July 20, 2023

U.S. Department of Transportation
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE
West Building, Ground Floor
Room W12-140
Washington, DC 20590-0001

I am responding to your April 21, 2023, Advance notice of proposed rulemaking (ANPRM) Side Underride Guards (88 FR 24535; Docket No. NHTSA-2023-0012). The ANPRM summarizes the National Highway Traffic Safety Administration's (NHTSA 2023) analysis of the potential effects of a requirement for side underride guards on new trailers and semitrailers and the cost-benefit analysis (CBA) by the National Center for Statistics and Analysis (NCSA 2023). I find that NHTSA's analysis and the NCSA's CBA contain numerous serious errors that inaccurately reduce the economic and societal benefit estimates for side underride guards on semitrailers. Many of my concerns relate to NHTSA's lack of adherence to the requirement to base decisions on the **best reasonably available** scientific, technical, economic, and other information on the need for, and consequences of, the intended regulation (Section 1 of Executive Order (E.O.) 12866). These fundamental flaws are shared by others, but most noticeably:

1. Insurance Institute for Highway Safety (IIHS) 2023: "IIHS believes side underride guards have the potential to save many more lives than NHTSA has estimated in its cost-benefit analysis. We urge the agency to perform a more thorough analysis that does not depend on multiple assumptions that guards will provide no benefit outside a narrow range of conditions."

2. National Transportation Safety Board (NTSB) 2023: "...the NTSB is concerned that NHTSA's cost-benefit analysis for side underride guards described in the ANPRM took a narrow focus, which led to an underestimation of the potential benefits of side underride guards."

3. National Association of Mutual Insurance Companies (NAMIC) 2023: "NAMIC shares IIHS' conclusion that side underride guards have the potential to save many more lives than NHTSA has estimated in its cost-benefit analysis, and we join IIHS in urging NHTSA to perform a more thorough analysis based on the IISH input and not depend on multiple assumptions that guards will provide no benefit outside a narrow range of conditions."

Cost Benefit Analysis

Because the CBA (NCSA 2023) was overly restrictive and not based on the best reasonably available data, I am enclosing a cost benefit analysis that examined the economic and societal benefits and costs associated with implementing side underride guards on semi-trailers (Hein 2023; Enclosure 1, 1a). Please consider this analysis. Side underride crashes involving semi-trailers lead to a significant number of fatalities and serious injuries each year, resulting in substantial costs to society. In the absence of side underride guards on semi-trailers, side underride crashes result in a minimum annual baseline of between 200 to 400 fatalities and 200 to 400 serious injuries, which annually costs society between $2,670,920,000 and $5,341,840,000. Side underride guards are highly effective in reducing crash severity of a passenger vehicle into a semi-trailer (Brumbelow 2012; NCSA 2023). The benefits of installing these

guards include an annual prevention of between 50 and 150 fatalities, as well as an annual reduction of between 50 and 150 serious injuries. The costs associated with side underride guards encompass the installation and maintenance expenses ranging from $1,000 to $3,000 per semi-trailer, along with a fuel impact of 0.25 percent due to the additional weight of 500 pounds. Subtracting the costs from the benefits of side underride guards, the study estimates a minimum annual net present value of between $540,242,339 and $1,385,702,339. Moreover, the installation of aerodynamic skirts on semi-trailer side underride guards can yield additional annual benefits of $746,426,163, resulting in a total net present value of $2,132,128,502. These additional benefits are achieved through fuel savings of 714 gallons of diesel per semi-trailer, assuming a conservative 5 percent reduction in fuel consumption. The positive net present value demonstrates that the benefits of installing side underride guards on new semi-trailers exceed and fully offset the costs. Therefore, mandating the installation of side underride guards through Federal regulation is considered cost-effective.

Comments

NHTSA "must consider and respond to significant comments received during the period for public comment."[1] because "the opportunity to comment is meaningless unless the agency responds to significant points raised by the public."[2] Moreover, "during notice and comment proceedings, the agency is obligated to identify and respond to relevant, significant issues raised during those proceedings."[3,4] Consequently, please address and rectify all of the following issues in the ANPRM and CBA (NHTSA 2023, NCSA 2023).

Using Travel Speed instead of Speed Differential: The NCSA (2023) target population is based on overly restrictive assumptions. Of particular importance is the use of "Travel Speed" of fatal crashes cataloged in the Fatality Analysis Reporting System (FARS), rather than using speed differential (or Delta V; see also IIHS 2023). I reviewed the 2017 raw FARS data (NHTSA 2017) to conservatively evaluate Case Listings where NCSA (2023) inappropriately excluded fatal crashes by using the data element "Travel Speed" to estimate the target population, rather than estimating the target population by calculating the speed differential between the vehicles involved in the fatal crash (Table 1). Because roughly 70 percent of crashes involving the side of a tractor-trailer are underride (see IIHS 2023 comment and references therein), Case Listings with the data element "Underride/Override" coded as "unknown" are putative side underride crashes because the data element "angle" and "clock points" are coded as "12" and "3" or "12" and "8" (NHTSA 2017).

