**DEPARTMENT OF TRANSPORTATION**

**National Highway Traffic Safety Administration**

**49 CFR Part 571**

**Docket No. NHTSA-2022-0053**

**RIN 2127-AL58**

# Federal Motor Vehicle Safety Standards; Rear Impact Guards, Rear Impact Protection

**AGENCY:** National Highway Traffic Safety Administration (NHTSA); Department of Transportation (DOT).

**ACTION:** Final rule.

**SUMMARY:** This final rule upgrades NHTSA's safety standards addressing rear underride protection in crashes of passenger vehicles into trailers and semitrailers by adopting similar requirements to Transport Canada's standard for rear impact guards. Adopting these standards will require rear impact guards to provide sufficient strength and energy absorption to protect occupants of compact and subcompact passenger cars impacting the rear of trailers at 56

kilometers per hour (km/h) (35 miles per hour (mph)). Upgraded protection will be provided in crashes in which the passenger motor vehicle hits: (a) the center of the rear of the trailer or semitrailer; and, (b) in which 50 percent of the width of the passenger motor vehicle overlaps the rear of the trailer or semitrailer. This rulemaking commenced in response to petitions for rulemaking from the Insurance Institute for Highway Safety (IIHS) and from Ms. Marianne Karth and the Truck Safety Coalition (TSC). This final rule responds to and fulfills the rulemaking mandate of Section 23011(b)(1)(A) of the November 2021 Bipartisan Infrastructure Law (BIL) that directs the Secretary to upgrade current Federal safety standards for rear impact guards. NHTSA is also issuing this final rule pursuant to DOT's January 2022 National Roadway Safety Strategy, which describes the five key objectives of the Department's Safe System Approach: safer people, safer roads, safer vehicles, safer speeds, and post-crash care. One of the key Departmental actions to enable safer vehicles is to issue a final rule to upgrade existing requirements for rear impact guards on newly manufactured trailers and semitrailers.

**DATES:** *Effective Date:* This final rule is effective on **[INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION OF THIS FINAL RULE IN THE FEDERAL REGISTER].**

*Compliance Date:* **[INSERT DATE TWO YEARS AFTER DATE OF PUBLICATION OF THIS FINAL RULE IN THE FEDERAL REGISTER].** Optional early compliance is permitted.

*Petitions for Reconsideration:* Petitions for reconsideration of this final rule must be received no later than **[INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].**

**ADDRESSES:** Petitions for reconsideration of this final rule must refer to the docket and notice number set forth above and be submitted to the Administrator, National Highway Traffic Safety

Administration, 1200 New Jersey Avenue SE, West Building, Washington, DC 20590. All petitions received will be posted without change to http://www.regulations.gov, including any personal information provided.

*Privacy Act:* DOT will post any petition for reconsideration, and any other submission, without edit, to www.regulations.gov, as described in the system of records notice, DOT/ALL-14 FDMS, accessible through https://www.transportation.gov/individuals/privacy/privacy-act-system-records-notices. Anyone is able to search the electronic form of all submissions to any of our dockets by the name of the individual submitting the submission (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the Federal Register published on April 11, 2000 (Volume 65, Number 70; Pages 19477-78).

**FOR FURTHER INFORMATION, CONTACT:**

*For technical issues:* Ms. Lina Valivullah, National Highway Traffic Safety Administration, 1200 New Jersey Avenue SE, West Building, Washington, DC 20590 (telephone) 202-366-8786, (email) Lina.Valivullah@dot.gov.

*For legal issues:* Ms. Deirdre Fujita, Office of the Chief Counsel, National Highway Traffic Safety Administration, 1200 New Jersey Avenue SE, West Building, Washington, DC 20590, (telephone) 202-366-2992, (email) Dee.Fujita@dot.gov.

**SUPPLEMENTARY INFORMATION:**

**Table of Contents**

## I. Executive Summary

### a. Overview

NHTSA is issuing this final rule to upgrade Federal Motor Vehicle Safety Standard (FMVSS) No. 223, "Rear impact guards," and FMVSS No. 224, "Rear impact protection," which together provide protection for occupants of passenger vehicles in crashes into the rear of

trailers and semitrailers. FMVSS No. 223, an equipment standard, specifies strength and energy absorption requirements in quasi-static force tests of rear impact guards sold for installation on new trailers and semitrailers. FMVSS No. 224, a vehicle standard, requires new trailers and semitrailers with a gross vehicle weight rating (GVWR) of 4,536 kilogram (kg) (10,000 pounds (lb)) or more to be equipped with a rear impact guard meeting FMVSS No. 223.[1] The notice of proposed rulemaking (NPRM) preceding this final rule was published on December 16, 2015.[2]

Rear underride crashes occur when a passenger vehicle crashes into the rear end of a generally larger vehicle, and the front end of the passenger vehicle slides under (i.e., underrides) the rear end of the larger vehicle. Underride may occur in collisions between a passenger vehicle and the rear end of a large trailer or semitrailer (referred to in this rule collectively as "trailers") because the bed and chassis of the trailer is often higher than the front of the passenger vehicle. In extreme underride crashes, "passenger compartment intrusion" (PCI) may occur when the passenger vehicle underrides the rear end of the trailer to such an extent that the rear end of the trailer strikes and enters the passenger compartment of the colliding passenger vehicle. PCI can result in severe injuries and fatalities to the occupants of the passenger vehicle.

Rear impact guards are mounted on the rear of trailers to prevent underride and PCI. In a collision between a passenger vehicle and the rear of a trailer equipped with a rear impact guard, the rear impact guard engages the striking passenger vehicle and prevents it from sliding too far under the struck vehicle's bed and chassis. FMVSS Nos. 223 and 224 ensure a rear impact guard

[1] NHTSA established the two-standard approach to address compliance burdens on small trailer manufacturers, of which there is a significant number. Under FMVSS No. 223, the guard may be tested for compliance while mounted to a test fixture or to a complete trailer, at the manufacturer's option. FMVSS No. 224 requires the guard to be mounted on the trailer or semitrailer in accordance with the instructions provided with the guard by the guard manufacturer. Under this two-standard approach, a small manufacturer that produces relatively few trailers can certify its trailers to FMVSS No. 224 with assurance without having to undertake destructive testing of what could be a substantial portion of its production. The two-standard approach was designed to provide small trailer manufacturers a practicable and reasonable means of certifying to FMVSS No. 224.

[2] 80 FR 78417.

is configured low and wide to impede a striking passenger vehicle, is strong enough to withstand a 48 km/h (30 mph) impact of the colliding vehicle, and has energy-absorbing capability to further mitigate harm to occupants in the striking vehicle.

NHTSA designed FMVSS No. 223 and 224 to work in conjunction with FMVSS No. 208, "Occupant crash protection," so that occupants are protected with seat belts and air bags in the underride crash - thus maximizing the likelihood of avoiding serious or fatal injury in the impact into the guard. When FMVSS Nos. 223 and 224 were issued in 1996, FMVSS No. 208 required passenger cars to provide crash protection in a 48 km/h (30 mph) rigid barrier crash test. The agency designed the underride protection standards so that occupants would be reasonably protected in underride crashes up to 48 km/h (30 mph). Since then, FMVSS No. 208's test speed has been increased to provide high levels of occupant protection in a 56 km/h (35 mph) frontal crash.

With FMVSS No. 208 now providing crash protection up to 56 km/h (35 mph), NHTSA is amending FMVSS Nos. 223 and 224 to mandate the guards withstand crash velocities up to that speed. This final rule adopts requirements of Canada Motor Vehicle Safety Standard (CMVSS) No. 223, "Rear impact guards."[3] CMVSS No. 223 requires rear impact guards with sufficient strength and energy absorption capability to protect occupants of compact and subcompact passenger cars impacting the rear of trailers at 56 km/h (35 mph). Under this final rule, the impacting vehicle's FMVSS No. 208 occupant protection technologies could absorb enough of the crash forces from the impact to reduce significantly the risk of fatality and serious injury to occupants of the colliding vehicle. As the current requirements in FMVSS Nos. 223 and 224 were developed with the intent of providing underride crash protection to occupants of

[3] This final rule also adopts Transport Canada's definition of "rear extremity" to define where aerodynamic fairings are to be located on a trailer to avoid posing a safety hazard in rear underride crashes.

passenger vehicles in impacts up to 48 km/h (30 mph), increasing the robustness of the trailer/guard design such that it will be able to withstand crash velocities up to 56 km/h (35 mph) represents a substantial increase in the stringency of our standards. There is a 36 percent increase in crash energy in a 56 km/h (35 mph) impact of a vehicle compared to a 48 km/h (30 mph) impact of the same vehicle.

This final rule is based on the best available science. The underlying field data used in the December 16, 2015 NPRM and this final rule are from a 2013 NHTSA-funded study conducted by the University of Michigan Transportation Research Institute (UMTRI) to supplement UMTRI's Trucks Involved in Fatal Accidents (TIFA) survey data for years 2008 and 2009. (The 2013 NHTSA-funded study is referred to in this preamble as the 2013 UMTRI Study.)[4, 5] The TIFA database had analyzed FARS data to obtain more detailed information on fatal large truck crashes, and had provided more detailed information than in FARS on the involved large trucks, motor carriers, and sequence of events leading to the crash.[6] The 2013 UMTRI Study supplemented these TIFA data by collecting specific data pertaining to trailer rear extremity crashes. In the 2013 UMTRI Study, UMTRI also determined whether a rear impact guard was required, and if not required, the criterion that had excluded the vehicle. The 2013 UMTRI Study collected detailed information on fatal vehicle crashes into the rear of trailers, the relative impact velocity, and the extent of underride in these crashes. The data from the 2013 UMTRI Study enabled NHTSA to establish national estimates of rear impact crashes into heavy vehicles that resulted in PCI. Because of the detailed analysis and the supplemental information

[4] NHTSA discussed the results of this study in detail in Appendix A of the NPRM. *See* 80 FR 78447-78452.
[5] Heavy-Vehicle Crash Data Collection and Analysis to Characterize Rear and Side Underride and Front Override in Fatal Truck Crashes, DOT HS 811 725, March 2013, https://www.nhtsa.gov/sites/nhtsa.gov/files/811725.pdf.
[6] The TIFA survey data contain data for all trucks with a GVWR greater than 4,536 kg (10,000 lb) that were involved in fatal traffic crashes in the 50 U.S. States and the District of Columbia.

collected for each crash, the 2013 UMTRI Study forms the most comprehensive and valid data set available to inform NHTSA about crashes involving trucks and trailers and the incidence and extent of underride.

### b. NHTSA's Statutory Authority and Response to BIL

#### 1. National Traffic and Motor Vehicle Safety Act

This final rule is issued under the National Traffic and Motor Vehicle Safety Act (Safety Act) (49 U.S.C. 30101 et seq.). Under the Safety Act, the Secretary of Transportation (NHTSA by delegation)[7] is responsible for prescribing motor vehicle safety standards that are practicable, meet the need for motor vehicle safety, and are stated in objective terms.[8] "Motor vehicle safety" is defined in the Safety Act as "the performance of a motor vehicle or motor vehicle equipment in a way that protects the public against unreasonable risk of accidents occurring because of the design, construction, or performance of a motor vehicle, and against unreasonable risk of death or injury in an accident, and includes nonoperational safety of a motor vehicle."[9] "Motor vehicle safety standard" means a minimum performance standard for motor vehicles or motor vehicle equipment.[10] When prescribing such standards, the agency must consider all relevant, available motor vehicle safety information, and consider whether a standard is reasonable, practicable, and appropriate for the types of motor vehicles or motor vehicle

[7] 49 CFR 1.95. The Secretary also delegated to NHTSA the authority set out for Section 101(f) of Public Law 106-159 to carry out, in coordination with the Federal Motor Carrier Safety Administrator, the authority vested in the Secretary by subchapter 311 and section 31502 of title 49, U.S.C., to promulgate safety standards for commercial motor vehicles and equipment subsequent to initial manufacture when the standards are based upon and similar to a Federal Motor Vehicle Safety Standard promulgated, either simultaneously or previously, under chapter 301 of title 49, U.S.C.
[8] 49 U.S.C. § 30111(a).
[9] 49 U.S.C. § 30102(a)(8).
[10] 49 U.S.C. §30102(a)(9).

equipment for which it is prescribed.[11] The agency must also consider the extent to which the standard will further the statutory purpose of reducing traffic crashes and associated deaths.[12]

**2. Bipartisan Infrastructure Law**

On November 15, 2021, President Biden signed the Infrastructure Investment and Jobs Act (IIJA),[13] commonly referred to as the Bipartisan Infrastructure Law (BIL). Section 23011 of BIL specifies provisions for underride protection measures for trailers and semitrailers. As discussed in detail below, the provisions direct the Secretary to upgrade current Federal safety standards for rear impact guards and conduct additional research, report to Congress on the effectiveness, feasibility, costs, and benefits of side guards, establish an advisory committee on underride protection, and implement the recommendations issued by the Government Accountability Office (GAO) on improved data collection, inspection and research of truck underride guards.

Section 23011(b)(1)(A) of BIL states that, not later than 1 year after the date of enactment of the Act, the Secretary shall promulgate regulations that revise FMVSS No. 223 and FMVSS No. 224 to require new trailers and semitrailers to be equipped with rear impact guards that are designed to prevent PCI from a trailer or semitrailer when a passenger vehicle traveling at 56 km/h (35 mph) makes an impact: (a) "in which the passenger motor vehicle impacts the center of the rear of the trailer or semitrailer" (full overlap with the rear of the trailer or semitrailer); (b) "in which 50 percent of the width of the passenger motor vehicle overlaps the rear of the trailer or semitrailer"; and (c) "in which 30 percent of the width of the passenger motor vehicle overlaps the rear of the trailer or semitrailer, if the Secretary determines that a

[11] 49 U.S.C. § 30111(b).
[12] Id.
[13] Pub. L. 117-58

revision of [FMVSS Nos. 223 and 224] to address such an impact would meet the requirements and considerations described in subsections (a) and (b) of section 30111 of title 49, United States Code" (i.e., the Safety Act). Section 23011(b)(1)(B) states that the regulations promulgated under Section 23011(b)(1)(A) shall require full compliance not later than two years after the date on which those regulations are promulgated.

Section 23011(b)(2) of BIL directs the Secretary to conduct additional research on the design and development of rear impact guards that can: prevent PCI in cases in which the passenger motor vehicle is traveling at speeds of up to 65 mph; and that can protect occupants against severe injury in crashes of passenger vehicles into the rear of trailers and semitrailers at speeds up to 104.5 km/h (65 mph). Section 23011(b)(3) directs that, not later than 5 years after the date the regulations under Section 23011(b)(1)(A) are promulgated, the Secretary shall review and evaluate the need for changes to FMVSS No. 223 and FMVSS No. 224 in response to advancements in technology and update the standards accordingly.[14]

Section 23011(c)(1)(A) of BIL directs the Secretary to complete, not later than 1 year after enactment of the Act, additional research on side underride guards to better understand the overall effectiveness of the guards. Section 23011(c)(1)(B) requires the Secretary to assess, among other matters, the feasibility, benefits, and costs of, and any impacts on intermodal equipment, freight mobility (including port operations), and freight capacity associated with, installing side underride guards on new trailers and semitrailers within one year of enactment of BIL, and if warranted, develop performance standards for side underride guards. Section 23011(c)(3) also directs the Secretary to publish the results of the side underride guard assessment specified in Section 23011(c)(1)(B) within 90 days of completion of the assessment

[14] There are also provisions relating to the Federal Motor Carrier Safety Regulations.

and provide an opportunity for public comment. It also directs that, within 90 days from the date the comment period closes, the Secretary shall submit a report to Congress on the assessment results, a summary of comments received, and a determination whether the Secretary intends to develop performance requirements for side underride guards, including any analysis that led to that determination.

Section 23011(d) of BIL directs the Secretary to 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. This section also provides details on the membership of the advisory committee, frequency of meetings of the advisory committee, the Secretary's support to the advisory committee, and details of a biennial report to Congress that the advisory committee is required to submit.

Section 23011(e) of BIL directs the Secretary to implement the recommendations on truck underride guard data collection issued by the Government Accountability Office (GAO) on March 14, 2019[15] within 1 year after the date of enactment of the Act.

**3. Implementation of BIL**

This final rule fulfills the BIL rulemaking mandate to NHTSA set forth in Section 23011(b). As directed by Sections 23011(b)(1)(A)(i) and (ii), this final rule revises FMVSS Nos. 223 and 224 to require trailers and semitrailers to be equipped with rear impact guards that prevent passenger compartment intrusion from a trailer or semitrailer when a passenger motor vehicle traveling at 35 miles per hour makes: (a) an impact in which the passenger motor vehicle impacts the center of the rear of the trailer or semitrailer; and (b) an impact in which 50 percent of the width of the passenger motor vehicle overlaps the rear of the trailer or semitrailer.

[15] GAO Report to Congressional Requestors, "Truck Underride Guards – Improved Data Collection, Inspections, and Research Needed," March 14, 2019, (GAO-19-264), https://www.gao.gov/assets/gao-19-264.pdf.

This final rule fulfills these BIL rulemaking mandates of Sections 23011(b)(1)(A)(i) and (ii) and achieves, effectively and expeditiously, the Congressional goal that focuses on improving rear impact guard performance. The 2015 NPRM proposed to adopt the Canadian quasi-static test requirements for rear impact guards, which ensure rear impact guards provide sufficient strength and energy absorption to protect occupants of compact and subcompact passenger cars impacting the rear of trailers at 56 km/h (35 mph).[16] The NPRM reported on crash tests conducted by IIHS that showed that rear impact guards installed on trailers that were designed to the proposed requirements were able to prevent PCI in 35 mph crashes of a passenger vehicle into the rear of the trailer where: (a) the front end of the passenger vehicle fully overlapped the rear of the trailer (full overlap crash); and (b) 50 percent of the width of the front end of the passenger vehicle overlapped the rear of the trailer (50 percent overlap crash). These data show that trailers and semitrailers equipped with rear impact guards meeting the requirements of this final rule will have guards that are designed to prevent PCI when a passenger motor vehicle traveling at 35 mph impacts the center of the rear of the trailer or semitrailer, or makes impact in which 50 percent of the width of the passenger vehicle overlaps the rear of the trailer or semitrailer, in accordance with BIL.

NHTSA's work on this final rule also meets the BIL mandate in Section 23011(b)(1)(A)(iii). In developing this rule, the agency considered a requirement that rear impact guards withstand a 56 km/h (35 mph) crash of a passenger vehicle into the rear of a trailer in which only 30 percent of the width of the passenger motor vehicle overlaps the rear of the

[16] At the time of enactment of BIL, the agency's December 16, 2015 NPRM upgrading FMVSS No. 223 and FMVSS No. 224 had been published and DOT's work was close to completion on the final rule. BIL provides a very short timeframe (1 year) for issuance of a final rule. The short timeframe is indicative of Congress's intent that a final rule based on the 2015 NPRM will complete the rulemaking proceedings specified in Section 23011(b)(1)(A) of the Act.

trailer or semitrailer (30 percent overlap crash). After analyzing the issue, we determined such a standard would not meet the requirements and considerations of Sections 30111(a) and (b) of the Safety Act. Our consideration of this matter is discussed below.

**Sections 30111(a) and 30111(b)**

49 U.S.C. 30111(a) of the Safety Act authorizes the Secretary (NHTSA, by delegation) to prescribe Federal motor vehicle safety standards that are practicable, meet the need for motor vehicle safety, and are stated in objective terms. "Motor vehicle safety" is defined in the Safety Act as "the performance of a motor vehicle or motor vehicle equipment in a way that protects the public against unreasonable risk of accidents occurring because of the design, construction, or performance of a motor vehicle, and against unreasonable risk of death or injury in an accident, and includes nonoperational safety of a motor vehicle."[17]

49 U.S.C. 30111(b) specifies that, when prescribing such standards, the Secretary must, among other things, consider all relevant, available motor vehicle safety information, consider whether a standard is reasonable, practicable, and appropriate for the types of motor vehicles or motor vehicle equipment for which it is prescribed, and consider the extent to which the standard will further the statutory purpose of reducing traffic crashes and associated deaths and injuries. NHTSA has considered the factors in Section 30111(b) and concludes 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. Accordingly, NHTSA cannot conclude that a Federal mandate for such a requirement for all trailers is warranted at this time.

[17] 49 U.S.C. 30102(a)(8).

Rear impact guards are designed to absorb energy and prevent PCI by attaching to substantial structural elements of a trailer or semitrailer, such as the chassis longitudinal frame rails, by way of vertical support members. The vertical members of the rear impact guard usually attach to the longitudinal frame rails so that impact loads are directly transmitted to the frame rails with minimal or no damage to the overall trailer structure. The test results from the initial testing at IIHS reported in the NPRM show that in the 30 percent overlap crashes, only a small lateral portion of the rear impact guard (about 22 percent of the guard width) engaged with the front end of the passenger vehicle. This small lateral portion did not include a vertical support member of the guard, so when a Chevy Malibu test vehicle struck this small lateral portion of the guard, the guard deformed locally and did not prevent PCI. In these initial IIHS crash tests, only the Manac rear impact guard was able to prevent PCI in the Chevy Malibu in the 56 km/h (35 mph) full overlap, 50 percent overlap, and 30 percent overlap crash test conditions. NHTSA believes the Manac performed this way because, unlike most trailer designs where the vertical members of the rear impact guard attach directly to the longitudinal frame rails of the trailer, the vertical members of the Manac rear impact guard were located further outboard from the location of the trailer longitudinal frame rails and were attached to a reinforced floor section of the trailer.

While the more outboard vertical supports of the Manac guard could withstand the force from the 30 percent low overlap crash of the Malibu, data suggest the further outboard vertical supports may reduce guard strength near the center of the horizontal member of the rear impact guard. In the 56 km/h (35 mph) full overlap crash tests of the Malibu, the greatest amount of underride (1,350 mm) was in the test with the Manac trailer. (In contrast, the extent of the underride was 990 mm in the test with the Wabash trailer.) NHTSA found this observation

critical because it indicated 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. This finding was of key concern because full and 50 percent overlap crashes are more frequent than low overlap (30 percent or less) crashes. NHTSA seeks not to amend FMVSS No. 223 in a manner that could reduce safety in the more frequent crash conditions.

Further, data indicate that most fatal light vehicle crashes into the rear of trailers are at speeds much higher than 56 km/h (35 mph). The agency is concerned that adopting requirements to mitigate PCI in 30 percent low overlap crashes could result in rear impact guard designs that may reduce protection against PCI in higher speed crashes. NHTSA remains concerned about potential negative safety consequences if a final rule were to adopt requirements that result in moving the vertical members of rear impact guards more outward laterally to prevent underride in a 56 km/h (35 mph) 30 percent low overlap crash, at the expense of protection against higher speed crashes. The agency believes this issue should be more fully explored before possibly adopting a 30 percent low overlap requirement.

