

DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

49 CFR Part 224

[Docket No. FRA–2021–0080, Notice No. 2]

RIN 2130–AC77

Reflectorization of Rail Freight Rolling Stock; Codifying Existing Waivers

AGENCY: Federal Railroad Administration (FRA), Department of Transportation (DOT).

ACTION: Final rule.

SUMMARY: This rule amends the standards for Reflectorization of Rail Freight Rolling Stock (Reflectorization Standards or Part 224) to codify waivers and remove the outdated implementation schedule. The changes are expected to enhance safety, promote innovation, clarify existing requirements, and reduce unnecessary paperwork burdens. The amendments are consistent with the mandate of the Infrastructure Investment and Jobs Act (IIJA), which requires FRA to review and analyze certain longstanding waivers to determine whether incorporating the waivers into FRA’s regulations is justified.

DATES: This final rule is effective January 27, 2026.

ADDRESSES: *Docket:* For access to the docket to read background documents or comments received, go to <https://www.regulations.gov> and follow the online instructions for accessing the docket.

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SUPPLEMENTARY INFORMATION:

Abbreviations and Terms Used in This Document

AAR—Association of American Railroads
ASLRRA—American Short Line and Regional Railroad Association
CFR—Code of Federal Regulations
DOT—U.S. Department of Transportation
EA—Environmental Assessment
EIS—Environmental Impact Statement
FR—Federal Register
FRA—Federal Railroad Administration
GS—General Schedule
IIJA—Infrastructure Investment and Jobs Act (Pub. L. 117–58)
IRFA—Initial Regulatory Flexibility Analysis
LED—Light-Emitting Diode
MOW—Maintenance of Way
NEPA—National Environmental Policy Act

NPRM—Notice of Proposed Rulemaking
OMB—Office of Management and Budget
PRA—The Paperwork Reduction Act
RFI—Request for Information
RIT—Run-Into-Train
RRA—Running Repair Agent
RSI—Railway Supply Institute
S–916—AAR’s Standard S–916; Retroreflective Comparator Panel Requirements
SCABT—Single Car Air Brake Test
STB—Surface Transportation Board
THEERP—Tourist, Historic, Excursion, Educational, Recreational, or Private
TTI—Texas A&M Transportation Institute
UMLER—Universal Machine Language Equipment Register
U.S.C.—United States Code

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I. Executive Summary

Purpose of the Regulatory Action

Consistent with E.O. 14192, Unleashing Prosperity Through Deregulation (90 FR 9065, Feb. 6, 2025), and E.O. 14219, Ensuring Lawful Governance and Implementing the President’s “Department of Government Efficiency” Deregulatory Initiative (90 FR 10583, Feb. 25, 2025), FRA is reviewing its regulatory requirements in parts 200 through 299 of title 49, Code of Federal Regulations (CFR). This final rule is based on FRA’s review of the Reflectorization Standards in part 224. This rule is expected to enhance safety, promote innovation, reduce unnecessary costs, and clarify existing requirements.

This rule also responds to the mandate of section 22411 of IJJA (Pub. L. 117–58), codified at 49 U.S.C. 20103(d)(4), which requires the Secretary to review and analyze existing waivers issued under 49 U.S.C. 20103 that have been in continuous effect for a 6-year period to determine whether issuing a rule implementing the waiver provisions is in the public interest and consistent with railroad safety. After conducting the appropriate analysis, if the Secretary concludes that it would be in the public interest and consistent with railroad safety to initiate a rulemaking to incorporate into the regulations the relevant aspects of the waivers analyzed, section 22411 specifically authorizes the Secretary to initiate such a rulemaking.

Summary of the Regulatory Action

Part 224, Reflectorization of Rail Freight Rolling Stock (Reflectorization Standards or Part 224) contains minimum safety requirements to help motor vehicle operators see rail freight rolling stock at night and under conditions of poor visibility. Part 224 was designed to reduce the number and severity of highway-rail grade crossing accidents and deaths, injuries, and property damage resulting from those accidents. Generally, FRA has provided two types of relief, in the form of waivers, from part 224’s requirements: (1) relief to THEERP operations;¹ and (2) relief to allow the use of a performance-based method (comparator panels) to determine when to replace reflectorization sheeting.²

On July 21, 2022, FRA issued an NPRM proposing to codify those

¹ A list of active waivers FRA has issued to THEERP operations is available in the docket. For an example, see Docket No. FRA–2019–0047.

² Docket No. FRA–2015–0105, Document No. 1 (available at <https://www.regulations.gov/document/FRA-2015-0105-0001>).

waivers.³ As explained in the NPRM, FRA proposed to codify the waivers for two reasons. First, freight rolling stock used exclusively for THEERP purposes do not typically travel over low visibility highway-rail grade crossings at nighttime. Second, allowing for performance-based methods of reflectorization evaluation and replacement is a more reliable and accurate way to evaluate the effectiveness of the retroreflectivity of the required sheeting than part 224's current 10-year default replacement cycle. Codifying these waivers is expected to enhance safety (*i.e.*, by ensuring retroreflective sheeting is replaced when it is no longer effective), promote innovation, and reduce unnecessary paperwork burdens for both industry and FRA by eliminating the need to continue to use the waiver process for relief. Codifying these waivers will also provide the railroad industry with regulatory certainty as to the applicability of part 224 to equipment used for THEERP purposes.

In addition, FRA proposed to remove § 224.107, which has become outdated. Section 224.107 requires the locomotive fleet population to be fully equipped with part 224 compliant retroreflective sheeting by November 28, 2010, and the freight car fleet to be compliant by November 28, 2015.⁴ FRA proposed to remove this section because the

implementation dates have passed and are no longer necessary to have in the regulation.

Two comments to the NPRM were submitted by AAR and the Railway Supply Institute (RSI).⁵ As discussed in more detail below, the comments generally supported the proposal in the NPRM with some suggested revisions. In addition, in response to DOT's April 3, 2025 request for information (RFI) related to reducing regulatory burdens,⁶ AAR commented that FRA should finalize the NPRM and reiterated the revisions AAR requested in their comment to the NPRM.⁷

FRA reviewed the comments, and in response as described in more detail below, has clarified the inspection process for properly trained and experienced inspectors and to allow additional flexibility to conduct inspections in limited space. No other changes to the proposed rule text are provided in this final rule.

This final rule is effective immediately, consistent with 5 U.S.C. 553(d)(1), as it is "a substantive rule which grants or recognizes an exemption or relieves a restriction."

Costs and Benefits of the Regulatory Action

This rule eliminates the need for railroads to submit waiver petitions (and repeated extensions of those

waivers approximately every 5 years) from part 224 for certain older railroad equipment used in THEERP operations and eliminates the Federal Government's need to review and approve the waiver petitions and extension requests. In addition, the rule allows railroads and private car owners to replace retroreflective sheeting based on performance, instead of time, thus increasing efficient use of resources and reducing environmental waste from discarding retroreflective sheeting prior to the end of its useful life. FRA estimates there will be minor costs for purchasing and recalibration of the comparator panels used to evaluate retroreflective sheeting, and training employees in their use (about 0.2 percent of total final rule costs).