Travel Speed is Underreported and Inaccurate: The data element "Travel Speed" records the speed the vehicle was traveling prior to the occurrence of the crash as reported by the investigating officer. NCSA (2023a) reports that this data element is "…collected after the crash, and is an estimate of the travel speed, which is often a judgment, rather than a measurement". In fact, NHTSA (see Blower and Woodroffe 2013) has previously reported that relatively few of the large truck crashes had speed data that could be used to estimate impact speeds. It is also noteworthy that the Government Accounting Office (GAO 2019) reported that "on average, 62 percent of fatalities from underride crashes with

[1] *Perez v. Mortg. Bankers Ass'n*, 135 S. Ct. 1199, 1203 (2014).
[2] *Home Box Off. v. F.C.C.*, 567 F.2d 9, 35 n.58 (D.C. Cir. 1977)
[3] *North Carolina Growers' Ass'n, Inc. v. United Farm Workers*, 702 F.3d 755, 769 (4th Cir. 2012).
[4] United States Senate; Permanent Subcommittee on Investigations. 2019. *Abuses of the Federal Notice-and-Comment Rulemaking Process.*

passenger compartment intrusion reported in 2008 through 2017 did not include a reported speed. For example, for these fatalities in 2017, 72 percent had speed coded in FARS as missing or not reported. A state and a local police official told us that determining the speed of an underride crash can be challenging due to the often severely damaged condition of the passenger vehicle following an underride crash. Officials representing state police said that they are better able to document whether or not speeding was a factor in an underride crash, rather than an exact speed. IIHS representatives also acknowledged the difficulty in documenting the speed involved in an underride crash, and further stated that this difficulty brings into question the accuracy of the speed data that are recorded in FARS for underride crashes." IIHS (2023) clearly identified the significance of this issue.

Inappropriately Truncating the Target Population: Applying NCSA's (2023) undercount factor to the number of FARS (2017) fatal crashes in Table 1, yields a conservative target population estimate of 50 fatalities (1.78 x 28) that could have been prevented by side underride guards. This estimate is extremely conservative because it was not derived using photographs to validate FARS undercounting. IIHS (2023) calculated a more robust estimate based on the Large Truck Crash Causation Study (LTCCS; Brumbelow 2012), which represents the best currently available data source for estimating the benefits of side underride guards. Applying the proportions calculated from the LTCCS fatalities, IIHS estimated that 159-217 fatalities could be addressed by a side underride guard standard. Brumbelow (2012) also reported that injuries and deaths from side underride collisions into heavy trucks and trailers are a significant public health issue with an estimated 530 passenger vehicle occupant fatalities each year during 2006–2008 in two-vehicle collisions between passenger vehicles and the sides of large trucks. Side underride guards are designed to engage car safety systems (e.g., airbags, crumple zones, seat belts) during a collision to reduce the degree of passenger compartment intrusion (Mattos et al. 2001). Significant expenses went into developing these car safety systems, but without side underride guards they are rendered useless. Similarly, Hein (2023a) and Padmanaban (2013) estimated an undercount factor of 2.4 and 3.1, respectively, which would yield target population of 67 (2.4 x 28) and 87 fatalities (3.1 x 28). 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). Consequently, I recently submitted a petition under the Administrative Procedure Act to the U.S. Department of Transportation (USDOT) and NHTSA that would improve the data sources on which NHTSA relied upon by resolving 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 (Hein 2023b; Enclosure 3).

Table 1 FARS Case Listings of likely side underride crashes and fatalities in relation to travel speed and Delta V (NHTSA 2017) to estimate the target population, rather than estimating the target population by calculating the speed differential between the vehicles involved in the fatal crash.

Case Listing	Travel speed	Delta V	Fatalities
40611	53	18	2
40822	39	38	1
220712	55	35	1
290541	58	5	1
340315	67	21	1
420404	65	0	2
450928	20	20	1

510130	52	37	1
61895	55	15	1
122087	45	0	1
370827	60	25	1
420731*	45	25	1
100030	59	31	1
420963	45	30	1
420090*	50	15/25	1
210344*	45	5	1
60806	48	43	1
120108	55	51	1
450054	60	50	1
450669	50	45	1
122686	50	45	1
220519	55	5	1
122686	50	45	1
10309	50	45	1
420962	50	5	1
420969	40	15	1
Total	26 crashes		28
*involved multiple vehicles			

False and Misleading Statements: NHTSA's (2018) report contradicts NCSA (2023) that you *"…do not have information available on the degree to which side guards may offer a safety improvement beyond their 40-mph test limit. As such, any estimated benefits above 40 mph would be purely speculative".* In fact, NHTSA (2018), identified three different sets of impact conditions to evaluate side underride guards. These three sets of design impact conditions were defined by one impact speed in combination with three different impact angles. The selected impact speed is **50 mph**, and the selected impact angles are 15, 22.5, and 30 degrees. Importantly, NHTSA (2018) noted that:

> "*…in a majority of underride collisions, the passenger vehicle is moving in a forward orientation towards the semitrailer, making contact at an oblique angle (<90 degrees). During an oblique impact with an SUPD, the objective is to contain and redirect the impacting vehicle. The redirected vehicle has an exit velocity and, thus, not all of the energy of the vehicle must be dissipated by the SUPD. The lateral energy that must be managed by the SUPD is referred to as the impact severity. Impact severity is defined as the lateral energy of the vehicle during an oblique impact with the SUPD and is a function of vehicle weight, speed, and angle" and*
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> *"Depending on the angle of an oblique impact, higher speeds into a side underride guard are more survivable as the angle decreases and become more of a glancing blow because the energy is redirected and not completely absorbed by the side guard (like a 90-degree impact). The impact severity for a 50-mph impact at 30 degrees is 67 kip-ft; at 22.5 degrees is 39 kip-ft; and 15 degrees is 18 kip-ft."*

NHTSA (2018) found that "Accident data and case evaluations indicate that the vast majority of truck underrides occur in the impact speed range of 30 to 50 mph." Notably, NHTSA (2018) concluded that

"The successful testing and simulations at speeds up to 50 [mph] and angles from 90 to 15 degrees further speaks to the wide range of accident scenarios and severities for which side underride protection is proven effective." Importantly, in 2021, 43.1 percent of two-vehicle fatal crashes between a large truck and the other vehicle (excluding large trucks) were proceeding straight at the time of the traffic crash, indicating a high potential for oblique angle crashes that would be minimized by side underride guards (NCSA 2023b). Consequently, NCSA (2023) eliminating all crashes greater than 40 mph without considering the angle of impact is incorrect and too simplistic, leading to NHTSA's flawed conclusion that a side guard would not prevent underride fatalities above 40 mph. In fact, the effectiveness of side guards should be appropriately modeled using logistic regression, which would verify that the probability of a side underride guard's success or failure is a function of speed differential, angle of crash impact, and weight of the passenger vehicle.

