help mitigate instances of side underride crashes would be general driver education and outreach about how to operate around CMVs, additional measures to prevent distracted driving, as well as improving driver retention within the trucking industry through a variety of measures.

Conspicuity tape maintenance was proposed as another potential avenue to help mitigate underride crashes. However, I must raise opposition to the following motion:

- Motion: The ACUP should include in its Report to Congress a recommendation that FMCSA should issue stronger conspicuity requirements, at minimum, a requirement to maintain and replace conspicuity tape every 5 years.
    - Response: The effectiveness of conspicuity tape should be measured the same way that tail/marker lighting is currently measured. NHTSA states, "On the rear, at each side, red reflectors or reflectorized material visible from all distances within 500 to 50 feet to the rear when directly in front of lawful upper beams of headlamps." Citations are currently issued for damaged or missing conspicuity tape. Tape is an annual and pre-trip inspection item. A time stamped conspicuity tape product would have a distribution pipeline period that the five-year clock would be running on. The requirement approved in the motion also encourages downgrading of tape to only last the required duty cycle. The tape is extremely difficult to remove because it's designed that way. Paint is easier to remove. Scarce maintenance personnel are allocated working on systems that have a greater yield of lives saved, such as brakes and tires.

Public Law 117-58, Section 23011

Section 23011(d)(1) tasked ACUP, "to provide advice and recommendations to the Secretary on safety regulations to reduce underride crashes and fatalities relating to underride crashes."[1] The legislation also specifically defines "underride crash" as, "a crash in which a trailer or semitrailer intrudes into the passenger compartment of a passenger motor vehicle."[2] A number of pages included the majority report directly address lateral protection devices (LPUs) and vulnerable road users (VRUS) such as pedestrians and bicyclists, separate from underride crashes in which a trailer or semitrailer intrudes into the passenger compartment of a passenger motor vehicle. While USDOT and industry stakeholders must be vigilant in reducing fatalities and injuries involving CMVs and VRUs, there are various operational, design, and practical differences between LPUs and other underride equipment that does comply with the task required in Section 23011. These differences were acknowledged and discussed during ACUP meetings, but nonetheless discarded in the majority report.

The legislation also tasks NHTSA with conducting additional research, undergoing rulemaking processes, and *if warranted*, develop performance standards for side underride guards. I believe ACUP missed an opportunity to achieve consensus on recommendations that would have assisted the agency in fulfilling the intent of Section 23011. However, I urge NHTSA to continue further research and gathering stakeholder input as required by Congress.

In closing, ACUP advanced numerous policies that were merely supported by a slim margin of Committee members rather than a consensus. The move that transformed "consensus" into a simple majority produced a splintered final report that minimizes professional driver and industry perspectives. As such, USDOT should not promulgate new or amend existing underride standards until fully considering the practicability and feasibility the equipment has on trailer and semitrailer operations. This includes conducting additional comprehensive research, analysis, and testing as directed by Public Law 117-58, Section 23011. I do not concur with the final

[1] Public Law 117-58, section 23011(d)(1).
[2] Public Law 117-58, section 23011(a)(4).

report as submitted with particular objections to the majority report that have been outlined in the minority report and in this letter of dissent.

Thank you,

Doug Smith
Ralph Smith Co./Owner-Operator Independent Drivers Association

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	**Kristin Glazner**
Voting Member Organization	**Wabash**
Stakeholder Representation	**Trailer Manufacturer**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report, Section I ("Majority Report"), as written**

   Voting Member Signature _____ **Date:** _____

2. **Concur with the Final Report, Section II ("Minority Report"), as written**

   Voting Member Signature _____ **Date:** _____

3. **Concur with the Final Report,**
   ☐ Section I ("Majority Report"),
   ☐ Section II ("Minority Report"),
   as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature _____ **Date:** _____

4. **Non-Concur with both Sections I and II of the Final Report as written. Letter of Dissent must be provided.**

Voting Member Signature: M. Kristin Glazner **Date: June 27, 2024**

I do not concur with the ACUP Report. This summary reflects the entirety of my comments.

ACUP's value lies in fulfilling its charge to find common ground among disparate views on how NHTSA can and should address underride protection. My focus has been on areas for which I believe ACUP may provide actionable consensus recommendations that will assist NHTSA.

For several reasons, ACUP's deliberative processes and governance structure did not yield actionable recommendations arising from informed compromise. The Committee was not convened until halfway through its two-year charter, and only met six times. No guidance was provided about resources available to ACUP to effectively fulfill the role set by Congress. The primary source for information presented to ACUP was ACUP members themselves; ACUP did not solicit input from technical experts on most of the topics covered. ACUP members were required to submit motions on various topics *before* receiving or offering any information about those topics, meaning a substantial portion of each meeting was devoted to discussing and voting on motions that often were unrelated to any information made available to or discussed by the group. Contrary to agency direction, discussions were conducted by Committee members via email exchanges on wide-ranging topics. No external report writer was retained.

The result is separate "majority" and "minority" reports. While an accurate reflection of division within the Committee, these reports do not satisfy our obligation under the ACUP Charter to produce consensus recommendations that meaningfully inform NHTSA and Congress on underride protection. I am a member of ACUP as a whole and do not consider myself to be in the "majority" or the "minority."

The "majority report" is misleading insofar as it combines content that is reflective of the Committee's work with concepts and information that were neither presented to nor discussed by the Committee, are unsupported by data, or are inaccurate. The "majority report" does not distinguish true consensus views from editorial content by the report's sole author. This is unfortunate, because although there were subjects on which the Committee did reach genuine consensus, they cannot be readily identified within the "majority report." I refer any reader of the ACUP Report to the meeting minutes, available meeting recordings, and any Committee email records for the most accurate documentation of the Committee's work.

Lastly, my understanding based on NHTSA's guidance is that its rulemaking decisions are data-driven. To that end, I moved at the March 13, 2024, meeting that the Committee recommend that NHTSA conduct comprehensive, updated research on U.S. underride crash characteristics, including the frequency of 30 percent rear overlap crashes. This motion passed 13-4 and thus represents a true consensus view of ACUP. I commend this consensus recommendation to NHTSA's attention.

In the event the Committee meets again under its extended Charter, my hope is that additional support for the DFO and an improved process will facilitate more productive discussions.

ADVISORY COMMITTEE ON UNDERRIDE PROTECTION (ACUP)

Statement of Concurrence / Non-Concurrence

Voting Member Name	**Jeff Bennett**
Voting Member Organization	**Utility Trailer Manufacturing Company, LLC**
Stakeholder Representation	**Motor Vehicle Engineer**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report as written**

   Voting Member Signature _____ **Date:** _____

2. **Concur with the Final Report as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)**

   Voting Member Signature Jeff Bennett Jeff Bennett (Jun 26, 2024 23:05 PDT) **Date: June 26, 2024**

Except as otherwise noted in the attached Letter of Concurrence and Dissent, I concur ONLY with Section II, Minority Report and certain Technical Bulletins as referred to in the Minority Report; I have not had an opportunity to review statements submitted by other individual members so I cannot say at this time whether I concur or dissent from those.

SEE ATTACHED:

JEFF BENNETT – MOTOR VEHICLE REPRESENTATIVE

—LETTER OF CONCURRENCE AND DISSENT FROM THE BIENNIAL REPORT—

3. **Non-Concur with the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____

JEFF BENNETT – MOTOR VEHICLE ENGINEER REPRESENTATIVE

– LETTER OF CONCURRENCE AND DISSENT FROM THE BIENNIAL REPORT –

I[1] generally concur with the statements contained in the Minority Report included as Section II of the Biennial Report to Congress and the Secretary of the Advisory Committee on Underride Protection ["**Biennial Report**"]. As noted in that Minority Report, other than the Minority Report, and the statements of certain ACUP members contained in this Appendix III.B., the Biennial Report reflects the work solely of the Committee Chair; I had no opportunity to provide input into the Biennial Report and its various conclusions and characterizations.

And as discussed in the Minority Report, many of the Biennial Report's recommendations are based on a distorted definition of "consensus" and reflect only the majority vote of ACUP membership, which itself was preordained by the biases and predetermined conclusions many of the ACUP members brought to their work. In reviewing the Biennial Report's recommendations in this Letter of Concurrence or Dissent, I will not repeat the criticisms contained and documented in the Minority Report, other than to emphasize—for certain recommendations—how narrow the majority vote was that allowed the recommendation to find its way into the Biennial Report.

For ease of reference, this Letter of Concurrence or Dissent will follow the organization the majority adopted in preparing the Biennial Report. But because the Biennial Report's recommendations do not list which ACUP motion is the foundation for the recommendation, and the "Record of Motions" contained in Appendix III.A. prepared by the majority is neither complete nor accurate, this Letter of Concurrence or Dissent will use the Record of Motions contained in Appendix G of the Minority Report for numerical references.

Section 1 (pp. 25)

The Biennial Report's estimates of underride fatalities and injuries[2] are based on a letter from Eric Hein to James Myers submitted toward the end of ACUP's work. Mr. Hein is the father of an underride victim; he is an unabashed advocate for underride guards and is part of the group that repeatedly has criticized NHTSA's conclusions concerning the number and extend of fatalities and injuries resulting from underride

[1] Although I am employed by trailer manufacturer Utility Trailer Manufacturing Company, LLC, I submit this Letter of Concurrence or Dissent solely in my capacity as an appointee to the ACUP as a representative of Motor Vehicle Engineers. *See* Public Law 117-58, section 23011(d)(1); ACUP Charter. The views expressed here may or may not be the views of my employer.

[2] Biennial Report, pp. 2-3.

crashes. He is hardly unbiased. Nor is he qualified to provide this information. According to his statements, Mr. Hein's career was spent with the US Forest Service. Although he says his responsibilities included managing large datasets, there is nothing that assures either the completeness or accuracy of his work.

Rather than relying on estimates from individuals who have an admitted agenda in finding flaws with NHTSA's conclusions concerning the extent of the underride problem, I recommend that the first priority should be to commission independent research into the extent of the underride problem, including key information concerning the nature of the injuries either themselves or that caused the fatality, and detailed information concerning the circumstances leading to the accident and the way the accident occurred. Factors to be considered are included in Section III.A. of the Minority Report, at page 17.

The Minority Report notes the importance of focusing on alternative crash-avoidance technologies, such as automatic braking. The Biennial Report dismisses these technologies by claiming that the technologies do not work because of the "gaping open space" underneath trucks.[3] The Biennial Report, however, provides no support for this claim.

I strenuously dissents from the arguments contained at pages 4-5 as to why a slim majority of ACUP member were able to write out of the ACUP's Charter any obligation to obtain a consensus for its recommendations. I agree with the analysis contained in the Minority Report on this topic.

Rulemaking: Side Underride (pp. 57)

I dissent from these recommendations. These were among the most contentious issues discussed by the ACUP, and the motions on which these recommendations are based were passed by a majority, but just barely. The recommendation to withdraw the ANPRM passed 7-6-4[4] and is offset by the defeat of Motion B4 on a 7-7-3 vote (the seven votes in favor were all part of the pro-underride-guard bloc discussed in the Minority Report): That motion B4 proposed a finding by ACUP that NHTSA had underestimated the number of preventable side-underride deaths and erroneously concluded that costs outweigh benefits. The proposed motion ended with a statement that "NHTSA should withdraw the 2023 side-impact-guard ANPRM." Of course, this last sentence is same statement that passed in Motion B2 by the narrowest of margins, even though it did not even gain a majority of total votes cast. When such a conclusion narrowly passes in one motion and then fails to gain a majority a few minutes later in the same meeting, it

[3] Biennial Report, pp. 3-4.

[4] Motion B2 (all references to motions in this Letter of Concurrence or Dissent are based on the numbers contained in Appendix G to the Minority Report – "*Corrected Record of Motions and Votes*."

cannot be said that withdrawing the ANPRM is wholeheartedly recommended by the ACUP.

Along the same lines, I dissent from the Biennial Report's dual recommendations that NHTSA require all semitrailers and single-unit trucks manufactured after 1998 to be equipped with side guards that will prevent PCI when struck by a midsize vehicle at any angle and any location.[5] The recommendation that all trailers manufactured in the last 26 years be retrofitted with guards passed by only a 8-6-3 vote (with six votes from the bloc predisposed to require underride guards); the recommendation regarding requiring such guards on new trailers was approved 11-6-0 (with seven or eight votes from the bloc predisposed to requiring underride guards); and the recommendation that the required side guards also prevent so-called vulnerable road users from passing underneath a guarded vehicle passed 9-8-0 (with seven votes coming from those predisposed to requiring underride guards). Such a dramatic requirement should not be based on a slim recommendation from the ACUP, particularly when those predisposed to require underride guards, regardless of costs, effectiveness and without consideration of inadvertent consequences, drove that result.