NHTSA has estimated the benefits and costs of adopting performance requirements to mitigate underride in low overlap (30 percent or lower overlap) crashes based on available information. We estimate 0.75 to 1.5 fatalities would be prevented annually if this rule included requirements to mitigate PCI in 30 percent overlap crashes at 56 km/h (35 mph) impact speed. (This estimate does not account for the possible dis-benefits in full and 50 percent offset crashes resulting from a low overlap requirement, discussed in the paragraph above.) The 0.75 to 1.5 fatalities prevented is based on an estimated 5.8 – 11.5 annual fatalities in low overlap crashes into the rear of trailers (crashes where 30 percent or less of the front end of the impacting vehicle

overlaps the rear of the trailer) and a 13 percent effectiveness of rear impact guards with 30 percent overlap crash protection in mitigating fatalities.

To prevent PCI in 30 percent overlap crashes, designs would have to either: (a) add additional vertical members at the lateral edge of the rear impact guard that connect to the trailer's transverse floor beam and strengthen the transverse floor beam of the trailer to withstand the loads transmitted from these vertical members at the edge of the guard; or (b) considerably strengthen the rear impact guard member so it would not deform locally in the 30 percent overlap crash. Both these approaches would add significant weight to the vehicles because they involve adding more vertical members, strengthening the floor beams, or strengthening the guard itself. Additionally, some guard designs may have restrictions in intermodal operations at loading docks and may not be practicable for all types of trailers covered by FMVSS No. 224.

NHTSA is required by Section 1 of Executive Order 12866 to conduct a benefit-cost analysis of any intended regulation.[18] NHTSA estimates that the annual minimum and average incremental fleet cost of equipping all new applicable trailers[19] with rear impact guards that mitigate PCI in 30 percent overlap crashes would be $9.9 million and $30.3 million, respectively. The total minimum to average undiscounted incremental lifetime fuel cost due to increase in weight is estimated to be $93 million to $130 million. The overall undiscounted cost increase (material cost and lifetime fuel cost) is a minimum of $103 million to on average $161 million.

Using the estimate of 0.75 to 1.5 fatalities that would be prevented annually, the undiscounted cost per life saved using the minimum cost estimate ranges from $69 million to $151 million. The undiscounted cost per life saved using the average cost estimate ranges from

[18] "Significant" actions are also subject to Section 6's requirements for a benefit-cost analysis.
[19] 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.

$183 million to $215 million. The Department of Transportation has recently updated the value of a statistical life, consistent with OMB Circular A-4, to $11.6 million.[20] Therefore, a requirement for equipping all new applicable trailers with rear impact guards that mitigate PCI in 30 percent overlap crashes is not cost-effective.[21] This indicates that total costs of such a requirement exceed overall benefits.

For the above reasons, NHTSA has determined that requirements to mitigate PCI in a 30 percent overlap crash at 56 km/h (35 mph) would not meet the requirements of Section 30111(a) of the Safety Act. We have decided that an FMVSS that requires *all* covered vehicles (trailers and semitrailers) to provide rear impact protection in full-frontal, 50 percent overlap, and 30 percent overlap crashes at 56 km/h (35 mph) impact speed would not be reasonable or practicable for this FMVSS and would not meet the requirements of Sections 30111(a) and (b) of the Safety Act for issuance of Federal motor vehicle safety standards. Accordingly, based on all available data, we have decided that a Federal mandate for a 30 percent overlap crash for all vehicles subject to FMVSS Nos. 223 and 224 is not reasonable at this time.

However, while NHTSA cannot conclude that the data and science currently available for agency decision-making support mandating installation of a rear impact guard that prevents PCI in all three overlap conditions (full, 50 percent, and 30 percent overlap) on *all* vehicles, the

---

[20] For more information on the value of a statistical life, see a 2021 Office of the Secretary memorandum on the "Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses – 2021 Update." https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis. Circular A-4 provides OMB's guidance to Federal agencies on the development of a regulatory analysis required under Section 6 of E.O. 12866.

[21] Cost-effectiveness represents a measure of the average monetary cost per unit of change (benefit). In regulatory analyses for safety policies, cost-effectiveness generally measures the average estimated change in total costs per unit improvement in safety (e.g., cost per life saved). A policy alternative can be considered cost-effective if the estimated cost per unit increase is less than an appropriate benchmark. For example, a proposed safety standard could be considered cost-effective if the average cost per life saved equivalent (i.e., combining lives saved and injuries avoided, weighted by the relative values of injuries to fatalities) under the proposed standard were less than the comprehensive economic cost of a fatality ($11.6 million in 2020 dollars). That is, the proposed standard would yield safety benefits at a lower cost than the benchmark value for those benefits.

Federal standards act as a floor, not a ceiling, to establish the minimum level of performance that meet the safety needs presented by the data. FMVSS are written in terms of minimum performance requirements for motor vehicles or motor vehicle equipment to protect the public against unreasonable risk of injury and death in crashes. Manufacturers have flexibility in design as long as their products comply with applicable FMVSS. There are rear impact guard designs in the current trailer and semitrailer market that prevent PCI in all three crash conditions described in Section 23011(b)(1)(A) of BIL: (1) full overlap crash, (2) 50 percent overlap crash, and (3) 30 percent overlap crash at 56 km/h impact speed. This final rule does not preclude these designs from the trailer and semitrailer market, as long as they meet all requirements of the FMVSS to ensure adequate protection in (1) and (2), above.

In response to the research mandate in Section 23011(b)(2) of BIL, NHTSA is conducting additional research on the design and development of rear impact guards that can prevent underride and protect passengers in crashes into the rear of trailers at crash speeds up to 104.5 km/h (65 mph). As part of this research effort, NHTSA will also evaluate potential cost-effective rear impact guard designs that could improve protection in the less-frequent 30 percent low overlap crashes while enhancing protection in full and 50 percent overlap crashes at higher speeds.

NHTSA is also working on implementing the other provisions of § 23011 of BIL.

**c. DOT National Roadway Safety Strategy**

This final rule accords with DOT's January 2022 National Roadway Safety Strategy to address the rising numbers of transportation deaths occurring on the country's streets, roads, and highways.[22] At the core of this strategy is the Department-wide adoption of the Safe System

[22] https://www.transportation.gov/sites/dot.gov/files/2022-01/USDOT_National_Roadway_Safety_Strategy_0.pdf

Approach, which focuses on five key objectives: safer people, safer roads, safer vehicles, safer speeds, and post-crash care. DOT announced it will launch new programs, coordinate and improve existing programs, and adopt a foundational set of principles to guide this strategy. The National Roadway Safety Strategy includes issuing a final rule to upgrade existing requirements for rear impact guards on newly manufactured trailers and semitrailers as a key Departmental action to enable safer vehicles.[23]

**d. NTSB Recommendation**

This final rule accords with an April 3, 2014 recommendation from the National Transportation Safety Board (NTSB) regarding tractor-trailer safety (H-14-004). NTSB recommended that NHTSA revise FMVSS Nos. 223 and 224 to ensure that newly manufactured trailers over 4,536 kg (10,000 lb) GVWR provide adequate protection of passenger vehicle occupants from fatalities and serious injuries resulting from full-width and offset trailer rear impacts. In its recommendation, NTSB made favorable reference to IIHS's petition for rulemaking (the petition is discussed below).

**e. Impacts of this Rulemaking**

NHTSA has issued a Final Regulatory Evaluation (FRE) that analyzes the potential impacts of this final rule. The FRE is available in the docket for this rule.[24]

NHTSA estimates that 94 percent of new trailers sold in the U.S. subject to FMVSS Nos. 223 and 224 are already designed to comply with CMVSS No. 223. The agency estimates that about 0.56 lives and 3.5 serious injuries would be saved annually by requiring all trailers covered

[23] *Id*., p. 31.
[24] The FRE may be obtained by downloading it or by contacting Docket Management at the address or telephone number provided at the beginning of this document.

by Standard No. 224 to be equipped with CMVSS No. 223 compliant guards. The undiscounted equivalent lives saved are 1.4 per year.

Considering that 94 percent of applicable trailers already have CMVSS compliant guards, the annual average incremental fleet cost of equipping all applicable trailers with CMVSS No. 223 rear impact guards is estimated to be $2.10 million in 2020 dollars. In addition, the added weight of 48.9 pounds per vehicle would result in an estimated annual fleet fuel cost of approximately $4.43 million and $5.59 million discounted at 7% and 3%, respectively. As such, the total incremental cost would range from $6.54 million to $7.69 million discounted at 7% and 3%, respectively, as shown in Table 1.

Table 1. Cost of the Final Rule with Average Increase in Weight (in Millions of 2020 dollars)

| Discount rate | Undiscounted | 3% | 7% |
|---|---|---|---|
| Material* | $2.10 | $2.10 | $2.10 |
| Fuel | $6.90 | $5.59 | $4.43 |
| Total | $9.00 | $7.69 | $6.54 |

* Material costs are not discounted since they occur at the time of purchase

The estimated equivalent lives saved (ELS) ranges from 0.90 lives to 1.14 lives discounted at 7% and 3%, respectively. The cost of the final rule is the regulatory cost and ranges from $6.54 million to $7.69 million discounted at 7% and 3%, respectively. The cost per ELS ranges from $6.77 million to $7.25 million discounted at 3% and 7%, respectively, as shown in Table 2 below.

Table 2. Cost per Equivalent Lives Saved (in Millions of 2020 dollars)

| Discount rate | Undiscounted | 3% | 7% |
|---|---|---|---|
| Total cost | $9.00 | $7.69 | $6.54 |
| Equivalent lives saved | 1.40 | 1.14 | 0.90 |
| Cost per ELS | $6.42 | $6.77 | $7.25 |

The net benefit of the final rule is the difference between the comprehensive benefit and the total cost. The estimated net benefit ranges from $4.36 million to $6.04 million discounted at 7% and 3%, respectively, as shown in Table 3 below.

Table 3. Net Benefits (in Millions of 2020 dollars)

| Discounted rate | Undiscounted | 3% | 7% |
|---|---|---|---|
| Comprehensive benefit | $16.96 | $13.73 | $10.90 |
| Total cost | $9.00 | $7.69 | $6.54 |
| Net benefit | $7.96 | $6.04 | $4.36 |

Table 4 summarizes the total costs, comprehensive benefits, and net benefits for both 3 and 7 percent discount rates.

Table 4. Costs and Benefits (in Millions of 2020 dollars)

| Discount Rate | Material Cost | Fuel Cost | Total Costs | Comprehensive Benefits | Net Benefits |
|---|---|---|---|---|---|
| 3% | $2.10 | $5.59 | $7.69 | $13.73 | $6.04 |
| 7% | $2.10 | $4.43 | $6.54 | $10.90 | $4.36 |

### f. No Significant Changes to the NPRM

After carefully reviewing the comments, NHTSA is adopting most of the proposed rule, while clarifying the wording that attachment hardware remain intact during quasi-static load tests in FMVSS No. 223. NHTSA is also making a technical correction to the citation referenced in the definition of "temporary living quarters" in FMVSS No. 224.

## II. Background

### a. Current Requirements

FMVSS No. 223 requires rear impact guards to meet the strength requirements and energy absorption requirements of the standard at certain specified test locations. Test locations P1, P2, and P3 are depicted in Figure 1. Test location P1 is 3/8$^{th}$ of the width of the horizontal member from the centerline on either side of the horizontal member. Test location P2 is at the centerline of the horizontal member. Test location P3 is 355 millimeters (mm) (14 inches) to

635 mm (25 inches) from the horizontal member centerline. The strength tests are conducted separately from the energy absorption test.

The strength requirements (S5.2.1) specify that the guard must resist the following force levels without deflecting by more than 125 mm (4.9 inches):

- 50,000 Newtons (N) (or 50 kiloNewtons (kN)) at P1 on either the left or the right side of the guard;
- 50,000 N at P2; and,
- 100,000 N at P3 on either the left or the right side of the guard.

In the strength test, the force is applied by a force application device (rectangular rigid steel solid face of 203 mm x 203 mm and thickness of 25 mm) until the force level is exceeded or until the displacement device is displaced at least 125 mm, whichever occurs first.

The energy absorption requirements (S5.2.2) specify that a guard (other than a hydraulic guard) must absorb, by plastic deformation, within the first 125 mm of deflection at least 5,650 Joules (J) of energy at each test location P3. In the test procedure, force is applied to the guard using the force application device until displacement of the device has reached 125 mm, recording the value of force at least 10 times per 25 mm of displacement. The force is then reduced until the guard no longer offers resistance to the force application device. A force versus deflection diagram is plotted with deflection (measured displacement of the force application device) along the abscissa (x-axis) and the measured force along the ordinate (y-axis), as shown in Figure 2, and the energy absorbed by the guard is determined by calculating the shaded area bounded by the curve in the diagram.

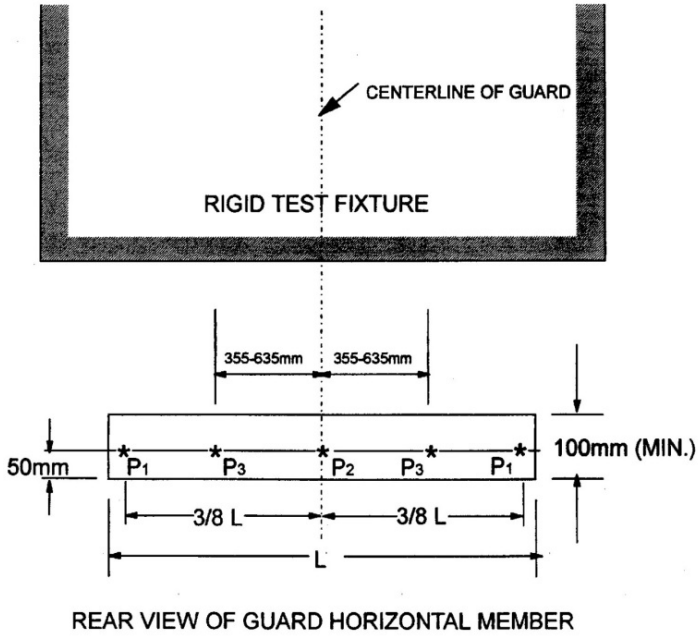



**Figure 1: FMVSS No. 223 quasi-static test loading locations**

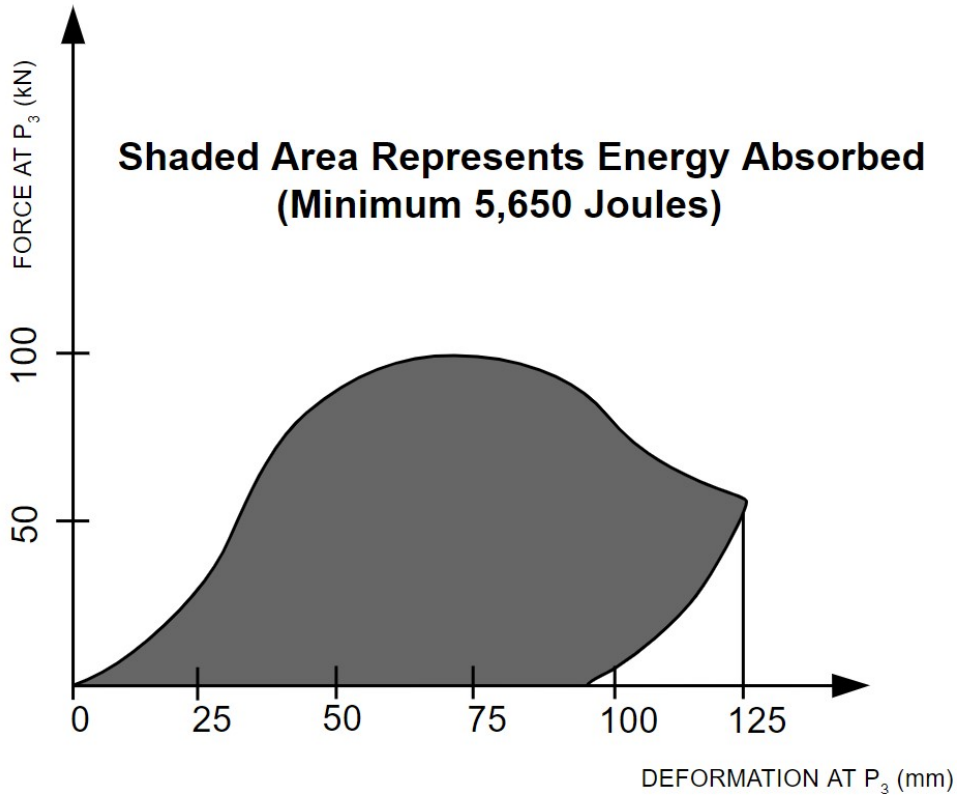



**Figure 2: FMVSS No. 223 guard energy absorption (typical force-deflection curve at P3)**

FMVSS No. 224 requires each vehicle to be equipped with a rear impact guard certified to FMVSS No. 223 and attached to the vehicle's chassis in accordance with installation instructions that the guard manufacturer provided pursuant to FMVSS No. 223. Standard No. 224 specifies that the ground clearance (vertical distance of the bottom of the horizontal member from ground) of the rear impact guard be no more than 560 mm (22 inches) and located not more than 305 mm (12 inches) forward of the rear extremity of the trailer and extend laterally to within 100 mm (4 inches) of each side of the vehicle as shown in Figure 3.

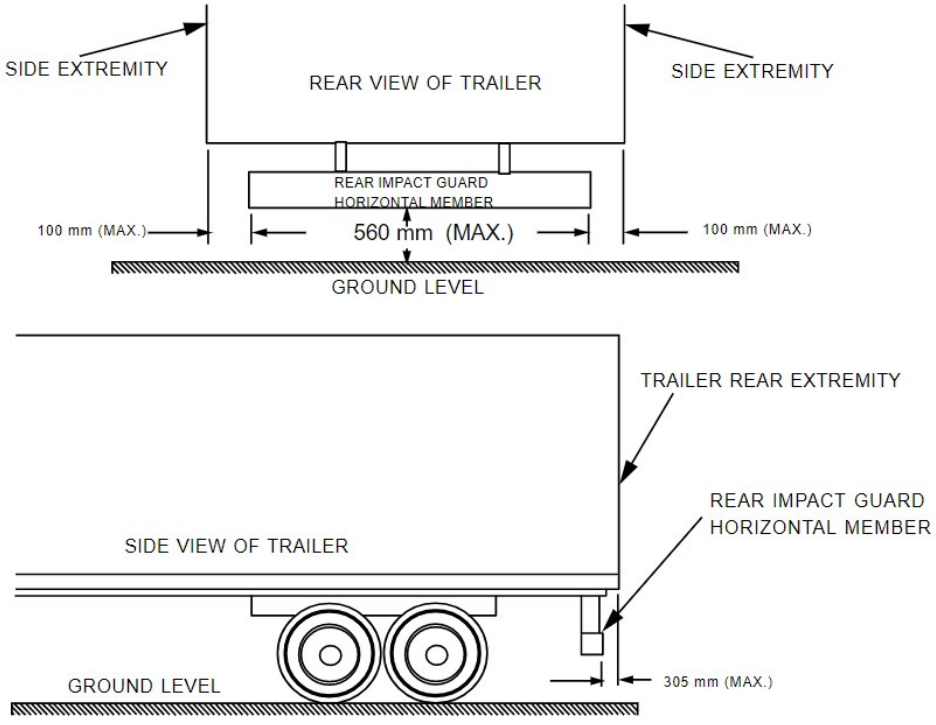



**Figure 3: FMVSS No. 224 configuration requirements**

**b. Petitions**

IIHS requested, among other things, that NHTSA upgrade rear impact guard strength requirements, reduce the number of exempted vehicles to provide occupant protection in higher speed crashes and move the P1 test location farther outboard to improve crash protection in low

overlap conditions. IIHS requested that NHTSA require attachment hardware to remain intact for the duration of the quasi-static test or until reaching a force threshold "much higher than that required for the guard itself."[25] The Karth/TSC petition asked that NHTSA improve the safety of rear impact guards. In later correspondence with NHTSA, these petitioners state that if FMVSS No. 223 were amended to be equivalent to CMVSS No. 223, injuries and fatalities could be avoided.[26] We provided a detailed discussion of the petitions, and our response to them, in the NPRM preceding this final rule.

**c. Summary of Proposed Changes**

NHTSA proposed to adopt requirements of Transport Canada's standard for rear impact guards, which require rear impact guards to provide sufficient strength and energy absorption to protect occupants of compact and subcompact passenger cars impacting the rear of trailers at 56 km/h (35 mph). The NPRM proposed the following specific changes to FMVSS Nos. 223 and 224.[27]

***Performance requirements***

[25] After submitting its petition in 2011, IIHS conducted additional crash tests of a 2010 Chevrolet Malibu at 56 km/h (35 mph) into eight guard/trailers: A 2011 Wabash, 2012 Manac, 2012 Stoughton, 2013 Great Dane, 2012-2013 Hyundai, 2013 Strick, 2013 Utility, and 2013 Vanguard, all of which were certified as complying with CMVSS No. 223. NHTSA included a summary of the IIHS tests in the December 16, 2015 NPRM. 80 FR 78452-78460. All eight trailers were able to prevent PCI with 100 percent overlap. In the tests with 50 percent overlap, apart from the 2013 Vanguard trailer, the remaining seven guard/trailers were able to prevent PCI. The rear impact guard on the 2013 Vanguard failed at the attachments where the bolts sheared off during the crash resulting in PCI.

[26] NHTSA responded to the Karth/TSC petition by issuing two separate notices, one of which was the NPRM preceding this final rule (July 10, 2014; 79 FR 39362). The other was an advanced notice of proposed rulemaking (ANPRM) published on July 23, 2015 (80 FR 43663) pertaining to the agency's estimated benefits and costs of rear impact guards for single unit trucks (SUTs) and of an alternative of increasing the conspicuity of SUTs through conspicuity tape. FMVSS No. 108, "Lamps, reflective devices, and associated equipment," requires retroreflective material on the rear and sides of trailers to improve the conspicuity of the vehicles to other motorists as a means of preventing underride crashes. The ANPRM analyzed estimated benefits and costs of requiring similar tape for SUTs. NHTSA will follow up on the ANPRM in a document separate from this final rule.

[27] In addition, we proposed a few housekeeping amendments. We proposed to add back "low chassis vehicles" into the list of vehicles excluded from FMVSS No. 224 in the applicability section (S3). The vehicles were excluded from the standard in the January 24, 1996 final rule establishing FMVSS No. 224 (61 FR at 2035) but were inadvertently omitted from S3 when S3 was amended by a final rule responding to petitions for reconsideration (63 FR 3654, January 26, 1998). We also proposed to correct typographical errors in the standards. We make these changes in this final rule.