Ignoring Underride Research and Data: NHTSA used computer-based crash simulations to determine that rear truck underride guards provide significant crash attenuation for serious and fatal injury non-PCI underride crashes (NHTSA 1991, p. 53-54). The 1981 NPRM proposed to adopt a FMVSS for all new trucks and trailers with a GVWR of 4536 kg (10,000 lbs) or more. This NPRM was issued after research and **computer modeling** studies indicated that it was feasible to manufacture light-weight guards that could prevent excessive underride and absorb crash energy (NHTSA 1996). Moreover, computer-based simulations are often used by researchers investigating crash attenuation of side underride guards up to 50 mph (Bodapati 2004; Moradi et al. 2011; Moradi 2012; Galipeau-Belair et al. 2013; Galipeau-Belair 2014; Mattos et al. 2021). Significant protection of occupants in passenger vehicles (e.g., reductions in compartment intrusion reductions) were demonstrated. Consequently, NHTSA cannot ignore these data and must apply a speed differential of 50 mph in the CBA (NHTSA 2023; NCSA 2023). Moreover, there is a wealth of best available scientific information that NHTSA (2023) and NCSA (2023) is required to review or reference (see Enclosure 2 Underride Literature).

Semi-trailer Defect Investigation: On September 14, 2021, I submitted a petition to NHTSA requesting that the agency investigate whether a defect related to motor vehicle safety exists in van-type or box semi-trailers due to a lack of side underride guards (Hein et al. 2021). NHTSA subsequently denied the petition because "…the issues raised by the petitioners are best addressed through the congressionally-directed evaluation of SUGs under section 23011 of the BIL [2021 Bipartisan Infrastructure Law]" (NHTSA 2022a). NHTSA has thus formally noticed, and I am expecting, that the issue of retrofitting and defect analysis will be part of the investigations addressed by the Advisory Committee on Underride Protection.

Ignoring Research and Data from Semi-trailer Manufacturers: In response to Hein (et al. 2021), in December 2021, NHTSA (2022a) sent an information request letter to eight (8) manufacturers asking for information related to side underride. Letters were sent to the following trailer manufacturers: Great Dane; Hyundai Translead; Kentucky Trailer; Stoughton; Strick Trailers; Utility Trailer Manufacturing; Vanguard; and Wabash. NHTSA received separate responses from each manufacturer and concluded that the eight manufacturers surveyed represent nearly 100% of the subject vehicle population (NHTSA 2022a); *yet, there is no mention of the survey or responses in NHTSA (2023) or NCSA (2023).* Moreover, NHTSA (2022a) research demonstrated that 245,000 semitrailers would be subject to side underride guards, which was even higher than the 3-year (2020-2022) average semitrailer output of 211,472 from these eight manufacturers was (Trailer Body Builders 2022, 2023). Inexplicably, NCSA (2023) and NHTSA (2023) did not use either of these estimates and incorrectly used inflated numbers of 260,000 semitrailers as a percentage of the commercial semitrailer fleet, which was based on outdated 2010 information provided by the trucking industry to calculate the "current" subject semitrailer population.

These overestimates are not only significantly higher than NHTSA's (2022a) estimate, but also are not based on the best reasonably available information. Please use the correct estimates of 211,472 semitrailers, with the total semitrailer population of 2.45 million that would be subject to side underride guards.

Disregarding Safety Benefits of Side Underride Guards at Higher Speeds: It is also extremely likely that safety benefits would accrue from side underride crashes at speeds higher than 40 mph speed differential, because a side underride guard would likely exceed crash tests performance. Furthermore, Side underride guards have already been certified to prevent PCI (Passenger Compartment Intrusion) at an impact speed of 45 mph and 47.5 mph with a vehicle GVW of 1,500 kg (Ponder 2018; Airflow 2022). Side underride guards offer significant benefits to society by reducing the risks and associated costs of semitrailer and vehicle collisions; however, **these were completely and inappropriately ignored by NHTSA** (2023) and NCSA (2023). NHTSA's decision to assume guard failure at 41 mph and above does not reflect a genuine effort to establish the possible benefits of side underride guards. Rather than conduct its own higher speed testing, or even assume progressively lower benefits up to some upper speed bound, NHTSA inexplicably chose to assume no benefit. Consequently, truncating all fatal crashes above 40 mph travel speed is a flaw that is inconsistent with your requirement to "base decisions on the best reasonably available scientific" information.

Eliminating Years of FARS Data: NCSA (2023) ignored calendar years 2018 to 2021 from its analysis of the underride safety problem and like AEB (NHTSA 2023a) may claim that those years may be atypical. However, E.O. 12866 requires agencies to base their decisions on the *best reasonably available scientific, technical, economic, and other information* on the need for, and consequences of, the intended regulation, which would include these years. For example, there is no mention from NCSA (2023b) that large truck fatalities in 2021 were from an "atypical" year. NHTSA's stated mission is to "[s]ave lives, prevent injuries, reduce vehicle-related crashes." As part of this responsibility NHTSA operates, publishes, and maintains the FARS. NHTSA has identified accurate underride crash data as the critical tool for identifying and analyzing crash trends and developing countermeasures and strategies to mitigate and prevent deaths and severe injuries, such as those caused by underride/override crashes (NHTSA 2022b). NHTSA has also reported that one of the important ways it uses FARS data is to "…estimate the potential effectiveness of new technology, especially crash avoidance technology" (NHTSA 2016). Moreover, the FARS data also affords a basis for decision-making in areas of traffic and motor vehicle safety and countermeasure development (NHTSA 2021). Consequently, given your record on the importance of FARS data and the requirement to use the "best reasonably available" information, the CBA (NCSA 2023) must be updated to include all the FARS data, including years from 2018 to 2021.

Excluding Truck and Bus Data: Explain why NCSA (2023) includes SAS code that also queried for underrides of single unit trucks and buses; however, these data are not included in the CBA analysis.