The flaws in these recommendations is that they assume as true the critical element that has not been established: that side-underride guards are effective in significantly preventing or minimizing the fatalities and injuries that actually occur from underride accidents. The Committee did not receive any unbiased, scientifically grounded evidence either that NHTSA "artificially constrained" the number of lives that would be saved, or that the fatalities and injuries that occur in these collisions occurred in such a way that available technologies could prevent them.

The motions refer to preventing PCI in collisions that occur "at any angle, at any location, and at any closing speed up to and including 40 mph." But no evidence presented to the ACUP showed that this technology exists. To the contrary, there has been limited testing of three guards: the AngelWing invented by Perry Ponder, the SafetySkirt invented by ACUP Committee Member Aaron Kiefer, and the Side-Impact Guard invented by Utility Trailer Manufacturing Company. This testing demonstrates that the guards will ***not*** prevent PCI in all these situations.

The Insurance Institute for Highway Safety tested the AngelWing twice: once at 35 mph and once at 40 mph.[6] Both tests stopped the Chevy Malibu used. The ACUP also saw videos of a SafetySkirt and Utility's Side-Impact Guard stopping mid-sized

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[5] Biennial Report, p. 6; based on Motions B9 and B10.

[6] As described in detail in the Minority Report, IIHS for some reason did not use the same criteria in testing the AngelWing as it did in all of its tests of the rear guards: It did not fully load the trailer, and it concentrated the load at the rear. The effect of this was to decrease the trailer's inertia, effectively lowering the speed of the collision. *See* Minority Report, p. 20 note 34.

automobiles at 35 mph. But these tests occurred into the center of the guard and occurred at a 90-degree angle.

There has not been any test conducted at the end of the guard, and only one test in an overlap situation—similar to the tests IIHS performed on the rear guard (but which, for some reason, it has not yet been willing to conduct on side guards). Utility Trailer conducted the 30% overlap test on its Side-Impact Guard, and (as shown in the Minority Report[7]) it failed to prevent PCI. Also, Utility Trailer learned of tests conducted on an AngelWing using a Ford Fiesta crashing at 45 mph at 45-degree angle into the center of the guard. Although ACUP Members Karth and Kiefer were present at the test, they did not show the test results to the ACUP. But I did show the video, in which the AngelWing detached from the trailer, collapsed, and allowed significant PCI.[8]

Nor have there been any tests that will calibrate a potential side-underride guard's performance with the requirements currently stated as minimums for rear-impact guards. As noted in the Biennial Report, the Department has significantly upgraded the FMVSS 223 strength requirements for rear-impact guards to match the Canadian standards. But there has not been any testing to the specific requirements of these new standards, which require the guard to resist at least 78,683 pounds of force applied across the horizontal guard without deflecting more than 125 mm, and require that the guard must absorb at least 14,751 ft lbs. of energy within the first 125 mm of deflection through plastic deformation. And the FMVSS 223 requirement that, after load application, ground clearance not exceed 560 mm creating high-centering situations that in tests of the AngelWing will significantly damage the guard and the trailer.[9] This damage will not occur absent the side-underride guard.

The bottom line: Significant additional work, work supported and augmented with unbiased testing, to determine the extent to which technologies can mitigate or prevent fatalities and injuries attributable to underride.

But before this testing and development is performed, the independent, science-based research on the nature, scope, and exact cause of the crashes and associated injuries as detailed earlier in this Dissenting Letter needs to be completed. Only by knowing the scope of the problem, and exactly what causes it, can suitable technological response be developed. Hanging an additional 800-1,000 pounds of iron on the side of a trailer[10] may seem like the panacea, but that conclusion does not have any scientific basis to back it.

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[7] Minority Report, pp. 2122.

[8] Minority Report, pp. 2223.

[9] See FMVSS 223.

[10] Utility's Side-Impact Guard weights 962 lbs. Minority Report, p. 27 note 44.

Finally, additional research into unintended consequences of adding side guards to trailers needs to be comprehensively studied. The ACUP received evidence that existing side-guard technology damages the trailer and is subject to failure in high-centering situations. There are also concerns of high centering causing trailers to be stuck on railroad tracks: Fortunately, the ACUP unanimously approved a recommendation that NHTSA should work with the Federal Railroad Administration to conduct research on potential impacts of side-underride guards during highway rail-grade crossings.[11] Additional factors to be considered in evaluating unintended consequences include the effect of adding 800-1,000 lbs. to the trailer weight (in terms of added fuel costs, damage to infrastructure, and additional fatalities due to the need for additional loads), compliance with safety standards (such as air-hose regulations) and bridge laws, and interaction with equipment that traditionally sits under the trailer, such as spare-tire carriers, equipment boxes, lift-gates and their controls, aerodynamic devices, and the like.

In terms of added fuel costs, the Biennial Report argues that the costs can be offset by attaching aerodynamic devices to the side-underride guard.[12] The flaws in that reasoning include the following:

- Many of the trailers involved either are required to have (due to various state regulations) or already have aerodynamic devices; for those trailers, there is no added fuel savings available. And any operator who wishes to achieve the fuel-savings benefits from a side aerodynamic device is already able to achieve these results without a side-underride guard and its associated fuel penalties.

- Tests demonstrate that aerodynamic devices only provide significant fuel benefits when the trailer is operated at above roughly 30 mph. Many semitrailers are not run on the open road but instead are used for short haul or local delivery; these include, for example, many grocery trailers. Adding a side aerodynamic device in these instances will do very little, if anything, to achieve added fuel savings. If anything, the added weight of the device will further decrease fuel economy.

- As noted in the Minority Report, there are significant compatibility problems between the rigid side-underride guard and the flexible aerodynamic device. As the trailer encounters changes in grade, the inability of the aerodynamic device to flex (because it is rigidly held in place by the side-underride guard) causes damage to the aerodynamic device, often causing it to tear, pieces of the guard (or the entire guard) to break off, or to being removed by the operator due to its

[11] Biennial Report, p. 8 (last bullet point); "*Corrected Record of Motions and Votes*," Minority Report Appendix H, Motion B18.

[12] Biennial Report, p. 19

damaged condition. As pieces of the guard, or the guard itself, breaks off, other users of the highways are exposed to a dangerous condition.

- Additionally, when the aerodynamic skirt is removed from the guard, either by the operator because of damage, or due to the damage, the trailer is significantly less aerodynamic than without the side-underride guard in place. This further decreases fuel economy.

Were the Secretary and Congress inclined to require side-underride guards on trailers, it also would be appropriate to conduct studies to determine the extent to which those guards would prevent vulnerable road users ["**VRU**"] from passing under the required guard. But it is essential to recognize that the guard design that will help mitigate VRU injuries and fatalities is not necessarily the same guard design that would stop an automobile. Because guards designed for VRUs are lightweight and flexible, they do not suffer from all the same flaws as do side-underride guards as traditionally understood. But being lightweight and flexible means that that they are subject to the same damage and risks as face aerodynamic side skirts. Utility Trailer offers a pedestrian guard that is a modified Utility side skirt. The ACUP received evidence that such skirts suffer severe damage in change-of-grade situations, at times causing pieces of the guard to detach during operation. This, of course, is a potential hazard to the motoring public. These additional risks must be fully understood and weighed as decisions are made concerning how to address issues surrounding VRUs.

Rulemaking: Rear Underride (pp. 6-7)

I reaffirm my belief that unless a recommendation is based upon a true consensus of opinion of ACUP members, the Biennial Report should not contain that recommendation. The Minority Report already discussed in detail how a small majority of the ACUP distorted and redefined the word "consensus" to advance their predetermined agenda. I nonetheless provide my views concerning the following motions in the Biennial Reports' Rulemaking—Rear Underride section, as Imay have supported a motion that did not obtain consensus approval, and I may not approve of a motion that did obtain such consensus approval.

I **support** the following Biennial Report's recommendations contained in the Rear-Underride section, with qualifications noted *in italic*:

- Motion A12 (Recommendation #3, Biennial Report p. 6): Retrofit trailers manufactured since 1998 with rear guards consistent with TOUGHGUARD standards. ***But*** *using a TOUGHGUARD standard, which requires passing a series of crash tests at 100%, 50%, and 30% overlap, is impractical; rather, the standard should be based on the force requirements currently contained in FMV 223 and 224.* (Motion carried 8-1-6 with 53% of the vote.)

- Motion A13 (Recommendation #4, Biennial Report p. 7): apply rear-impact-guard regulations to single unit trucks. ***But*** *using a TOUGHGUARD standard, which requires passing a series of crash tests at 100%, 50%, and 30% overlap, is impractical; rather, the standard should be based on the force requirements currently contained in FMV 223 and 224.* (Motion carried 9-2-4 with 60% of the vote.)

- Motion A16 (Recommendation #5, Biennial Report p. 7): complete Heavy Vehicle Automatic Emergency Brake Rulemaking. (Motion carried 15-0-0 with 100% of the vote.)

I **dissent** from the following Biennial Report's recommendations contained in the Rear-impact Guards section, with additional reasons noted *in italic*:

- Motion A6 (Recommendation #1, Biennial Report p. 6): Amend 2022 Rear-Impact-Guard Rule to require all new trailers to meet the IIHS TOUGHGUARD test. (Motion carried 10-1-6 with 58% of the vote.)

- Motion A18 (Recommendation #6, Biennial Report p. 7): Require replacement of conspicuity tape every five years. *There was no evidence presented to the ACUP that lack of conspicuity tape was a significant issue, or that replacement every five years was necessary.* (Motion carried 11-4-1 with 68.75% of the vote.)

Research (pp. 7-9)

I reaffirm my belief that unless a recommendation is based upon a true consensus of opinion of ACUP members, the Biennial Report should not contain that recommendation. The Minority Report already discussed in detail how a small majority of the ACUP distorted and redefined the word "consensus" to advance their predetermined agenda. I nonetheless provide my views concerning the following motions in the Biennial Report's Research section, as I may have supported a motion that did not obtain consensus approval, and I may not approve of a motion that did obtain such consensus approval.

I **support** the following Biennial Report's recommendations contained in the Research section:

- Motion A17 (Recommendation #3, Biennial Report p. 8): NHTSA to research how survivability of rear-underride crashes changes with increased adoption of Automatic Emergency Braking at speeds from 35 mph to 65 mph. (Motion carried 15-0-0 with 100% of the vote.)

- Motion A3 (Recommendation #4, Biennial Report p. 8): NHTSA to comprehensively research underride crash characteristics, including frequency of 30% overlap crashes. (Motion carried 13-4-0 with 76% of the vote.)

- Motion A20 (Recommendation #5, Biennial Report p. 8): DOT to continue research into Enhanced Rear Signaling Systems to help prevent rear-underride crashes. (Motion carried 16-0-0 with 100% of the vote.)

- Motion A21 (Recommendation #6, Biennial Report p. 8): DOT to research efficacy of high-visibility Clearance Lamps to assist with a potential rulemaking for all commercial motor vehicles. Motion carried 14-1-1 with 87.5% of the vote.)

- Motion A22 (Recommendation #7, Biennial Report p. 8): DOT to research efficacious manner of reducing distracted driving, such as flashing lamps. (Motion carried 16-0-0 with 100% of the vote.)

- Motion B13 (Recommendation #8, Biennial Report p. 8): DOT to study conspicuity tape in service, including rates of compliance with reflectivity requirements and ability of law enforcement to enforce the requirements, including recommendations how to reduce most common forms of non-compliance. (Motion carried 16-1-0 with 94% of the vote.)

- Motion B21 (Recommendation #9, Biennial Report p. 8): NHTSA to assess risks of deflection into associated traffic lanes resulting from offset rear crashes and side-underride crashes, making the results public. (Motion carried 9-6-0 with 60% of the vote.)

- Motion B18 (Recommendation #11, Biennial Report p. 8): NHTSA to work with Federal Railroad Administration to research potential impact of side-underride guards during highway-rail-grade crossings, making the results public. (Motion carried 15-0-0 with 100% of the vote.)

- Motion B20 (Recommendation #13, Biennial Report p. 9): NHTSA to investigate potential for collision-mitigation technologies for light- and heavy-duty vehicles to reduce the risk associated with side-underride crashes. (Motion carried 15-0-0 with 100% of the vote.)

I **dissent** from the following Biennial Report's recommendations contained in the Research section, with additional reasons noted *in italic*:

- Motion B26 (Recommendation #10, Biennial Report p. 8): NHTSA to request Volpe Center to determine whether a side-underride guard effectiveness is similar or greater than Lateral Protective Devices in mitigating severity of

pedestrian, cyclist, and motorcyclist fatalities. (Motion carried 13-1-1 with 86.6% of the vote.)

