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Petition for Side Underride Guard Rulemaking
Title 13. Motor Vehicles, Division 2
Department of the California Highway Patrol
Chapter 6.5. Motor Carrier Safety
Article 8
General Equipment Requirements

Dear Commissioner Duryee and Director Pogue:

In accordance with the California Administrative Procedure Act, we hereby petition the Department of the California Highway Patrol (CHP; California Government Code § 11340.6) to promptly initiate and complete rulemaking to add side underride guards as a safety requirement to dry van-type or box semitrailers and single-unit trucks[1] because of a known safety hazard from collisions with passenger vehicles and other vulnerable road users (VRUs; pedestrians, bicyclists, or motorcyclists). These collisions frequently result in death and significant injuries (please see Appendix 1 containing a draft of the proposed regulation).

California Government Code § 11340.6 provides that *any interested person may petition a state agency requesting the adoption, amendment, or repeal of a regulation as provided in Article 5 (commencing with Section 11346). This petition shall state the following clearly and concisely:*

(a) The substance or nature of the regulation, amendment, or repeal requested.

(b) The reason for the request.

(c) Reference to the authority of the state agency to take the action requested.

[1]Single-unit trucks have a gross vehicle weight rating over 10,000 pounds and non-detachable cargo unit with all axles attached to a single frame.

This petition is requesting: **the CHP promptly initiate and complete rulemaking pursuant to the California Administrative Procedure Act (California Government Code § 11340 et seq.) to add side underride guards as a safety requirement to all dry van-type or box semitrailers and single-unit trucks**;

The reason for this petition: **annually, in California, there are recurrent deaths and serious injuries from passenger vehicle, motorcycle, pedestrian, and bicyclist collisions with dry van-type or box semitrailers and single-unit trucks lacking side underride guards; and**

The CHP has the authority: **to adopt, administer or enforce a regulation requiring side underride guards on van-type or box semitrailers and single-unit trucks** under Title 13. Motor Vehicles, Division 2. Department of the California Highway Patrol, Chapter 6.5. Motor Carrier Safety, Article 8. General Equipment Requirements.

An "underride" collision occurs when a passenger vehicle collides with a semitrailer causing the passenger vehicle to slide under the body of the semitrailer or single-unit truck, often crushing the vehicle and passengers within, causing blunt force trauma, or decapitation to the occupants. Due to the height difference between passenger vehicles and semitrailers or single-unit trucks a collision bypasses the car's safety features because the point of impact is the windshield and passenger compartment, not the front bumper (e.g., see Mattos *et al.* 2021). Without engaging the passenger vehicle's safety features which would otherwise absorb the force of the collision, the interior passenger compartment is crushed when it contacts the semitrailer, resulting in death or severe injuries for the occupants.

The bottom edge of a semitrailer is between forty-two and forty-five inches high, which is about eye height for passengers of a motor vehicle. Side underride occurs because passenger vehicle bumpers are not at the same height as the structure of the large truck. A side underride guard helps mitigate windshield-first crashes and improves the chances that a car's air bags, and other lifesaving occupant protection systems can function as intended (Consumer Reports 2019, 2023; Mattos *et al.* 2021). Side underride guards work by engaging these safety features of cars, as well as preventing vehicles from going under the truck and encountering the semitrailer's frame or rear wheels, increasing the chance of survival with these types of collisions, many of which would be minor collisions if not for the underride.

Bicyclists, like pedestrians and motorcyclists, are considered VRUs because they are unprotected by an enclosed vehicle compartment, leaving them more at risk to injury or death in a crash with a semitrailer or single-unit truck, particularly because side underride guards are lacking on these vehicles (Volpe 2021). During a crash with a semitrailer or single-unit truck, VRUs frequently fall into the exposed space between the front and rear wheels and suffer fatal crushing injuries. While side underride guards are specifically intended to prevent a vehicle from underriding a semitrailer, they are also effective in mitigating pedestrian, bicyclists, and motorcyclists fatalities, particularly if an aerodynamic side skirt is attached to the side guard (e.g., Volpe 2021; Epstein 2022; Brumbelow 2023; Insurance Institute for Highway Safety (IIHS) 2023). Side underride guards can help prevent VRUs from going into the exposed space underneath trucks and semitrailers (Epstein *et al*. 2014; Epstein 2022; Volpe 2021; Kwan (Volpe) 2019).