Using FARS 2017 data: NCSA (2023) does not indicate why the year 2017 was chosen to evaluate undercounting of underride crashes in FARS, nor whether 2017 is statistically representative sample from the overall FARS data (i.e., does 2017 accurately represent the number of side underride crashes throughout the years of FARS data?).

Validating FARS 2017 Data Without Photographs: NCSA (2023) noted that "In most cases, photographs of the incidents were not available." Without photographs, the ability to accurately determine whether the

FARS underride data element from crashes was coded correctly is severely limited. Consequently, the estimated "underreporting factor" used in NCSA (2023) is likely biased low.

Excluding All Industry Data on Side Guards: In response to a petition to initiate an investigation to recall semitrailers because they lack side underride guards (Hein et al. 2021), NHTSA received information on testing and development of side underride guards from major semitrailer manufacturers (NHTSA 2022a). NHTSA is also aware that Utility Trailer Manufacturing Company (UTM) developed and for 2 years has offered a patented side impact guard as a safety feature for all its refrigerated and dry van trailers that can be fitted with aerodynamic skirts (UTM 2022, 2023, 2023a). The addition of aerodynamic skirts to SUGs would decrease fuel consumption (UTM 2023; Hein 2023) and greenhouse gases and other pollutants. Utility also has at least 60 trailers outfitted with side underride guards (UTM 2023b; Bennett 2023); yet, NHTSA did not use any of these "reasonably available" data in the CBA (NCSA 2023).

Disregarding Fatal Crashes Involving More Than 2 Vehicles: A previous IIHS study investigated all crashes involving at least one large truck and at least one passenger vehicle in the Large Truck Crash Causation Study (Brumbelow 2012). Using photographs and coded variables, we identified 73 cases in which the most severe injury to a passenger vehicle occupant was due to side underride. One quarter of these cases (18 of 73) involved more than two vehicles (Brumbelow 2012).

Speed Differential Examples: The reconstruction of collisions involving a semi-trailer side underride by passenger vehicles is complex and challenging. A detailed analysis of the passenger vehicle's post-impact damage is required to evaluate the collision phase and ultimately to determine its impact speed (Castaneda 2012). FARS data and police reports are inaccurate (NCSA 2023a), particularly when using the data to sieve for the underride fatality target population.

Example 1: On November 13, 2015, my 16-year-old son Riley Eric Hein was killed in a side underride crash when a truck driver hauling a Utility Trailer 3000R refrigerated trailer ran his Honda Civic off the highway. The Civic bounced off a concrete Jersey barrier and went under the semitrailer at a shallow angle, at a speed variance (or Delta-v) of about 14.5 mph—much lower than the speeds at which side underride guard designs (AngelWing, SafetySkirt, and Utility Trailer's Side Impact Guard) have prevented side underride. Accident reconstructionist Will Bortles used two simulations that demonstrated, first, how Riley's crash happened and second, illustrating about how the crash would have happened if Utility Trailer had designed the 3000R trailer with AngelWing side underride guards—(i.e., the car would never have been trapped under the trailer). Speed variance should be considered in your analysis, not just the speed a passenger vehicle was traveling before a crash (e.g., the passenger vehicle crashing into a stationary semi or one traveling perpendicular to the passenger vehicle). Speed variance is the difference in speed between a semi and passenger vehicle (e.g., a semi going 70 mph and passenger vehicle going 65 would be a variance of 5 mph). Riley's example demonstrates that an oblique angle or sideswipe during a side underride crash with a speed variance under 35 to 40 mph, would effectively prevent the passenger vehicle from underriding the semitrailer. The Traveling Speed data element was "Not Reported" in the FARS Case Listing for Riley's death (350238).

Example 2: Indeed, traveling speed is frequently not reported. For example, in a fatal side underride crash that was the subject of a Special Crash Investigation (SCI) Report completed by NHTSA (2023), the Traveling Speed data element was "Reported as Unknown" in the FARS Case Listing (360121).
The dodge hit the side of the semitrailer with an attached aerodynamic skirt at an oblique angle. The aerodynamic skirt under the semitrailer was not designed or intended to provide rigid structural protection or prevent underride crash events similar to this crash. Even though the Dodge was going 42

mph at 0.3 seconds prior to crash, if "…the side skirting had been manufactured with some type of rigid structural beams and designed to provide crash protection, it likely would have provided some level of mitigation in this crash scenario and likely significantly reduced the degree of underride by the Dodge." (NHTSA 2023 SCI report). By defining the target population as only those side underride crashes with impact speeds 40 mph or less, eliminates crashes such as this example, which a side underride would have "…***likely significantly reduced the degree of underride***" resulting in serious injuries, rather than a fatality.

Lack of Required Peer Review: The report entitled, "Side Impact Guards for Combination Truck Trailers: Cost- Benefit Analysis" (CBA; National Center for Statistics and Analysis; NCSA 2023) did not undergo peer review, which is inconsistent with USDOT (2010) policy and two Presidential Memorandums (2009, 2021). USDOT policy states that "…data and research used to support DOT policy decisions will undergo independent peer review by qualified experts". The Presidential Memoradums (2009, 2021) state that "…When scientific or technological information is considered in policy decisions, the information should be subject to well-established scientific processes, including peer review". This regulatory cost-benefit analysis is particularly complex; therefore, the agency must subject its analytics, parameters, and assumptions to peer review.