NHTSA proposed that the loading and performance requirements of FMVSS No. 223 adopt the specifications in CMVSS No. 223. Specifically:

- The NPRM proposed to amend FMVSS No. 223 to require rear impact guards (except as noted below) to resist a uniform distributed load of 350,000 N without deflecting more than 125 mm, while absorbing at least 20,000 J of energy by plastic deformation within the first 125 mm of deflection;
- Alternatively, guards may resist a minimum uniform distributed load of 700,000 N without deflecting 125 mm.
- In accordance with CMVSS No. 223, we proposed to require that rear impact guards be required to maintain a ground clearance after the energy absorption test not exceeding 560 mm. For rear impact guards with strength exceeding 700,000 N in the uniform distributed load test, the post-test ground clearance is measured after the uniform distributed load test. A definition of "ground clearance" would be added to FMVSS No. 223.
- We proposed that FMVSS No. 223 require that any portion of the rear impact guard and attachments not separate from their mounting structure after completion of FMVSS No. 223's uniform distributed loading test and the energy absorption test.

***Definition of "rear extremity"***[28]

We proposed to replace the current definition of "rear extremity" in FMVSS No. 224 with that specified in CMVSS No. 223. The change was intended to ensure that aerodynamic fairings are located within a certain safe zone at the rear of the trailer. Aerodynamic fairings on the rear of trailers, also known as "boat tails," are rear-mounted panels on trailers that reduce

[28] We sought to further harmonize FMVSS No. 224 with CMVSS No. 223.

aerodynamic drag and fuel consumption. The safety concern about boat tails is that they generally extend beyond the rear extremity of trailers and thus can negate the crash protection provided by rear impact guards. That is, there is a possibility that a boat tail can protrude so far rearward that it can intrude into the passenger compartment in a crash and cause injury, notwithstanding the presence of an upgraded rear impact guard.

**III. Summary of Comments**

NHTSA received fifty (50) comments on the NPRM.[29] Ten comments were received from the three petitioners (IIHS, Ms. Marianne Karth (with her husband Mr. Jerry Karth), and the TSC), one comment was received from the National Transportation Safety Board (NTSB), six comments were received from industry associations (the Recreation Vehicle Industry Association (RVIA), the Truck Trailer Manufacturers Association (TTMA), the American Trucking Association, Inc. (ATA), the National Truck Equipment Association (NTEA), and the National Propane Gas Association (NPGA)), two comments were received from trailer manufacturers (Strick Trailers, LLC (Strick) and the Wabash National Corporation (Wabash)), seven comments were received from engineers (the Mechanical Engineering Underride Design Group at Virginia Tech (VT Group), Seven Hills Engineering, LLC (Seven Hills), Batzer Engineering, Inc. (Batzer), and Mr. Aaron Kiefer), two comments were received from attorneys (Mr. D.J. Young, III and Mr. Andy Young), ten comments were received from advocacy groups (e.g., Underride Network, Road Safe America (RSA), and Advocates for Highway and Auto Safety (AHAS)), and twelve comments were received from individual members of the general public.

Comments were generally in favor of upgrading rear impact guard performance. The petitioners, NTSB, engineers, attorneys, advocacy groups, and individuals from the general public argued, however, for increasing the stringency of FMVSS Nos. 223 and 224 beyond what was proposed in the NPRM. These groups also suggested that NHTSA take other actions suggested in the initial IIHS and Karth/TSC petitions that NHTSA had not proposed in the NPRM. The industry associations and trailer manufacturers were generally in favor of the proposed rule and opposed further changes to it. Comments also covered issues such as alternative guard designs, NHTSA's benefit-cost analysis, the proposed lead time, retrofitting issues, and side and front guards.

## IV. Response to Comments on the Proposed Amendments

### a. General Strength and Energy Absorption Requirements

In the NPRM, NHTSA proposed to harmonize FMVSS No. 223's test and performance requirements to those specified in CMVSS No. 223 by replacing the current quasi-static point load test at the P3 location with a uniform distributed load test of 350,000 N. Under this test, NHTSA proposed that the rear impact guard must resist the 350,000 N load without deflecting more than 125 mm, absorb at least 20,000 J of energy within 125 mm of guard deflection, and have a ground clearance not exceeding 560 mm after completion of the test.

#### Comments Received

Commenters supported upgrading FMVSS No. 223's requirements as proposed, but most also suggested that NHTSA issue requirements more stringent than those proposed. Multiple commenters argued that, because 93 percent of trailers already comply with CMVSS No. 223 according to the NPRM, the proposed requirements would make little tangible difference and not prevent the underride injuries that are still occurring. The Underride Network (Network) stated

that NHTSA's proposal would only "upgrade the standard as basically existed in 1996," without going further to include technological improvements made for rear impact guards. Wabash, on the other hand, suggested that even though most new trailers currently adhere to CMVSS No. 223, there is still a benefit to the proposed requirements. Wabash argued that adopting the proposed requirements would both mandate that the remaining portion of the new trailer fleet adopt upgraded rear impact guards and allow NHTSA to take enforcement action against any company that fails to install upgraded rear impact guards.

Some commenters also urged NHTSA not to adopt a proposal that only provides protection against underride at impact speeds up to 56 km/h (35 mph), stating that these crashes only represent a fraction of all rear underride crashes. These commenters remarked that NHTSA should do more to provide protections for underride crashes that occur at greater speeds. Some commenters suggested specific requirements that they believed NHTSA should adopt instead of those proposed in the NPRM. Network requested that the quasi-static loading tests use a force of 200 (kN) at the P1 and P2 test locations and 100 kN at the P3 test location. Mr. Kiefer suggested that rear impact guards should be quasi-statically tested to "at least 80% of reasonable crash pulse loadings." Mr. Karth referenced what he called a "new Australian/New Zealand proposed rule" and asked NHTSA to use that as a basis for its standards. According to Mr. Karth, the Australian/New Zealand proposed rule states that current vehicle crashworthiness technology can protect passengers in collisions with a deformable barrier at impact speeds around 64 km/h (40 mph) and that energy absorbing rear impact guards could reduce injury at higher speeds. Ms. Karth echoed this point, stating that adopting the Australian/New Zealand proposed rule would save more lives than adopting standards based on CMVSS No. 223. These and all other relevant comments are address below.

**Agency Response**

After reviewing the comments, NHTSA is adopting the strength and energy absorption standards as proposed in the NPRM. NHTSA recognizes that many commenters have asked NHTSA to require rear impact guards to provide protection against underride at impact speeds beyond 56 km/h (35 mph). As discussed below, NHTSA is researching this area. However, based on available data, the agency does not believe that such increased requirements are reasonable or practicable at this time. Rear impact guards are meant to work with passenger vehicle safety features to protect occupants of the vehicle during a collision. For these passenger vehicle safety features to activate, the passenger vehicle must collide with the rear impact guard, and this collision itself poses risks to passenger safety. Currently, FMVSS No. 208 requires passenger vehicles to provide protection in front collisions at speeds up to 56 km/h (35 mph). Even if a rear impact guard were to prevent PCI at impact speeds above 56 km/h (35 mph), a passenger vehicle in compliance with FMVSS No. 208 may not be able to protect the vehicle's occupants at speeds above 56 km/h (35 mph) in a collision with a rear impact guard. Commenters did not provide data showing current passenger vehicle safety features would prevent injuries in underride collisions above 56 km/h (35 mph). Accordingly, NHTSA concludes it is appropriate for this final rule to align the requirements in FMVSS Nos. 223 and 224 with those in FMVSS No. 208 and CMVSS No. 223, as proposed in the NPRM. This final rule adopts those proposed requirements.

Further, the 56 km/h (35 mph) crash speed accords with § 23011(b)(1)(A) of BIL. BIL states that, not later than 1 year after the date of enactment of the Act, the Secretary shall promulgate regulations that revise FMVSS No. 223 and FMVSS No. 224 to require new trailers and semitrailers to be equipped with rear impact guards that are designed to prevent PCI from a

trailer or semitrailer when a passenger vehicle traveling at 56 km/h (35 mph) makes an impact into the center of the rear of the trailer or semitrailer and in which 50 percent of the width of the passenger motor vehicle overlaps the rear of the trailer or semitrailer. This final rule's adoption of the NPRM's proposed test speed meets the BIL statutory mandate within the timeframe directed by the Act, and meets the requirements for FMVSSs required by the Safety Act.

In response to the research mandate in Section 23011(b)(2) of BIL, NHTSA is conducting additional research on the design and development of rear impact guards that can prevent underride and protect passengers in crashes into the rear of trailers at crash speeds up to 104.5 km/h (65 mph). After the completion of this research, NHTSA will evaluate potential requirements for rear impact guards for preventing underride and protecting occupants at impact speeds greater than 35 mph.

Commenters also referred to guard designs and recommendations developed by third parties that claim to offer greater protection at higher impact speeds than guards currently in use. There is no evidence that any have been finalized, implemented, and proven feasible for commercial use. The Intelliguard/Impact Project, a design source cited by Mr. Karth, explicitly stated, "The guard needs, however, further optimization to become commercially feasible."

Network asked NHTSA to test rear impact guards "at real world speeds," arguing that the Federal Highway Administration (FHWA) tests crash attenuators at 100 km/h (62.2 mph) and that NHTSA should crash test rear impact guards at similar speeds. In response, NHTSA notes, first, that it did not propose to test at highway speeds in the NPRM and believes this request may be outside the scope of this rulemaking. Further, NHTSA does not believe that Network's comparison of rear impact guards and FHWA roadside crash attenuators is appropriate. Roadside crash attenuators are stationary barriers placed alongside roads that are designed to

absorb a colliding vehicle's energy and safely redirect the vehicle or bring it to a stop. A typical crash attenuator system is 50 feet long. In contrast, rear impact guards are structures attached to the rear of mobile trailers to mitigate underride of the impacting vehicle. Roadside crash attenuators, therefore, are designed for a different environment than a rear impact guard, have different performance requirements,[30] and have fewer operational and practical restrictions on their size and weight versus rear impact guards. Similar performance for truck rear impact guards at highway speeds has not been shown to be technically feasible.

In terms of specific standards suggested by commenters, these commenters unfortunately did not provide sufficient information to warrant modifying the proposed requirements. Commenters did not provide data showing the extent to which guards compliant with these various standards are superior to the Canadian guards. NHTSA notes that the "Australian/New Zealand proposed rule" referenced by Mr. and Ms. Karth is not a regulatory requirement, but rather is an industry design guideline created by Standards Australia and Standards New Zealand. These guidelines do not provide information to warrant modifying NHTSA's proposal. In terms of rear impact guards performing at impact speeds above 56 km/h (35 mph), the guidelines only conjecture that guards *could* be developed that reduce serious injury to vehicle occupants at speeds above 70 km/h; they do not provide instructions on how to design such guards or data regarding practicability, effectiveness or performance. Not enough is known

[30] Roadside crash barriers, guardrails and other roadside safety features installed along U.S. highways undergo crashworthiness testing in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH). The AASHTO MASH was updated in 2016 and includes vehicle crash testing at 6 different test levels (TL-1 to TL-6) based on the type of crash attenuator, type of road, and traffic patterns.

- TL-1: Cars and trucks — 31 mph
- TL-2: Cars and trucks — 44 mph
- TL-3: Cars and trucks — 62 mph
- TL-4: Cars, trucks, and single unit trucks — 62 mph and 56 mph respectively
- TL-5: Cars, trucks, and tractor trailers — 62 and 50 mph respectively
- TL-6: Cars, trucks, and tractor tank trailers — 62 and 50 mph respectively

about these standards to assess the need for them or whether adopting them would meet the requirements of the Safety Act.

**b. Alternative Guard Designs**

Based on tests conducted by Transport Canada showing that a CMVSS No. 223 compliant guard was able to prevent PCI in 56 km/h (35 mph) vehicle impacts into the rear of trailers with 100 percent and 50 percent overlap, NHTSA proposed to adopt CMVSS No. 223's strength and energy absorption requirements.

**Comments Received**

NHTSA received many comments arguing that the proposed standards were inadequate because rear impact guards generally meet them already. Advocates and IIHS referred to a 2011 Wabash guard, involved in the tests conducted by IIHS, to argue that the guard exceeded the CMVSS force requirements by more than 70 percent in quasi-static tests. Other commenters also mentioned that they believed it possible to design a rear impact guard that could provide protection for rear underride crashes at speeds greater than 56 km/h (35 mph), several pointing to testing conducted by third parties to support these claims. Network and Mr. Karth stated that the Monash University Accident Research Centre (MUARC) tested energy-absorbing guards to 75 km/h (47 mph) in the early 1990s. They also claimed that the Impact Project had tested energy-absorbing guards to 40 mph with computer modeling showing that the guards might be able to perform at 50 mph or more. Mr. Young noted that the VC-Compat project is "currently proposing and recommending stronger rear impact guards to meet higher speeds."

Other commenters stated that they personally were either developing or had seen rear impact guards that were improvements over guards meeting the current and proposed standards. Mr. Karth pointed to a design developed by the VT Group which, he claimed, "shows promise of

greatly improving the current standard at a reasonable cost." Mr. Kiefer stated that he had developed a rear guard system that will exceed the proposed standards. Mr. Karth stated that he was told by a Mr. Sicking that he "can design a system which will prevent underride guard failures" that occur "at much higher speeds."

**Agency Response**

NHTSA has evaluated the data from IIHS and other research groups provided by the commenters and cannot agree that the information forms a technical basis for modifying the proposed requirements. Advocates and IIHS argued that rear impact guards could provide protection at speeds higher than 56 km/h (35 mph) because the Wabash guard exceeded CMVSS No. 223 force requirements by "more than 70 percent" in tests conducted by IIHS. Our analysis of the comment, however, determined that IIHS's tests were different than, and not comparable to, the CMVSS No. 223 tests. IIHS conducted a point load test at P3, which is very different than the uniform distributed load specified in CMVSS No. 223 and this final rule.[31] As the tests are not comparable, it cannot be concluded that the Wabash guard exceeded the CMVSS No. 223 force requirement by more than 70 percent. Additionally, the data do not show that the guard would provide better crash protection in dynamic impacts above 56 km/h (35 mph). I.e., the data did not link IIHS's quasi-static test values to evidence of actual dynamic crash performance at higher impact speeds.

Section 1 of 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. In accordance with the E.O., this final rule will complete the upgrade of Standard No. 223 to the Canadian standard as proposed, as it is based on

[31] A point load test applies a concentrated load to a focused point. The uniform distributed load tests specified in CMVSS No. 223 and this final rule apply the test load over a wider area.

the best information reasonably available at this time. However, while the commenters' information does not form a comprehensive or complete basis for modifying the rear impact guard requirements above that which was proposed, NHTSA is continuing to research this area in response to BIL. Pursuant to the research mandate in BIL § 23011(b)(2), NHTSA is conducting additional research on the design and development of rear impact guards that prevent underride and protect passengers in crashes into the rear of trailers at crash speeds up to 104.5 km/h (65 mph). The results of this research and other information will provide more data and other information that can guide decisions about updating the rear impact guard standards at a future date.

In response to commenters, NHTSA also reviewed guard designs and recommendations developed by third parties (MUARC, VT group, Aaron Kiefer, Sickling) that several commenters believed could offer greater protection at higher impact speeds than rear impact guards currently in use.[32] As these guards have not been finalized, implemented, proven effective or shown feasible for commercial use in the industry, the agency could not reasonably include requirements for these guards in FMVSS Nos. 223 and 224 at this time.[33] Also, not enough is known about the rationale for various specifications of the experimental guards. For instance, MUARC, an organization favorably cited by many commenters, stated[34] that it had designed a guard which prevented PCI in a 75 km/h (46 mph) centered impact test and recommended that guards be able to absorb 50 kiloJoules (kJ) and quasi-static forces of 200 kN

32 The petitioners, the attorney commenters, UN, AHAS, Seven Hills, Aaron Kiefer, and Andy Young cited design testing conducted by the Intelliguard/Impact Project, the VT Group, VC-Compat, MUARC, and Aaron Kiefer to support claims that guards with greater crash protection at higher impact velocities are feasible.

[33] Section 23011 (b)(1) of BIL requires a regulation revising FMVSS No. 223 and No. 224 not later than 1 (one) year after the November 15, 2021, date of enactment of the Act.

[34]MUARC discussed its research in a 2001 submission to the International Technical Conference on the Enhanced Safety of Vehicles. Rechnitzer, G., Powell, C., and Seyer, K., "Performance Criteria, Design, and Crash Tests of Rear Underride Barriers for Heavy Vehicles," Proceedings of the Seventeenth International Technical Conference on the Enhanced Safety of Vehicles, Paper No. 218, https://www-esv.nhtsa.dot.gov/Proceedings/17/00189.pdf.

at the P1 location, 100 kN at the P2 location, and 200 kN at the P3 location. It is unclear how MUARC developed these quasi-static test recommendations and how these recommendations relate to dynamic crash test performance. Further, MUARC's 50 kJ and the 100 kJ energy absorption recommendation does not specify the degree of deflection at which the guard must meet this energy absorption requirement, and the experimental guard designed by MUARC never advanced beyond the proof-of-concept phase.[35] There is no information on the long term durability and costs of a MUARC guard since it is not available for purchase and installation, nor can NHTSA know if such a guard can be feasibly and effectively used for different types of trailers, such as those with unique geometry.

NHTSA has the same concerns with the experimental guards described by the Impact Project, the VC-Compat project, the VT Group, Mr. Kiefer, and Mr. Sicking. Commenters did not provide information that the guards are effective at providing protection at impact speeds beyond 56 km/h (35 mph) and failed to provide a verifiable relationship between the results of the dynamic crash tests and quasi-static specifications that NHTSA relies on in FMVSS No. 223. In the absence of such data, there is insufficient information supporting using these experimental guards to form the requirements for FMVSS Nos. 223 and 224. As discussed above, however, NHTSA will continue researching guard performance in higher speed crashes in response to BIL and anticipates obtaining more comprehensive information about the performance and other features of potential guards designed for higher speed impacts.

**c. 700 kN Energy Absorption Test Option**

[35] Federal regulations in Australia for rear impact guards are similar to those in Europe and Australia. The MUARC recommendations are not used as performance requirements in Australian Federal standards and there are no manufacturers in Australia voluntarily designing their guards to meet the MUARC recommendations.

The NPRM proposed to include an option from CMVSS No. 223 permitting a rear impact guard not to meet the energy absorption requirements of the uniform distributed load test detailed above if it is able to resist 700,000 N (700 kN) of force without deflecting more than 125 mm and maintain a ground clearance of 560 mm after completion of the test. NHTSA noted in the NPRM that it did not believe that guards will likely be manufactured to this test but sought comment on whether this alternative testing option should be included in FMVSS No. 223.

**Comments Received**

Commenters were divided in their support of the 700 kN test option. TTMA stated in support that keeping this as an option would allow TTMA members to retain needed flexibility. Batzer asserted in support that, since passenger vehicles have improved their energy absorbing characteristics since the 1996 final rule, NHTSA does not need to require that rear impact guards meet an energy absorption requirement as long as the guards can provide a certain level of resistance force. Network stated that this option "might make sense," but also stated that rear impact guards must be able to absorb a minimum of 50 kJ, and preferred that guards be able to absorb 100 kJ. Ms. Wood agreed that rear impact guards must be able to absorb at least 50 kJ. The VT Group disagreed with including the 700 kN test, stating that doing so would afford manufacturers the ability to omit a horizontal member from a rear impact guard. The VT Group claimed that without a horizontally distributing structure, "a minor impact more closely resembles a pole strike."

**Agency Response**

NHTSA agrees with TTMA and Batzer and believes it appropriate to adopt the 700 kN test option. Network and the VT Group expressed reservations about the option, but they did not provide data or other evidence demonstrating that this option would be detrimental to safety.

They did not provide any further information supporting the request for a 50 kJ or 100 kJ energy absorption requirement, nor did they explain how the 700 kN test option would allow manufacturers to omit a horizontal member. FMVSS No. 223 S5.1 specifies that the vertical height of the horizontal member must be at least 100 mm and FMVSS No. 224 S5.1 specifies geometric requirements for the rear impact guard that remain unchanged by this test option.

Transport Canada developed the 700 kN test option based on rigid barrier crash test results suggesting that a resistance to a uniform load of at least 700 kN would help ensure that the rear impact guard will stay in place and prevent underride in an impact with a passenger car at impact speeds of 56 km/h (35 mph).[36] NHTSA concludes that the data from Transport Canada, cited in the NPRM, demonstrate the effectiveness and feasibility of this option in preventing underride at 35 mph.[37]

**d. Ground Clearance**

NHTSA proposed maintaining the current ground clearance requirement of 560 mm (22 inches) (S5.1.2, FMVSS No. 224) but also proposed updating FMVSS No. 223 to require rear impact guards to maintain a ground clearance of 560 mm (22 inches) after completion of the load application during the energy absorption test. Due to deformation that may occur upon loading, NHTSA noted that this requirement may correspond to an initial ground clearance on the trailer that is actually less than 560 mm (22 inches).

**Comments Received**

Many commenters suggested lowering the ground clearance requirement. These commenters generally argued that rear impact guards must align with the height of car bumpers

[36] Canada Gazette Part II, Vol. 138, No. 20, 2004-10-06, p. 1349.
[37] Boucher, D., "Heavy Trailer rear underride crash tests performed with passenger vehicles," Technical Memorandum No. TMVS-0001, Transport Canada, Road Safety and Motor Vehicle Regulation Directorate, July 2000.

and since NHTSA mandates that passenger car bumpers be 16 to 20 inches (406.4 to 508 mm) off the ground, NHTSA must lower the ground clearance requirement to this level. The VT Group stated that NHTSA's bumper standards in "49 CFR 581 requires a light vehicle bumper height of 16 to 20" inches and that lowering ground clearance to this level "could ensure proper initial engagement with light vehicle safety systems." Batzer similarly stated that the most effectively designed rear impact guard "would engage the bumper of the striking passenger vehicle." Commenters also suggested that, because the average guard height for trailers currently is 18 inches (457.2 mm), there is no need for NHTSA to allow for a higher ground clearance. Mr. D.J. Young, III and Mr. Andy Young stated that technology exists that can raise or lower rear impact guards, and therefore NHTSA should not be concerned that a lower ground clearance requirement could result in a rear impact guard scrapping or snagging along the ground.