- Motion B25 (Recommendation #13, Biennial Report p. 9): DOT to explore weight-limit exemption for side-underride guards. *Such an exemption is likely to have a negative effect on bridges and other infrastructure, and added weight could increase the severity of crashes of a semitrailer*. (Motion carried 7-6-2 with 46.6% of the vote.)

Miscellaneous (pp. 9-10)

I reaffirm my belief that unless a recommendation is based upon a true consensus of opinion of ACUP members, the Biennial Report should not contain that recommendation. The Minority Report already discussed in detail how a small majority of the ACUP distorted and redefined the word "consensus" to advance their predetermined agenda. I nonetheless provide my views concerning the following motions in the Biennial Report's Miscellaneous section, as I may have supported a motion that did not obtain consensus approval, and I may not approve of a motion that did obtain such consensus approval.

I **support** the following Biennial Report's recommendations contained in the Miscellaneous section:

- Motion B28 (Recommendation #1, Biennial Report p. 9): DOT to disseminate educational material to help law enforcement identify and record side-underride crashes. (Motion carried 15-0-0 with 100% of the vote.)

- Motion A23 (Recommendation #12, Biennial Report p. 9): FMCSA should work with state law enforcement and other stakeholders to emphasize education and the need to issue rear-impact guard violation citations and encourage maximum fines for violations affecting safety. (Motion carried 14-1-0 with 93% of the vote.)

- Motion B29 (Recommendation #7, Biennial Report p. 10): ACUP Report to reflect whether each Committee member concurs or does not concur with the report by allowing a statement of concurrence or nonconcurrence. (Motion carried 15-0-0 with 100% of the vote.)

I **dissent** from the following Biennial Report's recommendations contained in the Miscellaneous section, with additional reasons noted *in italic*:

- Motion A9 (Recommendation #3, Biennial Report p. 9): NHTSA / DOT to provide ACUP with scoping documents, directions, and discussions between NHTSA / DOT and Elemance regarding rear-guard analytical work between 2018

and 2024. *This Motion was not voted on separately; rather, it was combined with Motion A10. As noted in the Biennial Report at p. 13 ("ACUP's Assessment"), NHTSA already considered this and similar requests and—after comprehensive review—determined that these are "deliberative materials" that ACUP was not entitled to access. The pro-underride-guard group appealed his decision; the appeal was rejected.* (Motion A9 was combined with A10. A10 motion carried 12-3-1 with 75% of the vote.)

- Motion A10 (Recommendation #4, Biennial Report p. 9): NHTSA / DOT to provide ACUP with scoping documents, directions, discussions, test results, data, memoranda, reports and/or notes generated before, during, and following quasi static testing of trailer rear-underride guards conducted by Karco or other contractors on behalf of NHTSA/DOT between 2016 and 2024. *As noted in the Biennial Report at p. 13 ("ACUP's Assessment"), NHTSA already considered this and similar requests and—after comprehensive review—determined that these are "deliberative materials" that ACUP was not entitled to access. The pro-underride-guard group appealed his decision; the appeal was rejected.* (Motion carried 12-3-1 with 75% of the vote.)

- Motion A11 (Recommendation #5, Biennial Report p. 9): NHTSA / DOT to produce all documents related to rear guard standards including test data, contracts, studies, scoping documents, analyses, reports, memoranda, and/or other communications or references related to trailer and/or straight truck rear guard strength, design, quasi static or dynamic testing, and/or test protocols between 1970 and 1998. *As noted in the Biennial Report at p. 13 ("ACUP's Assessment"), NHTSA already considered this and similar requests and—after comprehensive review—determined that these are "deliberative materials" that ACUP was not entitled to access. The pro-underride-guard group appealed his decision; the appeal was rejected.* (Motion carried 10-6-0 with 62.5% of the vote.)

- Motion B3 (Recommendation #6, Biennial Report p. 9): NHTSA, per the Modernizing Regulatory Review Executive Memo and corresponding guidance, must fully account for regulatory benefits that are difficult or impossible to quantify when conducting rulemaking analysis. *This recommendation presents NHTSA with an impossible task: accounting for items that are "impossible" to quantity and to include them in a cost-benefit analysis.* (Motion carried 9-2-6 with 52.9% of the vote.)

Assessment of DOT's Progress in Advancing Safety Regulations Relating to Underride Crashes (pp. 1119)

This section of the Biennial Report contains the criticisms often repeated by those who are unhappy with NHTSA's conclusions concerning the lack of cost-benefit for a side-underride requirement, including Mr. Brumbelow who sent NHTSA a letter in connection with the ANPRM that forms the basis for these criticisms (and which is cited in the Biennial Report). The Minority Report already addresses many of these issues, noting the lack of objective information.

Also, there is no basis—again other than recalculations prepared by Mr. Brumbelow—as to what the actual cost-benefit of a side-underride-guard requirement would be. The ACUP's directive was to provide "written consensus advice" on safety regulations to reduce underride crashes and fatalities. Congress did not establish the ACUP to perform cost-benefit analyses, and there is nothing to suggest that the Committee members, individually or collectively, are qualified to perform this analysis, let alone more qualified than NHTSA, which performs this analysis routinely. Accordingly, all conclusions in the Biennial Report concerning the results of Mr. Brumbelow's revised cost-benefit calculation should be disregarded.[13]

As further noted in the Minority Report, and earlier in this Letter of Concurrence and Dissent, the proper approach is for DOT and Congress to authorize unbiased, scientific-based research into the scope of the underride problem, and the ability of technologies to solve it while avoiding or minimizing unavoidable consequences. Only with this information will NHTSA be able to make appropriate policy recommendations concerning what "safety regulations to reduce underride crashes and fatalities relating to underride crashes"[14] are cost justified.

4. Automatic Emergency Braking (pp. 20-21)

As noted earlier, the ACUP unanimously recommended that NHTSA research how survivability of rear-underride crashes changes with increased adoption of Automatic Emergency Braking at speeds from 35 mph to 65 mph.[15] Similarly, the ACUP voted unanimously that NHTSA investigate potential for collision-mitigation technologies to reduce the risk associated with side-underride crashes.[16] These motions were unanimously adopted because they make real-world sense: it is far better to take steps to

[13] Biennial Report, p. 17.

[14] Public Law 117-58, section 23011(d)(1).

[15] Motion A17.

[16] Motion B20.

avoid any collision entirely, or at least to lessen the force involved in a collision, rather than attempt to dissipate the energy from and unpredictable forces involved in myriad crash scenarios.

The Biennial Report makes a number of assertions about limitations on these technologies based either on no research, or on research from those who have a bias toward requiring underride guards. As noted earlier, additional unbiased research is needed to fully understand the scope of the underride problem, including the various crash scenarios that lead to the fatalities and injuries. With this information, the ability of alternative technologies to solve the problem—both immediately and as technologies become more widespread—can be fully understood. These conclusions are essential to determining whether a requirement to install guards, whether just on new trailers or on all trailers manufactured in the last 24 years, is cost justified.

5. Allegations of Suppression of Underride Research Received by the ACUP (pp. 22-23)

I wholeheartedly agree with the Minority Report's recommendation that Congress and the DOT should completely disregard this section of the Biennial Report. As admitted in the Biennial Report, the materials giving rise to this section and which are included as Appendixes D through F to the Biennial Report, are based on an unsolicited letter ACUP received from Quon Kwan and are said to be bolstered "by an anonymous source within the DOT" (citing statements made in a Frontline video presentation).[17]

Mr. Kwan appears to be a disgruntled former employee who is upset because, he says, a report ultimately published concerning lateral protection devices or pedestrian guards differed from the version on which he worked while employed at the FMCSA. In his letter, Mr. Kwan suggests—without any evidence—that individuals at NHTSA may have been unduly influenced into changing the conclusions of the report as Mr. Kwan worked on it. As the Biennial Report notes, after receiving the unsolicited letter, NHTSA "did not allow the ACUP to discuss or hear his statement and referred the matter to the Department's Office of Inspector General."[18] I submit this was the appropriate action and should have been the end of the discussion.

But unhappy with this result, the Committee Chair, Lee Jackson, unilaterally decided to include Mr. Kwan's letter, along with versions of the Volpe Center reports, in the Biennial Report. He did this even though, admittedly, none of these materials was even reviewed by or considered by the ACUP, let alone decided on as being a consensus view (or even a majority view) of the Committee. Faced with this plain abuse of discretion by Chair Jackson, I sent Mr. Jackson an email requesting that the material be removed

[17] Biennial Report, p. 22.

[18] Biennial Report, p. 23.

from the Biennial Report because it was never considered. Mr. Jackson refused, noting that, "***I believe*** that Congress should be made aware of it, and that it is relevant to the report" (emphasis supplied). In other words, Mr. Jackson substituted his personal views for the views of the ACUP. This, unfortunately, is consistent with the general approach taken in the Biennial Report: either a subset of ACUP members predisposed to requiring underride guards, or Mr. Jackson by himself, sees fit to make sweeping recommendations based on personal beliefs, regardless of input from other ACUP members. In any case, the letter from Mr. Kwan and the related Volpe reports should be disregarded entirely.

—Submitted by Jeff Bennett, Motor Vehicle Engineer Representative

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

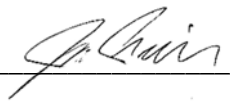
Voting Member Name	**John Freiler**
Voting Member Organization	**Truck Trailer Manufacturers Association**
Stakeholder Representation	**Trailer Manufacturers**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report as written**

   Voting Member Signature _____ **Date:** _____

2. **Concur with the Final Report as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)**

   Voting Member Signature  **Date:** 27JUN2024

See attached file "JF ACUP Lost Opportunities – Final".

3. **Non-Concur with the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____

Lost Opportunities

Executive summary: *The ACUP Majority Report is a slanted report leaving out vital information and pushing only one view despite the charter's call for "consensus". There was some consensus around conducting more studies which do merit consideration, as is reflected in the Minority Report and this document, but the committee is deeply divided and unable to produce significant work.*

On the Majority Report's "Advice and Recommendations to the Secretary":

While the goals of the advisory committee were laudable, we failed to accomplish them in major part because of one simple thing: the definition of "consensus". It should be no surprise to people that there were contentious issues with differing viewpoints and with a properly formed committee, these issues could be hammered out and possibly some real progress on preventing underride deaths could have been reached. Alas, a slight majority elected to forgo this hopeful possibility and rammed through a definition of "consensus" as being a bare majority. At that point, communication largely broke down and very little real progress has been made.

The majority report attempts to justify the abandonment of real consensus recommendations by noting that they broke no laws. It was never held that what the majority did was illegal, simply that it was bad for the committee and made it more difficult for us to meet our mandate, to actually improve safety on the nation's roadways.

The final report is essentially anti-trucking and anti-DOT overall. I have rated the various motions made about what to include in the report by the degree of support: number of "Yes" votes divided by the total number of members present. Many of the recommendations didn't even have 50% of the committee's support due to abstentions. (For example, the motion to ask DOT to suspend the SUG rulemaking got 7 votes in support, 6 votes against and 4 abstentions, resulting support is 7 in favor out of 17 total votes resulting in 41% support.)

I would strongly recommend that the Secretary of Transportation or anyone else reading this report consult this list. The motions with 100% support should be the highest priority with the others above 80% support represents actual consensus. The rest of the recommendations, especially those below 70% should be considered one-sided. While there are a few good ideas that failed to gain true consensus, the vast majority of the low-support recommendations were fueled by ignorance of industry, safety, regulations, and the regulatory process. Quite a few of the information requests of DOT seem to have been little more than fishing expeditions, looking into materials over 25-year-old data and internal deliberative work.[1]

For example, the Majority Report falsely claims in discussion of side guards that Industry says most trips weigh-out[2] when the fact is that we claim that weight displacement is significant. Indeed, TTMA has referenced that 30% of trips are at or near weigh-out conditions which is the actual figure from size &

[1] Majority Report p9 5th, 6th, & 7th bullet points.

[2] Majority Report Page 3 "DOT research has found that 'most long haul truck shipments cube out before they weigh out', despite protestations from industry saying otherwise".

weight studies[3]. The majority proceeds as if that figure is zero in brushing aside all matters of freight displacement and the additional load-miles that will be necessarily added to our nation's roadways and the accidents and consequent deaths from all causes that those load-miles will create.

Broadly, the recommendations with consensus are to conduct further studies, improve data collection, and focus on rulemaking that can reduce accidents from all sort of collisions: conspicuity improvements, and automatic braking and other driver assistance technology.