Inconsistent Application of Required Baseline Data: The CBA did not comply with the Office of Information and Regulatory Affairs (OIRA 2003) requirement from Circular A-4 that agencies identify a baseline in their "Regulatory Analyses" where benefits and costs are defined in comparison with a clearly stated alternative. NCSA (2023) should have developed a "No Action" baseline for comparison that identified what the world will be like if the proposed rule is not adopted. Oddly, NHTSA inconsistently applies the requirement to develop a baseline for cost benefit analyses. For example, NHTSA (2023a) developed a baseline for evaluating the costs and benefits of a regulation to mandate automatic emergency braking systems for light vehicles, which reflects how the world would look in the absence of regulation. Inexplicably, NHTSA ignored the requirement in "Side impact guards for combination truck-trailers: Cost-benefit analysis" (NCSA 2023); there is no baseline identified (e.g., the current annual societal cost of hundreds of fatalities and serious injuries that occur from side underride crashes with semitrailers that lack side underride guards). Without this side impact guard information, the reader is likely to inaccurately conclude that there is no societal cost under the current No Action baseline.

Inaccurate Calculations: Please check that the NCSA (2023) calculations for the 3 and 7 percent discount rates are correct. For example, I can replicate OIRA's (2003, p. 21) and U.S. Department of Transportation (USDOT 2016) examples using the discount rate formula [discount factor is equal to 1/(1+ i)t where i is the interest rate and t is the number of years from the date of initiation for the program or policy until the given future year]. However, I cannot replicate NCSA's (2023) calculations (with t = 2; eligible new trailers in 2022, 2020 dollars) using the same discount rate formula (e.g., 7%; 296.3/1.072 = 258.8) and applying these, as an example, to Table ES-5. I also could not replicate the discount rates in Table 21. If these are incorrect, please verify the accuracy of other calculations throughout NCSA (2023). I could not check any other discount rate calculations because no other undiscounted estimates were provided in NCSA (2023). When discount rates are reported, please also include all undiscounted estimates.

Table ES-5. Total Incremental Fuel Cost (in Millions).

Undiscounted	Reported 3% Discount	Reported 7% Discount	Using OIRA's Formula for a 3% Discount	Using OIRA's Formula for a 7% Discount
$296.3	$245.0	$195.2	$279.3	$258.8
$515.4	$426.3	$339.7	$485.8	$450.2

Lack of Transparency and Illegal Delay of Releasing Records: Side underride guards were mentioned within the preliminary regulatory evaluation for rear underride guards (NHTSA 1991). Without any documentation, analysis, or data, NHTSA inexplicably reported in a "preliminary regulatory evaluation" (NHTSA 1991) that side underride guards were found not to be cost-effective. I requested these records and their underlying data and analysis through the Freedom of Information Act (FOIA) in June 2021. Although FOIA is meant to provide clarity and ensure transparency, not obscure Government operations, to date NHTSA has yet to release any records related to its 1991 preliminary regulatory evaluation. Therefore, the 1991 preliminary regulatory evaluation is suspect and, at this point, has no basis in fact. It is arbitrary and capricious for NHTSA to continue to cite or rely upon any of the records related to the 1991 preliminary regulatory evaluation without disclosing the underlying data and analysis (i.e., showing your work); therefore, the 1991 preliminary regulatory evaluation that side underride guards are not cost effective should be expunged.

Update the Value of Statistical Life: The USDOT (2023a) recently updated the Value of Statistical Life estimate to $12.5 million. The CBA (NCSA 2023) should be correspondingly updated.

Crash Avoidance Technology: The trucking industry continues to favor crash avoidance or prevention (e.g., automatic emergency braking systems (AEB)) over side underride guards (Horvath 2023). Automatic emergency braking systems on semi-trucks is likely to only minimize crash severity of striking rear-end crashes, and the associated fatalities and injuries that would be prevented if all large trucks were equipped with AEB systems (AAA Foundation for Truck Safety 2017). The American Transportation Research Institute (ATRI; 2022) reported that 92 percent of responding trucking fleets added safety technologies (e.g., automated emergency braking, road-facing cameras, lane departure warning, forward collision warning) in the last three years with 56 percent of carriers implemented three or more new safety technologies. Even with crash avoidance systems, large-truck crashes continued to rise by over 17 percent in 2021 and most people killed in large-truck crashes were occupants of other vehicles (NCSA 2023b).

While AEB may help avoid many types of crashes, these systems do not prevent side underride crashes. Without side underride guards on semitrailers, AEB sensors on passenger vehicles are unlikely to appropriately detect and classify forward objects as a semitrailer to apply brakes and avoid or mitigate the crash because the area beneath a semitrailer would be empty. It is likely that AEB on passenger vehicles may only have the potential to help reduce the severity of side underride crashes if SUGs were installed on semi-trailers and AEB sensors could detect and apply brakes at speeds up to 100 km/h (62 mph) when manual braking is applied and up to 80 km/h (50 mph) when no manual braking is applied. These are the collision avoidance speeds that are currently proposed by to be required by NHTSA (NHTSA 2023a) and significantly expand the number fatalities prevented and serious injuries minimized by a requirement that new semitrailers are equipped with side underride guards.

Without SUGs on semitrailers, AEB does not prevent underride: The first example is of Joshua Brown's side underride crash with a semitrailer (NTSB 2017). The car was equipped with a forward collision warning system and AEB, ***but those systems did not activate***. The Tesla's automated vehicle control system was not designed to, and did not, identify the truck crossing the car's path or recognize the impending side underride crash; consequently, the Autopilot system did not reduce the car's velocity, the forward collision warning system did not provide an alert, and ***the automatic emergency braking did not activate***, resulting in the fatality of the driver.

The second example comes from another side underride crash involving a Tesla (NTSB 2019). The car's forward collision warning and ***AEB did not activate before the crash***. There was no evidence of system- or driver-applied braking or steering before the side underride impact, which resulted in the fatality of the driver.

Finally, other crash avoidance systems do not prevent a side underride (NHTSA 2023b). NHTSA (2023b) reported that "The EDR data indicated that the Dodge driver initiated right steering and braking avoidance action at 1.5 seconds prior to AE, when the vehicle's speed was 94 km/h (58 mph). ***The braking input reduced the Dodge's speed to 67 km/h (42 mph) at 0.3 seconds prior to AE, and the vehicle's antilock braking and stability control systems were engaged***, but the side underride crash of the passenger into the semitrailer still resulted in the fatality of the driver."