FRA expects the rule to enhance safety, promote innovation, clarify existing requirements, and reduce unnecessary burdens. Entities that have been operating under these waivers have not shown an increase in accidents/incidents. Also, retroreflective sheeting that is performing poorly will likely be replaced sooner under this rule's amendments than under the existing 10-year replacement cycle, better ensuring continued effectiveness of the sheeting. Overall, FRA estimates the rule will result in net benefits. FRA's estimates of benefits for the final rule are shown in the table below.

TABLE ES—1: SUMMARY OF TOTAL BENEFITS OVER THE 20-YEAR PERIOD
[2024 Dollars]

Impact	Undiscounted	Present value 7%	Present value 3%	Annualized 7%	Annualized 3%
Baseline Cost	\$722,686,030	\$382,807,968	\$537,587,568	\$36,134,364	\$36,134,329
<i>Baseline Costs consist of Visual Inspection & Replacement, 10-Year Renewal, Transportation of Cars Typically not Interchanged, and Waivers.</i>					
Final Rule Cost	549,991,943	291,377,977	409,151,953	27,504,020	27,501,438
<i>Final Rule Costs for Visual Inspection & Replacement; Periodic Evaluation & Retroreflective Sheeting Replacement (Performance-Based); Transportation of Cars Typically not Interchanged; 10-Year Renewal (@15% of Cars, Provides Flexibility for Small Entities); and Comparator Panel Purchase, Recalibration, and Employee Training.</i>					
Net Benefits *	172,694,087	91,429,991	128,435,615	8,630,344	8,632,891
Government Cost Savings for Waivers (from Baseline)	193,149	103,285	144,275	9,749	9,698
Qualitative Benefit: Reduced waste from not replacing effective reflective sheeting prematurely.					

* Net benefits from cost savings = baseline costs – final rule costs.

³ 87 FR 43467.

⁴ 49 U.S.C. 20148.

⁵ Docket No. FRA–2021–0080 (AAR comment at FRA–2021–0080–0002, <https://www.regulations.gov/comment/FRA-2021-0080-0002>).

www.regulations.gov/comment/FRA-2021-0080-0002, and RSI comment at FRA–2021–0080–0003, <https://www.regulations.gov/comment/FRA-2021-0080-0003>).

⁶ 90 FR 14593 (Apr. 3, 2025).

⁷ Docket No. DOT–OST–2025–0026, <https://www.regulations.gov/comment/DOT-OST-2025-0026-0829>.

II. Statutory and Regulatory Background

A. Existing Reflectorization Requirements

As discussed in the NPRM,⁸ the Reflectorization Standards are being updated to address two issues. First, the current requirement for the retroreflective sheeting to be applied on the sides of rail freight rolling stock to enhance the visibility of trains does not consider the utility of the requirement on THEERP operations. Second, the requirement that retroreflective sheeting be replaced every 10 years without considering its effectiveness are overly burdensome. As the rule was implemented, FRA's Railroad Safety Board (Board) granted a series of waivers: (1) excluding equipment used for THEERP purposes from the Reflectorization Standards;⁹ and (2) permitting freight railroads to develop and implement a performance-based alternative method to replace retroreflective sheeting when it is no longer effective.¹⁰

B. Waivers Excluding From Part 224 Rail Freight Rolling Stock Used Only for THEERP Purposes, Except for Incidental Freight Service

As discussed in the NPRM,¹¹ certain railroads petitioned for relief, because adding retroreflective sheeting to their equipment would detract from its aesthetic or historical nature. The railroads asserted THEERP operating conditions significantly reduce the benefit of retroreflective sheeting, which increases visibility of trains primarily during nighttime conditions and at passive grade crossings.

While monitoring implementation of these waivers, FRA reviewed all accident and incident reports from railroads operating under the waivers and identified no injuries or deaths that were attributable to the lack of part 224 reflectorization. Given the railroad industry's long-term success in safely operating under these waivers, FRA is codifying them in part 224. This change eliminates the need for further waivers and the associated employee hours spent on their documentation and requests for renewal approximately every five years.

C. Waivers Allowing Development and Testing of Alternative Methods (Comparator Panel Evaluation) To Determine When To Replace Retroreflective Sheeting.

As discussed in the NPRM,¹² AAR petitioned, and the Board granted,¹³ a waiver extending the replacement requirement for at least three years to develop an alternate evaluation method. AAR's testing showed that sheeting applied to rail cars more than nine years prior met or exceeded the Reflectorization Standards.¹⁴ AAR finalized the design, specifications, and procedures for a standard comparator panel for evaluating the effectiveness of retroreflective sheeting on rail freight rolling stock, and the Board approved use of AAR's comparator panel process in lieu of the 10-year replacement cycle.¹⁵

III. Overview and Technical Discussion of Requirements

A. Exclusion From Part 224 Rail Freight Rolling Stock Used Only for THEERP Purposes, Except for Incidental Freight Service

The Reflectorization Standards were developed because low visibility, particularly at highway-rail grade crossings, can contribute to motorists colliding with rail equipment (run-into train (RIT) accidents). As discussed in the NPRM,¹⁶ adding reflectorization to rail equipment reduces the likelihood of RIT accidents for conventional freight operations. Locomotives and passenger cars used exclusively in passenger service are excluded¹⁷ because the conspicuity of equipment used in conventional passenger service is significantly better than the conspicuity of equipment used in freight service.¹⁸

Similarly, retroreflective sheeting provides no clear safety benefit for equipment used exclusively for THEERP purposes because, like other passenger equipment, equipment used exclusively for THEERP purposes is generally more highly visible than conventional railroad equipment and is used in a

more protected operating environment. For these reasons, this final rule excludes equipment used for THEERP purposes from the Reflectorization Standards.

B. Allowing Alternative Methods (Comparator Panel Evaluation or Retroreflectometer Measurement) To Determine When To Replace Retroreflective Sheeting.

As noted in the NPRM and described above,¹⁹ pursuant to a waiver AAR developed an alternate method for evaluating the effectiveness of retroreflective sheeting more than 10 years old.²⁰ Following development, FRA agreed to allow a pilot program for AAR to test the comparator panel method in service.²¹ A trained railroad inspector would place a comparator panel immediately adjacent to, or overlapping, retroreflective sheeting installed on rail freight rolling stock and determine its relative brightness. When the comparator panel was equal to, or brighter than, the existing installed sheeting, the existing sheeting was replaced. Testing showed the comparator panel is an accurate and easy way to determine when retroreflective sheeting needs to be replaced in compliance with the Reflectorization Standards. Similarly, a retroreflectometer device can be used to take direct measurements of the sheeting and be an effective performance-based method for evaluating retroreflectivity. As such, this final rule adds comparator panel evaluation and direct measurements with a retroreflectometer, as alternative options to determine compliance with the Reflectorization Standards. These methods provide flexibility for the rail industry while, in most instances, enhancing safety because allowing for alternative methods of reflectorization evaluation and replacement is a more reliable and accurate way to evaluate the effectiveness of the retroreflective sheeting than part 224's current 10-year default replacement cycle.