Oddly, I find a number of recommendations that achieved high levels of consensus were left out of the Majority report[4]. Whether this was due to intentional distortion or simple oversight, I cannot say with certainty, but I find it troubling that frequent points raised by industry resulting in recommendations to include a study of railroad crossings issues and a study of how collision mitigation technologies will reduce risk (see footnotes 9 & 11) were excluded despite getting unanimous support from the committee.

The motions below are sorted by support percentage and then meeting date. Foot notes tag each motion to their place in the 06.18.2024 version of the Majority Report.

100%, 3-13: A recommendation that NHTSA must expeditiously complete Heavy Vehicle Automatic Emergency Brake Rulemaking for all classes of CMVs (RIN 2127-AM36)[5].

100%, 3-13: A recommendation that NHTSA conduct a study to research how the survivability rate of rear underride crashes will change with increased passenger vehicle adoption of Automatic Emergency Braking at currently tested speeds (35 mph) as well as highway speeds (up to 65 mph).[6]

100%, 3-13: A recommendation that DOT should continue research into Enhanced Rear Signaling Systems that could help better prevent rear underride crashes.[7]

100%, 3-13: A recommendation that DOT conduct research into efficacious methods of reducing Distracted Driving such as flashing lamps.[8]

100%, 5-22: DOT should work with FRA to examine potential impacts the installation of SUGs would have during highway grade crossings and make such review public.[9]

100%, 5-22: To further GAO recommendation #1 regarding improvements to Model Minimum Uniform Crash Criteria, NHTSA should take additional steps to include both vehicle-related side underride crashes and Vulnerable Road Users in reporting fatalities related to side underride guard crashes.[10]

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[3] "…weigh-in-motion data for 3-S2s indicate that over 70 percent operate at 70,000 pounds gross vehicle weight or less." (Comprehensive Truck Size and Weight Limits Study, November 2013, Modal Shift Analysis, p8.)

[4] The Majority Report has been undergoing revisions once the Minority Report started pointing out deficiencies. I have made every effort to correct these updates as the report has been changed.

[5] Majority Report, p7 2nd bullet point.

[6] Majority Report, p8 1st bullet point.

[7] Majority Report, p8 3rd bullet point.

[8] Majority Report, p8 5th bullet point.

[9] Excluded from original Majority Report, inserted on p8 9th bullet point.

[10] Excluded from Majority Report.

100%, 5-22: NHTSA should investigate the potential for collision mitigation technologies for light and heavy-duty vehicles to prevent or reduce the risk associated with side underride crashes.[11]

100%, 5-22: The ACUP shall recommend that DOT disseminate educational material in addition to the existing brochure for law enforcement to help them identify and record side underride crashes.[12]

100%, 5-22: The ACUP include a page showing each members concurrence or non-concurrence with the final report as well as allowing each member to make a statement on the final report to be included as an appendix. [13]

94%, 3-13: A recommendation that NHTSA should additionally require Single Unit Trucks to adhere to conspicuity requirements.[14]

94%, 4-24: The department should conduct a study of conspicuity tape in service. This study focuses on actual rates of compliance with the regulated minimum reflectivity requirements, the ability of enforcement personnel to accurately and adequately enforce these requirements, and make recommendations on how to reduce the most common forms of non-compliance found.[15]

93%, 3-13: A recommendation that FMCSA work with State law enforcement and other stakeholders to emphasize education and the need to issue RIG violation citations and encourage maximum fines for violations affecting safety. [16]

88%, 3-13: The ACUP should recommend that DOT research the efficacy of high visibility ID lamps that illuminate the rear of a CMV to assist with potential Clearance Lamp rulemaking for all CMVs[17]

87%, 5-22: The ACUP shall recommend in its report that NHTSA request that the DOTs Volpe Center evaluate the effectiveness of a side underride guard to determine if their effectiveness is similar or greater than Lateral Protection Devices in mitigating the severity of pedestrian, cyclist and motorcyclist fatalities.[18]

87%, 5-22: The ACUP shall recommend in its report that NHTSA create a field in the FARS system to determine if an underride crash occurred involving a large truck and a pedestrian/cyclist.[19]

81%, 3-13: that pursuant to the IIJA, within five years of implementing (V)[20], the Secretary shall review and update FMVSS 223/224 standards in response to advancements in technology [21]

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[11] Excluded from original Majority Report, inserted on p9 1st bullet point.
[12] Excluded from original Majority Report, inserted on p9 3rd bullet point.
[13] Majority Report, p10 1st bullet point.
[14] Majority Report, p7 4th bullet point. The addition of "tape" was not approved by the ACUP.
[15] Majority Report, p8 6th bullet point.
[16] Majority Report, p9 4th bullet point.
[17] Majority Report, p8 4th bullet point. The first instance of "Clearance Lamps" was "ID Lamps" on the approved version.
[18] Majority Report, p8 8th bullet point.
[19] Majority Report, p7 8th bullet point.
[20] See 59% from 3-13
[21] Majority Report, p6 6th bullet point.

75%, 3-13: Committee recommends that NHTSA conduct comprehensive research on U.S. underride crash characteristics, including the frequency of 30 percent overlap crashes. include photos as much as possible. [22]

71%, 4-24: NHTSA should complete a new side impact guard cost benefit analysis and rulemaking that counts previously omitted underride victim categories, including pedestrians, bicyclists, and motorcyclists.[23]

69%, 3-13: A recommendation that FMCSA should issue stronger conspicuity requirements, at minimum, a requirement to maintain and replace conspicuity tape every 5 years.[24]

65%, 4-24: NHTSA should issue an Advanced Notice of Proposed Rulemaking on Front Impact Guards.[25]

65%, 4-24: NHTSA may harmonize with global front override regulations, including UNECE-93 and any revisions to it, in order to provide improved motor vehicle safety, as indicated in Section 24211 of the IIJA:

The Secretary shall cooperate, to the maximum extent practicable, with foreign governments, nongovernmental stakeholder groups, the motor vehicle industry, and consumer groups with respect to global harmonization of vehicle regulations as a means for improving motor vehicle safety. (IIJA, p. 397, https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf)[26]

65%, 4-24[27]: To require all new semitrailers, and single unit trucks that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (pci) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph. [28]

60%, 3-13: The ACUP should recommend in its report to congress that congress regulate single unit trucks (SUTs) with the same rear impact guard standards that currently only apply to semitrailers.[29]

60%, 3-13: A recommendation NHTSA expeditiously conduct rear impact guard testing at "highway speeds" (up to 65 mph) as IIJA already directed NHTSA to do (Sec 23011 (b)(2)(A,B) and publish the results within 2 years. [30]

60%, 5-22: NHTSA should assess risks associated with deflection into adjacent lanes associate with partial offset rear crashes as well as side underride crashes and make results public.[31]

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[22] Majority Report, p8 2nd bullet point. Photo note missing.
[23] Majority Report, p6 1st bullet point.
[24] Majority Report, p7 3rd bullet point.
[25] Majority Report, p7 5th bullet point.
[26] Majority Report, p7 6th bullet point.
[27] Referred to as "Motion 9": see 53% from 4-24.
[28] Majority Report, p6 3rd bullet point.
[29] Majority Report, p7 1st bullet point. "Congress" changed to NHTSA in Majority Report.
[30] Majority Report, p7 7th bullet point.
[31] Majority Report, p8 7th bullet point.

59%, 3-13[32]: Recommendation that the 2022 RIG Rule should be amended to require that all new trailers meet the TOUGHGUARD test protocol or equivalent[33]

53%, 4-24: ACUP affirms that NHTSA, per the Modernizing Regulatory Review Executive Memo and corresponding guidance, must fully account for regulatory benefits that are difficult or impossible to quantify when conducting rulemaking analysis.[34]

53%, 4-24: To require the side guards referenced in motions 9 & 10 above[35] to also prevent a vulnerable road user (VRU) from passing underneath the guarded vehicle in an interaction with the side of the vehicle.[36]

53%, 3-13: The ACUP should include in its congressional report a recommendation that all trailers manufactured between 1998 to the current time that do not have ToughGuard awarded rear impact guards should be retrofitted with crash proven reinforcement device(s). These reinforcement devices, at minimum, should be tested and proven to mitigate PCI and create crash compatibility consistent with a ToughGuard awarded rear impact guard when attached to a minimally compliant FMVSS 223 rear impact guard. [37]

47%, 4-24[38]: To require semitrailers, and single unit trucks manufactured after 1998 that have crash incompatible open space(s) along the side(s) to be equipped with side guards capable of preventing injurious passenger compartment intrusion (pci) when struck by a midsize vehicle at any angle, at any location, and at any closing speed up to and including 40 mph.[39]

47%, 3-13: The ACUP should include in its Report to Congress a fact-based history of underride crashes.

47%, 5-22: The ACUP shall recommend in its report that DOT explore the need for Federal weight limit weight-based exemption for side underride guards. [40]

41%, 4-24: NHTSA should withdraw its previously submitted ANPRM or reissue a revised ANPRM and cost-benefit analysis that acknowledges and accommodates critiques made by commenters that the cost-benefit approach taken artificially constrained the number of lives saved and also failed to account for cost-savings (such as fuel efficiency gains provided by side underride guards).[41]

[32] Motion V. from 3-13. See 81% from 3-13
[33] Majority Report, p6 5th bullet point.
[34] Majority Report, p9 8th bullet point.
[35] See 81% from 3-13 and 59% from 3-13.
[36] Majority Report, p6 4th bullet point.
[37] Majority Report, p6 7th bullet point.
[38] Motion 10 from 4-24. See 53% from 4-24.
[39] Majority Report, p6 2nd bullet point.
[40] Majority Report, p9 2nd bullet point.
[41] Majority Report, p5 1st bullet point.

On the Majority Report's "Assessment of DOT's Progress in Advancing Safety Regulations Relating to Underride Crashes"

The Majority Report glosses over so much work done by the agency in the 1970's, 80's and 90's with simplistic line "would not try again until 1996" and tries to implicate industry in stopping the saving of lives. However, the facts are that the rigid guards proposed at the time would themselves cause deaths of occupants due to excessive deceleration loads. Tests done in 1979 into rigid guards confirmed these findings[42] and the Texas Transportation Institute recommended halting rulemaking. More studies led to a 1991 proposal. At that time TTMA got ahead of the regulations and wrote a Recommended Practice describing rear impact guard loads and dimensions. That publication was kept until superseded by DOT requirements which also added an energy absorption requirement. What's billed in the Majority Report as "weaker than the previous one by 80%" was actually the result of long and arduous study to find the right loads to save the most lives. Even today, nearly 50% of fatalities resulting from crashes into the rear of trailers have no PCI[43] while the Majority Report seems to presume that PCI is the be-all and end-all of safety.

The Majority Report further attacks the department claiming "a 2018 NHTSA report demonstrating effectiveness of side impact guard up to 50mph" without citation. I believe they are referring to a computer model study done to try to design a side underride guard that would deflect a lightweight vehicle at an angled crash at 50mph.[44] Nothing was "demonstrated" as no devices were built, nor were they actually tested. While computer models are great in helping advance engineering efforts, the real world frequently fails to live up to those models as was demonstrated with the physical crash test done at 45 MPH that failed to prevent PCI and was shown to ACUP. This matter was glossed over before being raised during the meeting and now is unfortunately absent from the Majority Report as well.

I want to end this section with praise for the DOT professionals helping this committee. They were patient and professional throughout.

On the Minority Report:

While much of my comment was prepared before I had a chance to see a draft of the Minority Report, I see much the same things I point out in my letter included in the minority report, so I can support this part of the final report.

On the Appendices:

These are mostly a collection of materials presented during our meetings, minutes and so forth, but the inclusion of the Quon Kwan testimony is inappropriate: When this was proposed as a potential agenda

[42] Federal Motor Vehicle Safety Standards; Rear Underride Protection, 46 Fed. Reg. 2138 (January 8, 1981)

[43] See https://www.nhtsa.gov/sites/nhtsa.gov/files/811652.pdf In this 2011 NHTSA-commissioned study, by University of Michigan Transportation Institute, of TIFA data for year 2008 (ten years after rear impact guards were required to meet FMVSS 223 & 224), Tables 30 and 31 on page 44 show that more fatalities occurred in crashes with no underride, or some underride over the impacting vehicle's hood but *not* into the windshield, than in crashes *with* windshield penetration (see the data line labeled "tractor/trainer, guard"). A later study combines 2008 and 2009 TIFA data. See https://www.nhtsa.gov/sites/nhtsa.gov/files/811725.pdf (see table 24 on page 36). While the combined data do not show more than half of the fatalities occurring without windshield penetration, the number is still substantial.

[44] DOT HS 812 522 Computer Modeling and Evaluation Of Side Underride Protective Device Designs (April 2018).

item of one of our meetings, we were informed that this issue is currently being dealt with by the Department's office of Inspector General and that we were not to include it on our discussions. We complied with that request and no discussion of these documents was considered by the committee.