**Agency Response**

NHTSA proposed amending FMVSS No. 223 to require that, after the energy absorption test where the guard is displaced 125 mm, the rear impact guard has to maintain a ground clearance not exceeding 560 mm (22 inches) but did not propose to alter the 560 mm (22 inches) ground clearance requirement in FMVSS No. 224. The NPRM explicitly stated that NHTSA was denying the request made by petitioners to lower the ground clearance requirement and NHTSA did not propose such a change in the NPRM. The suggestions to lower the ground clearance requirement are thus not within the scope of this rulemaking. Further, NHTSA included in the NPRM its rationale for denying the request to lower the ground clearance requirement, and, after reviewing the comments and other information, NHTSA has not changed

its position on these points. In the interest of discussion, NHTSA will briefly repeat its reasoning here.[38]

Comments stating that NHTSA should modify the ground clearance requirement to align with NHTSA's bumper standard (49 CFR part 581) misunderstood the purpose of the bumper standard and repeat a concern to which NHTSA responded in the 1996 final rule establishing FMVSS Nos. 223 and 224.[39] The bumper standard under 49 CFR part 581 is designed to prevent damage to a car body and its safety related equipment in impacts of 3.2 km/h (2 mph) across the full width of the bumper and 1.6 km/h (1 mph) on the corners. The bumper standard is not, in other words, intended to provide occupant protection from crashes at injury-causing impact speeds. That function is instead performed by the vehicle's chassis energy-management design and its energy-absorbing frame rails, which rely on the engagement of the vehicle's major structural components with the rear impact guard.

Nor is it the case that the major structural components of vehicles have been so lowered as to necessitate lowering the ground clearance requirement. To the contrary, the height of the top of the engine block appears to have *increased* since NHTSA promulgated the 1996 final rule that required the 560 mm (22 inches) ground clearance. Using engine block height as a suitable metric to represent a major structural element of the striking vehicle that would engage the rear impact guard, when NHTSA issued the 1996 final rule, NHTSA determined the typical height of the top of the engine block as between 660 and 790 mm (26 and 31 inches). 61 FR at 2017. In contrast, as discussed in the 2015 NPRM for this final rule, data show that the current height of the top of the engine block is between 739 mm (29.1 inches) and 1300 mm (51.2 inches), with an average height of 889 mm (35 inches) (80 FR at 78425). Thus, passenger vehicle designs have

[38] NHTSA's entire rationale is detailed in the NPRM for this final rule. *See* 80 FR 78424-78426.
[39] *See* final rule, 61 FR 2004, 2017; January 24, 1996.

changed in years since the establishment of the 560 mm (22 inches) ground clearance specification such that there is a greater likelihood of engagement of their major structural components with the rear impact guard.

Further, NHTSA is concerned that some trailers may face operational issues if NHTSA lowered the ground clearance requirement. Trailers may snag and scrape at loading docks and steep railroad crossings, resulting in damage to the guard, if guards were required to be lower to the ground. The commenters advocating for a lower ground clearance requirement provided no data to show that this possible risk can be overcome or is offset by any potential benefits. Similarly, NHTSA does not believe it is appropriate to lower the ground clearance requirement and then force operators involved in intermodal operations to possess trailers with rear impact guards that can be raised and lowered. Doing so would unnecessarily burden the industry and raise costs, and commenters have not identified any associated benefits that would justify this decision.

**e. Requiring Attachment Hardware to Remain Intact**

The NPRM focused on ensuring the attachment hardware of the rear impact guard remained intact in the quasi-static loading tests. It proposed to prohibit the complete separation of any portion of the guard and the guard attachments from its mounting structure after completion of the quasi-static uniform distributed load test (proposed S5.2.1). NHTSA stated in the NPRM (80 FR at 48429) that it was interpreting "'any portion of the guard and the guard attachment completely separating from its mounting structure' to mean the condition where any member of the guard becomes detached from any other member of the guard or from the trailer such that the joint is no longer mechanically bound together." The agency further stated that it would not consider a partial separation of the members at a joint where there is still some degree

of mechanical connection between the members as a "complete separation." *Id.* NHTSA sought comment on this proposed performance criterion and whether its objectivity could be improved by, *e.g.*, specifying the percentage of fasteners or welds that remain intact during the test.

**Comments Received**

Commenters had different views regarding the proposed requirement that attachment hardware remain attached throughout the quasi-static test. Notably, commenters in favor of such a requirement still asked NHTSA to refine the language used in the regulatory text. The NTSB stated that it supported developing performance criteria to determine objectively the degree of separation that may significantly reduce rear impact guard performance, but the commenter did not provide information on what the criteria should be. IIHS stated that the standard should require rear impact guards to withstand the quasi-static load tests without any separation between the guard and guard attachments rather than adopt the criterion of complete separation that NHTSA proposed. IIHS believed that NHTSA's language in the preamble, stating that the agency would consider partial separation acceptable as long as there was still some degree of mechanical connection between the guard's members, was vague. Due to this perceived ambiguity, IIHS questioned whether NHTSA would consider a joint where 3 of 4 bolts were sheared to constitute a partial separation.

The TTMA, on the other hand, expressed concerns with making the standard overly complicated in trying to make it more objective, stating that setting specific requirements for numbers of welds or fasteners to remain intact "would unnecessarily complicate the standard compared to the Canadian equivalent, and could preclude the use of designs with components that may be designed to shear or tear as part of an energy mitigation strategy." Seven Hills

remarked that TTMA's concerns could be alleviated by modifying the design of rear impact guards.

**Agency Response**

NHTSA agrees with the comments that FMVSS No. 223 should require attachment hardware to remain attached during the quasi-static load test. However, NHTSA does not agree with IIHS's specific suggestion of a requirement that there be no separation at any point. Guards may be designed to have attachment hardware shear away from the guard during impact to absorb the impact energy. The agency does not find it necessary to prohibit these kinds of guards if they meet the criterion discussed below.

While NHTSA requested comments on an objective criterion that would keep guards from separating from their attachment hardware (other than by prohibiting a "complete separation"), the agency did not receive any data or bases to aid NHTSA on this issue. NHTSA agrees with commenters, though, that the language the agency used in describing the requirement in the NPRM could be clearer. NHTSA proposed in S5.2.1 that a tested guard must resist the force levels specified in S5.2.1 (a) through (c) without deflecting by more than 125 mm and "without complete separation of any portion of the guard and guard attachments from its mounting structure." This final rule replaces the phrase "without complete separation of any portion of the guard and guard attachments from its mounting structure" in proposed S5.2.1 and S5.2.2(a)(1) with the phrase "without eliminating any load path that existed before the test was initiated." "Load path" is a standard engineering term. The agency is defining "load path" to mean a route of force transmission from the horizontal member of the guard to the chassis.[40]

[40] "Chassis" is defined in FMVSS No. 223, S4, as the load supporting frame structure of a motor vehicle.

Load paths represent how forces applied to the guard will transmit through the guard to the chassis based on the geometry of the guard. For the purposes of FMVSS No. 223, NHTSA will determine load paths by visual inspection prior to conducting the quasi-static load tests. NHTSA will assess whether any load paths are eliminated after any force applied during the test using the force application device is removed. "Eliminating a load path" means that a load path designed to transmit force from the horizontal member of the rear impact guard to the chassis, can no longer transmit the force.

If two or more members in the load path are joined using multiple bolts, NHTSA will not consider each bolt to be an individual load path. For instance, if the vertical member of a rear impact guard was attached to the horizontal member by four bolts, NHTSA would not consider the load path to have been eliminated if one, two, or three of the bolts sheared off or otherwise became disconnected during testing. On the other hand, if all four bolts sheared off, or otherwise became disconnected, the agency would consider this to constitute an eliminated load path, even if the guard's members remained in contact due to friction or the structural integrity of another portion of the guard. To use another example, if two members in a load path are connected by a single weld and if the weld developed one or more discontinuous cracks during testing, NHTSA would not consider this to constitute an eliminated load path. If, however, a continuous crack developed during testing along the entire length of the weld holding the two members together, this would constitute an eliminated load path as a route of force transmission would have been eliminated even if the members remained in contact through friction or the structural integrity of another portion of the guard. When all mechanical connection along a route of force transmission from the horizontal member of the guard to the chassis is lost, we would consider this to be an eliminated load path. If the two members in a load path were connected by two

welds and a continuous crack developed along the entire length of only one of the welds, this would not constitute an eliminated load path.

**f. Definition of Rear Extremity**

The NPRM proposed replacing the current definition of "rear extremity" in FMVSS No. 224 with the definition from CMVSS No. 223. NHTSA proposed this change to account for aerodynamic fairings, also known as "boat tails," which are rear-mounted panels that reduce aerodynamic drag and fuel consumption. The proposed change to the definition of "rear extremity" was meant to ensure that aerodynamic fairings would be placed where, in a collision, they would not jeopardize the safety of occupants in vehicles striking the rear of the trailer.

**Comments Received**

Network, TTMA, and NTSB all supported NHTSA's proposed change. The VT Group and Batzer raised concerns that aerodynamic fairings could pierce windshields in instances of partial underride and pose an impalement hazard. Batzer further suggested that NHTSA require every trailer manufacturer and/or user with a non-standard end profile to do a formal engineering analysis of their equipment to document that they have considered the safety implications of their design.

**Agency Response**

After reviewing the comments on this issue, NHTSA agrees with commenters supporting the proposal. The proposed definition for "rear extremity" is based on the Canadian definition, which Transport Canada arrived at after extensive research into aerodynamic fairings. While commenters raised concerns over impalement risks, aerodynamic fairings are typically lightweight structures and no commenter provided evidence showing a risk of vehicle occupant impalement by such fairings. NHTSA will continue to monitor rear impact collisions and revisit

the definition if necessary. Requiring trailer manufacturers to do a formal engineering analysis on aerodynamic fairings, as Batzer suggested, is beyond the scope of the proposal.

**g. Low Chassis Vehicle Correction**

FMVSS No. 224 excludes several types of trailers from application of the standard (S3). As noted in the NPRM, low chassis vehicles[41] were originally excluded from FMVSS No. 224 in a 1996 final rule establishing the standard (61 FR 2035) but NHTSA inadvertently did not list the vehicles in S3 in a 1998 amendment that responded to petitions for reconsideration (63 FR 3654). The agency proposed to correct the omission and list low chassis vehicles back in S3.

Although the NPRM did not propose to expand the applicability of FMVSS No. 224, NHTSA received many comments urging NHTSA to apply the standard to vehicles now excluded from it. We discuss these comments in Section V below. As to correcting S3 to add low chassis vehicles back into S3, NHTSA did not receive any comments opposed to the correction. Accordingly, this final rule corrects S3 as proposed.

**h. Technical Correction**

The NPRM's proposed regulatory text for FMVSS No. 224 included restated current text in S3 that excluded vehicles with temporary living quarters "as defined in 49 CFR 529.2." RVIA commented on this proposed wording, stating that the NPRM's reference to "temporary living quarters as defined in 49 CFR 529.2" was an incorrect reference. RVIA suggested that the definition of temporary living quarters should point to 49 CFR 523.2.

RVIA is correct that the NPRM's reference to 49 CFR 529.2 as providing a definition for temporary living quarters was erroneous. 49 CFR 529.2 does not include any definition for

[41] A "low chassis vehicle" is defined in FMVSS No. 224 as a trailer or semitrailer having a chassis that extends behind the rearmost point of the rearmost tires and a lower rear surface that meets the configuration requirements of S5.1.1 through 5.1.3 of Standard No. 224.

temporary living quarters. The preamble for the 1996 final rule properly referred to 49 CFR 523.2 (61 FR at 2022), but the regulatory text for the 1996 final rule mistakenly referenced 49 CFR 529.2 (61 FR at 2035). NHTSA is taking this opportunity to make a technical correction to FMVSS No. 224 and make clear that the definition of temporary living quarters is defined in 49 CFR 523.2.

## V. Response to Comments on Issues Not Proposed in the NPRM

NHTSA received a number of comments on aspects of FMVSS No. 223 and 224 that the agency did not propose to change. Although these comments were beyond the scope of the rulemaking, we discuss them here to further our dialogue in this area.

### a. Vehicles Excluded from FMVSS No. 224

FMVSS No. 224 (S3) excludes pole trailers, pulpwood trailers, road construction controlled horizontal discharge trailers, special purpose vehicles, wheels back vehicles, or temporary living quarters (S3). NHTSA did not propose to remove any of these exclusions. We evaluated the exclusions when we were drafting the NPRM and decided not to change them (80 FR 78426-78428). The decision was based on our analysis of data provided by the 2013 UMTRI Study.[42]

#### Comments Received

A number of commenters disagreed with NHTSA's continued exclusion of various vehicles. Commenters raised the most concerns about the exclusions for single unit trucks (SUTs)[43] and wheels back trailers.

---

[42] As discussed earlier in this preamble, the 2013 UMTRI Study collected supplemental data to that collected in TIFA for the years 2008 and 2009. The supplemental survey data included details of the truck rear extremity, whether a rear impact guard was required, relative impact speed of the crash, and the extent of underride.

[43] SUTs are trucks with a GVWR greater than 4,536 kg (10,000 lb) with no trailer. They are primarily straight trucks, in which the engine, cab, drive train, and cargo area are mounted on one chassis. As SUTs are not trailers, they are not subject to FMVSS Nos. 223 and 224.

***SUTs.*** VT Group believed that regulating SUTs was necessary, citing data NHTSA included in the NPRM that, of the 121 light vehicle fatal crashes annually that result in PCI, 19 percent occur in impacts with SUTs without guards. NTSB argued that the adverse effects of SUT crashes have been underestimated in the past "because these trucks are frequently misclassified and thus undercounted." Based on previous research findings portraying underride as underreported in FARS,[44, 45] Ms. Karth stated that NHTSA's analysis for SUTs was skewed by what she believed to be inaccurate, underreported information about PCI from underride. Mr. Young commented that further consideration of ways to engineer guards for SUTs "is warranted despite the difficulties associated with those vehicles."

***Agency Response.*** Because of prior research findings raising the possibility of underreporting of underride in FARS, NHTSA initiated research in 2010 with UMTRI that formed the basis of the 2013 UMTRI Study. The purpose of this research was to gather accurate data on the rear geometry of SUTs and trailers, the configuration of rear impact guards on SUTs and trailers, and the incidence and extent of underride and fatalities in rear impacts with SUTs and trailers. UMTRI collected the supplemental information as part of the TIFA survey for the years 2008 and 2009.[46, 47] These data enabled NHTSA to obtain national estimates of rear impact crashes into heavy vehicles that resulted in PCI. Using information derived by reviewing police crash reports,[48] UMTRI estimated the relative speed of fatal light vehicle crashes into the rear of SUTs and trailers. Because of the detailed analysis and the supplemental information

---

[44] Braver, E.R.; Mitter, E.L.; Lund, A.K.; Cammisa, M.X.; Powell, M.R.; and Early, N. 1998. A photograph-based study of the incidence of fatal truck underride crashes in Indiana. Accident Analysis and Prevention, vol. 30, no. 2, pp. 235-243.
[45] Blower D and Campbell K. 1999. Underride in Rear-End Fatal Truck Crashes, The University of Michigan Transportation Research Institute, 1999.
[46] Analysis of Rear Underride in Fatal Truck Crashes, 2008, DOT HS 811 652, August 2012, *infra*.
[47] Heavy-Vehicle Crash Data Collection and Analysis to Characterize Rear and Side Underride and Front Override in Fatal Truck Crashes, DOT HS 811 725, March 2013, *infra*.
[48] Information included police estimates of travel speed, crash narrative, crash diagram, and witness statements. The impact speed was estimated from the travel speed, skid distance, and an estimate of the coefficient of friction.

collected for each crash, the 2013 UMTRI Study forms the most comprehensive and valid data set available to inform the agency regarding crashes involving SUTs and trailers and the incidence and extent of underride.

Regarding NTSB assertions that SUT crashes are underestimated in FARS because trucks are frequently misclassified, and with respect to Ms. Karth's comment that underride and PCI are underreported in FARS, NHTSA did not use FARS data in developing this rulemaking and instead used TIFA data for the years 2008 and 2009 with supplemental information reported in the 2013 UMTRI Study.[49] As explained earlier in this preamble, the TIFA database is supplemental to FARS, and has improved the accuracy of FARS data on fatal large truck crashes. It provides more detailed information than in FARS on the involved large trucks, motor carriers, and sequence of events.[50] The TIFA and 2013 UMTRI Study comprise the best scientific data on underride crashes. Thus, this rulemaking used the most accurate estimate of SUT crashes, as determined by the best available scientific data in the area, and we do not believe SUT crashes were underestimated.

With further regard to whether NHTSA's data underreported underride, we believe that the data appear to include some crashes that did not actually result in underride. In the 2013 UMTRI Study, the extent of underride was estimated in terms of the amount of the striking vehicle that went under the rear of the struck vehicle and/or the extent of deformation or intrusion of the striking vehicle. The categories were "no underride," "less than halfway up the hood," "more than halfway but short of the base of the windshield," and "at or beyond the base

[49] Heavy-Vehicle Crash Data Collection and Analysis to Characterize Rear and Side Underride and Front Override in Fatal Truck Crashes, DOT HS 811 725, March 2013.

[50] NTSB stated in a 2013 safety study, "The TIFA database provides more accurate classifications of large truck vehicle body types by using information from the vehicle identification number (VIN) and by collecting additional data for all fatal large truck crashes." Crashes involving single-unit trucks that resulted in fatalities and injuries, National Transportation Safety Board Safety Study, NTSB/SS-13/01, PB2013-106637, June 2013.

of the windshield." NHTSA believes it is most relevant for this rulemaking to consider the relevant crashes to be as an underride that resulted in PCI beyond the base of the windshield. However, since the 2013 UMTRI Study determined the extent of underride by the extent of deformation and intrusion of the vehicle, there were a number of TIFA cases involving large vans and large pickups that did not actually underride the truck or trailer, but that had sustained PCI because of the high speed of the crash and/or because of the very short front end of the vehicle. Because these large striking vehicles did not underride the struck vehicle, NHTSA's interpretation in the NPRM of PCI from the 2013 UMTRI Study potentially overestimated the occurrence of PCI due to underride. We believe, in other words, that NHTSA's analysis using data in the 2013 UMTRI Study potentially overestimated PCI due to underride.

NHTSA responded to the Karth/TSC petition by publishing two separate notices.[51] NHTSA first published an advance notice of proposed rulemaking (ANPRM) on July 23, 2015 pertaining to issues concerning rear impact guards for single unit trucks (SUTs), including whether to apply FMVSS No. 224 to the vehicle type and whether to apply FMVSS No. 108's requirements for conspicuity tape.[52] Second, NHTSA published the NPRM preceding this final rule upgrading rear impact guards on December 16, 2015. Comments relating to the application of FMVSS No. 224 to SUTs will be addressed in a follow up document to the 2015 ANPRM and will not be addressed in this final rule.

***Wheels Back Vehicles.*** TSC opposed FMVSS No. 224's exclusion of wheels back trailers. Similarly, Advocates suggested that the NPRM's discussion of the involvement of wheels back vehicles in fatal crashes did not support the agency's conclusion that excluding

[51] 79 FR 39362.
[52] 80 FR 43663.

wheels back trailers "may not have significant safety consequences."[53] The commenter criticized the 2013 UMTRI Study that NHTSA relied on, stating that the sort of speed estimates used in the study are notoriously inaccurate and that data generated in the TIFA database frequently depend on unreliable telephone interviews and post-crash interviews. IIHS similarly objected to NHTSA's use of the supplemented TIFA data, stating that UMTRI had previously cautioned against defining degrees of underride, and that NHTSA's use of estimated crash speeds was speculative. IIHS also noted that the 2008-2009 TIFA survey found that one-half of wheels back trailers involved in fatal crashes were equipped with rear impact guards, which IIHS believed raised concerns "about the validity of the comparisons of underride severity by trailer type." Network stated that, as modern cars require flat surfaces to interact with vehicle safety systems, the safety systems will not engage when a vehicle impacts the rear of wheels back trailers, as tires on a wheels back trailer present an uneven surface hazard. Network also stated that agricultural trucks in North Dakota have shown a net benefit from adding rear impact guards.

***Agency Response.*** NHTSA has considered the comments but does not believe available data support applying FMVSS No. 224 to wheels back trailers.[54] In the UMTRI study, crashes into the rear of wheels back trailers accounted for 6 percent of all fatal light vehicle crashes into the rear of trucks and trailers that resulted in PCI. Detailed analysis of the fatal light vehicle impacts into the rear of wheels back trailers that resulted in PCI in 2009 indicated that the crashes were generally at very high impact speeds that are considered unsurvivable. In all these crashes, it is unlikely that a rear impact guard designed to CMVSS No. 223 would have

[53] The NPRM provided data that wheels back vehicles account for 20 percent of fatal light vehicle impacts into the rear of trailers, and that 16 percent of fatal light vehicle impacts into wheels back trailers resulted in PCI.
[54] 80 FR 78427-78428.

prevented PCI into these vehicles. A rear impact guard would not have prevented these fatalities.[55]

NHTSA has also analyzed comments criticizing the 2013 UMTRI Study as applied to wheels back trailers and believes that the data in the study are sound. The UMTRI data were enhanced specifically for trailer rear impact analysis and the study contains enriched data specific to impact performance. The 2013 UMTRI Study[56] was based on enhanced Trucks in Fatal Accidents (TIFA) data for the years 2008 and 2009. The enhanced data included supplemental information, collected as part of the NHTSA funded study, on the rear-end configuration of SUTs and trailers and the incidence and nature of underride and associated fatalities in crashes into the rear of SUTs and trailers, and an estimate of the relative velocity of the light vehicle crash.[57] The data from the 2013 UMTRI Study comprise the most accurate and complete dataset available for evaluating the incidence of underride and are appropriate for use for evaluating underride incidences in light vehicle crashes into the rear of wheels back trailers. While commenters made general statements that the variables used in this data set are unreliable, none presented alternative data that they considered more accurate.

NHTSA also does not agree with IIHS that the presence of wheels back trailers with rear impact guards in the 2013 UMTRI Study raises doubts about NHTSA's conclusion there is an absence of a safety need for the guards. First, while IIHS references data from the TIFA data

---

[55] 80 FR at 78428.

[56] Heavy-Vehicle Crash Data Collection and Analysis to Characterize Rear and Side Underride and Front Override in Fatal Truck Crashes, DOT HS 811 725, March 2013, *supra*. Also available at *https://www.nhtsa.gov/sites/nhtsa.gov/files/811725.pdf*

[57] UMTRI estimated the relative speed of fatal light vehicle crashes into the rear of SUTs and trailers using all available information, including police estimates of travel speed, crash narrative, crash diagram, and witness statements. The impact speed was estimated from the travel speed, skid distance, and an estimate of the coefficient of friction. Relative velocity was computed as the resultant of the difference in the trailer (truck) velocity and the striking vehicle velocity and could only be estimated for about 30 percent of light vehicle fatal crashes into the rear of trailers and SUTs.

sets for 2008-2009 to claim that half of wheels back trailers involved in a fatal crash were equipped with rear impact guards, the data do not provide information on the guards equipped or the need for a guard. The data sets do not record if any of the guards were original equipment or were even compliant to a standard such as FMVSS No. 223. The presence of a rear impact guard that lacks sufficient strength and energy absorption characteristics specified in FMVSS No. 223 would not mitigate PCI in light vehicles at impact speeds 30 mph or lower.