1. The Existing 10-Year Replacement Cycle Ensures Effective Retroreflective Sheeting, but Often Requires Replacement Sooner Than Necessary

As discussed in the NPRM,²² the 10-year replacement cycle helps ensure rail

¹² 87 FR 43467 (Section II. C.).

¹³ Docket No. FRA-2015-0105, Document No. 1 (available at <https://www.regulations.gov/document/FRA-2015-0105-0001>).

¹⁴ Docket No. FRA-2015-0105, Document No. 9 (available at <https://www.regulations.gov/document/FRA-2015-0105-0009>).

¹⁵ Docket No. FRA-2015-0105, Document No. 21 (available at <https://www.regulations.gov/document/FRA-2015-0105-0021>); Docket No. FRA-2015-0105, Document No. 22 (available at <https://www.regulations.gov/document/FRA-2015-0105-0022>).

¹⁶ 87 FR 43467 (Section III. A.).

¹⁷ 49 CFR 224.3(c).

¹⁸ 70 FR 149.

¹⁹ 87 FR 43467 (Section III. B.).

²⁰ Docket No. FRA-2015-0105, Document No. 9 (available at <https://www.regulations.gov/document/FRA-2015-0105-0009>).

²¹ Docket No. FRA-2015-0105, Document No. 22 (available at <https://www.regulations.gov/document/FRA-2015-0105-0022>).

²² 87 FR 43467 (Section III. B. 1.).

⁸ 87 FR 43467.

⁹ A list of active waivers FRA has issued to THEERP operations is available in the docket.

¹⁰ Docket No. FRA-2015-0105, Document No. 1 (available at <https://www.regulations.gov/document/FRA-2015-0105-0001>).

¹¹ 87 FR 43467 (Section II. B.).

freight rolling stock is equipped with effective retroreflective sheeting, but it may also result in railroads unnecessarily replacing sheeting that continues to be effective beyond 10 years of service. The pilot program confirmed AAR testing²³ that showed the sheeting could continue to comply with the Reflectorization Standards for a significant amount of time beyond 10 years of service, especially when periodically cleaned. The data also showed that not all initially applied compliant material performs equally well throughout its anticipated useful life and can be affected by the type of service or commodity (salt, coal, chemicals, etc.) and environmental conditions (multiple freeze-thaw cycles, extreme cold or heat, high humidity, etc.) that the equipment endures. Under the more extreme of these circumstances, samples yielded measurements, after being cleaned, that were below the minimum comparator panel values just one to two years after application. One cause for the poor performing samples was found to be internal degradation of the sheeting due to damage or delamination, which can lead to mold or mildew growth over the microprismatic layer. Such poor performing or internally degraded material could be identified early on through use of the comparator panel or direct measurements with a retroreflectometer, allowing for earlier replacement. Overall, this would lead to better performing sheeting in service, resulting in an increase in safety compared to a blanket application of a 10-year replacement cycle.

To understand the efficacy of the comparator panels better, FRA sought comments from the industry regarding the proportion of sheets that were replaced as a direct result of not meeting the performance criteria versus sheets that were replaced under § 224.109. In response to the NPRM, AAR provided comments which included a chart containing the trends for when and why sheeting was replaced.²⁴ AAR created Why Made Code (WMC) 1F for sheeting replaced that did not meet the minimum reflectivity levels per Rule 66²⁵ (7,290 sheets in 2019, 16,779 sheets in 2020, and 18,808 sheets in 2021). AAR submitted its comment on September

16, 2022, and thus there are no data presented after 2021 to present.

When FRA granted AAR relief from the Reflectorization Standards to develop and test the comparator panel method, AAR estimated they avoid unnecessarily replacing all the retroreflective sheeting on 584,500 freight cars (at least 14 retroreflective sheets per car based on minimum required area) that would have cost approximately \$79 million during those first three years.²⁶ Codifying the performance-based method will avoid requiring railroads to replace the sheeting unnecessarily on approximately 1.5 million freight cars over the next 10 years.

In addition, as discussed in the NPRM,²⁷ FRA believes railroads may be unnecessarily replacing compliant retroreflective sheeting because the inspection and replacement process can be cumbersome, and detailed tracking is not required.

During the approximately 3-year period of relief from the 10-year replacement requirement from 2015 to 2018, and prior to AAR implementing the pilot program to test its performance-based method, the majority of retroreflective sheeting in service on AAR-member railroads was installed in 2005 and continued in service beyond 10 years. After reviewing pertinent records, FRA is unaware of any reportable RIT accidents attributable to under-performing retroreflective sheeting. Once the pilot program was approved to test the comparator panel method on in-service equipment, all sheeting on equipment within AAR interchange was evaluated using the comparator panels whenever the equipment underwent the single car air brake test (SCABT) or annual locomotive inspection and replaced as necessary when sheeting failed the comparator evaluation. By gradually replacing retroreflective sheeting as needed, a significant amount performed effectively beyond 10 years and was allowed to continue in service beyond 10 years. These findings help confirm AAR's conclusion that retroreflective sheeting can perform effectively beyond 10 years of service.

Only AAR-member railroads have participated in the pilot program to test

the comparator panel method, but FRA anticipates additional railroads would choose to use it, if codified. In response to the public notice FRA published related to AAR's waiver petition, three commenters expressed concurrence with the proposal of an alternative method in lieu of the 10-year replacement cycle and suggested relief should be applied to all railroads.²⁸

FRA concludes that allowing an alternative evaluation of installed retroreflective sheeting will better tailor the replacement requirements to the condition of the sheeting. The retroreflective sheeting has a finite service life, and performance-based methods of evaluation will help ensure: (1) sheeting that continues to perform well after the 10 years of service can remain in service; and (2) sheeting that underperforms before the 10 years of service can be identified and replaced on a more frequent, as needed basis. FRA understands that not all railroads may benefit from the use of alternative methods because of the financial burden of procuring a comparator panel or retroreflectometer device and related training for employees, particularly for some small railroads with limited equipment. Such railroads may prefer to continue to utilize the 10-year replacement cycle. Therefore, this final rule retains the 10-year replacement cycle as an option.

2. FRA Worked Closely With AAR and TTI To Develop a Comparator Panel That Could Be Used With the Reflectorization Standards

As discussed in the NPRM,²⁹ FRA worked closely with AAR and TTI to develop a comparator panel that could evaluate retroreflective sheeting and determine whether it complies with existing photometric performance requirements in the Reflectorization Standards. Based on the existing standards, which set the current minimum photometric performance standards at certain observation angles, AAR constructed the comparator panel by adding a set of fine dot matrix markings such that the target reflectivity was achieved at the desired boundary conditions. To find an appropriate target retroreflectivity for the comparator panel, AAR and TTI sampled part 224 compliant sheeting from various manufacturers and gathered the retroreflectivity measurements (with the 922 RoadVista). With the specifications for the retroreflective comparator panels

²³ Docket No. FRA-2015-0105, Document No. 1 (available at <https://www.regulations.gov/document/FRA-2015-0105-0001>), Appendix B: Supporting Documentation from AAR Equipment Engineering Committee.