While I understand the allegations raised are serious, I feel it is inappropriate to include such documents here, they were not considered by the committee as a whole and are already the subject of an investigation.

Moving Forward:

If this committee is to make any future improvements, it should be reformed: anyone who served on this version of the committee should be specifically excused from consideration for the reformed committee so we can get away from the deepened divisions. Additionally, a specified figure for the meaning of "consensus" to keep a simple majority of members from simply pushing forward a one-sided view is vital if we are to bring valuable insight to the Secretary.

Signed:

John Freiler

ACUP member representing trailer manufacturers.

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	**Jeff R. Zawacki**
Voting Member Organization	**Hendrickson USA, L.L.C.**
Stakeholder Representation	**Vehicle Engineers**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report as written**

   Voting Member Signature _____ **Date:** _____

2. **Concur with the Final Report as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)**

   Voting Member Signature Jeff R Zawacki **Date:** 6-26-2024

I concur with the Final Report as written with exception to the following sections;

- Section I – Majority Report
- Section III – Appendices
  - D. Quon Kwon Testimony
  - E. Volpe Center Scope of Work – "Truck Side Guards to Reduce Vulnerable Road User Fatalities"
  - F. Allegedly Suppressed Volpe Center Final Report: " Truck Side Guards and Skirts to Reduce Vulnerable Road User Fatalities: Final Report on Net Benefits and Recommendations
  - G. NHTSA Petition under the Administration Procedure Act re: FARS filed by Eric Hein

I take exception to theses portions of the Final Report for the following reasons;

1) The Majority Report contains recommendations, thoughts and opinions that are not the 'Concensus' view of the committee as required by the charter and outlined in detail in the Minority Report
2) The Appendices contain information that was not discussed or deliberated on by the committee and as such do not represent the consensus view of the committee as detailed in the Minority Report

I agree with the recommendations detailed in section II – Minority Report which represents the consensus view of the committee.

3. **Non-Concur with the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	**Lee Jackson**
Voting Member Organization	**Traffic Crash Reconstruction, Inc.**
Stakeholder Representation	**Motor Vehicle Crash Investigators**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report as written**

   Voting Member Signature  **Date: 06/26/2024**

2. **Concur with the Final Report as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)**

   Voting Member Signature _____ Date: _____

3. **Non-Concur with the Final Report as written. Letter of Dissent must be provided.**

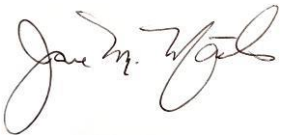
   Voting Member Signature _____ Date: _____

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	**Jane Mathis**
Voting Member Organization	**Parents Against Tired Truckers (P.A.T.T.)**
Stakeholder Representation	**Families of Underride Crash Victims**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report, Section I ("Majority Report"), as written**

   Voting Member Signature  **Date: 06/27/2024**

2. **Concur with the Final Report, Section II ("Minority Report"), as written**

   Voting Member Signature _____ Date: _____

3. **Concur with the Final Report,**
   ☐ Section I ("Majority Report"),
   ☐ Section II ("Minority Report"),
   as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature _____ Date: _____

4. **Non-Concur with both Sections I and II of the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ Date: _____

ADVISORY COMMITTEE ON UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	**Marianne W. Karth**
Voting Member Organization	**AnnaLeah & Mary for Truck Safety**
Stakeholder Representation	**Families of Underride Victims (& truck crash survivor)**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Majority Report as written**

   Voting Member Signature _____ Date: _____

2. **Concur with the Final Minority Report as written**

   Voting Member Signature _____Date: _____

3. **Concur with the Final**

   ☒ Majority

   ☐ Minority

   Report as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature Marianne W. Karth **Date: June 27, 2024**

   Note: Please see the detailed explanation in the attached pages.

4. **Non-Concur with both the Final Majority and Minority Reports as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ Date: _____

Concur With the Majority Report -- "With Exceptions"
Marianne Karth

The Advisory Committee on Underride Protection (ACUP) was composed of truck trailer industry representatives, as well as advocates, victims, and many others. I think Congress intended to put these varied stakeholders together to share information and expertise, have informed discussions, and try to find mutual agreement to protect the public from underride death and injury. The ACUP heard multiple presentations, engaged in discussions, made and passed motions -- some of which passed with a simple majority, the same way the Supreme Court decides cases and Congress makes laws. Federal law (IIJA and FACA), guidance (GSA), the ACUP's by-laws, and NHTSA allowed ACUP to operate in this way. These were included in this Majority Report, as well as a general assessment that in 50 years NHTSA has made "no substantial progress" in preventing or mitigating side underride crashes. **I concur.** However, there are a number of important subjects **omitted** from the Majority Report, which I discuss below.

The Majority Report did not address a recurring impediment to the ACUP's efforts: some representatives of the trucking industry concealed relevant information that would have advanced the ACUP mission. For instance,

- The Truck Trailer Manufacturers Association (TTMA) representative and its member representatives on the ACUP — Utility Trailer Manufacturing and Wabash National — withheld a draft recommended practice on side impact guards that likely contains many relevant engineering details: specifications, testing protocol, and performance criteria for side impact guards.

- The American Trucking Associations (ATA) representative on the ACUP concealed the unpublished Volpe Center final report on side guards and pedestrian/bicyclist deaths, which ACUP asked NHTSA for and was denied. ATA's Dan Horvath, ACUP member, was thanked by name in the acknowledgements of the unpublished final report for "peer review, discussion, and feedback," and ATA's role in editing the report was disclosed by FRONTLINE/ProPublica. We finally received a copy of the Volpe Center final report from a whistleblower who felt compelled to make its suppressed findings see the light of day: it is cost-effective to prevent those fatalities with aero-side guards. Then NHTSA prohibited the ACUP from discussing it.

- Wabash National's representative on the ACUP, Kristin Glazner, concealed the details of her company's actions related to underride protection. Most of Wabash's trailers are sold without TOUGHGUARD rear guards. They offer it only as an Option and court records show that over 90% of recent trailer sales do not have the TOUGHGUARD Option installed. In 2022, Wabash sold 52,035 new trailers. That means at least 46,832 new trailers shipped out the door with a Rear Impact Guard which would not protect against 30% offset underride crashes. Additionally, she concealed the details of Wabash's own

development of a side impact guard, which had been discussed by its VP for Product Engineering, Robert Lane, at a public Underride Briefing for Congressional staff in October 2017. Lane told the audience, *"We're attempting to develop a device that will provide underride prevention and that is the side underride prevention -- as prescribed by the IIHS... We debuted this device at the North American Commercial Vehicle Show. And that was in Atlanta two weeks ago. It's a prototype. And we've got a ways to go. But we are fully committed to commercializing this device and making a commercially viable device. Wabash National has always been a safety leader in the industry, and we'll continue to be committed to work with our customers and our shareholders to make our highways safer."* Wabash Trailers, Side & Rear, Robert Lane, Underride Briefing on The Hill

- Utility Trailer Manufacturing's representative on the ACUP refused to disclose full documentation of all test results and protocols on its side impact guard and misrepresented its sales data when it said to the ACUP that "we can't even give it away," while telling DOT in a letter that their side impact guard "has been included on approximately 67 trailers, of which 51 have been sold to customers." Utility has also not sought to have their side impact guard independently tested, even after IIHS extended multiple invitations, and has never explained why it did not seek independent testing for its side impact guard. Additionally, Utility's representative on the ACUP complained to NHTSA and sought to have removed from the ACUP's Majority Report the notarized whistleblower statement and unpublished side guard research document. In the minority report he authored, he tried to disparage them by inaccurately calling the whistleblower a "disgruntled employee." There is no evidence for that epithet. In fact, the whistleblower received the Department's highest award for excellence, and he retired on his own terms at age 70. Trailer manufacturers apparently prefer that Congress does not probe the matter.

- The industry's preferred solution to preventing underride crashes is crash avoidance technologies. What they know, but don't publicly acknowledge, is that IIHS crash test research has shown that passenger vehicle AEB technology, even on many current models, is not reliably able to prevent a collision with the rear of a tractor-trailer. Likely, it will take years to improve the technology and resolve the auto industry's predictable litigation before the entire fleet of passenger vehicles will even have AEB. Even then, collision avoidance technologies, by themselves, will not sufficiently prevent underrides and deadly passenger compartment intrusion.

Had the trailer industry contributed its expertise and knowledge in preventing and mitigating underride crashes, the work of the ACUP would have been more effective and efficient. But they did not.

In fact, it is hard to comprehend industry's seeming disregard for the marked difference in the severity of injuries which occur when a trailer is *guarded* from underride -- and a passenger vehicle's crashworthy features are allowed to work as intended or a Vulnerable Road User is

protected from being swept under the truck and crushed by the tires -- versus those that occur when a trailer is *unguarded* (or inadequately guarded). Crash dummy data from both side crash testing of the AngelWing at 40 mph in August 2017 by the Insurance Institute for Highway Safety (IIHS) -- see Tables 3-6, all indicating below serious injury thresholds -- and rear guard crash testing research conducted by the IIHS, confirm the life-saving difference made by adequate underride protection guards. This can also be observed in conclusions from the Texas A&M computer modeling study (2018) conducted under contract with NHTSA which states,

> *. . . it can be concluded that the SUPD [Side Underride Protection Device] designs are expected to perform acceptably for impacts near the ends of the SUPD. Some internal occupant compartment deformation of the impact side A-pillar was observed for the highest severity impact system, but the injury risk associated with this level of deformation in this area is considered low.* (p.67/77)

Additionally, data from crash test vehicles at the D.C. Underride Crash Test Event in March 2019 showed that the AngelWing and the SafetySkirt prevented life-threatening injuries. Likewise, a 2021 SAE research paper on side underride guards reports that,

> *The results of the analysis indicate that available side underride guards are effective at reducing passenger compartment intrusion (PCI) substantially in what are often fatal side underride crashes. This is supported by physical testing that has shown good performance up to 64 km/h. Nearly all passenger compartment intrusion above the beltline was mitigated other than in the purely lateral impact conditions. When intrusion did extend above the beltline, e.g., in the purely lateral sliding condition, the amount of PCI was similar to the intrusion generated in a 56 km/h side impact of a 5-star rated vehicle. Further, the average amount of PCI in the above tests was similar to the amount resulting from small overlap tests of the same vehicle. These results demonstrate that an underride guard can provide a sufficient reaction surface to allow for the vehicle's passive and active safety systems to protect the occupant. The underride guard also causes the location of PCI to move from near the occupant's head and torso to the lower extremities which reduces the likelihood of serious or fatal injury.*
> Protecting-Passenger-Vehicles-from-Side-Underride-With-Heavy-Trucks, p.8

The Majority Report did not address the fact that NHTSA, too, concealed relevant information from the ACUP and impeded the advisory committee's work in other ways as well. The IIJA imposed a number of requirements on NHTSA to advance progress toward underride protection, including the establishment of the ACUP. Section 23011(d)(5) required DOT to provide support to the ACUP: "On request of the Committee, the Secretary shall provide information, administrative services, and supplies necessary for the Committee to carry out the duties of the Committee." But NHTSA improperly denied information requested by the ACUP.

FRONTLINE/ProPublica's investigative documentary, *America's Dangerous Trucks*, provoked the ACUP to request the unpublished version of the Volpe Center research report that was reportedly revised by agency officials in response to pressure from the trucking industry.

NHTSA's designated federal officer (DFO) replied in writing to the ACUP that the agency would not provide "FOIA exempt" materials to the Committee, citing exemption 5 of the Freedom of Information Act that protects "inter-agency or intra-agency memorandums or letters which would not be available by law to a party other than an agency in litigation with the agency."[1] The DFO's reply implied that the draft report requested by the ACUP was pre-decisional and deliberative and would receive privilege under the FOIA.

However, NHTSA was incorrect to apply the FOIA Exemption 5 to the ACUP's request. The FOIA applies to requests for information made by "the public." The ACUP members are not the general public but are Congressionally-mandated, agency-selected experts. Their information requests were made pursuant to IIJA Section 23011(d)(5), not FOIA.

The ACUP reiterated its request for information and submitted a six-page legal opinion from Professor Michael Oswalt, professor of law at Wayne State Law School. Professor Oswalt's memorandum concluded: "ACUP *may* receive deliberative materials; [and] ACUP *must* receive requested deliberative materials," citing appellate case law, a DOJ Office of Legal Counsel opinion, the General Services Administration Guidelines for federal advisory committees, and the IIJA.