Further, IIHS implies that the guards prevented underride rather than the wheels of wheels back trailers, but does not provide information to substantiate the claim that the guards had prevented underride rather than the wheels of the trailer. IIHS provided no data to suggest this interaction with the guard versus the wheels is occurring. In the 1996 final rule that established FMVSS No. 224, NHTSA determined that "a fixed rear axle with the tires mounted within 305 mm [12 inches]…of the vehicle's rear extremity constitutes an adequate substitute for a rear impact protection guard from the standpoint of preventing PCI."[58] This is a straightforward conclusion and no information has been provided to change our conclusion on this issue. We similarly do not find Network's statement that vehicle crashworthiness safety systems will not engage during impacts with the rear of wheels back trailers to be supported by any evidence. Network did not support its assertion, and it is contradicted by the results of past dynamic crash tests of light vehicles into the rear of wheels back trailers.[59]

***Horizontal discharge trailers*:** NHTSA disagrees with TTMA and NTEA's views that there should be a blanket exclusion of end-dump trailers from FMVSS No. 224. When we

[58] 61 FR 2024.

[59] *Id.* Two crash tests involving wheels back trailers were conducted in support of the 1996 final rule. For these wheels back trailers, the rear tires were located about 100 to 205 mm (4 to 8 in) forward of the rear extremity of the trailer. In each test, in an offset crash in which a Chevrolet Impala struck the tires and in a centric crash in which a VW Rabbit struck the axle and other components between the tires, PCI was prevented at about 56 kph (35 mph).

modified FMVSS No. 224 to exclude road construction controlled horizontal discharge trailers (S4), we received comments similar to those sent by TTMA and NTEA that requested us to exclude gravity feed end-dump trailers.[60] In response, NHTSA noted that end-dump trailers are versatile vehicles that may not necessarily interact with equipment in a way that necessitates an exception, as many fall under the exception for wheels back trailers and many may also be able to accommodate a rear impact guard. For these reasons, we explained that we preferred to review the necessity of exempting end-dump trailers on a case-by-case basis in the context of temporary exemptions under 49 CFR part 555. NHTSA continues to believe this is the most appropriate approach to these vehicles.

***Trailers with lift gates****:* In response to Mr. Young's comment that trailers with lift gates should not be excluded from the standard, trailers with lift gates are not currently excluded from FMVSS No. 224, and NHTSA did not propose any changes in this regard.[61] Trailers with certain kinds of lift gates may fall under the definition of "special purpose vehicle," but the comment did not refer to such vehicles.

**b. Testing on a Trailer Rather Than a Fixture**

FMVSS No. 223 currently provides that NHTSA may test a rear impact guard when attached, per manufacturer's instructions, to either a rigid test fixture or to a complete trailer, at the guard manufacturer's option. As discussed in the NPRM, NHTSA denied the request from the petitioners to remove the option of testing on a rigid test fixture. The agency determined that the two tests are essentially equivalent and that requiring that guards be tested when attached to the trailer could be a significant cost burden to small trailer manufacturers.

**Comments Received**

[60] *See* 69 FR 67663, 67666.
[61] *See* 69 FR 64495, 64497.

Many commenters expressed a preference to NHTSA's testing guards only when attached to a complete trailer. Ms. Karth and Network stated that rear impact guards and the trailers to which they are attached are a system and that compliance testing should be conducted with the guard attached to the trailers and/or a portion of the trailer that includes all structures to which the guard attaches. Batzer believed that testing rear impact guards on the trailer on which they will be mounted "would produce more confidence in the design." IIHS and Advocates stated that testing on rigid test fixtures disregarded the fact that crash tests with rear impact guards attached to trailers resulted in deformation to the trailer. IIHS stated that allowing rear impact guards to be tested when attached to a rigid fixture rather than to an actual trailer is "insufficient to guarantee underride prevention" because a guard certified to meet the standards of CMVSS No. 223 may be attached to a trailer structure that does not have the demonstrated capability to resist the same force level. IIHS claimed that the relatively weaker structure of the trailer may deform during a crash, leaving "open the possibility that guards will be attached to trailer structures that are too weak to withstand the forces of a crash, in which case the strength of the guard itself is irrelevant." Advocates also believed that "significant issues with the performance of the guard and the attachment system would not be detected" if the guard was tested on a rigid test fixture. Some commenters also argued that the higher burdens to small manufacturers "is an insufficient justification." TSC stated that NHTSA should require testing on a trailer as it reflects a real-world scenario "even if the process is more costly."

**Agency Response**

We considered the suggestion to remove the option for fixture testing when we evaluated the petitions and ultimately concluded not to include it in the proposed rule. Many of the commenters raise points NHTSA discussed in the NPRM and points NHTSA had discussed in

the original 1996 final rule. In the 1996 final rule, NHTSA explained that, even though testing on a trailer is desirable "because there is nothing more 'appropriately configured' for guard mounting on the actual trailer" and because such testing also tests the structural integrity of the trailer chassis, the agency's data demonstrated that rear impact guards tested on rigid test fixtures performed similarly to their performance on an actual trailer.[62] NHTSA reiterated this point in the NPRM for this final rule, and commenters did not provide any new information to suggest that testing on a rigid test fixture is no longer acceptable. NHTSA concludes that a guard shown to be compliant when tested on a rigid test fixture will perform to the same benchmark when attached to a trailer.

NHTSA stated its view that a rear impact guard attached to a rigid test fixture would not have a trailer to absorb a portion of the load so the severity of the fixture test might be higher than a trailer test. IIHS and Advocates seemed to argue the opposite, stating that testing on rigid test fixtures disregarded the fact that crash tests with rear impact guards attached to trailers resulted in deformation to the trailer. NHTSA cannot conclude that trailer deformation itself indicates that the total resistance of a guard-attachment-trailer system is lower than that of the guard alone on a rigid test fixture. The trailer structure may have deformed because it offered resistance to the dynamic loads. As stated in the NPRM, testing on a rigid test fixture has an advantage over trailer testing in its potential to show that the guard is capable of resisting all loads and absorbing all the energy.

---

[62] *See* 61 FR 2008, 2014. NHTSA's testing showed that the maximum force measured in quasi-static tests of rear impact guards attached to a fixture is similar to the maximum force generated in dynamic crash tests with the rear impact guard installed on a trailer. Additionally, rear impact guards that were only ten percent stronger than the minimum level of strength necessary to pass quasistatic test requirements performed adequately in dynamic tests with the guard installed on a trailer.

The commenters did not provide information showing that requiring each rear impact guard be tested on a trailer would offset the significant costs of doing so, especially for small trailer manufacturers with low sales volumes. As noted in the NPRM, if small manufacturers were to test the rear impact guard on the trailer, this testing could involve sacrificing what could constitute a substantial part of their overall trailer production. NHTSA does not believe there is a safety basis justifying these impacts on these manufacturers.

Finally, NHTSA emphasizes the test specifications in the FMVSS reflect how NHTSA will perform tests to evaluate compliance; they do not limit how manufacturers certify compliance. Inserting a requirement into FMVSS No. 223 specifying how manufacturers can certify their own compliance, as suggested by Batzer and VT Group, is not in accordance with the purpose and structure of the FMVSS.

**c. Low Overlap Crash Performance**

Both petitioners IIHS and TSC/Karth requested that NHTSA take steps to prevent underride in low overlap crashes (crashes with 30 percent overlap or less of the impacting vehicle with the trailer rear).[63] IIHS's petition asked NHTSA to evaluate relocating the quasi-static point load test at the P1 location further outboard toward the end of the guard horizontal member so that guards are tested for strength further outboard. IIHS suggested that, based on its interpretation of the crash tests of the 2010 Chevrolet Malibu into the rear of the 2011 Wabash trailer, doing so would provide underride protection to full, 50 percent, and 30 percent overlap crashes.[64]

[63] Overlap is the percentage of the light vehicle width that interacts with the rear of the trailer in a collision. Offset means the centerline of the light vehicle is not aligned with the centerline of the trailer. Other organizations may use low overlap or offset to refer to different specified amounts of overlap.

[64] In IIHS's 30 percent overlap crash test with the Chevrolet Malibu, the front end of the Malibu only contacted the portion of the rear impact guard lateral of the vertical support member.

NHTSA reviewed the requests in the petitions but did not propose to move the P1 location further outboard as a part of this rulemaking. The requests were not supported by sufficient information, as the petitioners did not explain why moving the P1 location further outboard would improve guard performance in low overlap crashes.

NHTSA determined that the performance of rear impact guards in crashes other than low overlap should be enhanced before turning to performance specific to low overlap crashes. We analyzed the data collected in the 2013 UMTRI Study and found that underride crashes of 30 percent overlap or less represented a smaller portion of the rear underride fatality problem than non-low overlap crashes. We decided to focus the NPRM on crashes other than low overlap because those were the more prevalent fatal crashes.

The data do not show that improving low overlap crash performance would improve non-offset crash performance. In fact, data indicate a potential negative consequence. NHTSA expressed a concern in the NPRM about a potential risk that bolstering performance in a 30 percent overlap crash might degrade protection in 50 and 100 percent overlap crashes. The Manac rear impact guard features vertical supports towards the lateral edge of the trailer. While this guard was able to prevent PCI in the 56 km/h (35 mph) 30 percent overlap condition during IIHS's crash tests, in IIHS's 56 km/h (35 mph) full overlap crash test, the Manac guard had the greatest amount of deformation (1,350 mm) of any guard. NHTSA was concerned that these data indicated that rear impact guards designed like the Manac, with the main vertical supports for the guard more outboard, may not perform as well compared to other guards in full overlap crashes at crash speeds at or greater than 56 km/h (35 mph).

To summarize, data indicated that: (a) full and 50 percent overlap crashes are more frequent than 30 percent overlap crashes; (b) most fatal light vehicle impacts into the rear of

trailers are at speeds greater than 56 km/h (35 mph); and, (c) improving performance against low overlap crashes could reduce performance of the guard in full and 50 percent overlap crashes. Given those factors, we decided not to take an approach in this rulemaking that would improve guard performance in a 30 percent overlap crash but that could lessen protection in 50 and 100 percent overlap crashes at higher speeds (speeds higher than the 35 mph speed on which the amended FMVSS No. 223 would be based).

**Comments and Agency Response**

Several commenters disagreed with NHTSA's decision to refrain from pursuing rulemaking on low overlap crashes. Some commenters pointed to existing guards (e.g., the Manac guard) that they stressed provided protection against crashes with low overlap. Some disagreed with NHTSA's concern that such a guard might not perform as well in crashes with full or 50 percent overlap at crash speeds greater than 56 km/h (35 mph). Seven Hills stated that the extent of underride seen in the full overlap crash test with the Manac guard was due to the Chevrolet Malibu fitting "just between both uprights contacting only the horizontal bar," and that this scenario "represents an extremely small fraction of possible crash scenarios." IIHS argued that the Manac design performed well and that it is not the only possible guard design; IIHS said it tested a 2015 Vanguard design that was also able to prevent severe underride at 30 percent overlap.[65] Conversely, Wabash concurred that the design of the Manac guard reduced protection in full overlap conditions.

**Agency Response**

[65] In 2017, IIHS introduced the TOUGHGUARD award for trailers that mitigate PCI in a 56 km/h (35 mph) crash of a Chevrolet Malibu into the rear of the trailer in all three overlap conditions (full, 50 percent, and 30 percent). IIHS awarded the TOUGHGUARD to nine North American trailer manufacturers that offer this feature on at least some trailers.

Several commenters argued that fatal low overlap crashes occurred more frequently than stated by NHTSA. IIHS believed that the data underlying NHTSA's finding that 40 percent of light vehicle impacts into the rear end of trucks and trailers in fatal crashes were offset crashes were collected "during phone interviews with someone who was familiar with each crash but may not have been at the crash scene" and "took place 1-2 years after the crash." Advocates remarked that TIFA survey data "is known to consist of notoriously suspect crash data and analysis." In response, NHTSA does not agree that the agency did not accurately calculate the prevalence of low overlap crashes. The 2013 UMTRI Study forms the most scientific, comprehensive and valid data set available to inform the agency and safety community on this issue.

IIHS referred to its 2010 study of passenger vehicle crashes into the rear of trailers and semitrailers in the Large Truck Crash Causation Study (LTCCS) to argue that, "guard deformation or complete failure was frequent and most commonly due to weak attachments, buckling of the trailer chassis, or bending of the lateral end of the guard under narrow overlap loading."[66] IIHS noted that there were 30 LTCCS cases in the study involving trailers with guards that met the FMVSS No. 224 geometric requirements and among these 30 cases, 30 percent (n=9) were crashes in which less than half of the passenger vehicle overlapped the trailer.

In response, the data used in the 2010 IIHS study comprised too small a sample to generalize the extent of low overlap crashes in the U.S. NHTSA notes that in 22 of the 30 cases, it was not clear whether the rear impact guards on the trailers were compliant with FMVSS No. 223 and among the 9 low overlap crashes. Seven rear impact guards on the trailer exhibited deformation similar to that in the IIHS 30 percent overlap crash tests (the lateral end of the guard

[66] Quoting from its study. Brumbelow, M.L., Blanar, L., "Evaluation of US Rear Underride Guard Regulation for Large Trucks Using Real-World Crashes," Stapp Car Crash Journal, Vol. 54, November 2010, pp. 119-131.

bent forward in the impact). In the other 2 cases, the rear impact guards experienced failure at other locations likely due to the guards being weak in general. Among the 30 LTCCS cases IIHS analyzed, only 8 were crashes of passenger vehicles into the rear of trailers with FMVSS No. 223 compliant rear impact guards. Among these 8 trailers, 2 rear impact guards showed no signs of failure, 3 rear impact guards failed at the attachment to the trailer structure, 1 rear impact guard bent forward due to localized loading from a low overlap crash, and 2 rear impact guards were damaged too severely to determine the failure mechanism. In other words, the 2010 IIHS study uses too small a data sample to generalize the extent of low overlap crashes in the U.S. In contrast, the 2013 UMTRI Study provides a scientific annual estimate of all fatal crashes into the rear of trailers in the U.S., including offset crashes and the extent and type of rear impact guard damage in crashes.

Seven Hills said it did not understand why NHTSA was considering the extent of guard damage, as a fatal collision involving major damage to a guard should be treated the same as a fatal collision that did not involve major damage. It also argued that minimal guard damage in fatal offset impacts indicates that the problem is lack of adequate guard strength on the outside edges of trailers. The commenter said that the absence of a difference in the percentage of light vehicle crashes with PCI in offset crashes and non-offset crashes shows a need to improve the performance of rear impact guards in low overlap conditions, particularly when such PCI is occurring in what Seven Hills viewed as "otherwise non-injurious speed differences."

In response, NHTSA believes examining the extent of rear impact guard damage, along with the occurrence of PCI, is important to determine the utility of improving guards to protect against non-offset crashes. Rear impact guards sustain more damage in non-offset crashes, which suggests that non-offset crashes are potentially more harmful and thus should be

addressed first. Our statement that we found no difference between the percentage of light vehicle crashes with PCI in offset crashes and non-offset crashes was not meant to suggest that offset crashes are not a concern. Rather, because (a) more fatal light vehicle crashes into the rear of trucks and trailers are non-offset crashes, (b) non-offset occur significantly more frequently than low overlap crashes (crashes with 30 percent or less overlap of the impacting vehicle with the rear of the trailer), and (c) non-offset crashes appear more harmful of the two, NHTSA was explaining why it decided to pursue this rulemaking on non-low overlap crashes at this time.

IIHS stated that guard damage is not an adequate metric for the severity of underride and questioned whether NHTSA could accurately calculate the extent of guard damage based on TIFA survey data. In response, NHTSA notes that the damage to the guard was not used to assess the severity of underride but was part of the information collected to determine impact severity. The 2013 UMTRI Study used enhanced data on the rear of the trailer to determine the extent of guard damage. The severity of underride and the occurrence of PCI were determined from the light passenger vehicle information.

IIHS noted that the Manac rear impact guard was not the only design that performed well in the 30 percent overlap crash and that other designs such as the Vanguard rear impact guard also mitigated PCI in 30 percent overlap crashes. The agency agrees that other rear impact guard designs that connect directly to the longitudinal frame rails of the trailer through the vertical members are able to mitigate PCI in 30 percent overlap crashes without reducing protection against PCI in full and 50 percent overlap crashes. However, as shown later in the section, these guards add cost and weight to the trailer.

TSC and Advocates stated that, even if the majority of fatal light vehicle crashes into the rear of trucks and trailers were non-offset crashes, this still meant that 40 percent were offset

crashes. Other commenters also disagreed with NHTSA's decision to focus this rulemaking on fatal non-low overlap crashes, despite that such crashes occur more frequently than low overlap crashes. In response, NHTSA notes that this final rule would afford protection to occupants involved in 56 km/h (35 mph) crashes into the rear of trailers where the impacting vehicle fully overlaps with the trailer rear, and in offset crashes where 50 percent of the light vehicle front end overlaps with the trailer rear, and in offset crashes where a load bearing vertical member connecting the rear impact guard to the trailer is engaged by the front end of the impacting vehicle. In response to the comments, we reiterate some of the details provided in the NPRM and provide further reasoning below for not proceeding with low overlap performance requirements in this final rule.

**Further Analysis on Requirements for Protection in Low Overlap Crashes**

Rear impact guards are designed to absorb energy and prevent PCI by attaching to substantial structural elements of a trailer or semitrailer, such as the chassis longitudinal frame rails, by way of vertical support members. The test results from the initial testing at IIHS reported in the NPRM show that many trailer rear impact guards designed to CMVSS No. 223 met the proposed performance requirements in the NPRM in full overlap and 50 percent overlap crashes but were unable to prevent PCI in a 35 mph crash into the rear of the trailer where only 30 percent of the width of the passenger vehicle front end overlapped with the rear of the trailer. In these 30 percent overlap crashes, only a small lateral portion of the rear impact guard (about 22 percent of the guard width) engaged with the front end of the passenger vehicle. This small lateral portion typically did not include a vertical support member of the guard, so when the passenger vehicle struck this small lateral portion of the guard, the guard deformed locally and did not prevent PCI.

In the initial crash tests conducted by IIHS, only the Manac rear impact guard was able to prevent PCI in the Chevy Malibu in the 56 km/h (35 mph) full overlap, 50 percent overlap, and the 30 percent overlap test conditions. Unlike most trailer designs, however, where the vertical members of the rear impact guard attach directly to the longitudinal frame rails of the trailer, the vertical members of the Manac rear impact guard were located further outboard from the location of the trailer longitudinal frame rails and attached to a reinforced floor section of the trailer. While the more outboard vertical supports of the Manac guard improved rear impact protection in low overlap crashes of light vehicles into the rear of trailers, the further outboard vertical supports appeared to reduce guard strength near the center of the horizontal member of the rear impact guard. In the 56 km/h (35 mph) full overlap crash tests of the Malibu, the greatest amount of underride (1,350 mm) was in the test with the Manac trailer. In contrast, the extent of the underride was 990 mm in the test with the Wabash trailer.

The full overlap IIHS crash test results raise the possibility that for crash speeds greater than 56 km/h (35 mph), 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. Since full and 50 percent overlap crashes are more frequent than low overlap (30 percent or less) crashes, and because most fatal light vehicle impacts into the rear of trailers are at speeds greater than 56 km/h (35 mph), the agency is concerned that such guard designs may reduce protection against PCI in the more frequent higher speed full and 50 percent overlap crashes. NHTSA is concerned about potential negative safety consequences accruing from a rule that resulted in designs that moved the vertical members of rear impact guards more outward laterally to prevent underride in a 56 km/h (35 mph) 30 percent low overlap crash, if such a rule reduced protection in full and 50 percent overlap crashes.

NHTSA has estimated the potential benefits of adopting a 30 percent overlap crash. The agency estimated the number of fatalities in 30 percent or lower overlap crashes in the field based on the available information, estimated the effectiveness of the rear impact guards that prevent PCI in 30 percent overlap crashes, and estimated the lives saved by a requirement for rear impact guards mitigating PCI in 56 km/h (35 mph) 30 percent overlap crashes.

The 2013 UMTRI Study found that 40 percent of light vehicle impacts into the rear ends of trucks and trailers in fatal crashes met the UMTRI definition of "offset crashes,"[67] and that 60 percent were non-offset impacts. However, for a typical trailer rear width of 2,600 mm, an offset crash defined in the 2013 UMTRI Study is when 867 mm of the width of the trailer from its lateral edge is engaged by the impacting vehicle. In contrast, as detailed in the 2015 NPRM, in the IIHS 30 percent overlap crash of a Malibu with the rear impact guard of a trailer, the Malibu interacted with only 637 mm of the rear of the trailer (approximately a quarter of the trailer rear width) from its lateral edge. This difference is important as it relates to how the impacting vehicle engages the vertical members connecting the rear impact guard to the trailer. On a typical 2,600 mm width trailer, the vertical members connecting the rear impact guard to the trailer are located at about 753 mm from the left and right lateral edge of the trailer. Therefore, "offset" crashes in the 2013 UMTRI Study included crashes in which a vertical member of the rear impact guard was engaged. In contrast, in IIHS's 30 percent overlap crashes, the vertical members of the rear impact guards were not engaged.

[67] UMTRI defined "offset crashes" as impacts with the outer one-third or less of the rear plane of the trailer. For a 2,600 mm wide trailer, one-third of the trailer width is 867 mm from the lateral edge of the trailer, which includes the location of the vertical member. In contrast, the IIHS 30 percent overlap crash test is a 30 percent overlap of the impacting vehicle with the trailer rear. For a 2,600 mm wide trailer, 30 percent overlap of a passenger vehicle corresponds to 637 mm from the lateral edge of the trailer, which does not include the location of the vertical member.

Stated differently, the definition of an offset crash in the 2013 UMTRI Study includes crashes that would not have been considered low overlap crashes under IIHS's test program (as they had greater than 30 percent overlap of the front end of the vehicle). NHTSA reviewed a sample of the crash cases which were identified as "offset crashes" in the 2013 UMTRI Study. Based on the damage to the rear impact guard and the damage to the front end of the impacting vehicle in each of these offset crash cases, NHTSA determined that in many crashes the front end of the striking vehicle engaged the portion of the rear impact guard containing the vertical member, and therefore were not "low overlap" crashes as would have been considered under the IIHS protocol (crashes with 30 percent or less of the impacting vehicle front end overlapping the rear width of the trailer). This review indicated that a substantial number of cases identified as "offset crashes" in the 2013 UMTRI Study were not "low overlap" crashes like those in the IIHS 30 percent overlap crash test.