Side underride guards are highly effective in preventing death and injury, which fully aligns with California's Safe System Approach (Caltrans 2021, 2022, 2022a). This StoryMap, Under the Radar: The Deadly Gap in California Side Underride Protection (Hein 2024), provides a comprehensive overview of the California side underride issue, including decades of design, research, and testing. These deaths and injuries represent *an unreasonable risk* to the public that is foreseeable and unfortunately, predictable. The following are not unusual incidents, but are common tragic examples throughout California of fatalities from side underride crashes between semitrailers and passenger vehicles and VRUs: Ventura, Freemont, San Francisco, Livermore, San Diego, Easton, Murrieta, Santa Maria, Fresno, Sacramento, and Apple Valley.

The trucking industry has developed side underride guards as a countermeasure to address this safety hazard, but they are not required to be installed. Many semitrailer manufacturers hold patents for side underride guards: Wabash (2012, 2020, 2021), Vanguard (2019), Great Dane (2021), Utility Trailer Manufacturing Company (UTM; 2022, 2023a), Fortier (2019), and Fontaine (2021). Wabash[2] (2012, 2020) and Vanguard[3] (2019) side underride guard patents clearly acknowledge the unreasonable risk posed by the geometric mismatch of semitrailers and passenger vehicles. Stoughton (2022, 2022a), UTM (2023b, 2023c), Hyundai Translead (2022), and Wabash (Wilson 2017) have also successfully crash tested their side underride guards. Hyundai Translead (2022) indicated they will install a side underride guard as optional equipment if requested.

In 2019, one semitrailer manufacturer developing its own side underride guards estimated that it would be feasible to have these guards designed, tested, and available for sale within the next 2 years (Government Accounting Office 2019). In 2021, UTM, the largest semitrailer company in the United States, started offering a side impact [underride] guard as safety option on all its refrigerated and dry van trailers, which can be installed during manufacturing (UTM 2022, 2023, 2023b, 2023c). In fact, there are already many UTM semitrailers currently operating in the U.S. with OEM side impact guards (UTM 2022, 2024; Bennett 2023).

The UTM side impact guard can also be fitted with aerodynamic skirts (UTM 2022, 2023, 2024). If an aerodynamic skirt is installed with a side underride guard, 700 gallons ($3,675.00 using $5.25/gallon; UTM 2023) of diesel fuel would be saved annually (8,450 gallons or $44,000 over the 12-year life of a semitrailer) which would quickly offset the cost of a side guard (Hein 2023b; Kwan (Volpe) 2019). Wabash (2021) even indicated that its side underride system may

[2] Wabash (2012, 2020) reported that "Truck trailers typically have a higher elevation than passenger vehicles. This presents a risk that a passenger vehicle will underride the trailer in an accident, potentially resulting in damage to the underriding vehicle and injury to occupants therein. Accordingly, some trailers may include a side protection device, or underride guard, to reduce the risk of such passenger vehicles underriding the trailer. The side protection device is intended to reduce the extent to which a "passenger vehicle" (as defined in 49 C.F.R. Part 571S) can intrude under the side of a trailer, diminishing passenger compartment intrusion." Wabash found that the "side underride system may reduce the risk of passenger vehicle underride in the event of a side impact collision, as well as reduce the risk of pedestrians, bicyclists, or motorcyclists from falling or sliding under the trailer, for example, between the landing gear and rear wheel assembly."

[3] Vanguard (2019) indicated that "Truck trailers typically have a higher elevation than passenger vehicles. This presents a risk that a passenger vehicle will underride the trailer in an accident, potentially resulting in damage to the underriding vehicle and injury to occupants therein. Accordingly, the United States Federal Motor Vehicle Safety Standards require the installation of underride guards or bumpers on certain trailers. The underride guards must comply with certain deflection and energy absorption requirements. Underride guards are common on the rear of trailers; however, underride guards between the landing gear and wheel assembly of the trailer are less common. A device positioned between the landing gear and wheel assembly of the trailer can function to prevent an impacting vehicle from underriding the trailer. Additionally, such a device can have features to reduce the aerodynamic drag on the trailer."

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".