Disregarding Vulnerable Road Users: The unguarded areas beneath semitrailers also present hazards that result in death and injury to motorists, cyclists, and pedestrians (vulnerable road users). Kiefer (2016) patented and tested a underride system for semitrailers that is designed specifically for preventing or minimizing underride deaths and related injuries in collisions between passenger vehicles, pedestrians, motorcycles, and bicycles. The NTSB's (2014, 2019a) recommended that NHTSA require side underride protection on certain newly manufactured truck tractors and truck trailers, which would also have the potential to mitigate the severity of truck side impacts with pedestrians, bicyclists, or motorcycles. By preventing these road users from being pulled under the truck, side underride guards can reduce the severity of injuries sustained in these types of accidents.

Encouraging Innovation; Cost and Weight Savings: Over the years, manufacturers have designed large trucks, trailers, and components to reduce weight (Berg 2015). A side underride guard regulation would encourage innovation, and, like rear underride guards, engineering solutions would reduce the cost and weight, while increasing effectiveness in preventing fatalities and reducing serious injuries. For example, Stoughton produces trailers with rear impact guards that prevent passenger compartment intrusion (PCI) that do not add additional weight, cost, or negatively impact aerodynamics. The Stoughton rear impact guard, made of steel, includes two vertical supports on the outer ends of the horizontal member that fasten to a robust undercarriage of the trailer. Oddly, FMCSA (2022) questioned the engineering of Stoughton's rear impact guard, concluding that "…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." However, a closer review would have demonstrated that Stoughton's claims are valid due to a reduced amount of material used to manufacture a rear impact guard to obtain weight and fuel savings reduction (e.g., see Stoughton 2016, 2017; Heavy Duty Truck Magazine 2017; Miller and Smidler 2017). Similarly, Wabash (2020) patented a lighter rear guard that reduces the overall weight of the semitrailer, allowing the operator to either increase the load capacity and/or lower fuel consumption. Like rear underride guards, future engineering of side underride guards will undoubtedly bring about further innovations in weight and cost reductions, including mass production of side guards during manufacturing of semitrailers. As the

demand for side underride guards increased, manufacturers would be incentivized to create more advanced and effective systems.

Legal Liability: NHTSA (2023) and NCSA (2023) did not consider the benefits of reducing the legal and financial liability to the trucking industry from the lack of side underride guards on semitrailers. This is best exemplified by a jury verdict in response to lawsuit my family filed concerning my son Riley's death. We challenged the blatant disregard for human lives and safety in favor of company profits. In August 2019, after a 2-week trial in Santa Fe, New Mexico, a jury reached a $42 million verdict against the Barkandi Express Trucking Company and Utility Trailer Manufacturing Company. Of this, the judgement against Utility Trailer Manufacturing Company was $18.9 million (see Sievers 2020). The jury found that Utility Trailer Manufacturing Company was negligent in Riley's death because they ignored basic facts: hundreds of people continue to die every year from semitrailer side underride collisions and their semitrailer lacked a side underride guard to prevent Riley's death (Sievers 2020). If side underride guards were Federally-mandated, my son Riley would be alive; the autopsy confirmed he had no physical injuries from the crash.

The Following Address False Industry Claims

Industry Disagreement Is Not Based on Data or Facts: The disagreements of economic and operational difficulties for side underride guards are identical to those made for rear underride guards (NHTSA August 14, 1970; 35 FR 12956-12957). In 1971, NHTSA withdrew the proposed rule for rear underride guards because "the safety benefits achievable in terms of lives and injuries saved would not be commensurate with the cost" (NHTSA June 18, 1971; 36 FR 11750), after the trucking industry vigorously opposed the proposed rule to require rear underride guards challenging its value in saving lives and reducing injuries, while claiming the cost would be unjustifiably high and that it would prove to be an excessive economic burden (NY Times 1971). Subsequently, the Truck Trailer Manufacturers Association (TTMA 1979; Enclosure 4) alleged that rear underride guards would cost $37.4 billion; each guard would weigh 1,400 to 1,700 pounds; rear guards would result in lower payloads and increased fuel costs; and would result in an additional cost of $24,497 per semitrailer. None of these claims were valid; in reality, they have all been shown to be exaggerations, identical to the claims that have been made by the trucking industry on side underride guards, which are detailed below. In 1996, NHTSA estimated rear impact guards would cost approximately $128 to $148 per trailer or semitrailer (NHTSA; January 24, 1996; 61 FR 2004). In 2022, NHTSA estimated that a rear underride guard would cost $254.35 per guard (NHTSA; July 15, 2022, 87 FR 42339).

Industry Lobbying: The trucking industry has resisted side underride legislation for decades (Thompson et al. 2023, 2023a). Their arguments about costs, weight, operational issues, technological problems, and unavailability have long ago been shown to be false. In fact, after losing several lawsuits, some semitrailer manufacturers have been investigating and patenting side underride guards but have not moved forward due to lack of a regulatory requirement to do so. NHTSA should require data or research from the industry to confirm any statements; otherwise, these claims should be dismissed as a red herring meant to mislead or distract from how to prevent side underride fatalities and minimize serious injuries.

Lack of Side Underride Research: The trucking industry falsely suggests that very little research has been conducted on side underride guards. Please review Hein (2021a) and Enclosure 2, which demonstrates a wealth of research on side underride guards.

Lack of Real World Testing: The trucking industry falsely claims that side underride guards have never been evaluated in "real world" situations. In fact, starting in 2010, the AngelWing has been installed on a small number of semitrailers that have already logged over 1 million miles delivering loads with no issues of road clearance, structural deficiencies (e.g., stress cracks on welds), or loading/unloading at docks (Berry 2021, Heres 2021, Camden 2021, P. Ponder pers. comm.). Moreover, UTM has 60 trailers currently operating in the U.S. with the UTM SUG installed (UTM 2022; Bennett 2023).