The 2013 UMTRI Study found that there are annually 72 fatalities in light vehicle crashes into the rear of trailers that result in PCI. According to this study, almost 40 percent of the impacts by light vehicles were "offset," meaning that they occurred on the outer left or right third of a trailer's rear. For trailers required to have rear impact guards, there was no difference in the extent of underride, including PCI, for offset and non-offset impacts of light vehicles into the rear of trailers.[68] Therefore, we determined the number of annual fatalities in offset crashes with PCI into the rear of trailers as the product of the annual number of fatalities in light vehicle crashes with PCI into the rear of trailers (72) and the percentage of offset crashes (40%). Accordingly, the number of fatalities in offset crashes with PCI from the 2013 UMTRI Study is 28.8 (=72 x 40%). Yet, as explained above, NHTSA reviewed a sample of the offset crashes in

[68] Figure 5 in the 2013 UMTRI Study. Heavy-Vehicle Crash Data Collection and Analysis to Characterize Rear and Side Underride and Front Override in Fatal Truck Crashes, DOT HS 811 725, March 2013, infra.

the 2013 UMTRI Study and found that in most of these offset crashes, there was more than 30 percent overlap of the impacting vehicle with the rear of the trailer (demonstrated by the impacting vehicle having engaged the rear impact guard at the location of a vertical member). Thus, to estimate the benefit of a requirement to prevent PCI in 30 percent overlap crashes, NHTSA assumed 20 to 40 percent of these 28.8 annual fatalities[69] were in crashes with 30 percent or less overlap of the front end of the impacting light vehicle with the trailer. Therefore, NHTSA estimated that there are 5.8 – 11.5 (= 28.8 x 20% to 28.8 x 40%) annual fatalities in low overlap crashes into the rear of trailers.

The 2013 UMTRI Study also found that only 26 percent of crashes into the rear of trailers were at relative impact speeds of 56 km/h (35 mph) or less. Though the 2013 UMTRI Study found that the crash speeds in offset crashes were higher than those in non-offset crashes, NHTSA used 26 percent to estimate the number of crashes into the rear of trailers with 30 percent or lower overlap that were at crash speeds 56 km/h (35 mph) or lower. Rear impact guards may not be able to mitigate all fatalities in crashes into the rear of trailers with relative velocity of 56 km/h (35 mph) or less because some crashes may be due to circumstances other than underride (i.e. unrestrained status of occupants, elderly and other vulnerable occupants, post impact vehicle kinematics that could expose vehicle to subsequent impacts[70]). For the purpose of this analysis, NHTSA assumed that the incremental effectiveness of rear impact guards (CMVSS No. 223 compliant guards that also mitigate PCI in 30 percent overlap crashes) in preventing fatalities in light vehicle impacts with 30 percent overlap into the rear of trailers with

[69] As explained above, NHTSA's review of a sample of offset crashes into the rear of trailers in the 2013 UMTRI Study indicated that a majority of these offset crashes were with more than 30 percent overlap of the impacting vehicle with rear of the trailer.

[70] The IIHS tests showed that in 30 percent overlap crashes where PCI is mitigated, the impacting light vehicle rotates during the crash and therefore could be exposed to impact by vehicles traveling in adjacent lanes.

crash speeds less than 56 km/h is 50 percent. Therefore, NHTSA estimated the overall effectiveness of upgrading from the final rule compliant guards to final rule compliant guards that also prevent PCI in 30 percent overlap crashes to be 13 percent (=26% x 50%). NHTSA estimates that the annual number of lives saved in low overlap crashes into the rear of trailers at relative velocities of 56 km/h (35 mph) or less to be 0.75 to 1.5 (= 5.8 x 0.13 to 11.6 x 0.13).

To prevent PCI in 30 percent overlap crashes, designs would have to either: (a) add additional vertical members at the lateral edge of the rear impact guard that connect to the trailer's transverse floor beam and strengthen the transverse floor beam of the trailer to withstand the loads transmitted from these vertical members at the edge of the guard; or (b) considerably strengthen the rear impact guard member so it would not deform locally in the 30 percent overlap crash. In these circumstances all the loads will still be taken up by the longitudinal chassis rails. This means that both these approaches would add significant weight to the vehicles because they involve adding more vertical members, strengthening the floor beams, or strengthening the guard itself.

Currently, there are 4 trailer manufacturers that offer rear impact guards that prevent PCI in all three IIHS crash test conditions (35 mph crash of a passenger vehicle with (1) full overlap, (2) 50 percent overlap and (3) 30 percent overlap with the rear of the trailer) as standard equipment. In 2020, the total trailer output of these 4 manufacturers is about 28 percent of the total number of trailers produced in 2020 (211,807).[71] Many other trailer manufacturers offer rear impact guards that prevent PCI in the three IIHS crash test conditions as optional equipment.

---

71 https://cdn.baseplatform.io/files/base/ebm/trailerbodybuilders/document/2021/04/TBB_Top_25_CY2020.6089da057e9d0.pdf

NHTSA reviewed the rear impact guard offerings in the trailer industry. The incremental cost and weight increase of a trailer with a rear impact guard that prevents PCI of passenger vehicles in all three overlap conditions (full, 50 percent, and 30 percent overlap) compared to an equivalent trailer by the same manufacturer with a rear impact guard that meets the performance requirements of this final rule[72] ranges from $100 to $1,000 and from 25 kg (55 lb) to 118 kg (260 lb), respectively. The large range in cost and weight is because some trailers need significant modifications to accommodate rear impact guards with 30 percent overlap protection, the higher cost of high-strength/light-weight materials for the guard, and other such factors. The weighted average (weights based on trailers produced in 2020)[73] of this incremental cost and weight increase of trailers with rear impact guards which prevent PCI in 30 percent overlap crashes is $306 and 35 kg (77 lb), respectively.

Stoughton Trailer, a trailer manufacturer, produces trailers with rear impact guards that prevent PCI in all three overlap conditions at 56 km/h (35 mph) as standard equipment and notes on its website that its rear impact guards do not add additional weight, cost, or negatively impact aerodynamics (presumably compared to rear impact guards that would meet this final rule requirements).[74] 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. 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

[72] As noted previously, the final rule requirements ensure preventing PCI in a 35 mph passenger vehicle crash with full and 50 percent overlap with the rear of a trailer.

[73] https://cdn.baseplatform.io/files/base/ebm/trailerbodybuilders/document/2021/04/TBB_Top_25_CY2020.6089da057e9d0.pdf

[74] https://www.stoughtontrailers.com/Portals/0/documents/Rear%20Underride%20Guard%20Sales%20Sheet.pdf

add weight or cost to the trailer. Accordingly, NHTSA decided not to include this guard design in this analysis.

There are some unique rear impact guard designs that meet the performance requirements in this final rule and are also able to mitigate PCI in 30 percent overlap crashes without significant increase in weight. However, these unique designs may have restrictions in intermodal operations at loading docks[75] and may not be practicable for all types of trailers covered by FMVSS No. 224. The benefit-cost analysis assumes intermodal operability is maintained and so these unique rear impact guard designs were not considered for this analysis.

There are 211,807 trailers produced in 2020[76] among which 65 percent (137,675 = 211,806 x 65%) are required to be equipped with rear impact guards, of which 28 percent are already equipped with rear impact guards that meet the performance requirements of this final rule and mitigate PCI in 30 percent overlap crashes. The annual average and minimal incremental fleet cost of equipping all new applicable trailers[77] (99,126 = 137,675 x 72%) with rear impact guards that mitigate PCI in 30 percent overlap crashes is $30.3 million (= 99,126 x $306) and $9.9 million (= 99,126 x $100).

In addition, the average weight increase of 35 kg (77 lb) from installing a guard that could mitigate PCI in a 30 percent overlap crash would increase fuel consumption. With 192,000 class 8 truck annual sales,[78] the total average incremental lifetime fuel cost is estimated

---

[75] In order to comply with OSHA requirements (OSHA 29 CFR 1910.26(d)), loading docks have vehicle restraints that are designed to connect to rear impact guards to prevent the vehicle from moving during loading and unloading operations. Unique rear impact guard designs that are wider than 7.5 inches, with unique profiles (such as pentagonal shapes) have provided challenges to connect the vehicle restraints to the rear impact guard.

[76] Id.

[77] There were 211,807 new trailers produced 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, 21 percent are already equipped with guards that mitigate PCI in 30 percent overlap crashes.

[78] See statista for class 8 truck annual sales. https://www.statista.com/statistics/261416/class-3-8-truck-sales-in-the-united-states/

to be $130 million undiscounted, $106 million with 3 percent discounting, and $84 million with 7 percent discounting. If the minimum weight increase of 25 kg (55 lb) is used instead, the total minimum incremental lifetime fuel cost is estimated to be $93 million undiscounted, $75 million with 3 percent discounting, and $60 million with 7 percent discounting. The overall undiscounted cost increase (material cost and lifetime fuel cost) is $161 million on average and $103 million at a minimum.

NHTSA is required by Section 1 of Executive Order 12866 to conduct a benefit cost analysis of any proposed regulatory requirements.[79] The undiscounted cost per life saved using the average cost estimate ranges from $107 million to $215 million, while that using the minimum cost estimate ranges from $69 million to $138 million, which is significantly greater than the value of a statistical life ($11.6 million).[80] Therefore, a requirement for equipping all new applicable trailers with rear impact guards that mitigate PCI in 30 percent overlap crashes is not cost-effective.[81] This indicates that total costs of such a requirement exceed overall benefits. Detailed calculations for the benefits, costs, and cost per life saved are provided in the FRE accompanying this final rule.[82]

For the above reasons, we have determined that an FMVSS that requires vehicles to provide rear impact protection in 56 km/h (35 mph) full-frontal, 50 percent overlap, and 30

[79] "Significant" regulatory actions are also subject to Section 6 to assess potential benefits and costs.
[80] For more information on the value of a statistical life, see a 2021 Office of the Secretary memorandum on the "Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses – 2021 Update." https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis
[81] Cost-effectiveness represents a measure of the average monetary cost per unit of change (benefit). In regulatory analyses for safety policies, cost-effectiveness generally measures the average estimated change in total costs per unit improvement in safety (e.g., cost per life saved). A policy alternative can be considered cost-effective if the estimated cost per unit increase is less than an appropriate benchmark. For example, a proposed safety standard could be considered cost-effective if the average cost per life saved equivalent (i.e., combining lives saved and injuries avoided, weighted by the relative values of injuries to fatalities) under the proposed standard were less than the comprehensive economic cost of a fatality ($11.6 million in 2020 dollars). That is, the proposed standard would yield safety benefits at a lower cost than the benchmark value for those benefits.
[82] NHTSA has placed a copy of the FRE in the docket for this final rule.

percent overlap not to be reasonable or practicable. We conclude that such a revision would not meet the requirements of Section 30111(a) and (b) of the Safety Act for issuance of Federal motor vehicle safety standards. Accordingly, we have decided to refrain from adopting a requirement for a 30 percent overlap crash at this time.

However, as explained above, the Federal standards act as a floor, not a ceiling, to establish the minimum level of performance that meet the safety needs presented by the data. FMVSS are written in terms of minimum performance requirements for motor vehicles or motor vehicle equipment to protect the public against unreasonable risk of injury and death in crashes. Manufacturers have flexibility in design as long as their products comply with applicable FMVSS. There are rear impact guard designs in the current trailer and semitrailer market that prevent PCI in all three crash conditions described in Section 23011(b)(1)(A) of BIL: (1) full overlap crash, (2) 50 percent overlap crash, and (3) 30 percent overlap crash at 56 km/h impact speed. While data do not support the agency's requiring these guards for all vehicles, this final rule does not preclude these designs from being on the trailer and semi-trailer market.

Some commenters suggested design changes to rear impact guards that they viewed as increasing protection in low overlap conditions. Network requested that NHTSA require a barrier width within 100 mm of the trailer's outer frame; Advocates similarly stated that if rear impact guards were extended, protection against underride would be enhanced. Network and Ms. Wood also suggested that rear impact guards have angled struts attached to the ends of the guard. Batzer recommended that guards have support at their corners, while Seven Hills stated that a solution could be using three- or four-vertical support configurations. The VT Group suggested that stronger material selection for the horizontal member can improve a rear impact guard's load capability during low overlap crashes.

In response, NHTSA does not believe that it is reasonable, or appropriate, to mandate in this rulemaking that rear impact guards have designs of the specificity suggested by the commenters. The design of rear impact guards is dependent on trailer geometry and structure and we do not wish to unnecessarily restrict the flexibility of manufacturers to design appropriate guards. NHTSA also does not believe that it should mandate the materials used in constructing rear impact guards, as our standards are performance oriented.[83] Finally, this issue was not proposed in the NPRM and is not within the scope of this rulemaking.

**d. Half-Guard Testing**

CMVSS No. 223 allows for compliance testing on half of a symmetric rear impact guard through an application of a 175,000 N distributed load at the P3 location. NHTSA determined that half guard testing was not needed in FMVSS No. 223 and explained in the NPRM why it did not propose the inclusion of half-guard testing in the proposal.

**Comments Received**

Commenters on this issue all argued in favor of including an option allowing for testing of half of the rear impact guard. TTMA, Strick, and Mr. Young stated their general belief that testing on a half-guard will produce the same result as testing on the full guard. They further suggested that half-guard testing is beneficial to manufacturers, as they can test one half-guard, make any changes to the second half-guard, and then test the modified second half-guard with less time and effort. TTMA also remarked that allowing an option for half-guard testing would ensure maximum harmonization with the Canadian standard CMVSS No. 223.

**Agency Response**

[83] 49 U.S.C. 30102(a)(10).

NHTSA reviewed the comments and confirms its earlier decision that a half-guard testing option is not needed in FMVSS No. 223. As noted in the NPRM, CMVSS No. 223 allows for half-guard testing because at the time the standard was written, guard manufacturers lacked the equipment to apply a distributed force of 350,000 N as would be required in a test of the full guard. CMVSS No. 223 thus allowed manufacturers to use then existing equipment to certify rear impact guards through half-guard testing. No commenter suggested that this rationale should be applied to FMVSS No. 223 or that manufacturers presently lack the capability to conduct tests on a full guard. Significantly, there is also an absence of data showing that half-guard testing provides results representative of full guard performance.

NHTSA notes that the test procedures included in an FMVSS specify the compliance tests that NHTSA conducts. Manufacturers may use other reasonable methods to certify the compliance of their vehicles or equipment, provided that their vehicle or motor vehicle equipment complies. In other words, any changes to FMVSS Nos. 223 and 224 would not directly affect how manufacturers choose to structure their guard development processes, as long as the vehicle or equipment complies. If manufacturers believe that testing on half-guards will allow them to better iterate designs, the standard does not prevent them from doing so. The guard must meet the FMVSS when tested by NHTSA according to the test procedures in the standard.

**e. Retrofitting**

The NPRM did not propose to require used trailers be retrofitted with CMVSS No. 223 compliant rear impact guards, as NHTSA had estimated in the NPRM that the cost of retrofitting all applicable FMVSS compliant trailers far exceeds the total benefits from such a retrofit requirement.

**Comments Received**

Many commenters disagreed with NHTSA's decision not to propose that all trailers be retrofitted with newly compliant guards. Network commented that older guards can be easily fixed. Messrs. Kiefer and Young remarked that more lives would be saved if NHTSA required retrofitting. TSC remarked that NHTSA underestimated the potential benefits to requiring trailers be retrofitted. TSC stated that NHTSA based its analysis on the number of light vehicle crashes into the rear of trailers that resulted in PCI, which TSC claimed came from data sources that often do not report on intrusion. Conversely, ATA stated that retrofitting trailers will have a negative cost-benefit ratio, stating that there are more than 11.7 million commercial trailers registered in the states in 2012, many of which are not used on a regular basis. ATA argued that retrofitting them would create significant costs without any corresponding benefit.

**Agency Response**

As further detailed in the Final Regulatory Evaluation (FRE) accompanying this final rule, NHTSA evaluated requiring all trailers to be retrofitted with CMVSS No. 223 compliant guards. This evaluation suggests that such a requirement would not be practicable or cost-effective. Further, vehicle owners would need to assess each trailer-guard combination individually to determine whether an upgraded guard would be compatible with the used trailer, accounting for age and condition of the vehicle. A used trailer may not be structurally capable of accommodating a new upgraded guard without the addition of unique parts. Owners may not have the technical expertise to know if an upgraded rear impact guard installed on a used trailer would be able to meet the intended performance level.

## VI. Lead Time

The NPRM proposed a lead time of two years following the date of publication of a final rule. NHTSA received mixed comments on the proposed lead time. Mr. Young and Network remarked that given most trailers already meet the proposed requirements, a two-year lead time was unnecessary. Mr. Young stated that NHTSA instead should require immediate compliance. TTMA commented that, for "nearly all trailer models," TTMA members have the capability to manufacture to the proposed standard but suggested that manufacturers of other models may have to develop and test new rear impact guards. TTMA suggested a lead time that provides for an optional early compliance date may be worthwhile.

Section 23011(b)(1)(B) of BIL provides that the regulations promulgated under subparagraph (A) shall require full compliance with each FMVSS revised pursuant to those regulations not later than 2 years after the date on which those regulations are promulgated.

After considering the comments and § 23011(b)(1)(B) of BIL, NHTSA is adopting a two-year compliance date. The agency estimates that 94 percent of new trailers sold in the United States subject to FMVSS Nos. 223 and 224 already comply with the requirements of this final rule. This means, however, that there remain many trailer manufacturers who will need time and resources to design and produce new rear impact guards that are compliant with this final rule. Establishing too short a lead time will disadvantage these manufacturers, many of which may be small manufacturers. NHTSA proposed a two-year lead time for the 1996 final rule and the agency believes this length of time is consistent with BIL and remains appropriate. Manufacturers may choose to comply with the new standards earlier.

## VII. Benefit-Cost Analysis

For the NPRM, NHTSA developed a Preliminary Regulatory Evaluation (PRE) to estimate the benefits and cost of this rulemaking. We first estimated the annual number of

fatalities and injuries in light vehicle crashes with PCI into the rear of trailers that could be prevented by the rulemaking.[84] We found that, annually, there are 72 light vehicle occupant fatalities in crashes into the rear of trailers with rear impact guards with PCI.[85] About 26 percent of fatal light vehicle crashes into the rear of trailers occur at speeds of 56 km/h (35 mph) or less, the speeds at which this rule would be effective. Thus, the agency estimated that there are 19 fatalities (= 72 x 0.26) that occur in crashes with a relative velocity of 56 km/h (35 mph) or less.

CMVSS No. 223 guards may not be able to mitigate all fatalities in crashes into the rear of trailers with relative velocity of 56 km/h (35 mph) or less because some crashes may involve low overlap (30 percent or less) and some fatalities may be due to circumstances other than underride (e.g., unrestrained status of occupants). NHTSA thus assumed that the incremental effectiveness of CMVSS No. 223 compliant guards over FMVSS No. 224 compliant guards in preventing fatalities in light vehicle impacts with PCI into the rear of trailers with crash speeds less than 56 km/h (35 mph) is 50 percent.[86] Since only 26 percent of light vehicle crashes with PCI into the rear of trailers are at relative velocity less than or equal to 56 km/h, NHTSA estimated the overall effectiveness of upgrading to CMVSS No. 223 compliant guards to be 13 percent (= 26% x 50%).

Since a number of vehicles currently meet CMVSS No. 223, this benefit must be reduced by the proportion of new trailers already compliant with CMVSS No. 223, which the agency estimated to be 93 percent. Assuming 13 percent effectiveness of these guards in fatal crashes

---

[84] NHTSA did not include non-PCI crashes into the rear of trailers into the analysis of benefits of the final rule because the agency assumed that the passenger vehicle's restraint systems, when used, would mitigate injury.
[85] NHTSA only counted crashes into trailers with rear impact guards as these would be the only trailers that NHTSA assumes would equip upgraded rear impact guards and thus be affected by this rule.
[86] The estimation of rear impact guard effectiveness is detailed in the FRE. Fatalities and injuries would also depend on other factors such as occupant age, seat belt use, and crash dynamics. Considering these factors, and using engineering judgement we believe 50 percent is a reasonable estimate of the effectiveness of CMVSS compliant rear impact guards.

with PCI into the rear of trailers, the agency estimated that about 0.66 (= 72 x (1-0.93) x 0.13) lives would be saved annually by requiring all applicable trailers to be equipped with CMVSS No. 223 compliant guards. NHTSA estimated that a total of 2.7 serious injuries would also be prevented annually with this rear impact guard rule. Including fatalities and serious injuries, the agency estimated that 1.4 equivalent lives would be saved annually.

To determine the costs of the final rule, NHTSA considered the incremental fleet cost of equipping all applicable trailers with CMVSS No. 223 rear impact guards and the increased fuel costs resulting from the added weight CMVSS No. 223 compliant guards would place on trailers.

The average cost of a Canadian compliant rear impact guard was estimated as $492. The incremental cost of equipping CMVSS No. 223 compliant rear impact guards on applicable new trailers (those that are subject to FMVSS No. 223) was estimated as $229 per trailer. There were 243,873 trailers produced in 2013,[87] among which 65 percent were required to be equipped with rear impact guards. Of those, 93 percent were already equipped with CMVSS No. 223 compliant guards. The annual incremental fleet cost of equipping all applicable trailers with CMVSS No. 223 rear impact guards was estimated at $2.5 million (= 243,873 x 0.65 x (1.0-0.94) x $229). NHTSA determined that upgrading from the FMVSS No. 223 compliant guard to the CMVSS No. 223 compliant guard would add an average incremental weight of 22.2 kg (48.9 lb) to the trailer, thereby reducing the overall fuel economy during the lifetime of the trailer. The incremental increase in lifetime fuel cost for a 22.2 kg (48.9 lb) weight increase of a trailer was estimated to be $1,042.2 and $927.7 discounted at 3 percent and 7 percent, respectively. The annual incremental lifetime fuel cost of equipping all applicable trailers with CMVSS No. 223

[87] http://trailer-bodybuilders.com/trailer-output/2014-trailer-production-figures-table

rear impact guards was estimated as $9.2 million and $8.2 million in 2013 dollars discounted at 3 percent and 7 percent, respectively.

The agency estimated that the net cost per equivalent lives saved would be $9.1 million and $9.5 million in 2013 dollars discounted at 3 percent and 7 percent, respectively. At 3 percent discount rate, the net benefit of the proposed rule would be $0.59 million. At 7 percent discount rate, the net benefit of the proposed rule would be $0.13 million.

**Comments.** NHTSA received several comments on the estimates provided in the NPRM. A few commenters suggested NHTSA should not conduct a benefit-cost analysis for a safety focused regulation in the first place and/or should comply with Vision Zero and make saving human life a priority over monetary issues. Some others believed that NHTSA's benefit-cost analysis was fundamentally flawed because, they argued: safety-related benefits should intrinsically outweigh costs related to upgrading equipment, NHTSA should not shift the costs of its rule to the public at the benefit of truckers, or that NHTSA should use costs only to compare outcomes that involved a rear impact guard not failing upon collision.