Many researchers have crash tested side underride guards, demonstrating this safety technology is available, has been well-studied, and would be an inexpensive solution to the known hazard of side underride collisions (IIHS 2017; Wilson 2017; Ponder 2020; Kiefer 2023; SafetySkirt 2020; Seven Hills Engineering 2023; CBS News 2022; UTM 2023b, 2023c; Bodapati 2006; Moradi *et al*. 2011; Moradi 2012; Galipeau-Belair *et al*. 2013; Galipeau-Belair 2014; National Highway Traffic Safety Administration (NHTSA) 2018; Mattos *et al*. 2021). NHTSA even concluded that side underride guards have a 97 percent effectiveness in mitigating fatalities in underride crashes into the side of trailers at impact speeds up to 40 mph (NHTSA 2023). Still, NHTSA has failed to initiate any rulemaking to mandate their use. Unfortunately, it is extremely unlikely that NHTSA will enact a side underride guard mandate quickly because a proposed and final rulemaking for side underride guards would be an extremely long process.[4] Even when required, NHTSA is laxed at meeting deadlines; at least 13 proposed rules issued by NHTSA are years overdue based on deadlines set in laws passed by Congress (Associated Press 2021).

In addition to industry-designed side underride guards, individuals have patented side underride guards (Kiefer 2018 (SafetySkirt); Ponder 2020 (AngelWing)). These side underride guards are also readily available on the open market as a retrofit (Airflow Deflector 2024; SafetySkirt 2020). The IIHS crash testing of the AngelWing, which uses steel and, more recently, aluminum, demonstrated that side guards can prevent a passenger vehicle from going underneath a semitrailer at speeds up to 40 mph (IIHS 2017, 2023; GAO 2019; Ponder 2020a). The SafetySkirt, which uses a lightweight but strong fabric, has also been successfully crash tested to prevent side underride (SafetySkirt 2020; CBS News 2022). The AngelWing has been installed on 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), loading/unloading at docks, or serviceability (Berry 2021; Heres 2021; Camden 2021; Airflow Deflector 2024).

The effectiveness of side underride guards to protect VRUs has also been well established (Epstein *et al*. 2014; Epstein 2022; Volpe 2021). For example, the fatality rate for bicyclists and pedestrians colliding with the side of a truck decreased 40 percent following a national side guard requirement in the United Kingdom in the 1980s (Epstein *et al*. 2014). In fact, the National Transportation Safety Board ((NTSB) 2013, 2014, 2019) recommended side underride protection on certain newly manufactured truck tractors, truck trailers, and single-unit trucks, which would also have the potential to mitigate the severity of truck side impacts with VRUs. Unfortunately, NHTSA has not acted on any of the NTSB's side guard recommendations.

Between 2010 and 2021, there was a 67 percent increase in truck crash fatalities in California (Institute for Safer Trucking 2021). In 2019, 3,606 lives were lost, with 16,158 persons seriously injured on California's roadways (Caltrans 2021, 2022, 2022a). Moreover, in California during 2020 and 2021, 398 and 437 people were killed respectively from large truck crashes (Institute for Safer Trucking 2020, 2021). Analysis of 2006–2008 data indicates that 22 percent of

[4] NHTSA proposed rear impact (underride) guards in 1981 but did not finalize the rule until 1996 with an effective date of 1998 (NHTSA 1996; 61 FR 2004).

passenger vehicle occupant fatalities in 2-vehicle large truck crashes involve the side of the truck (Brumbelow 2012). In 2020, single-vehicle large truck crashes (including crashes that involved a bicyclist, pedestrian, or nonmotorized vehicle) made up 22 percent of all fatal crashes (Federal Motor Vehicle Safety Administration 2022), although this estimate is likely biased low due to undercounting (see Hein 2023a; 2024 and references therein). Each year, an average of 145 pedestrians and 40 cyclists were fatally injured in single-unit truck crashes nationwide (NTSB 2013). Annually, in California, there are approximately about 90 deaths (22% x 400 annual deaths from large trucks; Brumbelow 2012; Institute for Safer Trucking 2020, 2021) and hundreds of serious injuries from vehicle collisions with semitrailers lacking side underride guards (see also Bloch and Schmutzler 1998; Bodapati 2006; Braver *et al*. 1997; Government Accounting Office 2019; Mattos *et al*. 2021; NTSB 2014; Padmanaban 2013). California needs to act now to address this public safety hazard.