Unintended Consequences: The trucking industry frequently mentions possible "unintended consequences" of side underride guards (e.g., the remote chance of a SUG falling off a semitrailer or a passenger vehicle ricocheting off a SUG and causing a crash with multiple fatalities; Bennett 2023) For example, Lewie Pugh stated that "I also believe that there are certain instances where side underride guards will cost lives, and we don't know the unintended consequences." (cited in Thompson et al. 20233). These are clearly extremely remote possibilities and have no basis other than scare tactics, particularly when compared to the facts: hundreds of fatalities and serious injuries occur annually from side underride crashes.

Clearance Issues, Railroad Crossings: Side underride guards will not impede semitrailer hauling due to low ground clearance of curbs or railroad crossings. Guards on semitrailers would still leave 22-27 inches of clearance from the bottom of the guard to the ground. From 2014-2018 there were no fatalities from semitrucks and semitrailers on railroad grade crossings that were coded "semi-trailer stuck on tracks", which would include the population of trailers far lower to the ground than is required by a side guard (Ponder 2020a; 2020b). SafetySkirt (2019) has also demonstrated adequate clearance of a SUG over a raised median. Many semitrailers currently on the road, like low boys, auto transporters or double-drop trailers, have only 3 inches of ground clearance and are not an impediment to commerce. Low chassis trailers have minimal ground clearing and are not a side underride hazard. For example, beverage trailers, which are often loaded to the maximum of 80,000 lb weight limit, are goose-neck trailers with a low chassis that would prevent side underride collisions. Moreover, existing equipment on trucks and semitrailers has much less clearance: landing gear-8 inches; differential-10 inches; brake chambers-12 inches; and truck cab-8 inches. Finally, the Federal Railroad Administration (FRA) offers a Rail Crossing Locator App that allows the public to access the highway-rail grade crossing database and a variety of map features for route planning to avoid problematic grade crossings for any semi-trailer (FRA 2023).

Clearance Issues, Trains, Ships, Intermodal Loading and Unloading: Although the Virginia Port Authority (2023) is concerned that ground clearance on SUGs may be inadequate for loading and unloading of long trailers in trains or ships, they provided no specific data. Like rear underride guards, a SUG with 22 inches of ground clearance would not interfere with trains, ships, or intermodal loading and unloading (e.g., vessel loading ramps or on any 20 percent grade; NHTSA 1996). The American Trucking Associations (ATA) supported a 22 in proposed ground clearance for rear underride guards because 53-foot semi-trailers are rarely used on vessels, and because 20 percent grades are rare (cited in NHTSA 1996). Moreover, the Truck Maintenance Council of the ATA recommended a rear guard clearance of 22 in for general freight equipment (cited in NHTSA 1996). Furthermore, the TTMA (2019) has a final recommended practice trailer ground clearance that "…provides a uniform method for calculating the location of the minimum vertical ground clearance for rigid auxiliary equipment – such as fuel tanks, storage boxes, side-door steps, tire carriers, lift gates – that may be affixed underneath the semi-trailer without contacting the ground when the trailer goes over a change in grade, including grade changes attributable to loading docks, railroad crossings, steep driveways." According to a trailer designer and

manufacturer, the 22 in height for rear underride guards was acceptable because, although many trailers are still driven into ships rather than being crane loaded, vessel owners can adjust their ramps, and because it is compatible with the dimensions established by the trucking industry and loading dock restraint device manufacturers (NHTSA 1996). This rationale would also hold true for SUGs.

Virginia Port Authority (2023) also indicated that Side guards would impede the need for intermodal chassis trailers to stack. However, side guards have already been designed and installed on intermodal chassis trailers without issue (Alibaba 2023, 2023b). Moreover, Strick (2000) already has a proposed design for equipping intermodal chassis with a side guard.

The Virginia Port Authority (2023) also indicated that "…there have been no fatalities identified over the last five years from side underride incidents involving intermodal marine chassis indicating limited if any safety benefits from imposing new regulations." This statement is inaccurate. Please note this fatal side underride crash in Indiana in 2018 from an intermodal chassis fatal side underride crash (News Now Warsaw 2018).

Clearance Issues, Loading Docks: Moreover, an SUG with 22 inches of ground clearance would not be a hinderance on the maximum 6% dock slope as set forth in Society of Automotive Engineers' SAE J699 (cited in Ponder 2020a). Notably, the max SAE recommended dock slope is 6 percent (Kelly 2013; SAE International 2011). The analysis below was conducted by Christopher Bonanti, formerly NHTSA's Associate Administrator for Rulemaking, demonstrates that ground clearance is maintained with up to 10 percent dock slope, even with the semitrailer axles are set at the full rearward position (cited in Ponder 2020a). In fact, this analysis demonstrates that the AngelWing would clear a dock by nearly 6 inches, even when the dock slope is 10 percent, and the wheels are full rearward (which means the trailer is most likely to bottom out due to the extended wheelbase).

Figure 10 Clearance of a 53' Semitrailer loading/unloading cargo on 6% recessed ramps.

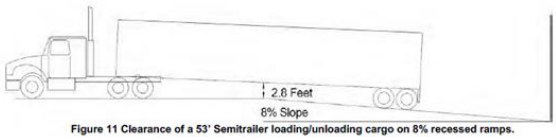

Figure 11 Clearance of a 53' Semitrailer loading/unloading cargo on 8% recessed ramps.

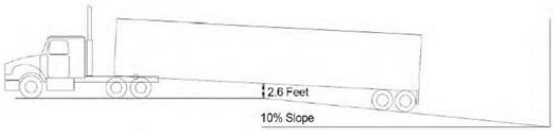

Figure 12 - Clearance of a 53' Semitrailer loading/unloading cargo on 10"% recessed ramps.