**Agency Response.** NHTSA implements its regulatory, enforcement, and oversight authority provided by the National Traffic and Motor Vehicle Safety Act (49 U.S.C. Chapter 301) (Safety Act) to protect all members of the public. NHTSA's authority to issue Federal motor vehicle safety standard is set forth in sections 30111 of the Safety Act. Each safety standard must be practicable, meet the need for motor vehicle safety, and be stated in objective terms. When issuing a safety standard, NHTSA must consider, among other things, relevant motor vehicle safety information, whether a standard is reasonable, practicable, and appropriate for the particular type of motor vehicle or motor vehicle equipment for which it is prescribed,

and the extent to which the standard will carry out section 30101 of the Act.[88] NHTSA issues its regulations in accordance with agency and Departmental regulations and in conformity with Executive Orders (E.O.).

Safety is of utmost importance, and NHTSA pursues such safety to the degree possible in accordance with its statutory authority and as instructed by Executive Order. Under the Safety Act, the reasonableness and practicability of a standard (both technologically and economically) must be considered. Under E.O. 12866, agencies are instructed to undertake a benefit-cost analysis to inform its rulemaking decisions to ensure agency regulations protect and improve the public's health, safety, environment, and well-being and improves the performance of the economy without imposing unacceptable or unreasonable costs on society. Thus, in response to commenters who urge us to adopt safety standards without regard to costs, we cannot do so under the Safety Act and the E.O.

NHTSA also cannot measure safety-related benefits categorically differently from costs, as requested by several commenters. Under E.O. 12866, as specified in Office of Management and Budget (OMB) Circular A-4, agencies must quantify and value safety impacts to compare them to the costs of the regulation. Agencies do so by calculating the value of the loss of life using a metric called the Value of a Statistical Life (VSL). The VSL includes costs such as medical care, reduced income, and the effects fatalities and injuries may have on family members. NHTSA uses the VSL to determine the monetary value of reducing fatalities and injuries, which NHTSA then compares to estimated costs of a regulation. NHTSA cannot arbitrarily increase the value of benefits outside of this framework.

[88] Section 30101 sets forth the purpose and policy of the Safety Act.

Some commenters also raised issues with what they viewed as specific shortcomings in the PRE's benefit-cost analysis. Some believed NHTSA did not properly consider all necessary variables in its analysis. For example, Network stated that NHTSA did not consider new technology or what it claimed to be the negative consumer choices fueled by fear to adopt smaller and lighter fuel-efficient vehicles due to increased crash incompatibility. Mr. Karth believed NHTSA should consider "what a parent would pay to protect their children," the "impact upon a family if a bread-winner is injured or lost," and "the medical expenses to care for a severely injured individual." Ms. Karth believed NHTSA's benefit-cost analysis did not "take into consideration the circumstances and costs of the full extent of underride research."

NHTSA has prepared a Final Regulatory Evaluation (FRE) for this final rule and has placed a copy of the FRE in the docket.[89] The FRE for this final rule discusses and explains the agency's final estimates for the benefits and cost that would result from this rulemaking. The analysis and findings are not significantly different from those of the PRE.

NHTSA believes that it has properly calculated the applicable benefits and costs to its rule using the appropriate variables. We sought to estimate the benefits of the rule by determining the number of lives and serious injuries it would prevent over the current situation and then monetize that number using the VSL value. We then compared these benefits with the cost of the rule, the increased material and fuel costs that requiring rear impact guard upgrades would necessitate. These variables encompass the benefits and costs that this rule would impose. In the absence of sufficient information to quantify changes in consumer behavior, we do not believe that factoring in variables such as negative consumer choices resulting from the fear of underride collisions is appropriate.

[89] The FRE may be obtained by downloading it or by contacting Docket Management at the address or telephone number provided at the beginning of this document.

Some comments remarked on what were perceived to be NHTSA's overestimation of projected costs. Mr. Karth questioned NHTSA's calculations as being overstated, particularly emphasizing that the fuel costs NHTSA projected in the PRE did not turn out to be accurate. The commenter also believed NHTSA's benefit-cost analysis is faulty because manufacturers have been willing to "provide a better rear impact guard even without regulation." Ms. Karth commented that customers have shown they are willing to pay for trailers to be safer, and manufacturers have shown that they are willing to respond to that demand and produce safer trailers. Network believed that NHTSA used outdated costs when analyzing how much an upgraded rear impact guard would cost. Mr. Brown indicated that the costs of the regulation could "be distributed to many different people and products."

**Agency Response.** We disagree that we overestimated the costs of the rule. We determined the incremental cost of installing CMVSS No. 223 compliant guards on all trailers that would need to upgrade to new guards and the resulting increase in fuel costs such installation would cause. While commenters pointed to factors they believed NHTSA should have considered, we do not believe such considerations are appropriate. For example, Mr. and Ms. Karth suggested that manufacturers have been willing to provide a better rear impact guard and that consumers have shown that they are willing to pay more for vehicles to have upgraded rear impact guards. The fact, however, that some manufacturers and consumers may be willing to accept increased costs is not relevant to estimating the increased costs of the guards, which is a factor germane to an analysis that seeks to quantify the costs of the rule and analyze societal impacts. Similarly, while Network remarked that NHTSA's estimates for the value of an upgraded rear impact guard were too high, it did so by reflecting on what it thought the cost of a guard should be. NHTSA determined this cost by looking to the average cost of CMVSS No.

223 compliant guards on the market, which the agency believes reflects a more realistic and accurate value.

In response to Mr. Karth's comment regarding NHTSA's estimated fuel costs from the PRE, NHTSA followed well established procedures to estimate incremental fuel costs due to increased weight of the rear impact guards and the most recent information on fuel price. NHTSA considered the most up-to-date data in developing this final rule, updated its variables where necessary in the FRE and used the most current data available to inform this rulemaking.

Some commentators stated that NHTSA underestimated the benefits of improved rear impact guards. According to Advocates, NHTSA based its calculation of the proposed rule's benefits on the agency's belief that only 26 percent of light vehicle occupant fatal crashes into the rear of trailers with rear impact guards that resulted in PCI occur at speeds of 35 mph or less. Advocates believed that using this number "significantly reduced the agency's estimate of the number of crashes and occupants that could be aided by the upgrade in rear protection guards" because it is based on speed estimates, which Advocates considers "notoriously inaccurate." TSC similarly commented that NHTSA derived speed estimates from "inconsistent, unreliable sources" and failed to count instances of PCI properly, resulting in NHTSA's underestimating the benefits of the intended rule.

**Agency Response.** NHTSA has analyzed the comments and believes it has properly calculated the benefits of this rulemaking. The agency determined the number of fatalities and serious injuries this rule would prevent by analyzing the supplemented TIFA data from the 2013 UMTRI Study. This data source is the most accurate available to determine the number of fatalities and serious injuries currently caused by fatal light vehicle crashes into the rear of trailers with PCI at speeds of 56 km/h (35 mph) or less--the crashes NHTSA is targeting in this

rule. We have used these data appropriately for determining the target population and estimating the benefits and in accordance with OMB Circular A-4[90] guidance on the development of regulatory analysis. NHTSA also notes that, while commenters objected to using data based on speed estimates and determinations of PCI, they did not present any alternative data source they believed was more reliable. The TIFA data have been thoroughly apprised for accuracy and are the best data available for an analysis of benefits. NHTSA has concluded the data are sufficient to proceed with quantifying the benefits of this rulemaking and to proceed to a final rule.

**Summary of the Final Regulatory Evaluation**

The estimated benefits and costs of the FRE are along the same lines as those in the PRE. In the FRE, NHTSA determined that 94 percent of applicable new trailers are now equipped with rear impact guards that are compliant with the updated FMVSS No. 223 requirements. Additionally, NHTSA updated the value of statistical life (VSL) in accordance with the March 2021 Department of Transportation revised guidance regarding the treatment of the economic value of a statistical life in U.S Department of Transportation regulatory analyses (2021 Update).[91]

Assuming 13 percent effectiveness of these guards in fatal crashes with PCI into the rear of trailers, the agency estimates that about 0.56 (= 72 x (1-0.94) x 0.13) lives would be saved annually by requiring all applicable trailers to be equipped with CMVSS No. 223 compliant guards. The agency also estimates that a total of 3.5 serious injuries would be prevented

[90] https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/.
[91] For more information, please see a 2021 Office of the Secretary memorandum on the "Guidance on Treatment of the Economic Value of a Statistical Life in U.S. Department of Transportation Analyses – 2021 Update." http://www.dot.gov/policy/transportation-policy/economy

annually with the rear impact guard final rule. Including fatalities and serious injuries, the rule would result in an estimated 1.4 equivalent lives saved annually.

NHTSA estimates the annual incremental fleet cost of equipping all applicable trailers with CMVSS No. 223 rear impact guards to be $2.1 million based on an average increase in cost of $254.35 per guard. The annual incremental lifetime fuel cost, based on an average weight increase of 48.9 pound per vehicle, is estimated to be $5.59 million and $4.43 million discounted at 3 percent and 7 percent, respectively. Therefore, the total cost of the final rule, including material and fuel costs, is $7.69 million discounted at 3 percent and $6.54 million discounted at 7 percent.

The agency estimates that the cost per equivalent life saved is $6.77 million and $7.25 million discounted at 3 percent and 7 percent, respectively, as shown in Table 5. A summary of the regulatory cost and net benefit of the final rule at the 3 percent and 7 percent discount rates are presented in Table 6. At 3 percent discount rate, the net benefit of the final rule is $6.04 million. At 7 percent discount rate, the net benefit of the final rule is $4.36 million.

**Table 5. Cost per Equivalent Life Saved (in Millions of 2020 dollars)**

| Discount Rate | Undiscounted | 3% | 7% |
|---|---|---|---|
| Total Cost | $9.00 | $7.69 | $6.54 |
| Equivalent Lives Saved | 1.40 | 1.14 | 0.90 |
| Cost per Equivalent Life Saved | $6.42 | $6.77 | $7.25 |

**Table 6. Net Benefits (in Millions of 2020 dollars)**

| Discount Rate | Undiscounted | 3% | 7% |
|---|---|---|---|
| Comprehensive Benefit | $16.96 | $13.73 | $10.90 |
| Total Cost | $9.00 | $7.69 | $6.54 |
| Net Benefit | $7.96 | $6.04 | $4.36 |

For further information regarding the aforementioned cost and benefit estimates, please reference the FRE that NHTSA placed in the docket.

## VIII. Regulatory Notices and Analyses

### Executive Order (E.O.) 12866 (Regulatory Planning and Review), E.O. 13563, and DOT Regulatory Policies and Procedures

We have considered the impacts of this final rule under Executive Orders 12866 and 13563, and the Department of Transportation's administrative rulemaking procedures. This final rule has been determined to be nonsignificant under E.O. 12866 and was not reviewed by OMB. We have discussed comments to the PRE and summarized the estimated costs, benefits, and cost-effectiveness of this final rule in the above section of this preamble, and in the FRE. NHTSA estimates that this final rule will save approximately 1.14 and 0.9 equivalent lives annually discounted at 3 percent and 7 percent, respectively. The total cost of the final rule, including material and fuel costs, is estimated to be $7.69 million discounted at 3 percent and $6.54 million discounted at 7 percent. The net cost per equivalent lives saved is $6.77 million and $7.25 million discounted at 3 percent and 7 percent, respectively. NHTSA's FRE fully discusses the estimated costs, benefits, and other impacts of this rule.

Consistent with E.O. 13563, NHTSA is amending FMVSS Nos. 223 and 224 because of retrospectively analyzing the effectiveness of the standards. NHTSA realized the merits of CMVSS No. 223 in addressing the same safety need that is the subject of FMVSS Nos. 223 and 224 and undertook this rulemaking to adopt upgraded strength and other requirements of CMVSS No. 223.

### Regulatory Flexibility Act

Pursuant to the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996), whenever an agency is required to publish a notice of proposed rulemaking or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effect of the rule on small entities (*i.e.*, small business, small organizations, and small governmental jurisdictions), unless the head of an agency certifies the rule will not have a significant economic impact on a substantial number of small entities. Agencies must also provide a statement of the factual basis for this certification.

I certify that this rule will not have a significant economic impact on a substantial number of small entities. NHTSA estimates there are 354 manufacturers of trailers in the U.S., 331 of which are small businesses. The impacts of this final rule on small trailer manufacturers would not be significant. This rule will make changes to the strength requirements applying to rear impact guards but will not affect the method by which small trailer manufacturers can certify compliance with FMVSS Nos. 223 and 224.

FMVSS No. 223, an equipment standard, specifies strength and energy absorption requirements in quasi-static force tests of rear impact guards sold for installation on new trailers and semitrailers. FMVSS No. 224, a vehicle standard, requires new trailers and semitrailers with a GVWR of 4,536 kg (10,000 lb) or more to be equipped with a rear impact guard meeting FMVSS No. 223. NHTSA established the two-standard approach to provide underride protection in a manner that imposes reasonable compliance burdens on small trailer manufacturers.

Under FMVSS No. 223, the guard may be tested for compliance while mounted to a test fixture or to a complete trailer. FMVSS No. 224 requires that the guard be mounted on the

trailer or semitrailer in accordance with the instructions provided with the guard by the guard manufacturer. Under this approach, a small manufacturer that produces relatively few trailers can certify its trailers to FMVSS No. 224 without feeling compelled to undertake destructive testing of what could be a substantial portion of its production. The two-standard approach was devised to provide small manufacturers a practicable and reasonable means of meeting the safety need served by a rear impact guard requirement. This final rule does not change the method of certifying compliance to the rear impact guard requirements of FMVSS Nos. 223 and 224.

**National Environmental Policy Act**

NHTSA has analyzed this final rule for the purposes of the National Environmental Policy Act and determined that it will not have any significant impact on the quality of the human environment.

**Executive Order 13132 (Federalism)**

NHTSA has examined this final rule pursuant to Executive Order 13132 (64 FR 43255, August 10, 1999) and concluded that no additional consultation with States, local governments or their representatives is mandated beyond the rulemaking process. The agency has concluded that the rulemaking would not have sufficient federalism implications to warrant consultation with State and local officials or the preparation of a federalism summary impact statement. The final rule will not have "substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government."

NHTSA rules can preempt in two ways. First, the National Traffic and Motor Vehicle Safety Act contains an express preemption provision: When a motor vehicle safety standard is in effect under this chapter, a State or a political subdivision of a State may prescribe or continue in

effect a standard applicable to the same aspect of performance of a motor vehicle or motor vehicle equipment only if the standard is identical to the standard prescribed under this chapter. 49 U.S.C. § 30103(b)(1). It is this statutory command by Congress that preempts any non-identical State legislative and administrative law addressing the same aspect of performance.

The express preemption provision described above is subject to a savings clause under which "[c]ompliance with a motor vehicle safety standard prescribed under this chapter does not exempt a person from liability at common law." 49 U.S.C. § 30103(e). Pursuant to this provision, State common law tort causes of action against motor vehicle manufacturers that might otherwise be preempted by the express preemption provision are generally preserved. However, the Supreme Court has recognized the possibility, in some instances, of implied preemption of such State common law tort causes of action by virtue of NHTSA's rules, even if not expressly preempted. This second way that NHTSA rules can preempt is dependent upon there being an actual conflict between an FMVSS and the higher standard that would effectively be imposed on motor vehicle manufacturers if someone obtained a State common law tort judgment against the manufacturer, notwithstanding the manufacturer's compliance with the NHTSA standard. Because most NHTSA standards established by an FMVSS are minimum standards, a State common law tort cause of action that seeks to impose a higher standard on motor vehicle manufacturers will generally not be preempted. However, if and when such a conflict does exist - for example, when the standard at issue is both a minimum and a maximum standard - the State common law tort cause of action is impliedly preempted. See Geier v. American Honda Motor Co., 529 U.S. 861 (2000).

Pursuant to Executive Order 13132 and 12988, NHTSA has considered whether this final rule could or should preempt State common law causes of action. The agency's ability to

announce its conclusion regarding the preemptive effect of one of its rules reduces the likelihood that preemption will be an issue in any subsequent tort litigation. To this end, the agency has examined the nature (e.g., the language and structure of the regulatory text) and objectives of this final rule and finds that this rule, like many NHTSA rules, prescribes only a minimum safety standard. As such, NHTSA does not intend that this final rule will preempt State tort law that would effectively impose a higher standard on motor vehicle manufacturers than that established by this rule. Establishment of a higher standard by means of State tort law would not conflict with the minimum standard in this final rule. Without any conflict, there could not be any implied preemption of a State common law tort cause of action.

**Executive Order 12988 (Civil Justice Reform)**

When promulgating a regulation, Executive Order 12988 specifically requires that the agency must make every reasonable effort to ensure that the regulation, as appropriate: (1) Specifies in clear language the preemptive effect; (2) specifies in clear language the effect on existing Federal law or regulation, including all provisions repealed, circumscribed, displaced, impaired, or modified; (3) provides a clear legal standard for affected conduct rather than a general standard, while promoting simplification and burden reduction; (4) specifies in clear language the retroactive effect; (5) specifies whether administrative proceedings are to be required before parties may file suit in court; (6) explicitly or implicitly defines key terms; and (7) addresses other important issues affecting clarity and general draftsmanship of regulations.

Pursuant to Executive Order 12988, NHTSA notes as follows: The preemptive effect of this final rule is discussed above in connection with Executive Order 13132. NHTSA notes further that there is no requirement that individuals submit a petition for reconsideration or pursue other administrative proceedings before they may file suit in court.

**Paperwork Reduction Act**

Under the Paperwork Reduction Act of 1995 (PRA), a person is not required to respond to a collection of information by a Federal agency unless the collection displays a valid OMB control number. Before seeking OMB approval, Federal agencies must provide a 60-day public comment period and otherwise consult with members of the public and affected agencies concerning each collection of information requirement. There are no PRA requirements associated with this final rule.

**National Technology Transfer and Advancement Act**

Under the National Technology Transfer and Advancement Act of 1995 (NTIAA) (Pub. L. 104-113, all Federal agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments. Voluntary consensus standards are technical standards (*e.g.*, material specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies, such as the International Organization for Standardization (ISO) and the Society of Automotive Engineers (SAE). The NTTAA directs us to provide Congress, through OMB, explanations when we decide not to use available and applicable voluntary consensus standards.

This final rule will adopt requirements of CMVSS No. 223. NHTSA's consideration of CMVSS No. 223 accords with the principles of NTTAA, in that NHTSA is considering an established, proven standard, and has not had to expend significant agency resources on the same safety need addressed by CMVSS No. 223.

**Unfunded Mandates Reform Act**

Section 202 of the Unfunded Mandates Reform Act of 1995 (UMRA), Pub. L. 104-4, requires Federal agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of more than $100 million annually (adjusted for inflation with base year of 1995). After analyzing the costs of this final rule, it will not result in expenditures by any of the aforementioned entities of over $100 million annually.

**Executive Order 13609 (Promoting International Regulatory Cooperation)**

The policy statement in section 1 of Executive Order 13609 provides in part:

> The regulatory approaches taken by foreign governments may differ from those taken by U.S. regulatory agencies to address similar issues. In some cases, the differences between the regulatory approaches of U.S. agencies and those of their foreign counterparts might not be necessary and might impair the ability of American businesses to export and compete internationally. In meeting shared challenges involving health, safety, labor, security, environmental, and other issues, international regulatory cooperation can identify approaches that are at least as protective as those that are or would be adopted in the absence of such cooperation. International regulatory cooperation can also reduce, eliminate, or prevent unnecessary differences in regulatory requirements.

This final rule adopts requirements of CMVSS No. 223 to upgrade FMVSS Nos. 223 and 224. NHTSA recognizes that these requirements are different from those in the European standard, ECE R.58, "Rear underrun protective devices (RUPD); Vehicles with regard to the installation of an RUPD of an approved vehicle; Vehicles with regard to their rear underrun protection."[92] R.58 specifies requirements that are similar to, but less stringent than, the current standards in FMVSS Nos. 223 and 224. R.58 specifies a quasi-static loading test of 25 kN at P1, 25 kN at P2, and 100 kN at P3. R.58 also does not specify any energy absorption requirements.

[92] Economic Commission of Europe (ECE) R.58, "Rear underrun protective devices (RUPDs); Vehicles with regard to the installation of an RUPD of an approved type; Vehicles with regard to their rear underrun protection (RUP)," February 2019, http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29regs/2017/R058r3e.pdf.

NHTSA has decided to adopt the strength requirements of CMVSS No. 223 rather than ECE R.58 because the rear impact protection requirements for trailers in Canada are more stringent than that in Europe and more appropriate for the underride crashes experienced in the U.S. Passenger vehicles in the U.S. are required by FMVSS No. 208 to have frontal air bag protection and comply with a full frontal 56 km/h (35 mph) rigid barrier crash test by ensuring that the injury measures of crash test dummies restrained in front seating positions are within the allowable limits. CMVSS No. 223 is designed to prevent PCI in full frontal 56 km/h (35 mph) crashes. Together, FMVSS No. 208 and FMVSS Nos. 223 and 224 will significantly reduce the harm resulting to occupants of passenger vehicles impacting the rear of trailers in crashes of up to 56 km/h (35 mph).

**Plain Language**

Executive Order 12866 require each agency to write all rules in plain language. Application of the principles of plain language includes consideration of the following questions:

- Has the agency organized the material to suit the public's needs?
- Are the requirements in the rule clearly stated?
- Does the rule contain technical language or jargon that is not clear?
- Would a different format (grouping and order of sections, use of headings, paragraphing) make the rule easier to understand?
- Would more (but shorter) sections be better?
- Could the agency improve clarity by adding tables, lists, or diagrams?
- What else could the agency do to make this rulemaking easier to understand?

If you have any responses to these questions, please send them to NHTSA.

**Privacy Act**

In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public to better inform its rulemaking process. DOT posts these comments, without edit, including any personal information the commenter provides, to www.regulations.gov, as described in the system of records notice (DOT/ALL–14 FDMS), which can be reviewed at www.dot.gov/privacy.

**Regulation Identifier Number**

The Department of Transportation assigns a regulation identifier number (RIN) to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. You may use the RIN contained in the hearing at the beginning of this document to find this action in the Unified Agenda.

**List of Subjects in 49 CFR Part 571**

Motor vehicle safety, Motor Vehicles, Reporting and record keeping requirements, Tires.

In consideration of the foregoing, NHTSA amends 49 CFR part 571 to read as follows:

**PART 571 – FEDERAL MOTOR VEHICLE SAFETY STANDARDS**

1. The authority citation for part 571 continues to read as follows:

**Authority:** 49 U.S.C. 322, 30111, 30115, 30117 and 30166; delegation of authority at 49 CFR 1.95.

2. Section 571.223 is amended by:

a. Revising S3;

b. Amending S4 by adding definitions of “ground clearance” and “load path,” in alphabetical order

c. Revising S5.2; S5.5(c); the introductory text of S6; S6.3; the introductory texts of S6.4, S6.4(a), and S6.4(b);

d. Removing S6.4(c);

e. Revising the introductory text of S6.5 and S6.5(a)

f. Adding S6.5(c)

g. Revising the introductory text of S6.6, S6.6(b), and S6.6(c);

f. Adding S6.7 through S6.9; and

g. Revising Figures 1 and 2 and adding Figures 3 and 4.