²⁴ Docket No. FRA-2021-0080, Document No. 2.
²⁵ AAR Rule 66 outlines the industry standards for the reflectorization of railway equipment. The rule provides standards for retroreflective sheeting and inspection, repair, and replacement of such sheeting.

²⁶ FRA Data Request for Docket FRA-2015-0105, Document No. 23 (Nov. 3, 2020). See the table, "Number of Freight Cars That Would Need a Full Renewal of Retroreflective Sheeting Based on 10-Year Age Limit." The figure of 584,500 freight cars is the sum of cars for the years 2016, 2017, and 2018. This is an update from the NPRM, which identified 584,500 "pieces of effective retroreflective sheeting," instead of freight cars. 87 FR 43467.

²⁷ 87 FR 43467.

²⁸ Docket No. FRA-2015-0105; comments from RSI, Colorado Springs Utilities, and North America Freight Car Association.

²⁹ 87 FR 43467 (Section III. B. 2.).

established, AAR procured six sample comparator panels for evaluation and took measurements of the retroreflectivity with the 922 RoadVista. The results show that the comparator panels could be used effectively with the Reflectorization Standards.

3. FRA Approved a Pilot Program To Test AAR's Standard S-916; Retroreflective Comparator Panel Requirements (S-916) in Service.

As discussed in the NPRM,³⁰ the Board approved an AAR pilot program to test its newly developed standard comparator panel and process for using it to evaluate retroreflective sheeting for compliance with the Reflectorization Standards instead of the 10-year replacement cycle.³¹ To facilitate the pilot program, AAR: (1) adopted AAR Standard S-916, *Retroreflective Comparator Panel Requirements*, prescribing the requirements for comparator panels to be used in the performance evaluation of retroreflective sheeting on freight cars and locomotives; (2) published Specification M-944, *Retroreflective Sheeting Inspection Procedure (M-944)*, which provides the process for conducting a performance evaluation of retroreflective sheeting on railroad freight cars and locomotives using a comparator panel or electronic handheld retroreflectometer; and (3) incorporated the specifications of the comparator card and inspection procedures into AAR Interchange Rule 66, *Reflective Sheeting*, including a new billing repair "Why Made Code: 1F" related to use of the comparator panel and replacing reflective sheeting for not meeting the minimum reflectivity levels per Rule 66.

Since late 2018, AAR's performance-based alternate method has been widely used by the industry (specifically within interchange among AAR member railroads). FRA understands the standard has been successful and has no record of accidents, incidents, or noncompliance related using the standard. FRA is codifying the current elements of the standard in this rulemaking proceeding. FRA requested comments on whether the elements of the standard should be codified to continue use of the standard for complying with part 224 and make it an option for the entire railroad industry. As discussed further below, the comments to the NPRM support codifying the proposed performance-based alternate method for evaluating

retroreflective sheeting for the entire industry.

IV. Response to Comments on the Proposed Rule and AAR's Response to DOT's RFI

Two comments to the NPRM were submitted to the docket for this rulemaking proceeding.³² FRA reviewed the comments, and in response, has updated proposed section 224.111(c)(2), *Retroreflective comparator panel evaluation process and criteria*, to clarify the reflectorization inspection process for properly trained and experienced inspectors, and to allow additional flexibility to conduct inspections in limited space. No other changes to the proposed rule text are provided in this final rule.

In the NPRM, FRA proposed to codify the current elements of AAR's performance-based alternate method for inspecting and replacing retroreflective sheeting. As discussed in the NPRM, AAR's performance-based alternate method is supported by successful testing conducted pursuant to a pilot program. The NPRM focused on AAR Specification M-944, which was used during the pilot program and provides a procedure for using the comparator panel comparison to evaluate sheeting. As mentioned in the NPRM, M-944 was incorporated into Rule 66, and therefore M-944 was no longer necessary as a standalone specification. AAR's comment³³ suggests that the flexibility provided by AAR Rule 66 should also be adopted in this final rule. AAR Rule 66 was also part of the pilot program, and in 2018, as testing progressed, it allowed properly trained and experienced employees to perform an initial visual inspection and determine whether a further evaluation using the comparator card is necessary.³⁴ FRA agrees that this flexibility has been effective and is adding it to this final rule.

AAR also commented that FRA's proposed distance requirement for measuring retroreflectivity should be removed because it may not be possible for an inspector to observe the sheeting from the proposed distances at some locations. AAR's Rule 66³⁵ recommends 15 feet for evaluating sheeting where

there is sufficient space, and that is consistent with FRA's proposal.³⁶ As discussed further below,³⁷ this final rule will allow for evaluations to be performed at the next closest alternative effective distance, when 15 feet is not practicable. This will provide additional flexibility where space is limited, and will maintain the current levels of safety, as it requires an effective evaluation. If space will not permit an effective evaluation, FRA expects the equipment to be moved to accommodate an effective evaluation or comply with the 10-year replacement cycle, as required by § 224.111(b).

RSI's comment³⁸ supports FRA's proposal to add comparator panel evaluation and direct measurements with a retroreflectometer as alternative options to determine compliance with the Reflectorization Standards and agrees that codifying the use of a performance-based method of retroreflective evaluation will increase safety by ensuring that retroreflective sheeting is replaced when it is no longer effective.

V. Section-By-Section Analysis

Section 224.3 Applicability

Section 224.3 sets forth the scope and application of part 224, as described further in the NPRM.³⁹

Section 224.107 Implementation Schedule

This final rule removes § 224.107, as described further in the NPRM.⁴⁰

Section 224.109 Inspection, Repair, and Replacement

The title is revised to "Inspection and replacement of missing, damaged, or obscured retroreflective sheeting." Paragraphs (a) and (b) of § 224.109 are revised to remove any references to § 224.107, because this final rule removes § 224.107, as explained above.

Section 224.111 Renewal

This section is retitled from "Renewal" to "Evaluation and replacement of 10-year-old or underperforming retroreflective sheeting." The existing title, "Renewal,"

³⁶ FRA also understands there is a wider range of distances where an effective evaluation can be performed. FRA's proposal aimed to provide flexibility for situations where space is limited by permitting a range of distances, 10–20 feet, where 15 feet is not practicable. According to AAR's comment, 10–20 feet does not provide enough flexibility, because it may not always be possible to take the measurement from 10–20 feet.

³⁷ Section V., Section-by-Section Analysis, § 224.11(c).

³⁸ Docket No. FRA-2021-0080, Document No. 3.

³⁹ 87 FR 43467 (Section IV.).

⁴⁰ 87 FR 43467 (Section IV.).

³² Docket No. FRA-2021-0080.

³³ Docket No. FRA-2021-0080, Document No. 1.

³⁴ See also AAR's comment in response to DOT's RFI in Docket No. DOT-OST-2025-0026 ("Finalize the NPRM published in July 2022 that codifies existing waivers on reflectorization and include revisions to allow for inspection by a light source (rather than requiring a comparator panel) and eliminating the requirement that performance evaluation occur at 10–20 feet.").