There is no applicable Federal Motor Vehicle Safety Standard for side underride guards on semitrailers. In 2021, Congress passed the Infrastructure Investment and Jobs Act that required the Secretary of Transportation to complete additional research on side underride guards and publish an assessment in the Federal Register (Infrastructure Investment and Jobs Act 2021). Although NHTSA requested comments and data on side underride guards by issuing an advance notice of proposed rulemaking ((ANPRM); NHTSA 2023; 88 FR 24535; Docket No. NHTSA-2023-0012), it took the agency 10 years and a Congressional requirement to even request public comments and information in response to an administrative petition for rulemaking that was submitted in September 2013 (NHTSA 2023). An ANPRM is used by an agency to obtain public participation in the formulation of a regulation before the agency has done significant research or investigation on its own. To be clear, NHTSA has not proposed rulemaking for side underride guards on semitrailers; they have only published a request for information or data to determine whether a side underride guard rule is needed to reduce this known hazard to the traveling public. NHTSA is currently analyzing comments, but there is no defined or required schedule for any further actions related to side underride guards. Alternatively, NHTSA has never acknowledged that side underrides involving single-unit trucks are also deadly, nor have they proposed any solution to mitigate this known hazard (e.g., see NTSB 2013; Kwan 2019, 2024; Volpe 2021).

Significantly, NHTSA has known of the danger of side underride collisions with semitrailers for over 50 years, but “no substantial progress has been made to prevent these horrific crash fatalities and injuries” (Advisory Committee on Underride Protection 2024). Despite NHTSA recognizing the side underride risk since 1969, side guards have never been mandated by the agency (U.S. Department of Transportation 1969). Side underride guards have an uncertain rulemaking future at the Federal level (Thompson *et al*. 2023, 2023a). Indeed, it is unlikely that NHTSA will take any proactive steps toward rulemaking for side underride guards on semitrailers or single-unit trucks, as the agency has been under the influence of the trucking industry for decades (Mehrotra and Thompson 2023; Thompson *et al*. 2023, 2023a; Vargas 2024). Because NHTSA is unlikely to proceed further on side underride guards for years, if at all, California has an opportunity to lead the Nation by mitigating this decades-long danger (Mattos *et al* 2021; NTSB 2014; Sievers 2020).

For nearly 60 years, the trucking industry has persistently fought against the requirement for side guards on semitrailers, even resorting to misleading claims that these safety features are both impractical and unwarranted (e.g., see Owner-Operator Independent Drivers Association 2024; Sievers 2020). The Truck Trailer Manufacturers Association (1969) wrote, "Side underride, we maintain, is not a hazard that warrants some kind of regulatory remedial action such as the issuance of a Motor Vehicle Safety Standard." Recently, Paul Bennett, the CEO and Chairman of UTM shockingly said, “I believe the side underride proposals will be dangerous and cause death and injury" (Thompson *et al*. 2023). In 2023, public records reveal that the trucking industry has enlisted an astonishing 190 lobbyists at the federal level (OpenSecrets 2024). Even more concerning, two-thirds (64.2%) of these lobbyists are former government employees, a significantly higher proportion than in most industries (OpenSecrets 2024). This aggressive recruitment or the "revolving door" between government and the trucking industry raises serious concerns about the integrity of our policymaking process at the Federal level, as it prioritizes industry influence over the safety of our Nation’s roadways. It is time to recognize the facts and mandate side underride guards by revealing the widespread, harmful false promoted by the trucking industry and their lobbyists at all levels of government. These false narratives are addressed in Appendix 2.

Federal law prohibits a state from imposing or enforcing a commercial motor vehicle safety standard for a component covered under the federal standards unless it is identical to or imposes a higher performance requirement than that required by the federal standard (i.e., “preemption”; see 49 USC 30103(b)). However, in the case of side underride guards, there is no Federal standard or performance requirement for side underride guards on semitrailers or single-unit trucks. Consequently, in California, there is no preemption issue, and the state can prescribe a side underride guard regulation for commercial motor vehicle safety.