In response, NHTSA wrote just four paragraphs when it denied again the ACUP's request for information. NHTSA's memorandum ignored most of the legal authorities cited by Professor Oswalt. Instead, NHTSA relied on narrow readings of the IIJA and the Federal Advisory Committee Act, concluding: "Neither the Federal Advisory Committee Act (FACA) nor IIJA compels this conclusion [that NHTSA must provide deliberative information to the ACUP]." To deny ACUP's request, NHTSA gave itself veto power not found in either law:

> the determination about what is necessary to provide for the ACUP to carry out its duties *resides with the chartering agency* based on the stated purpose of the committee. (emphasis added)

However, NHTSA misread the law. Nowhere in the IIJA or the FACA did Congress expressly assign to NHTSA or other chartering agencies a duty to determine what information the advisory committee needs to review or not to review. In fact, a more plausible interpretation of these laws is that advisory committees themselves are intended to determine what they need to perform their duties: they are composed of non-governmental experts and have responsibilities to provide independent advice and assessments to the Secretary and Congress.

Furthermore, based on the stated purpose of the committee — "to provide advice and recommendations to the Secretary on safety regulations to reduce underride crashes and fatalities" -- it is hard to imagine material *more* relevant than cost-benefit analyses of safety regulations to reduce underride crashes, which the unpublished final report contained. The standard NHTSA is misreading to deny the ACUP materials it requested in fact supports giving

[1] Department of Justice Guide to the Freedom of Information Act, Exemption 5 (online at https://www.justice.gov/archive/oip/foia_guide09/exemption5.pdf).

the ACUP those materials. NHTSA's attempts to hamper the ACUP from reviewing drafts of the suppressed safety report were overcome when Quon Kwan, the retired FMCSA project manager of the safety report, provided a notarized statement and the report the ACUP had sought to safety advocates, who attached them to a public letter to the Inspector General.

NHTSA also refused to comply with the ACUP's information request for the basis of determinations it made in relevant rulemakings. For example, the ACUP asked NHTSA why the cost-benefit analysis used in its side underride rulemaking *excluded* fatalities of Vulnerable Road Users. NHTSA misleadingly responded that the answers to that and other questions could be found in the cost-benefit analysis and referred the ACUP to review it. The cost-benefit analysis asserts that its scope is limited to crashes involving light passenger vehicles and large commercial trucks. But nowhere does it provide an explanation for why its scope excluded fatalities of Vulnerable Road Users.[2]

In other ways, too, NHTSA impeded the ACUP. NHTSA delayed formally organizing the committee, which deprived the ACUP of nearly half of its charter period. Under federal law, federal advisory committees are chartered for a two-year period (41 CFR § 102–3.55), unless Congress expressly authorizes a different duration, the charter is renewed, or the committee completes its work and terminates. DOT filed the ACUP's charter on June 22, 2022, but delayed organizing the first meeting of the ACUP until May 25, 2023. This delay deprived the advisory committee of 45% of its charter period (11 months out of a total of 24 months). NHTSA further delayed the Committee's work by scheduling the second meeting for November 15, 2023, nearly six months after the first meeting. At the ACUP's second meeting, Chairman Gildea requested that DOT extend the ACUP's charter, but she received no reply. At its third meeting, Chairman Jackson again requested an extension of the charter in order to allow the ACUP to meet monthly until October 2024. He received a reply only after the final meeting of the ACUP on May 22, 2024, when plans for the Report to the Secretary and Congress were already underway due to the expiration of the charter.

NHTSA also ignored the federal requirement to timely post advisory committee records (i.e., reports, transcripts, minutes, appendices, working papers, drafts, studies, agenda, or other documents) on the ACUP Federal Advisory Committee Act Database and make them available to the public. The General Services Administration (GSA) Final Rule for Federal Advisory Committee Management requires "...the contemporaneous availability of advisory committee records that, when taken in conjunction with the ability to attend advisory committee meetings, ensures that interested parties have a meaningful opportunity to comprehend fully the work undertaken by the advisory committee." In practice, NHTSA's implementation of the requirement

[2] Office of Regulatory Analysis and Evaluation, National Center for Statistics and Analysis, National Highway Traffic Safety Administration, "Side impact guards for combination truck-trailers: Cost-benefit analysis," Report No. DOT HS 813 404 (Apr. 2023) (online at https://downloads.regulations.gov/NHTSA-2023-0012-0087/attachment_2.pdf).

was exceedingly slow which, when combined with the truncated lifespan of the Committee, deprived the public of "timely access to advisory committee records," as the law requires.[3]

The Report did not address *why* the industry would conceal relevant information from a federal advisory committee they participated in, or why NHTSA would do the same. The industry's purpose could not have been to assist the ACUP in *recommending* underride guards. But it could have been to *thwart* agreement on side guards and enhanced rear guards. And that is what they have done, with their votes on policy recommendations and their comments in our deliberations. The latter were characterized by unsubstantiated, unscientific and untested engineering objections, including high-centering of side guards on railroad tracks, loading docks, secondary collisions from outward rotation following a 30% offset rear impact with a TOUGHGUARD, and so on.

Despite the fact that NHTSA has acknowledged that crashes at the corners of the rear guard result in more severe injuries than in center impacts, industry representatives on the ACUP objected to a federal requirement for rear impact guards that mitigate these more harmful crashes. The trailer manufacturing industry claims without support that such crashes are not frequent. In fact, there are many documented underride crashes where 30% overlap results in a driver surviving with minor injuries while a front seat passenger is killed, or vice versa -- because it's not the crash that kills but the underride (and any research of underride crash characteristics by NHTSA should address this). They have also asserted -- without data -- the dangers of unintended outward rotation causing secondary collisions with "innocent" (as Utility's Jeff Bennett put it) vehicles not involved in the primary collision. Besides the absurdity of implying that crash victims deserve all the blame for their death or injuries, these industry objections lack merit and display the indifference that some in the industry exhibit towards the human suffering that their trailers cause. According to a statement made during a discussion in February 2023 by Jared Bryson, a mechanical engineer from Virginia Tech, "If it collides at the rear corner, with or without guard, it will rotate." In other words, if there is a tendency for a colliding car that strikes the corner of a rear guard to rotate, it is true now and enhancing protection with a TOUGHGUARD standard will not change that. As for Bennett's hypothetical scenario of a second collision due to outward rotation, ACUP members received an analysis from engineer Salena Zellers, BioInjury LLC, which stated, "It is not possible to determine whether a vehicle that impacts the rear of a truck equipped with rear underride guards that are designed to protect in 30% offset impact, will spin out into traffic and impact a secondary vehicle resulting in mortality in a secondary accident. There are too many variables involved to gather data to prove or disprove that supposition." (See attachment.)

Trailer manufacturer members of the ACUP insisted on a supermajority standard for ratification of policy recommendations to prevent the ACUP from adopting policies the industry opposed. In their minority report they cited a dictionary definition for "consensus," but they ignored federal law, rules, and NHTSA's instructions to the ACUP. A supermajority standard was neither

[3] General Services Administration, Final Rule; Federal Advisory Committee Management, 66 FR 37728 (July 19, 2001) (online at https://www.gsa.gov/system/files/FACAFinalRule_R2E-cNZ_0Z5RDZ-i34K-pR.pdf).

required by nor consistent with the law and guidance on federal advisory committees. The ACUP asked NHTSA to provide a definition of consensus. NHTSA expressly directed the ACUP to choose its own threshold for consensus. By a majority vote on two occasions, the ACUP chose to utilize a simple majority standard to adopt motions for Advice and Recommendations to the Secretary. At no time did NHTSA ever advise or require the ACUP to use any other standard. Having lost the ability to veto recommendations disfavored by trailer manufacturers, the minority report attempts to discredit the validity of ACUP's recommendations by distinguishing between those recommendations that carried with industry's support and those that carried over the industry's opposition. Most of its pages are devoted to this red herring of the proper meaning of consensus. The minority's obsession inadvertently reveals their frustration with their inability to control the ACUP. It also exposes the trailer manufacturers' unreasonable bias against regulations requiring side impact guards and stronger rear guards. The trailer industry's cynicism is revealed by the minority report's call for "additional research" and "further investigation." Who can object to gathering information and expanding knowledge? But this industry is not interested in knowing what they can do to prevent fatalities caused by their trailers. This industry lobbied against the knowledge and research contained in the Volpe Center's study of preventing pedestrian and bicyclist fatalities with side guards, and NHTSA suppressed the research rather than publish it over the industry's objections. Their calls for more research disguise their opposition to safety regulation. Furthermore, their preference for AEB, the cost of which would be borne by automakers and consumers, as a solution to the underride problem exposes their unprincipled and unscientific opposition to safety regulations that would require them to pay the cost.

It should come as no surprise that a committee composed of members representing widely-divergent stakes in the underride issue would have difficulty finding common ground and tend to vote in blocks, which both industry representatives and safety advocates sometimes did. Yet, a similar group demonstrated that it *is* possible to advance safety when they crafted a consensus rear impact guard standard in June 2016. Stoughton Trailers displayed enthusiasm when a car driver and his passenger survived a 30% offset collision when a Stoughton TOUGHGUARD Rear Impact Guard prevented underride in 2017. Unfortunately, Stoughton did not have a company representative on the ACUP, though it was represented indirectly as a member of the TTMA.

But the trailer manufacturing industry did not exhibit corporate responsibility during ACUP's deliberations. Why would companies facing liability risk for fatalities, or a trade association comprised of those companies, obstruct a policy on guards that can *mitigate* the cost of that liability, not to mention prevent traffic fatalities?

Money. Most of the trailer industry apparently believes they will make more money by defending against judgments for fatalities caused by their trailers than by installing guards on their trailers to prevent those fatalities. That's how some big businesses operate. Utility was found negligent by a jury for the fiery underride death of a 16 year-old boy. Nevertheless, ACUP member and Utility executive Jeff Bennett disparaged Utility's own side impact guard as well as the SafetySkirt aftermarket/retrofit system developed by ACUP member Aaron Kiefer. SafetySkirt

provides a level of protection that exceeds Utility's side impact guard, since it prevents underride at locations around the periphery of a trailer. To such businesses, saving a penny today is preferable to saving two in the future, and preventing deaths caused by their products is not a top priority.

Over the past year of our deliberations, members of the trucking industry consistently raised technical objections about side impact guards and improved rear impact guards. To listen to them, these guards are infeasible. But their objections are implausible. Trailers are essentially boxes on wheels and impact guards are simply physical barriers. Trailer manufacturing requires basic engineering and metallurgy, not quantum physics. The United States has the best engineering schools in the world and produces many qualified people who possess the skills to prevent and mitigate underride crashes. As Aaron Kiefer said when interviewed in 2022 by PBS, "This is not rocket science, right? The trailer manufacturers have the engineers on staff who could create things like this overnight if they wanted to." Indeed, most of the needed research and development *has* already been performed: in TTMA's draft Recommended Practice, at Wabash, at Utility, and probably others as well.

Some American trailer manufacturers offer side underride protections on trailers they sell in foreign markets, where local regulations require them to install lateral protection devices. However, no trailer manufacturer has chosen to install side underride safety innovations on all of their products in the United States. Rather than discuss their patented knowledge with the ACUP to make safer American streets, industry representatives on the ACUP concealed important and relevant information, in apparent defense of their faith in lawyers to keep the costs of their negligence from landing on their balance sheets.

But why would NHTSA conceal information from the ACUP? We received troubling whistleblower testimony from a retired FMCSA project manager. According to his allegations, and confirmed by internal emails obtained through the Freedom of Information Act, NHTSA and Department senior officials in 2020 suppressed publicly-financed underride protection research and analysis, which concluded that it was cost-effective to prevent pedestrian and bicyclist fatalities with aerodynamic side guards. In 2023, many of the same senior officials oversaw the Advance Notice of Proposed Rulemaking on side impact guards. That rulemaking's cost-benefit analysis excluded consideration of the benefits of preventing pedestrian and bicyclist deaths, thereby reducing the benefits of regulation. At the root of both of these agency actions, confirmed by the whistleblower's assertion and FRONTLINE/ProPublica's revelation, is substantial evidence that the agency was accommodating industry opposition to side underride protection. Thus, the answer to our question: On the matter of underride protection at least, NHTSA behaves as if it has been captured by the industry it regulates.

We are at a crossroads. Thousands of lives have already been needlessly lost to dangerous trucks, and thousands more will predictably follow. My hope was that we could build upon what was done in 2016 when a group of diverse stakeholders found common ground and collaboratively addressed rear underride. That has obviously not occurred. NHTSA appears to be MIA, just as it has been for the past 50 years.

Congress is also at a crossroads. The ACUP Report's assessment of NHTSA's lack of progress on underride protection should spur Congress to action. When will Congress conduct oversight to address NHTSA's 50-year failure to address the underride problem?

We may all ask ourselves: What will we do going forward? Be guardians of public safety or bystanders to preventable underride deaths?