The added and amended text and figures read as follows:

**§ 571.223 Standard No. 223; Rear impact guards**

* * * * *

S3. *Application*. This standard applies to rear impact guards for trailers and semitrailers subject to Federal Motor Vehicle Safety Standard No. 224, *Rear Impact Protection* (§ 571.224).

S4.

* * * * *

*Ground clearance* means the vertical distance from the bottom edge of a horizontal member to the ground.

* * * * *

*Load path* means a route of force transmission between the horizontal member and the chassis.

* * * * *

S5.2 *Strength and Energy Absorption*. When tested under the procedures of S6 of this section, each guard shall comply with the strength requirements of S5.2.1 of this section at each test location and the energy absorption requirements of S5.2.2 of this section when a distributed load is applied uniformly across the horizontal member, as specified in S6.8 of this section. However, a particular guard (*i.e.*, test specimen) need not be tested at more than one location.

S5.2.1 *Guard Strength*. The guard must resist the force levels specified in S5.2.1(a) through (c) of this section without deflecting by more than 125 mm and without eliminating any load path that existed before the test was initiated.

(a) A force of 50,000 N applied in accordance with S6.6 at test location P1 on either the left or the right side of the guard as defined in S6.4(a) of this section.

(b) A force of 50,000 N applied in accordance with S6.6 at test location P2 as defined in S6.4(b) of this section.

(c) A uniform distributed force of at least 350,000 N applied across the horizontal member, as specified in S6.8 and in accordance with S6.6.

S5.2.2 Guard Energy Absorption.

(a) A guard, other than a hydraulic guard or one installed on a tanker trailer, when subjected to a uniform distributed load applied in accordance with S6.6(c) of this section:

(1) shall absorb by plastic deformation at least 20,000 J of energy within the first 125 mm of deflection without eliminating any load path that existed before the test was initiated; and

(2) have a ground clearance not exceeding 560 mm, measured at each support to which the horizontal member is attached, as shown in Figure 4, after completion of the load application.

(b) A guard, other than a hydraulic guard or one installed on a tanker trailer, that demonstrates resistance to a uniform distributed load greater than 700,000 N applied in accordance with S6.6(b) of this section, need not meet the energy absorption requirements of S5.2.2(a) but must have a ground clearance not exceeding 560 mm at each vertical support to which the horizontal member is attached after completion of the 700,000 N load application.

* * * * *

S5.5

* * * * *

(c) An explanation of the method of attaching the guard to the chassis of each vehicle make and model listed or to the design elements specified in the instructions or procedures. The principal aspects of vehicle chassis configuration that are necessary to the proper functioning of the guard shall be specified including the maximum allowable vertical distance between the bottom edge of the horizontal member of the guard and the ground to ensure post-test ground clearance requirements are met. If the chassis strength is inadequate for the guard design, the instructions or procedures shall specify methods for adequately reinforcing the vehicle chassis. Procedures for properly installing any guard attachment hardware shall be provided.

S6. *Guard Test Procedures*. The procedures for determining compliance with S5.2 of this section are specified in S6.1 through S6.9 of this section.

* * * * *

S6.3 *Point Load Force Application Device*. The force application device employed in S6.6 of this section consists of a rectangular solid made of rigid steel. The steel solid is 203 mm in height, 203 mm in width, and 25 mm in thickness. The 203 mm by 203 mm face of the block is used as the contact surface for application of the forces specified in S5.2.1(a) and (b) of this section. Each edge of the contact surface of the block has a radius of curvature of 5 mm plus or minus 1 mm.

S6.4 *Point Load Test Locations*. With the guard mounted to the rigid test fixture or to a complete trailer, determine the test locations P1 and P2 in accordance with the procedure set forth in S6.4(a) and (b) of this section. See Figure 1 of this section.

(a) Point Load Test location P1 is the point on the rearmost surface of the horizontal member of the guard that:

* * * * *

(b) Point Load Test location P2 is the point on the rearmost surface of the horizontal member of the guard that:

* * * * *

S6.5 *Positioning of Force Application Device*. Before applying any force to the guard, locate the force application device specified in S6.3 for the point load test location and that specified in S6.7 for the uniform distributed load test location, such that:

(a) The center point of the contact surface of the force application device is aligned with and touching the guard test location, as defined by the specifications of S6.4 of this section for the point load test locations, and S6.8 of this section for the uniform distributed load test location.

* * * * *

(c) If the guard is tested on a rigid test fixture, the vertical distance from the bottom edge of the horizontal member to the ground at the location of each support to which the horizontal member is attached, shall be measured.

S6.6 *Force Application*. After the force application device has been positioned according to S6.5 of this section, at the point load test locations specified in S6.4 of this section or the uniform distributed load test location specified in S6.8 of this section, apply the loads specified in S5.2 of this section. Load application procedures are specified in S6.6(a) through (d) of this section.

* * * * *

(b) If conducting a strength test to satisfy the requirement of S5.2.1 or S5.2.2(b) of this section, the force is applied until the forces specified in S5.2.1 or S5.2.2(b) of this section have

been exceeded, or until the displacement of the force application device has reached at least 125 mm whichever occurs first.

(c) If conducting a test to be used for the calculation of energy absorption levels to satisfy the requirement of S5.2.2(a) of this section, apply a uniform distributed force to the guard until displacement of the force application device, specified in S6.7 of this section, has reached 125 mm. For calculation of guard energy absorption, the value of force is recorded at least ten times per 25 mm of displacement of the contact surface of the loading device. Reduce the force until the guard no longer offers resistance to the force application device. Produce a force vs. deflection diagram of the type shown in Figure 2 of this section using this information. Determine the energy absorbed by the guard by calculating the shaded area bounded by the curve in the force vs. deflection diagram and the abscissa (X-axis).

* * * * *

S6.7 *Uniform Distributed Load Force Application Device*. The force application device to be employed in applying the uniform distributed load is to be unyielding, have a height of 203 mm, and have a width that exceeds the distance between the outside edges of the outermost supports to which the tested portion of the horizontal member is attached, as shown in Figure 3.

S6.8 *Uniform Distributed Load Test Location*. With the guard mounted to the rigid test fixture or to a complete trailer, determine the test location in accordance with the following procedure. See Figure 3 of this section. Distributed Force Test location is the plane on the rearmost surface of the horizontal member of the guard that:

(a) Is centered in the longitudinal vertical plane passing through the center of the guard's horizontal member; and

(b) Is centered 50 mm above the bottom of the guard.

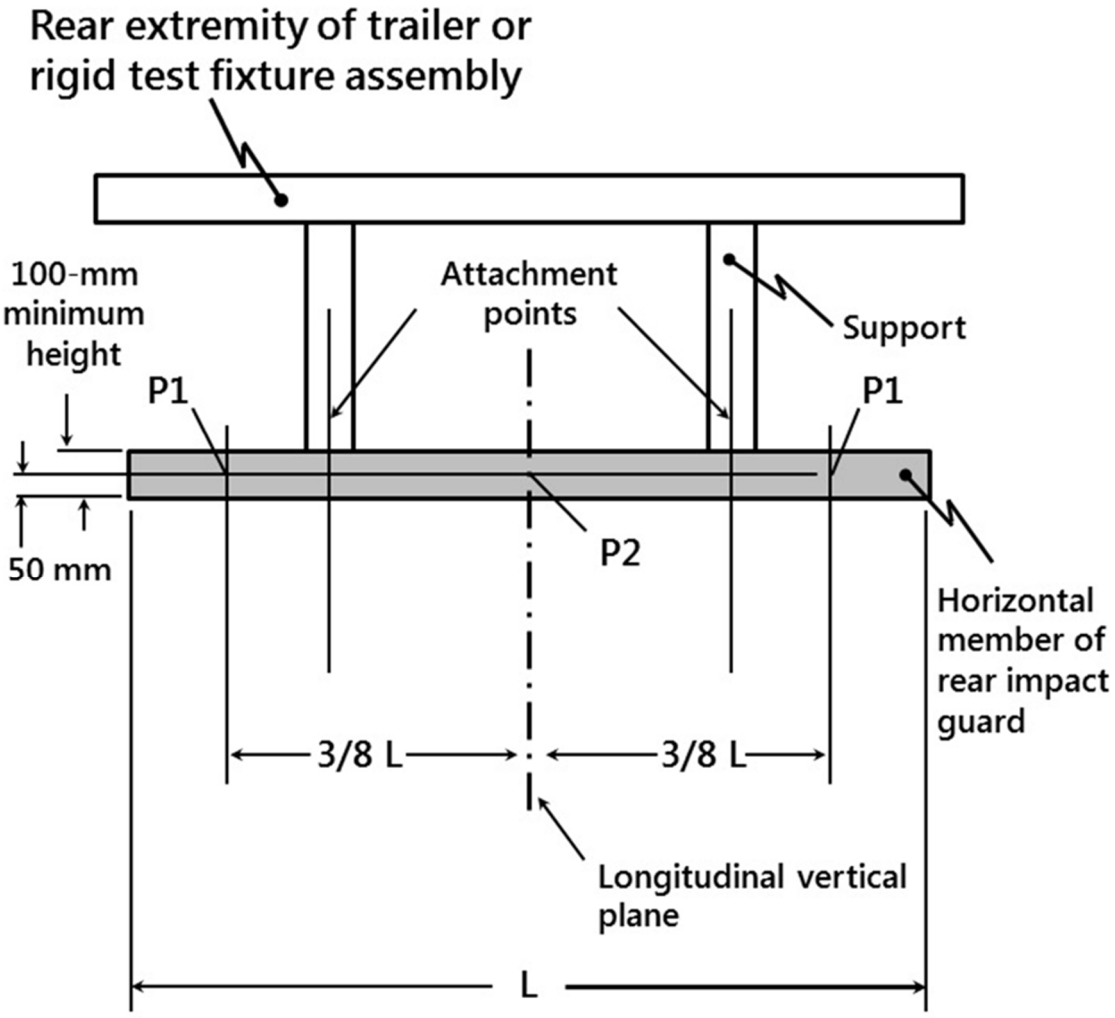
S6.9 Ground Clearance Measurement.

(a) For the test device attached to a complete trailer as specified in S6.2, the ground clearance of the guard at the vertical supports to which the horizontal member is attached shall be measured after completion of the uniform distributed load test in accordance with S6.6(b) or S6.6(c) of this section.

(b) For the test device attached to a rigid test fixture as specified in S6.2, the vertical distance from the ground to the bottom edge of the horizontal member at the vertical supports to which the horizontal member is attached shall be measured after completion of the uniform distributed load test in accordance with S6.6(b) or S6.6(c) of this section and subtracted from the corresponding ground clearance measured before the load application in accordance with S6.5(c). The difference in ground clearance before and after the load application is added to the allowable maximum vertical distance between the bottom edge of the horizontal member of the guard and the ground as specified in S5.5(c), to obtain the ground clearance after completion of the uniform distributed load test.

FIGURES TO § 571.223

**FIGURE 1: REAR VIEW OF THE REAR IMPACT GUARD**




Notes:
1. L means width of the horizontal member.
2. Drawing not to scale

(Note: Drawing is not to scale)

**FIGURE 2: TYPICAL FORCE DEFLECTION DIAGRAM**

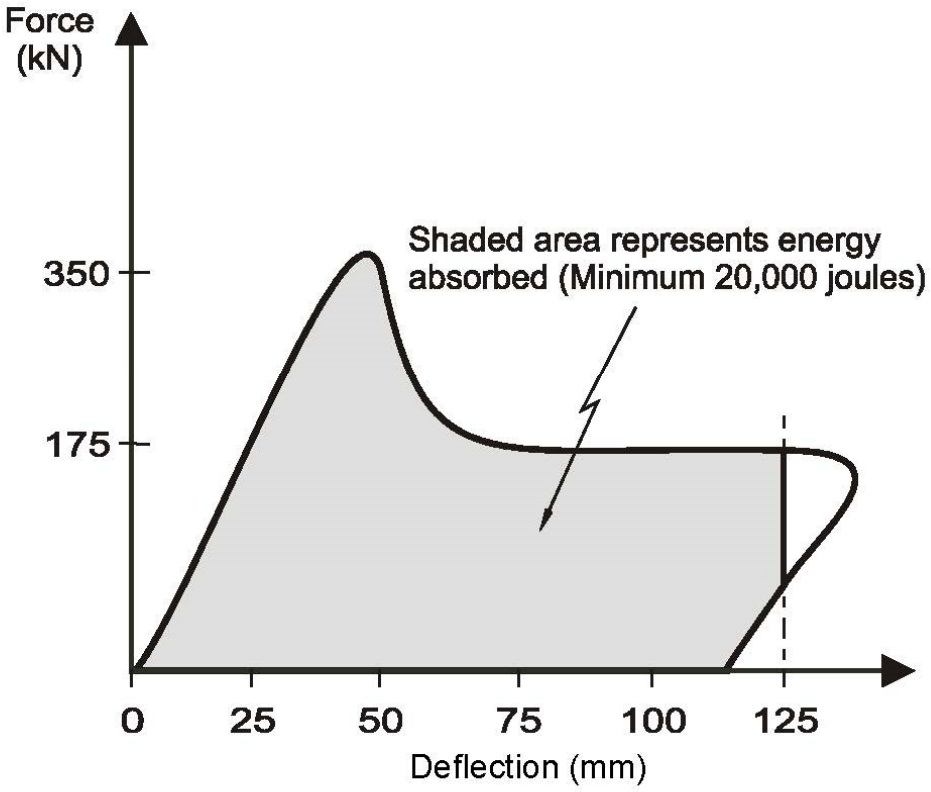
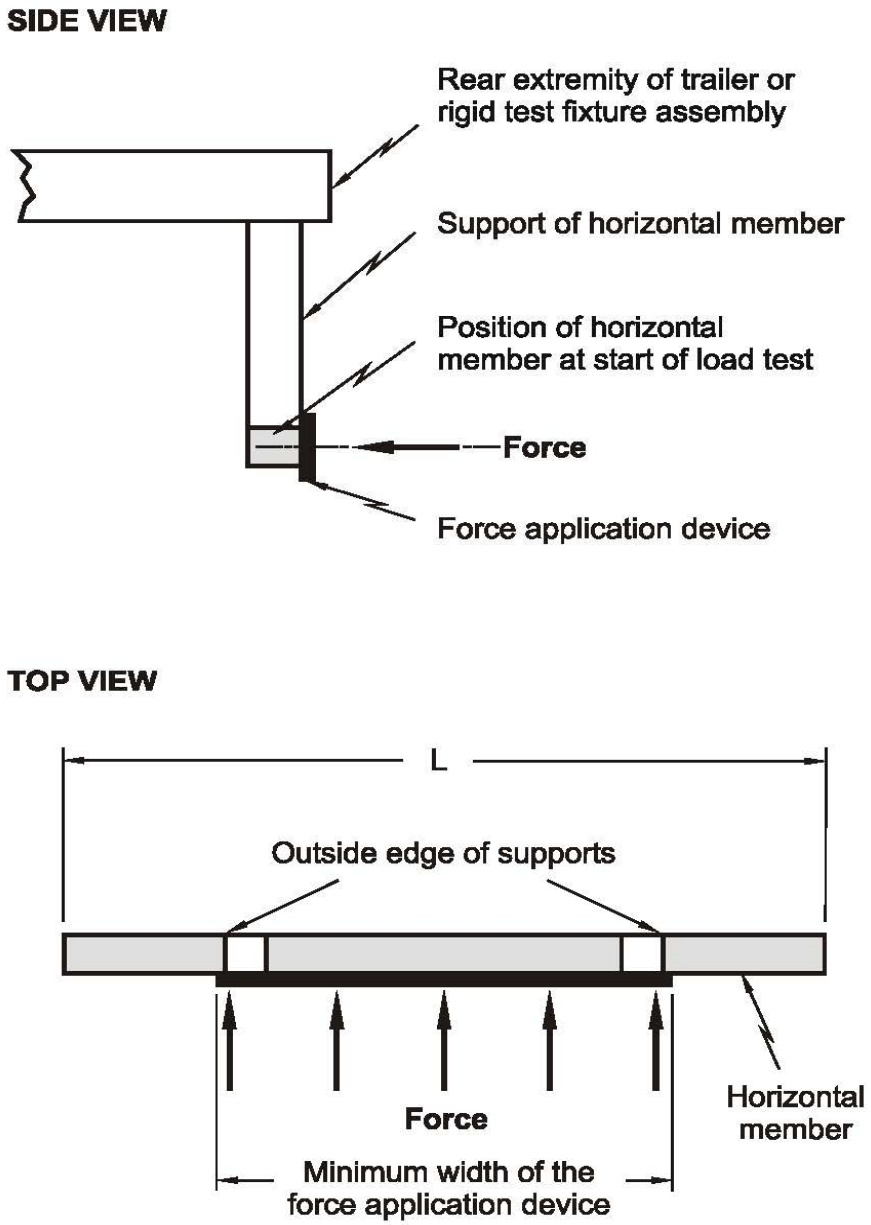


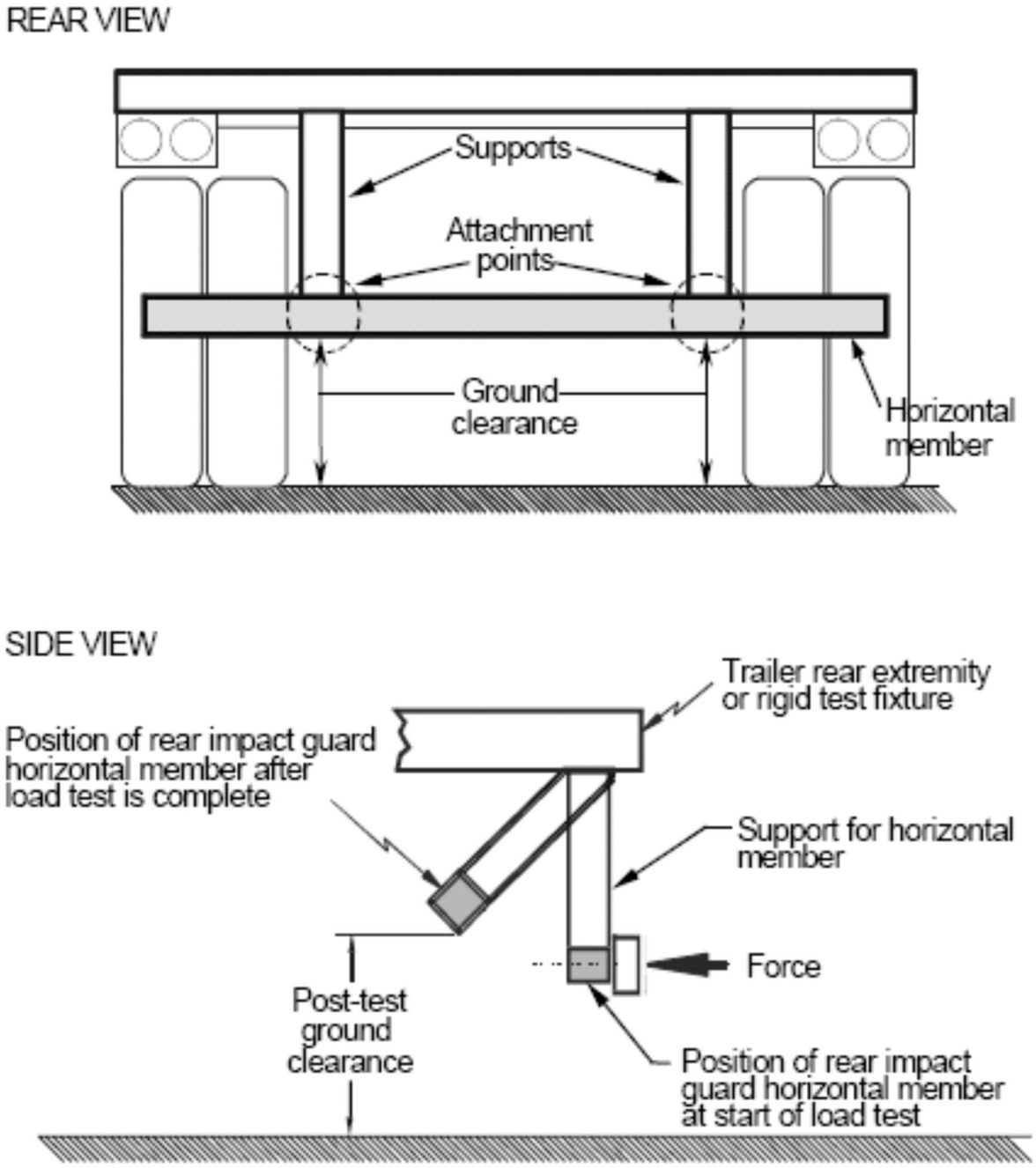
**FIGURE 3: UNIFORM DISTRIBUTED LOAD APPLICATION TEST**




Notes:
1. L means width of the horizontal member.
2. Drawings not to scale

(Note: Drawings are not to scale)

**FIGURE 4: POST-TEST GROUND CLEARANCE MEASUREMENT**




(Note: Drawings are not to scale)

3. Section 571.224 is amended by:

**a.** Revising the second sentence in S3; and

**b.** Revising the definition of "Rear extremity" in S4.

**§ 571.224 Standard No. 224; Rear impact protection.**

* * * * *

S3. *Application*. * * * The standard does not apply to pole trailers, pulpwood trailers, low chassis vehicles, road construction controlled horizontal discharge trailers, special purpose vehicles, wheels back vehicles, or temporary living quarters as defined in 49 CFR 523.2.

* * * * *

*Rear extremity* means the rearmost point on a trailer that is above a horizontal plane located above the ground clearance and below a horizontal plane located 1,900 mm above the ground when the trailer is configured as specified in S5.1 and when the trailer's cargo doors, tailgate and other permanent structures are positioned as they normally are when the trailer is in motion, with non-structural protrusions excluded from the determination of the rearmost point, such as:

(a) Tail lamps,

(b) Rubber bumpers,

(c) Hinges and latches, and

(d) Flexible aerodynamic devices capable of being folded to within 305 mm from the transverse vertical plane tangent to the rear most surface of the horizontal member for vertical heights below 1,740 mm above ground and, when positioned as they normally are when the trailer is in motion, are located forward of the transverse plane that is tangent to the rear bottom

edge of the horizontal member and intersecting a point located 1,210 mm rearward of the horizontal member and 1,740 mm above the ground.

* * * * *

Issued under authority delegated in 49 CFR 1.95 and 501.5.

_____
Steven S. Cliff
Administrator

Billing Code: 4910-59-P