Table 1 - 53' Semitrailer Clearance

19.69" Clearance with Side Underride	6 % Slope Clearance	8 % Slope Clearance	10 % Slope Clearance
Tire Location Forward	39.6" - 25.31" = **14.29"**	37.2" – 25.31" = **11.89"**	36" – 25.31" = **10.69"**
Tire Location at Maximum Aft	36" – 25.31" = **10.69"**	33.6" – 25.31" = **8.29"**	31.2" – 25.31" = **5.89"**

Side Underride Guard Weight: Side underride guards would not materially add weight to a semitrailer. A side underride guard's weight (which is approximately 200 to 500 pounds compared to a tractor-trailer's 80,000-pound weight limit; NHTSA 2018) will in most cases not be an issue because the majority of tractor-trailers never reach their weight limit. Dry vans rarely (approximately 2 percent of the time) or never travel at maximum weight, either because the goods fill the trailer volume before they gross out, or simply because their routes and cargo patterns are not conducive to traveling full. For semi-trailers, the majority of freight hauled in semi-trailers cubes-out (is volume-limited) before it grosses-out (is weight-limited) (EPA 2016). Federal Highway Administration (2000) estimated that about 80 to 90 percent of semi-trailers "cubes out before it weighs out". Indeed, Williams and Murray (2020) reported that the average operating weight of a tractor and semi-trailer in 2019 was 63,000 pounds, leaving 17,000 pounds on average before reaching the weight limit. Moreover, 27 states already have exemptions to this weight standard (Federal Highway Administration 2015; Appendix B). The current Federal vehicle weight limits strive to strike a balance among the preservation of the road and bridge infrastructure on the highway network, safety, and vehicle productivity. Today, trucks can achieve about 2,000 lbs. of weight reduction by investing in a limited degree of lightweight technologies while more aggressive investment can yield around 4,000 lbs. of savings (Fleetowner 2021; NAFCE 2021). Nevertheless, is it possible to provide a maximum weight exemption (i.e., 300 lbs) to the 80,000 lbs GVW standard to encourage innovation and lightweighting for side underride guards?

Inflated Costs: The American Trucking Association (Transport Topics 2023) suggests that equipping the entire fleet of 12 million semitrailers with side underride guards would cost $34.8 billion, knowing that in 2022 NHTSA surveyed all eight of the *relevant* semitrailer manufacturers, which represented nearly 100% of the current in-service subject semitrailer population (i.e., semitrailers that could be outfitted with side underride guards). Based on the manufacturer's responses, NHTSA estimated the ***total*** semitrailer population to be 2.45 million semitrailers (NHTSA 2022a).

Industry Crash Tests and Patents: NHTSA failed to find readily available information indicating that multiple semitrailer manufacturers and private individuals have conducted crash testing of side underride guards in the United States. Side underride guards are readily available. For example, Utility Trailer Manufacturing Company, the largest semi-trailer company in the United States, sells a patented SUG (Side Impact Guard) for all its refrigerated and dry van trailers, which has undergone extensive third

party testing and can be installed as safety option at the factory during semi-trailer manufacturing patented (UTM 2022, 2023a, 2023b). The AngelWing, Safetyskirt, and Wabash SUGs have similarly been successfully crash-tested by stopping a passenger vehicle from underriding a semi-trailer (IIHS 2017; Wilson 2017, Ponder 2020; Kiefer 2018; Safetyskirt 2021; Airflow 2022; CBS News 2022), while Fortier (Truck News 2022; Jenkins 2022) has also recently been successfully tested with computer simulations and crash tests. The AngelWing (Airflow 2022) and Safetyskirt (2021) are available to purchase. In addition, Wabash holds three patents (issued in 2012, 2020, and 2021), Vanguard holds one patent (issued in 2019), and Great Dane holds one patent (issued in 2021) for SUGs. Indeed, the industry has designed and patented side underride guards to solve this known safety hazard. Wabash (2021) even indicated that its side underride system may provide dual aerodynamic efficiency and protection to road users **without operational limitations such as "costly installation, access to the underside of the trailer, or adding considerable weight**". If NHTSA mandates side underride guards, the industry is ready and willing to respond (GAO 2019, p. 24).

Discontinue the use of Shelton: Shelton (2006) has been shown to contain misleading information and conclusions for side underride guards and should not be mentioned or used in or any cost-benefit analyses. The TTMA hired a former NHTSA official, Robert Shelton, to create a report that included a bogus cost-benefit analysis of a hypothetical Federal side underride guard requirement. Information and data were solicited by the TTMA's attorney from the large trailer manufacturers about the cost, weight, materials, and dimensions of their existing rear guards—after informing them that they would submit the data anonymously and that it would be used for a "TTMA-funded project…to develop and evaluate possible defense strategies to side underride lawsuits" (TTMA 2006). In fact, the TTMA (2004) and the largest semitrailer manufacturers in U.S. signed a document pledging to secretly work together to develop defense strategies regarding underride lawsuits, rather than fix the known problem and save lives (see also Thompson et al. 2023a). In conjunction, the TTMA also recruited auto industry statistician Jeya Padmanaban to create a report on the annual number of side underride deaths, resulting in a faulty and misleading analysis to provide a shaky foundation for Shelton's analysis of the benefits of side underride guards (Sievers 2020). The TTMA has continued to submit the erroneous Shelton (2006) report to the federal government on multiple occasions during public comments, and its members have attempted to use the report in defending lawsuits, to create the appearance that side underride guards would create an unjustifiable economic burden on the trucking industry (Sievers 2020).

Thank you for the opportunity to comment.

Sincerely,
Eric Hein
Eric Hein

Enclosures:

Enclosure1- Cost Benefit Analysis for Side Underride Guards
Enclosure 1a-ANPRM SUG Cost Benefit (Excel)
Enclosure 2-Underride Literature
Enclosure 3-FINAL APA petition for FARS underride data
Enclosure 4-TTMA 1979 Presentation to DOT on Rear Guard
Enclosure 5-Inaccurate FARS Reporting side underride records
Enclosure 6-2000 Strick Underride Guard Design