³⁵ Field Manual of the AAR Interchange Rules, Rule 66—Reflective Sheeting.

³⁰ 87 FR 43467 (Section III. B. 3.).

³¹ Docket No. FRA-2015-0105, Document No. 21.

reflects the only current replacement option, which is to renew the retroreflective sheeting after 10 years, regardless its condition. The revised title will indicate two options for replacing the retroreflective sheeting: the same 10-year replacement cycle; or using a performance-based method to determine when replacement is required.

Paragraph (a) identifies two options for replacing retroreflective sheeting: a 10-year replacement cycle; and an alternative method to determine when replacement is required. The existing 10-year replacement option is included in paragraph (b) and the alternative option in paragraph (c).

The 10-year replacement option is retained in paragraph (b) because some short line railroads or individual car owners may not want to invest in the equipment and training needed to switch to an alternative method. As discussed in the NPRM,⁴¹ it is not clear if, or how, railroads are able to distinguish between replacement sheeting and previously installed sheeting on the same piece of equipment. According to AAR, Universal Machine Language Equipment Register (UMLER)⁴² system updates have been inconsistent because the railroad industry no longer relies on the information provided by the UMLER fields. FRA requested comment in the NPRM from the railroad industry on how records are created and maintained to track the installation date of sheeting when only a portion of the required sheeting is replaced prior to 10-years from the date of original installation. In response, AAR commented that usage of Why Made Code 1F (reflective sheeting does not meet the minimum reflectivity levels per Rule 66) is generally how records are created and maintained to track replacement of sheeting because this is the billing code used. This method of recordkeeping is sufficient to facilitate compliance with the Reflectorization Standards, and this final rule incorporates FRA's proposal from the NPRM.

Paragraph (c) requires railroads to evaluate retroreflective sheeting during the SCABT and annual locomotive inspection. Paragraph (c)(1) provides the specifications for an acceptable comparator panel to carry out the evaluation. Paragraph (c)(2) sets forth the process and criteria for evaluating the existing sheeting using a light source

and, if necessary, using a comparator panel under paragraph (c)(1). Paragraph (c)(3) permits the use of a handheld retroreflectometer to perform the required evaluation. As part of FRA's routine compliance oversight, the agency expects to review railroads' inspection records to verify an alternative evaluation was conducted.

The retroreflectivity, color, and construction requirements in paragraph (c)(1)(i) through (iii) are the same as the current S-916. The labeling requirement in paragraph (c)(1)(iv) is also the same as the current S-916, with the additional requirement that a panel's label include information on the calibration status of the panel. Based on AAR's indication that the median time between SCABT is 25.6 months, this rule requires comparator panels to be recalibrated at least every two years (*i.e.*, no more than two years from its manufactured date or previous recalibration date, whichever is most recent). FRA sought comment in the NPRM on this timeframe and how much downtime is expected while a panel is out for recalibration. No comments were received, and this final rule incorporates FRA's proposal related to recalibration from the NPRM.

This final rule updates paragraph (c)(2) in response to AAR's comment to establish a comparator panel evaluation process and criteria consistent with the current AAR Rule 66 (and former M-944). Paragraph (c)(2) is added to this final rule to clarify the process for properly trained and experienced employees performing the evaluation. Such employees may pass sheeting they determine to be obviously compliant and fail sheeting they determine to be obviously non-compliant (including obscured) based on their initial visual inspection. Sheeting that is not determined to be obviously compliant or non-compliant shall be evaluated further using the comparator panel comparison. This process is consistent with Rule 66.

AAR Rule 66 recommends evaluating installed sheeting with a comparator panel from 15 feet. FRA understands that 15 feet provides an appropriate amount of space to perform the evaluation but also understands that during an SCABT or locomotive annual inspection it may not be practicable for an inspector to stand 15 feet from the equipment. To provide flexibility, the NPRM proposed requiring sheeting to be evaluated from a distance of between 10 and 20 feet, with a 15-foot distance being preferable. FRA sought comment in the NPRM on whether a range of 10 to 20 feet is sufficient to evaluate retroreflective sheeting properly and

whether the range provides sufficient flexibility. In response to AAR's comment, paragraph (c)(2)(v) in this final rule requires measurement from 15 feet when practicable but permits evaluation from the next closest alternative effective distance.

Consistent with Rule 66, paragraph (c)(2)(vi) sets forth the process for conducting the evaluation (*e.g.*, with a light source positioned adjacent to the inspector's eye and directed at the sheeting and comparator panel, the inspector compares the reflected light intensity of the entire installed sheeting to that of the comparator panel). Paragraph (c)(2)(vi)(A) provides that if the perceived reflected light intensity of the entire installed sheeting appears brighter than that of the comparator panel, the installed sheeting passes the evaluation. Paragraph (c)(2)(vi)(B) provides that if the perceived reflected light intensity of the entire installed sheeting does not appear brighter than the comparator panel or if the two are indistinguishable, the installed sheeting does not pass the evaluation. If the two are indistinguishable, the installed sheeting is already at or near the minimum threshold to comply with this section and would only continue to degrade below the threshold if allowed to continue in service until the next evaluation required by this section. Therefore, such sheeting must be replaced.

In paragraph (c)(3), handheld reflectometers are permitted for use to evaluate retroreflective sheeting and determine when it is required to be replaced under this part. FRA understands that reflectometers can be used to evaluate retroreflective sheeting easily, reliably, and accurately. Paragraph (c)(3) requires use of an annular reflectometer, placed directly against the retroreflective sheeting. FRA is requiring an annular device, if a reflectometer is used, because it is easier to ensure an accurate evaluation compared to other types of devices that require multiple measurements from different angles to evaluate the sheeting properly. Paragraph (c)(3)(iii) sets forth the minimum allowable retroreflective values and necessary measurement angles if a reflectometer is used. Due to the current high cost of a handheld reflectometer, FRA does not anticipate widespread use of reflectometers initially. However, if the cost diminishes over time, railroads may prefer to use reflectometers.

⁴¹ 87 FR 43467.

⁴² AAR's UMLER is a comprehensive system that provides data for rail equipment, including features for registration, maintenance, compliance with interchange rules, and reporting data.

VI. Regulatory Impact and Notices

A. E.O. 12866 (Regulatory Planning and Review) and DOT Regulatory Policies and Procedures

FRA has considered the impact of this final rule under E.O. 12866, Regulatory Planning and Review (58 FR 51735, Oct. 4, 1993), and DOT Order 2100.6B, Policies and Procedures for Rulemaking (Mar. 10, 2025). The Office of Information and Regulatory Affairs within the Office of Management and Budget (OMB) determined that this final rule is not a significant regulatory action under section 3(f) of E.O. 12866. FRA estimates this rule will result in net benefits over a 20-year period from not replacing retroreflective sheeting prior to the end of its useful life, while potentially improving safety by replacing in less than 10 years sheeting that has already reached the end of its useful life.