For the reasons discussed above, we urge the CHP to grant this petition for side underride guard rulemaking applicable to dry van-type or box semitrailers and single-unit trucks. California should be a leader in semitrailer safety by protecting all road users from the danger of side underride collisions.

Within 30 days of the receipt of this petition, we request that you agree to initiate and complete rulemaking proceeding under California Government Code § 11340.7(a) that provides “*Upon receipt of a petition requesting the adoption, amendment, or repeal of a regulation pursuant to Article 5 (commencing with Section 11346), a state agency shall notify the petitioner in writing of the receipt and shall within 30 days deny the petition indicating why the agency has reached its decision on the merits of the petition in writing or schedule the matter for public hearing in accordance with the notice and hearing requirements of that article*.”

Sincerely,

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Appendix 1

Amend Title 13. Motor Vehicles, Division 2
Department of the California Highway Patrol
Chapter 6.5. Motor Carrier Safety
Article 8
General Equipment Requirements

(a) Not later than January 1, 2026, every van-type or box semitrailer and single-unit truck, having a gross vehicle weight rating exceeding 10,000 pounds, that is manufactured, sold, or registered in the state shall be equipped with functional side underride guards on both lateral sides of the vehicle that meet the performance standards described in subsection b of this section.

(b) A "side underride guard" means a lateral protection system that meets both of the following equipment requirements:

1. It can provide vehicle crash protection for a midsize car, to prevent the intrusion of the occupant survival space, when struck at any location and from any angle at any speed up to and including 40 miles per hour; and

2. Physically covers and protects any exposed space between the front and rear wheels of the semitrailer or single-unit truck.

(c) To ensure that all van-type or box semitrailers and single-unit trucks are maintained in safe and proper operating condition at all times, the Department of Public Safety shall require that any motortruck, trailer or semitrailer involved in an accident, as defined in Section 390.5 of Title 49, Code of Federal Regulations, as those regulations now exist or are amended in the future, undergo and pass an inspection, as described in appendix G to subchapter B of Chapter III of Title 49, Code of Federal Regulations, or successor regulations, to certify that all components of the semitrailer or single-unit truck, as applicable, are in safe and proper operating condition.

(d) The Department shall require drivers of vehicles equipped with side underride guards to conduct regular inspections of side underride guards for damage and functionality and to repair or replace damaged units, as necessary.

(e) The semitrailer or single-unit truck manufacturer can build, certify, and label the side underride guards according to the equipment requirements, or purchase and install certified and labeled side underride guards from a manufacturer.

(f) The Department is authorized to promulgate rules necessary to implement the provisions of this section.

Appendix 2

Side Underride Guards: The Key Facts

Testing Has Validated Side Underride Guards: The AngelWing, SafetySkirt, Utility Trailer's Side Impact Guard, and Wabash side underride guards and have all been successfully crash tested using passenger vehicles (IIHS 2017; Wilson 2017; SafetySkirt 2020; CBS News 2022; UTM 2022, 2023b). These crash tests demonstrate that side underride guards would prevent almost all underride collisions at a speed differential of 35 to 40 mph (note: on a highway, the difference in speed of the vehicle and semitrailer is usually less than 40 mph). In addition to crash tests, computer-based simulations have often been used by researchers to demonstrate crash attenuation of side underride guards up to 50 mph (Bodapati 2006; Moradi *et al*. 2011; Moradi 2012; Galipeau-Belair *et al*. 2013; Galipeau-Belair 2014; NHTSA 2018; Mattos *et al*. 2021).

Side Guards Have High Ground Clearance: The side impact [underride] guard from Utility Trailer Manufacturing Company (2022, 2023b, 2024) did not high center in the same ground-clearance performance test used on its aerodynamic skirts, which eliminates trailer and guard damage in both loaded and unloaded trailers. Additionally, their patent clearly and repeatedly indicates the design achieves "effective ground clearance" (UTM 2023a). As such, side underride guards do not obstruct semitrailer hauling due to low ground clearance of curbs or railroad crossings. A side underride guard that protects all road users still leaves at least 22 to 27 inches of clearance between the bottom of the underride guard and the ground. In fact, many types of semitrailers currently on the road, like auto transporters, have only three inches of ground clearance and are not an impediment to commerce. Moreover, side underride guards with 22 inches of ground clearance would not be a hinderance on the maximum 6 percent dock slope as set forth in Society of Automotive Engineers' SAE J699 (cited in Ponder 2020; Kelly 2013; SAE International 2011).