ATTACHMENTS

Legal Opinion of Professor Michael Oswalt on the ACUP's access to deliberative materials
Legal Opinion of NHTSA on the ACUP's access to deliberative materials
Email Communication from Salena Zellers on Biomechanics of Secondary Collisions

Legal Opinion of Michael Oswalt on the ACUP's Access to Deliberative Materials

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Michael M. Oswalt
Professor of Law

February 2, 2024

The Honorable Pete Buttigieg, Secretary, U.S. Department of Transportation
Ms. Adrienne Gildea, Chair, the Advisory Committee on Underride Protection (ACUP)
Ms. Marianne Karth and Members of the ACUP
Mr. James Myers, Designated Federal Official for the ACUP
U.S. Department of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Buttigieg, Chair Gildea, Members of the Committee, and Mr. Myers:

I write to provide my opinion on the Advisory Committee on Underride Protection's rights to information held by the Department of Transportation. Committee members seek this information because of their statutory mandate to provide advice, recommendations, and progress reports to the Secretary, and to Congress, under the Infrastructure Investment and Jobs Act of 2021.

Background

In 2021, Congress passed the Infrastructure Investment and Jobs Act (IIJA).[1] Among other provisions, IIJA included Section 23011, requiring the Department of Transportation (DOT) to finalize various rules and research about protecting the public from underride crashes, a particularly gruesome form of traffic death where a passenger vehicle, motorcycle, bicycle or pedestrian collides with the bottom edge of a large commercial truck's freight box or semitrailer and may pass under the rear axles, causing decapitation and crushing to death.[2]

Most relevant here, Congress gave DOT one year to issue a final rule equipping trucks with rear impact guards to prevent underride crashes and complete research into side underride protection.[3] Congress created the Advisory Committee on Underride Protection (ACUP) to help them do it.[4]

As set out in Section 23011(d)(1), (5) and (6):

(d) ADVISORY COMMITTEE ON UNDERRIDE PROTECTION.—

[1] Infrastructure Investment and Jobs Act of 2021, Pub. L. No. 117-58, 135 Stat. 429 (2021).
[2] Infrastructure Investment and Jobs Act of 2021 § 23011(b)(1)(A), 135 Stat. at 768.
[3] Infrastructure Investment and Jobs Act of 2021 § 23011(b), 135 Stat. at 768.
[4] Infrastructure Investment and Jobs Act of 2021 § 23011(d), 135 Stat. at 770.

> (1) ESTABLISHMENT.—The Secretary shall establish an Advisory Committee on Underride Protection to provide advice and recommendations to the Secretary on safety regulations to reduce underride crashes and fatalities relating to underride crashes
>
> . . .
>
> (5) SUPPORT.—On request of the Committee, the Secretary shall provide information, administrative services, and supplies necessary for the Committee to carry out the duties of the Committee.
>
> (6) REPORT.—The Committee shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives a biennial report that—
>
> (A) describes the advice and recommendations made to the Secretary; and
>
> (B) includes an assessment of progress made by the Secretary in advancing safety regulations relating to underride crashes.

ACUP has asked DOT for information relevant to completing Congress's required report laying out the committee's advice, recommendations, and assessment of the agency's progress. Questions about how DOT calculates preventable deaths, the costs and benefits of various options for preventing deaths, and the reasons why some categories of underride fatality, but not others, have been or will be used in the rulemaking process have, for example, been asked. Committee members—who include representatives from truck and trailer manufacturers, law enforcement, crash investigators, insurance officials, safety organizations, and families who have lost loved ones to underride crashes—have also requested information about a DOT safety report featured on the PBS documentary series "Frontline."[5] Redlined drafts of the report featured in the show suggest that portions of the report were "stripped and the results were changed."[6]

The agency has not responded.

Three questions have now arisen.

Questions Presented

1) Whether ACUP may receive intra- or inter-agency deliberative materials that would otherwise be barred from public disclosure under Exemption 5 of the Freedom of Information Act?

2) Whether ACUP must receive requested intra- or inter-agency deliberative materials that would otherwise be subject to Exemption 5?

3) Whether ACUP's information requests can cover materials related to pending rulemakings?

Conclusions and Analysis

As explained below,

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[5] Frontline, America's Dangerous Trucks (Jun. 13, 2023), https://www.pbs.org/wgbh/frontline/documentary/americas-dangerous-trucks/.

[6] *Id.*

- ACUP *may* receive deliberative materials,
- ACUP *must* receive requested deliberative materials, and
- ACUP's information requests *may* relate to pending, not just completed, rulemakings.

ACUP may receive intra- and inter-agency deliberative materials that would otherwise be barred from public disclosure under Exemption 5 of the Freedom of Information Act

As a longstanding matter of administrative law, federal advisory committees like ACUP are permitted to receive relevant agency deliberative materials because the D.C. Circuit Court of Appeals, the Department of Justice's Office of Legal Counsel, and the Federal Advisory Committee Act's own rules expressly anticipate, and acknowledge, that advisory committees regularly receive them. Disclosure issues have arisen only where the question is whether the general public can access deliberative materials *already provided* to an advisory committee by an agency. In that context, the consistent conclusion has been that the public cannot make an end run around Freedom of Information Act[7] (FOIA) exemptions by asking the committee, instead of the agency, to see them.

As the D.C. Circuit in 1976 put the question and the answer where the public wanted to attend an advisory committee meeting including discussion of a privileged agency document with "various proposals and recommendations . . . relating to future planning of programs, policies and objectives":[8]

> "Here, we are concerned with a memorandum prepared by the agency and shown to the advisory committee. *A fortiori*, an intra-agency memorandum supplied by the agency to an advisory committee, is subject to exemption five of the Freedom of Information Act."[9]

Similarly, advisory committees themselves are enabled by the Federal Advisory Committee Act (FACA),[10] and when asked to consider the scope of FACA section 10(b), which mandates the "public inspection" of advisory committee "working papers, drafts," and other materials,[11] the Office of Legal Counsel (OLC or Office) in 1988 concluded, first, that FOIA exemption 5[12] "is not generally applicable to materials prepared by or for an advisory committee[.]"[13] Just like the D.C. Circuit, OLC then assumed that committees do, of course, possess privileged agency materials, necessitating the same carve-out from the public's right to information:

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[7] 5 U.S.C. § 552.

[8] *Aviation Consumer Action Project v. Washburn*, 535 F.2d 101, 104 (D.C. Cir. 1976).

[9] *Id.*

[10] Federal Advisory Committee Act, Pub. L. No. 92-463, 86 Stat. 770 (1972) (codified as amended at 5 U.S.C. app. 2 §§ 1-16).

[11] 5 U.S.C. app. 2 § 10(b).

[12] Exemption 5 states that FOIA's disclosure rules are not applicable "to matters that are—(5) inter-agency or intra-agency memorandums or letters which would not be available by law to a party other than an agency in litigation with the agency." 5 U.S.C. § 552(b)(5). As summarized by the Office Legal Counsel, "Exemption 5 of FOIA exempts inter-agency and intra-agency deliberative or predecisional documents from disclosure." Office of Legal Counsel, U.S. Department of Justice, 12 Op. O.L.C. 73, 74, April 29, 1988.

[13] Office of Legal Counsel, U.S. Department of Justice, 12 Op. O.L.C. 73, 77, April 29, 1988.

"[B]ut . . . [exemption 5] does extend to protected privileged documents *delivered from the agency to an advisory committee.*"[14] (emphasis added)

Confirming this, the Office called its conclusion "consistent with the holding in *Aviation Consumer Action Project v. Washburn*, 535 F.2d 101, 107-108 (D.C. Cir. 1976) that agencies may disclose predecisional documents to advisory committees without waiving their ability to protect the records under exemption 5 . . . ."[15]

The General Services Administration would later rely entirely on OLC's analysis in a final Federal Advisory Committee Act rulemaking in 2001.[16]

But it is not only the case that advisory committees may be provided with privileged agency documents. The requested materials must be provided.

ACUP must receive documents requested from the DOT

DOT must provide ACUP members, but not the public, with requested deliberative documents because the committee's right to request and receive DOT information is created by IIJA, not FOIA. Simply put, FOIA has exemptions and IIJA does not. Indeed, under Section 23011(d)(5), upon "request of the Committee, the Secretary *shall* provide information . . . necessary for the Committee to carry out the duties of the Committee."[17] The Secretary's disclosure duty is without exception, and the statute states no limits on what materials ACUP members might deem "necessary" to adequately advise Congress.

ACUP committee members, moreover, are decidedly not the "public." The Federal Advisory Committee Act itself arose from rapid advisory body growth that some compared to an emerging "fifth branch of government" or administrative "mini-republic of ideas."[18] FACA responded with numerous transparency reforms but also the inclusion of a range of government-like formalities, from expense accounting, to minute-keeping, to term limits, to the requirement that membership be "fairly balanced in terms of the points of view represented and the functions" performed.[19] In 2017, the federal government funded over a thousand total committees at a cost of nearly $400 million, not counting over $90 million on committee member travel and honoraria.[20]

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[14] *Id. See also id.* at 83 ("For the foregoing reasons, exemption 5 properly applies under FACA when the agency has transmitted to an advisory committee a document that would be protected from disclosure if in possession of the agency.").

[15] *Id.* at 82 ft. 29.

[16] Federal Advisory Committee Management, 66 Fed. Reg. 37,731-32 (Jul. 19, 2001) ("The opinion further states that: . . . 'documents prepared by an agency do not lose the protection of exemption 5 by virtue of the fact that they are delivered to an advisory committee.'" (citing Office of Legal Counsel, U.S. Department of Justice, 12 Op. O.L.C. 73, April 29, 1988)).

[17] Infrastructure Investment and Jobs Act of 2021 § 23011(d)(5), 135 Stat. at 771 (emphasis added).

[18] Brian D. Feinstein & Daniel J. Hemel, *Outside Advisors Inside Agencies*, 108 GEO. L.J. 1139, 1141-42, 1147-48 (2020) (citing SHEILA JASANOFF, THE FIFTH BRANCH: SCIENCE ADVISORS AS POLICYMAKERS (1990) and Sheila Jasanoff, *(No?) Accounting for Expertise*, 30 SCI. & PUB. POL'Y 157, 161 (2003)).

[19] *Id.* at 1148-49.

[20] *Id.* at 1150-51.

So while FACA committees are not the government,[21] their unique role and function within the bureaucracy equips them to appropriately, and discretely, access privileged agency information in ways FOIA does not contemplate for the general public. In ACUP's case, Congress could have cabined access to DOT documents in any number of ways at the committee's founding. By the IIJA's plain terms it did not.

Finally, and relatedly, the universe of materials subject to the DOT's mandatory disclosure is not limited to any step in the agency's deliberative timeline, and certainly not to completed actions or rulemakings.

ACUP's right to access DOT deliberative information includes materials relating to pending rulemakings

ACUP has the right to relevant information and documents at any stage in DOT's deliberative processes because its primary statutory duty "includes an assessment of progress made by the Secretary in advancing safety regulations."[22] A "progress" report surely encompasses interim steps, not just analysis of the final product. The word itself means "a forward or onward movement (as to an objective or to a goal),"[23] confirming that Congress expected ACUP to be engaged in iterative oversight, including evaluation of the agency's momentum.

In fact, a contrary interpretation—one that would restrict disclosure to completed rulemakings—would defeat Congressional intent with respect both to ACUP and the underlying FACA statute. Like all advisory committees, ACUP is "by its very nature . . . a group of 'outsiders' called upon because of their expertise to offer views and comments unavailable within the agency."[24] FACA's procedural guardrails are in place to ensure that ACUP's core function of providing "advice and recommendations"[25] is not "inappropriately influenced by the appointing authority or any special interest but will instead be the result of the advisory committee's independent judgment."[26] But if important decision-making data is available or unavailable based on the Secretary's personal assessment of its internal decisional timeline, true independence, and true independent judgment, is impossible. Advising meaningfully and recommending meaningfully—including what political scientists studying committees have called "sound[ing] the fire alarm when agencies deviate from their statutory mandates"[27]—requires connecting the deliberative dots in something close to real time. When it comes to assisting in the ins-and-outs of rulemaking, hindsight is not just 20/20, it's just not useful.

It is for this reason that although scholars suggest that the "major impediment" to Congressional oversight is a basic lack of information about administrative decision making,[28]

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[21] *See* Office of Legal Counsel, U.S. Department of Justice, 12 Op. O.L.C. 73, 81, April 29, 1988 ("Several courts, as well as this Office, have construed the statutory distinction to signify that advisory committees are not agencies.").

[22] Infrastructure Investment and Jobs Act of 2021 § 23011(d)(6)(b).