1. Need for Regulatory Action

The Reflectorization Standards were promulgated in 2005; in the 20 years since their publication, FRA has learned that the reflective sheeting applied to rail freight rolling stock can remain effective beyond the 10 years initially thought at the time the Reflectorization Standards were developed. This rulemaking updates the Reflectorization Standards considering this new information by allowing the use of alternative methods to evaluate retroreflective sheeting. The alternative methods allow railroads and private car owners to replace retroreflective sheeting as needed, based on performance, instead of a mandatory replacement based on length of time. The final rule also recognizes a segment of the regulated entities that operate THEERP freight rolling stock and extends the exclusion from the Reflectorization Standards to THEERP operations, as they pose a low risk of highway-rail grade crossing incidents. For both stakeholders that choose to use the alternative methods of evaluation and those that operate THEERP freight rolling stock, this final rule promotes regulatory certainty and efficiency. Unnecessary paperwork burdens are also reduced by no longer needing to file waivers with FRA for relief from part 224.

This rulemaking amends part 224 in two substantive ways. First, the rule codifies waivers excepting THEERP operations from reflectivity standards in § 224.3. Second, the rule codifies the AAR waiver allowing railroads to use alternative methods (*i.e.*, comparator panel or retroreflectometer) for determining when retroreflective

sheeting needs replacement. The comparator panel and retroreflectometer are added as options to the existing 10-year replacement cycle under § 224.111.

2. Baseline

The typical baseline scenario from which benefits and costs of the regulation are measured is the no-action baseline, which is an assessment of the railroad world without the rule.⁴³ Without this rule, it is likely that the railroads will continue to file waivers and waiver renewals for using the alternative method and exclusion of THEERP freight rolling stock from the Reflectorization Standards. One possible baseline assumes FRA approves most of these waivers with conditions, as it has in the past. In comparing this baseline to the final rule, the benefit from the rule would be the removal of unnecessary paperwork burdens of having to file future waivers and renewals with FRA.

However, another baseline might offer more information about the impacts of the rule. The waiver to use the comparator panel is relatively recent (2018), and many of the THEERP waivers are also less than 10 years old. The comparator-panel waiver covers almost all the rail freight rolling stock. Another baseline describes a scenario absent the comparator-panel waiver, that is, in which approval of the waiver is uncertain and reflective sheeting is replaced per the 10-year renewal cycle in existing § 224.111. The baseline used for this analysis is the 10-year renewal cycle outlined in existing § 224.111, which requires that all retroreflective sheeting be replaced every 10 years. This baseline is being used to estimate the substantive impacts of the rule better. The baseline scenario under existing § 224.111 is accounted for as a separate alternative under the Costs section below. Then the baseline scenario is compared to the final rule alternative in which waivers would not be necessary. FRA invited comment in the NPRM on the appropriate baseline to use for the regulatory analysis, which is discussed below.

Comments Filed on the Regulatory Analysis

FRA requested and received comments on its regulatory analysis. Comments were filed by AAR and RSI. Part of AAR's comments concerned the labor rate used to account for the costs and benefits of the rulemaking. RSI agreed with the conclusion of the

regulatory analysis that the benefits outweigh the costs.

AAR commented that the labor rate FRA used was significantly lower than the labor rate AAR provided to FRA in its prior information request.⁴⁴ AAR stated that FRA excluded overhead costs such as supervision, administration, procuring retroreflective sheeting, car cleaning supplies, business insurance, facility costs, and employer taxes.

FRA responds that it bases its labor rate on compensation and work hours reported by the Class I railroads and Amtrak to the Surface Transportation Board (STB), as noted in the NPRM. In consideration of an AAR comment to an earlier rulemaking, FRA has added a burden rate of 75 percent to the straight time labor rate.⁴⁵ FRA applies this labor rate across its regulatory analyses providing a consistent and transparent metric. A consistent rate avoids confusion and facilitates comparison within and across rulemakings. FRA's rate is also within the range of burden factors used by other U.S. DOT agencies. For example, the Federal Aviation Administration (FAA) typically uses the Bureau of Labor Statistics (BLS) data to estimate a wage multiplier.

Regarding the cost of overhead items such as supplies and tools used, AAR's Rule 66 requires only basic supplies. Rule 66 stipulates, "[c]leaning as referred to in this rule will be performed with a rag and water or suitable alternatives as directed by the sheeting manufacturer."⁴⁶ A railroad would likely already have these items. Therefore, adding a marginal cost for using these common supplies and tools would be a *de minimis* cost. Further, the cost of the retroreflective sheeting was already accounted for and based on data AAR provided. Adding overhead costs would be appropriate if FRA required use of unusual or expensive supplies and tools for this final rule. For example, if FRA required using the retroreflectometer, which is expensive and not widely used, then it would be appropriate to add additional overhead costs. The cost of the retroreflectometer, if required, would be a direct cost attributable to this final rule.

Some of the other costs items listed by AAR, such as insurance cost and taxes, represent (private) financial costs and not necessarily (societal) economic costs. FRA understands railroads may

⁴⁴ AAR, *FRA Data Request*, 2020.

⁴⁵ Docket No. FRA-1999-6689, Document No. 0054. Available: <https://www.regulations.gov/document/FRA-1999-6689-0054>. In this comment, the ratio of AAR's suggested hourly wage of \$32.59 to the base wage of \$18.86 is 1.73, which was rounded to 1.75 or a 75 percent increase.

⁴⁶ Rule 66(E)(9), p. 576.

⁴³ OMB, *Circular A-4: Regulatory Analysis* (Sept. 17, 2003). Available: <https://www.whitehouse.gov/wp-content/uploads/2025/08/CircularA-4.pdf>.

use these for accounting purposes; however, the economic analysis seeks to estimate the real resource costs of this rule, in this case, of labor costs. The real resource cost represents the opportunity cost of labor, *i.e.*, if an employee did not have to inspect and replace retroreflective sheeting in compliance with this final rule, the employee could perform other duties for the railroad. Specifically for insurance payments and taxes, OMB Circular A–4 advises not to include these transfer payments in estimating costs and benefits, because they represent monetary payments that may not reflect the availability of real resources.⁴⁷

Consistent with OMB Circular A–4, FRA addressed the effect of using AAR’s labor rate in its NPRM *Regulatory Impact and Notices Sensitivity Analysis* section. The NPRM Sensitivity Analysis briefly noted that the effect of using the higher AAR wage rate would not affect the overall results of the analysis. For the final rule, FRA expands this discussion. In addition, FRA had presented AAR’s data and estimated costs in the NPRM *Overview and Technical Discussion of Requirements* section. The Overview and Technical Discussion “showed its work” with supporting calculations enabling readers to use the higher labor rate if they so desired. As FRA’s labor rate is a consistent metric sourced in publicly accessible data, and better reflects real resource costs, FRA continues to use it for its economic analysis.

In its comment, RSI concurred with the cost-benefit analysis. RSI noted that the final rule will expand the benefits of using the alternative comparator panel method to all car owners, beyond those who are members of AAR. RSI also agreed that the baseline for the analysis was appropriate.