Side Guards Have No Operational Issues: Wabash (2021) indicated that its side underride system may provide dual aerodynamic efficiency and protection to road users without costly installation, access to the underside of the trailer, or adding considerable weight. Utility Trailer (2023b) describes that their Side Impact Guard is "fully compatible with Utility's Aerodynamic Side Skirt to improve safety without sacrificing performance". UTM's SIG Patent (UTM 2023a), indicated that "With the side guard bars and the leaf springs restraining the side skirts, these skirts can be more flexible below the side underride guards to accommodate inevitable high centering."

Side Guard Weight is Minimal: Side underride guards make up less than 1% of a semitrailer's 80,000-pound weight limit. On average, semitrailers operate at around 63,000 pounds (Williams and Murray 2020), as they often reach full cargo volume, known as "cubing out," before reaching the maximum allowable weight. In other words, a semitrailer usually fills all the footage of space before it ever gets close to reaching the weight limit. In fact, dry van semitrailers rarely (less than 2 percent of the time) travel at maximum weight, either because the goods fill the trailer volume (cube out) before they gross out, or simply because their routes and

cargo patterns are not conducive to traveling full (North American Council for Freight Efficiency 2021).

Cost of Side Guards: Wabash National (2023) estimated the cost of a side underride guard would be about $1,100. The AngelWing, an aftermarket retrofit side guard, is estimated to cost $2,990. NHTSA (2023) reported that the adoption of side underride guards would likely lead to reduced costs due to scale and competition (e.g., the difference between an aftermarket retrofit side underride guard such as the AngelWing and side guards that would be mass produced and installed as original safety equipment during the manufacturing of semitrailers).

Side Guards Are Cost Beneficial: Although only relevant in analysis during rulemaking and not a recall, Volpe analyzed side underride guards and determined adding guards to semitrailers would be significantly cost beneficial, saving both lives and fuel (Kwan 2024, 2024a). However, the DOT allowed American Trucking Associations lobbyists to secretly review and edit a final draft of a Volpe Report on side underride guards (Mehrotra and Thompson 2023; Vargas 2024). After this pressure from the American Trucking Associations, NHTSA stripped the cost-benefit analysis and conclusions from the final published report, which is now the subject of a whistleblower investigation (Vargas 2024). Similarly, Hein (2023) reported the estimated annual economic benefit of side underride guards of between $540 million to $1.4 billion, which is based upon the annual mitigation of between 50 to 150 fatalities and the annual mitigation of between 50 to 150 serious injuries. The mitigation of these fatalities and serious injuries would be easily achievable with an average of 279 passenger vehicle and Vulnerable Road User fatalities that occur annually.

Societal Cost of Side Underrides: In the absence of side underride guards on semitrailers, side underride crashes and fatalities result in a minimum annual baseline cost to society of between $4.0 to $5.9 billion. This calculation multiplied the U.S. Department of Transportation's (2023) monetized values of $313,000 by an estimated 200 serious injuries and $14 million by the estimated 179 fatalities per year from passenger vehicle side underride crashes plus an estimated 100 Vulnerable Road User deaths per year (Brumbelow 2023, IIHS 2023, NHTSA 2023).

Side Guards Would Lower Insurance Premiums: Volpe (2019; see Kwan 2024a) estimated that trucks equipped with side guards would annually save $665 ($815 adjusted to 2024) in insurance premiums, which would offset the cost of side guards in 14 months. The reduction in insurance premiums is because side guards would save lives and prevent serious injuries.

Jury Award Reductions: Side underride guards would help safeguard companies from legal liability. For example, in 2024, Tyson Foods reached a $32.5 million settlement after a fatal underride crash involving an Army veteran (Manins 2024). In 2019, a jury awarded $42 million related to a 2015 side underride crash involving Barkandi Express Trucking Company and Utility Trailer Manufacturing Company (Sievers 2020). The jury found that Utility Trailer Manufacturing Company was negligent because their newly manufactured semitrailer lacked side underride guards (Sievers 2020). Perhaps because Utility Trailer has been sued approximately 12 times in recent years based on a side-impact collision (UTM 2022b), Utility Trailer has developed and now sells side underride guards (UTM 2022, 2024; Bennett 2023).