[23] Merriam-Webster Online Dictionary, https://www.merriam-webster.com/dictionary/progress (quoting definition "2," where definition "1" refers generally to processions).

[24] *See* Office of Legal Counsel, U.S. Department of Justice, 12 Op. O.L.C. 73, 82, April 29, 1988.

[25] Infrastructure Investment and Jobs Act of 2021 § 23011(d)(6)(a).

[26] Federal Advisory Committee Act, 5 U.S.C. app. I, § 5(b)(3).

[27] Feinstein & Hemel, *supra* note 18, at 1153 (citing Matthew D. McCubbins & Thomas Schwartz, *Congressional Oversight Overlooked: Police Patrols Versus Fire Alarms*, 28 AM. J. POL. SCI. 165, 166 (1984)).

[28] Steven J. Balla & John R. Wright, *Can Advisory Committees Facilitate Congressional Oversight of the Bureaucracy?*, in CONGRESS ON DISPLAY, CONGRESS AT WORK 167, 172 (2000). *See also id.* (stating that "one way

the general fix is equally simple: FACA "committee members must have access to agency information."[29] The Senators and Representatives waiting for their IIJA Section 23011(d)(6)(B) "assessment of progress" would no doubt add: at any stage of agency lawmaking.

Thank you for the opportunity to submit this opinion.

Sincerely,

Michael M. Oswalt
Professor of Law

Institutional affiliation is provided for identification purposes only. Views expressed are my own and not necessarily shared by my employer.

for Congress to reduce its informational disadvantage is to provide [advocates] with access to [agency] decision making" and "suggest[ing] that Congress routinely establish[] access of this sort through advisory committees").

[29] *Id.* at 173.

Legal Opinion of NHTSA on the ACUP's Access to Deliberative Materials

U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**
Office of the Chief Counsel

1200 New Jersey Avenue SE.
Washington, DC 20590

MEMORANDUM

February 26, 2024

From: John Donaldson
Acting Chief Counsel

To: The Advisory Committee on Underride Protection

Through: James Myers
Designated Federal Officer

Subject: February 2, 2024 Opinion of Michael M. Oswalt

I am responding to a document the Advisory Committee on Underride Protection (ACUP) recently received about information available to Federal advisory committees. That document, from Professor Michael M. Oswalt of Wayne State Law School to the Secretary of Transportation and to the ACUP, states, among other things, that the Infrastructure Investment and Jobs Act (IIJA) *requires* that the ACUP be provided access to internal deliberations of Federal officials upon request. NHTSA respectfully disagrees. Neither the Federal Advisory Committee Act (FACA) nor IIJA compels this conclusion.

As a longstanding requirement of committee creation under the FACA, the chartering Federal agency is obligated to provide necessary administrative support for the committee. The language in IIJA does nothing more than echo this FACA requirement, allowing the ACUP to make requests for information, administrative services, and supplies and requiring the Secretary to provide those "necessary for the committee to carry out the duties of the committee." However, neither the FACA nor IIJA contains a mandate to provide deliberative materials—the determination about what is *necessary* to provide for the ACUP to carry out its duties resides with the chartering agency based on the stated purpose of the committee.

This approach applies to the ACUP and to all other advisory committees at DOT. The ACUP is not entitled as a matter of law to all information or services it might request, including pre-decisional or deliberative agency documents. We have determined that such documents are not necessary for the ACUP to fulfill its role of providing advice and recommendations, drawing on the varied perspectives of its members, on safety regulations to reduce underride crashes.

The Department will continue to respond to questions and provide all necessary support consistent with its statutory obligations. We appreciate the important advisory role of the ACUP, and we look forward to its next meeting on March 13.

Email Communication from Salena Zellers on Biomechanics of Secondary Collisions

It is not possible to determine whether a vehicle that impacts the rear of a truck equipped with rear underride guards that are designed to protect in 30% offset impact, will spin out into traffic and impact a secondary vehicle resulting in mortality in a secondary accident.

There are too many variables involved to gather data to prove or disprove that supposition. Here are just a *few* of the variables that would have to be considered:

1. Which side of the truck is impacted (road side or shoulder side)?
2. Does the car deflect into traffic or off the road?
3. Does the driver regain control of their vehicle after deflecting off the truck?
4. What is the speed of the primary vehicle?
5. What is the percentage of offset?
6. What is the impact angle?
7. If it deflects into traffic, are there other car(s) in the vicinity? (Dependent on variables that result in people driving their cars, as well as the location of the incident, time of day, time of year, etc.)
8. If there is a car in the vicinity of the impact and the primary vehicle spins off impacting that secondary vehicle:
    1. What type of vehicle is the secondary vehicle (truck, SUV, passenger car, etc)?
    2. What is the Delta V of that impact?
    3. Where is the impact to the secondary vehicle? (front/side/rear)
    4. Which seats are occupied, what are the demographics and health status of those occupants, what active safety features are being used, what passive safety features are available on that vehicle?
    5. Is the impact in the area of the occupant(s)?
    6. Is the impact such that the safety features of the secondary vehicle would protect those occupants?

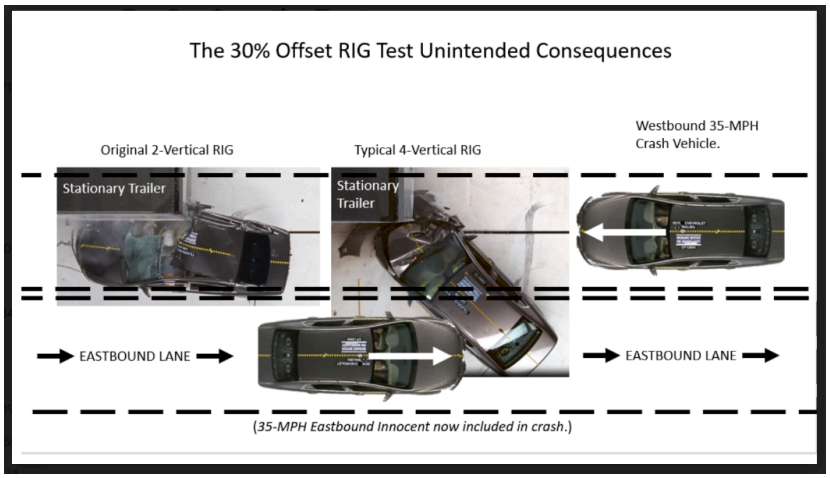
While the FARS data show that 24% of impacts between a vehicle and the rear of a truck involve more than one vehicle, most, if not all, of these crashes do not involve a truck with reinforced rear guards that protect in a 30% offset impact. Therefore, the crashes in FARS that involve secondary vehicles involve the other vehicles **because** the primary vehicle under rode the rear of the truck, not because they rotated into traffic. It is possible to analyze those crashes to determine if the secondary vehicles would have been affected by the primary vehicle spinning off. In fact, it is possible that the secondary vehicle could avoid the crash if the primary vehicle rotated out of the way.

In reality, the FARS data will not be helpful in determining if a vehicle impact into the rear of a truck equipped with rear underride guards designed to protect in 30% offset impact, will spin out into traffic and impact a secondary vehicle resulting in mortality in a secondary accident. Because most trucks are not equipped with these types of rear underride guards, you would need to determine how many vehicles in the vicinity of a vehicle to truck rear impact were **not**

involved in the crash, would be involved if the primary vehicle rotated into traffic. There is no way to determine that from FARS or any other data because vehicles that are not involved in the crash are not reported.

With respect to conducting a comparative biomechanical assessment of injuries between a 30% offset underride crash with intrusion into the occupant survival space and a secondary collision from a car rotating outboard into another lane of traffic, there are so many variables, including those listed above, that this assessment would not be predictive across the board.

However, the illustrations* provided, which show a vehicle spinning off into traffic after the impact, show the front of the secondary vehicle impacting the primary vehicle. Vehicle safety features for front seat occupants are finely tuned in frontal impacts and have been shown to protect occupants in crash severities including Delta Vs of 40 to 50 mph.



Jeff Bennett, Utility Trailer Manufacturing, PowerPoint Slide, 2/8/24 (*insert, mwk)

A History of the Trailer Rear Impact Guard from Utility's Perspective

A similar problem was addressed in the FHWA's evaluation criteria for guardrails place[d] along roadways. While the purpose of a guardrail is to redirect the car back onto the road rather than going off the road, the vehicle trajectory hazard is addressed by the design of the guardrail when possible. However, while a secondary impact is a risk, it is outweighed by the risk of the primary vehicle going off the road.

According to the FHWA [Guardrail 101 (dot.gov)]

> "The guardrail can operate to deflect a vehicle back to the roadway, slow the vehicle down to a complete stop, or, in certain circumstances, slow the vehicle down and then let it proceed past the guardrail."
> "The Guardrail Face. The face is the length of the guardrail extending from the end terminal alongside the road. Its function is always to redirect the vehicle back onto the roadway."

The National Cooperative Highway Research Program NCHRP Report 350 - Recommended Procedures for the Safety Performance Evaluation of Highway Features (part a) (trb.org), which was the standard for FHWA acceptance until 2018, stated the following:

> "Test article should contain and redirect the vehicle" [p 53]
> "After collision it is preferable that the vehicle's trajectory not intrude into adjacent traffic lanes." [p 55]
> "Vehicular trajectory hazard is a measure of the potential of the post-impact trajectory of the vehicle to cause a subsequent multivehicle accident, thereby subjecting occupants of other vehicles to undue hazard or to subject the occupants of the impacting vehicle to secondary collisions with other fixed objects. As indicated in Table 5.1, it is preferable that the vehicle trajectory and final stopping position intrude a minimum distance, if at all, into adjacent or opposing traffic lanes." [p 55]

Salena Zellers Schmidtke
Safety Research & Strategies, Inc., BioInjury, LLC., 703-980-2047

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	Theodore Delbridge, MD, MPH
Voting Member Organization	
Stakeholder Representation	Emergency Services

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report as written**

   Voting Member Signature _____ **Date:** 06/27/2024

2. **Concur with the Final Report as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)**

   Voting Member Signature _____ **Date:** _____

I feel the committee's delibrations in several cases concluded without reaching "consensus," but rather a simple majority opinion on matters. However, the descriptions in the report (motions) accurately reflect those circumstances.

3. **Non-Concur with the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	Theodore Delbridge, MD, MPH
Voting Member Organization	
Stakeholder Representation	Emergency Services

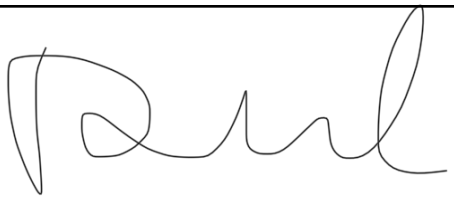
As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report as written**

   Voting Member Signature Theodore Delbridge **Date:** 06/27/2024

2. **Concur with the Final Report as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)**

   Voting Member Signature _____ **Date:** _____



I feel the committee's delibrations in several cases concluded without reaching

3. **Non-Concur with the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** "consensus," but

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	**Jennifer Tierney**
Voting Member Organization	**Truck Safety Coalition**
Stakeholder Representation	**Truck Safety**

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report, Section I ("Majority Report"), as written**

   Voting Member Signature Jennifer Mooney Tierney **Date: 06/27/2024**

2. **Concur with the Final Report, Section II ("Minority Report"), as written**

   Voting Member Signature _____ **Date:** _____

3. **Concur with the Final Report,**
   ☐ Section I ("Majority Report"),
   ☐ Section II ("Minority Report"),
   as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature _____ **Date:** _____

4. **Non-Concur with both Sections I and II of the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____

ADVISORY COMMITTEE ON
UNDERRIDE PROTECTION (ACUP)
Statement of Concurrence / Non-Concurrence

Voting Member Name	Harry Adler
Voting Member Organization	Institute for Safer Trucking
Stakeholder Representation	Truck Safety Organizations

As a voting member and full participant of ACUP, I hereby acknowledge that I have reviewed the *ACUP Final Report* and make the following declaration regarding the Report:

1. **Concur with the Final Report, Section I ("Majority Report"), as written**

   Voting Member Signature  **Date:** 06/28/2024

2. **Concur with the Final Report, Section II ("Minority Report") as written**

   Voting Member Signature _____ **Date:** _____

3. **Concur with the Final Report,**

   ☐ **Section I ("Majority Report"),**

   ☐ **Section II ("Minority Report"),**

   as written with the following exception(s): (Fully explain the areas of exception below, providing specific page number if appropriate. Submission of additional pages is permitted.)

   Voting Member Signature _____ **Date:** _____

4. **Non-Concur with both Sections I and II of the Final Report as written. Letter of Dissent must be provided.**

   Voting Member Signature _____ **Date:** _____