3. Costs

a. Methodology

Because the retroreflective sheeting is applied per rail car, this analysis used the per-car cost as the basis to estimate much of the costs related to retroreflective sheeting. The costs for preparing waiver petitions were estimated based on the labor costs of those employees preparing the waivers.

FRA requested data from AAR about the railroads’ experiences under the approved waiver using the comparator panel. FRA reviewed the data supplied by AAR and incorporated it into the cost estimates below. AAR provided data for before and after the comparator panel waiver.⁴⁸

In its estimates, AAR used an average labor rate of \$140.38 per hour or \$2.34 per minute, in 2020 dollars, which may be based on interchange billing rates. For its regulatory analyses, however, FRA uses standardized labor rates which the Class I railroads report to the STB. These rates are burdened by 75 percent for any fringe benefits.⁴⁹ For this analysis FRA used the STB wage rates for the relevant employee groups. These are STB Group 200 employees consisting of Executives, Officials, & Staff Assistants who likely complete waiver petitions for the railroads, and Group 400 Maintenance of Equipment & Stores employees who inspect and apply the reflective sheeting. The Executives, Officials, & Staff Assistants burdened rate is \$90.19 per hour or \$1.50 per minute, and the Maintenance of Equipment & Stores employees burdened rate is \$72.01 per hour or \$1.20 per minute.⁵⁰

To estimate Government costs and benefits resulting from reviewing and approving waivers, FRA used the General Schedule (GS) pay rates for grade GS–14 step 5 employees in the

Washington, DC area. The Federal pay rate was also burdened by 75 percent yielding a Federal pay rate of \$132.48 per hour.⁵¹

AAR provided counts of the maintenance of way (MOW) cars and locomotives that would be covered under part 224; however, FRA focused on freight rail cars to simplify the analysis. Given that MOW cars and locomotives represent a small portion of all freight rail cars (about 2.5 percent and 1.6 percent respectively), including them in the analysis would not significantly affect the results.

FRA used a 20-year period of analysis for this rulemaking because retroreflective sheeting appears to have an effective service life beyond 10 years (based on data from the AAR comparator panel waiver). FRA also identified one study that estimated prismatic sheeting used on traffic signs may last 15 to 30 years, which may be a reasonable proxy for similar sheeting used on rail cars.⁵² However, for the rail freight rolling stock used in THEERP operations, a 10-year period of analysis may be a better “fit” because overage equipment may only be actively used for an additional 5 to 10 years. Because the provision permitting use of the comparator panel covers most of the rail car fleet, FRA chose to use a 20-year period of analysis.

First, the costs for the baseline scenario under § 224.111 and the 10-year renewal cycle were determined, followed by the final rule costs. The difference between the two costs represents the estimated net benefits (or costs) of the final rule: *Baseline costs – final rule costs = Net benefits (or costs)*.

The costs and benefits associated with the final rule are summarized in Table V–1 below.

TABLE V–1—SUMMARY OF TOTAL BENEFITS OVER THE 20-YEAR PERIOD
[2024 Dollars]

Impact	Undiscounted	Present value 7%	Present value 3%	Annualized 7%	Annualized 3%
Baseline Cost	\$722,686,030	\$382,807,968	\$537,587,568	\$36,134,364	\$36,134,329
Final Rule Cost	549,991,943	291,377,977	409,151,953	27,504,020	27,501,438
Net Benefits	172,694,087	91,429,991	128,435,615	8,630,344	8,632,891

⁴⁷ OMB, *Circular A–4*, 2003. See section on *Other Key Considerations, The Difference between Costs (or Benefits) and Transfer Payments*.

⁴⁸ AAR, *FRA Data Request for Docket FRA–2015–0105, Document No. 23* (Nov. 3, 2020).

⁴⁹ The Class I railroads report service hours and compensation to the STB under 49 CFR 1245.2.

⁵⁰ STB, *Quarterly Wage Form A&B Data* (2024). Compiled from Class I railroad data reported on Wage Form A&B for year 2024. Calculated as: Wage (\$/hour) = sum of compensation for time worked

and paid for straight time rates (\$) for Class I railroads + sum of service hours for time worked and paid for straight time rates (hours) for Class I railroads. Available: <https://www.stb.gov/reports-data/economic-data/quarterly-wage-ab-data/>. Calculations for burdened wage: For Group 200 employees, \$51.54 per hour STB average straight time rate × 1.75 fringe benefit multiplier = \$90.19 per hour burdened wage rate. Similarly, for Group 400 employees, \$41.15 × 1.75 = \$72.01 per hour burdened wage rate.

⁵¹ Office of Personnel Management, *Salary Table 2024–DCB* (Jan. 2024). Available: https://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/salary-tables/pdf/2024/DCB_h.pdf. Calculation: \$75.70 per hour GS–14 Step 5 rate × 1.75 fringe benefit multiplier = \$132.48 per hour burdened rate.

⁵² Preston, Howard, *Traffic Sign Life Expectancy* (St. Paul, MN: 2014). Report No. MN/RC 2014–20. Minnesota Dept. of Transportation. Available: <https://www.lrrb.org/pdf/201420.pdf>.

TABLE V–1—SUMMARY OF TOTAL BENEFITS OVER THE 20-YEAR PERIOD—Continued
[2024 Dollars]

Impact	Undiscounted	Present value 7%	Present value 3%	Annualized 7%	Annualized 3%
Government Cost Savings for Waivers (from Baseline)	193,149	103,285	144,275	9,749	9,698

Qualitative Benefit: Reduced waste from not replacing effective reflective sheeting prematurely.

The impacts are described in detail below.

b. Baseline Costs Under § 224.111
Following the 10-Year Renewal Cycle

Absent this final rule, both THEERP and other rail operations to which the Reflectorization Standards apply will incur costs for the following requirements:

- Cost for inspection and replacement of missing, damaged, or obscured retroreflective sheeting (“sheeting”) under § 224.109.
- Cost to renew, *i.e.*, replace sheeting no later than 10 years after installation under § 224.111. The baseline assumes sheeting will be replaced periodically every 10 years.

• Incidental cost for transporting rail cars that would not typically appear on a repair track or shop for an SCABT to renew sheeting under § 224.111.

• Cost of petitioning FRA for waivers from the Reflectorization Standards.

These cost elements may be represented by the equation: *Baseline cost = Visual inspection & sheeting replacement + 10-year renewal + Transport + Waiver.*

The cost for inspection and replacement of missing, damaged, or obscured sheeting was determined by the cost of a visual inspection and sheeting replacement multiplied by the number of cars undergoing an SCABT. The SCABT serves as the triggering event for the inspection and replacement of sheeting under § 224.109. To determine the number of cars undergoing an SCABT per month, FRA used the median time between SCABTs of 25.6 months, and the average annual number of freight cars of 1,658,334 (an average over the period 2016–2020).⁵³ The cars per month were multiplied by 12 months to yield an estimated 765,385 cars per year undergoing an SCABT.⁵⁴

⁵³ FRA is using the same number of cars for the final rule as in the NPRM. Using currently available data from 2019–2023 yields only a small difference of –0.2 percent cars from the 2016–2020 average, and the 2016–2020 period better represents the period under the waiver for which AAR provided data.