Ice and Snow Resistance: Aerodynamic skirts, like the TrailerBlade (2023), are designed to resist snow and ice buildup. When installed on side underride guards, these skirts would not only improve fuel efficiency, but also help prevent snow and ice accumulation.

Trucking Industry Promotes False Narratives: The trucking industry frequently mentions implausible "unintended consequences" (see Thompson *et al*. 2023) such as a side guard detaching from a semitrailer and causing multiple highway fatalities. These are misleading scare tactics, especially when compared to the reality that hundreds of fatalities and serious injuries occur each year from side underride crashes (Brumbelow 2023, IIHS 2023, NHTSA 2023).

Industry Contradictions: Despite the trucking industry's opposition to adding a 500-pound side underride guard, semitrucks often feature optional additions like a 15,000-pound sleeper cab or a 500-pound grill guard.

Testing the Ends of Side Underride Guards: NHTSA (2018) concluded that "…the SUPD [side underride protection device] designs are expected to perform acceptably for impacts near the ends of the SUPD" and at 50 mph, "…the vehicle was successfully prevented from wedging under the tractor-trailer vehicle." Mattos *et al*. (2021) evaluated impacts centered on the underride guard ('Center') as well as those with the driver side tires aligned with the rear of the underride guard ('Rear'). A 'Gap' test was also conducted in which the front set of tires in the rear tandem were removed (Figure 10-bottom) to generate a 1686 mm gap between the aft end of the underride guard and the forward most part of the rear tires. As tested, there is an 80 percent or greater reduction in PCI for impacts with an side underride guard compared to the baseline condition. No adverse effects were observed because of the side underride guard.

Crash Test of 30% Frontal Impact of Side Guards: However, UTM (2022a) has also indicated that "Utility Trailer retained a certified test center to perform three 35-mph dynamic crash tests--two in the center of the guard, and the other at a 30% overlap. In each test, Utility Trailer's SIG prevented passenger compartment intrusion without significant injury to the instrumented crash test dummy." Although Utility Trailer found that when 30% of the front of a passenger vehicle is crashed into a side impact [underride] guard, there can be passenger compartment intrusion (UTM 2023d), Mattos *et al*. (2021) reported that not all PCI is deadly or even catastrophic because a side underride guard can provide a sufficient reaction surface to allow for the vehicle's passive and active safety systems (e.g., airbags, crumple zones) to protect the occupant. In fact, a closer examination of the UTM 30% offset crash test indicates that the airbag deployed and the A-pillar did not deform (UTM 2023b). UTM (2022b) reported that in the 30% overlap crash test "…the instrumented dummy survived the impact." This result confirms findings by Mattos *et al*. (2021) that the presence of a side 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.

Angular Crash Testing of Side Guards: Moradi *et al*. (2011) researched two different angular crash tests: a 90-degree impact and a 45-degree impact. The impact angle between the underriding vehicle and the truck affects the pattern of the damage and the way the impact energy is dissipated. If the angle of impact is small, the vehicle will be in contact with the trailer over a larger distance and slide along the side of the trailer. This will expose the underriding vehicle to a greater opportunity to contact the underbelly structures. Also, a significant amount of energy may be dissipated as the vehicle moves and slides along the side guard. For a small car,

the addition of the side guard reduces the probability of severe injury of occupants by about 250 percent compared to no guard configuration. Further it prevents the under-riding probability of the car which increases the injury potential catastrophically.

Less Than 90 Degrees Crash Testing of Side Guards: Galipeau-Belair (2014) also conducted research to determine how side underride guards would react during angle crashes compared to a perpendicular crash. Each of the three side underride guards were tested at angles of 15, 30, 45 and 60 degrees. When comparing these results to the perpendicular (90 degree) crashes, the side underride guards experienced much smaller deformations, and were still rigid enough to stop the car. As the angle increases, the deformation becomes larger, showing that the perpendicular (90 degree) crash was the worst condition for maximum deformation of the side underride guard. In all angular impact tests, the side underride guard remained rigid and proved to be effective at preventing the passenger vehicle from underriding the trailer.