⁵⁴ Calculation: 1,658,334 fleet size/26 months = 63,782 SCABT cars per month. Then 63,782 cars per month × 12 months = 765,385 cars per year that

Further, the cost of the visual inspection and sheeting replacement was determined by the sum of the cost of the visual inspection and cost to replace missing, damaged, or obscured sheeting. AAR indicated the time for a visual inspection was 0.83 minutes, the time to replace the first sheet per side was 9.3 minutes, the average number of sheets replaced during SCABTs was 0.71 sheets, and the cost per sheet was \$1.31; a recent market price check shows the cost per sheet at about \$2.95 in 2024 dollars.⁵⁵ Accounting for the labor time using the STB Maintenance of Equipment & Stores wage rate of \$1.20 per minute results in a per-car cost of \$14.21. Then the cost under § 224.109 was calculated by multiplying the estimated cars undergoing an SCABT by the cost per car, resulting in a cost of \$10,877,266 per year.⁵⁶

Similarly, the cost to renew the sheeting after 10 years was determined by the number of cars affected multiplied by the cost of renewal. The average number of cars that would need full renewal was 154,800 per year based on the average over the years 2016 to 2020.⁵⁷ That represents about 10 percent of the fleet per year, which is expected given the 10-year renewal period. The cost for sheeting material per car was estimated given 14 sheets (of 0.5 square-foot each) would be needed for 2 sides of the rail car (less than 50-foot car, seven sheets per side), for a cost of \$41.34 per car. AAR provided that the time to apply the sheeting was 9.3 minutes for the first

undergo an SCABT, or about 46 percent of the fleet. Source: *FRA Data Request*, 2020.

⁵⁵ W.W. Grainger, Inc., average of white and yellow retroreflective sheeting, 4”×18” 3M series 983–10 and 983–17. See for example Locomotives/Rail Cars, White, Premium Grade Reflective Tape—4TDU4\983–10—Grainger and Locomotives/Rail Cars, Yellow, Reflective Tape—38XP42\983–71—Grainger. Average of \$3.00 per sheet in 2025 dollars adjusted to 2024 dollars using GDP Deflator available at U.S. Bureau of Economic Analysis, “Table 1.1.9. Implicit Price Deflators for Gross Domestic Product” (accessed June 15, 2025).

⁵⁶ Calculations: Per-car cost for visual inspection and sheet replacement = 0.83 min. × \$1.20 per min. visual inspection + 9.3 min. × \$1.20 per min. sheeting replacement + 0.71 sheets × \$2.95 per sheet = \$14.21. Total cost for visual inspection and sheeting replacement = 765,385 cars × \$14.21 per car = \$10,877,206 per year.

⁵⁷ *FRA Data Request*, 2020.

sheet per side, and 2.6 minutes for each additional sheet, totaling almost 50 minutes for both sides of a rail car and \$60 in labor costs (using the STB Maintenance of Equipment & Stores wage rate of \$1.20 per minute). The cost per car for sheeting renewal is the sum of the material cost and labor application costs (\$41.34 + \$59.97 = \$101.31 per car). Then the renewal cost for all affected cars is \$15,682,399 annually.⁵⁸

To model the impacts more accurately under the baseline, FRA estimated the potential costs for transporting rail cars, that in their normal operations, would not appear on a repair track or shop (for an SCABT). These cars may be owned by private car owners that do not own repair shops, MOW cars that are not regularly interchanged, older cars that are not regularly interchanged, stored cars, and seasonally used cars. These cars may incur additional expense for transportation to a repair shop when their sheeting needs renewal after 10 years. However, this situation is mitigated by mobile repair units or a railroad’s Running Repair Agent (RRA) that can perform SCABTs and replace sheeting.⁵⁹ Nevertheless, FRA accounted for the transportation costs for some cars that may need to be moved for sheeting replacement because of scheduling issues with mobile repair agents or operational issues. As a proxy estimate for the number of cars requiring transport, FRA used the 23,000 freight cars that have interchange restrictions as reported by AAR; these cars are usually older cars.⁶⁰ Another way to estimate the number of affected cars is to consider the conditional probability of not undergoing an SCABT on a repair track or shop and cars that would need full sheeting renewal. The probability of not undergoing an SCABT was found by dividing the number of cars undergoing an SCABT by the average fleet size, then subtracting from 1, for a result of 0.54 or about 50

⁵⁸ Calculation: Cost to renew sheeting after 10 years = 154,800 cars × \$101.31 per car = \$15,682,399 per year on average.

⁵⁹ Railinc, *Running Repair Agents—Active*. Available: <https://findusrail.railinc.com/#/home>.

⁶⁰ AAR, *Railroad Facts: 2020 Edition* (Washington: 2020) 53.

percent.⁶¹ From the discussion above, the probability of renewal for a car is about 10 percent or 0.1. The conditional probability is the product of the two probabilities, equaling about 0.05 or 5 percent of the fleet, and representing 89,295 rail cars. Qualitatively, the majority of these cars can be serviced by mobile repair agents and RRAs, and FRA used 23,000 cars as a reasonable estimate.

For the transportation cost per car, FRA estimated the expected transportation cost as the probability that a car would need transportation for sheeting renewal multiplied by its transportation cost. FRA estimated a range of \$3,570 for \$4,750 to transport an empty car, or an average cost of \$4,160 per car; the expected cost in any one year is \$416.⁶² Then, the transportation cost for the rail car fleet is the estimated 23,000 affected cars multiplied by the expected transportation cost of \$416, for an overall transportation cost of \$9,568,071 annually. Given the uncertainty about the number of cars affected, there is a higher degree of uncertainty about this cost estimate and FRA invited comment on the inputs used. In its comment to the NPRM, RSI generally agreed with estimated impacts in the analysis when considering the rule's effects for all private car owners.

The last cost element in the baseline scenario is the cost of petitioning FRA for waivers from the Reflectorization Standards. When approved, waivers generally provide regulatory relief for five years. For this analysis, FRA distinguished between waiver extensions and waiver renewals. Waiver extensions permit the railroad or individual car owners to continue to operate under the original waiver for another five years. After 10 years, the railroad or individual car owner can no longer apply for an extension but must instead request a renewal of the waiver.⁶³ The baseline waiver cost is the estimated number of new waivers plus waiver extensions and renewals, multiplied by the cost of filing waivers. This analysis estimated the waiver costs

⁶¹ Calculation: $1 - 765,385 \text{ SCABT cars} / 1,658,334 \text{ average fleet size} = 1 - 0.46 = 0.54$, or about 50 percent of cars not likely to appear on a repair track or shop for an SCABT.

⁶² Calculation: Expected (transportation cost per car) = probability (car would need 10-year sheeting renewal) \times transportation cost = $0.1 \times \$4,160 = \416 .

⁶³ FRA has updated its waiver procedures requiring it to publish a **Federal Register** notice for a waiver extension and waiver renewal. The change affects only Government costs and may lead to slightly larger Government cost-savings to account for fewer **Federal Register** notices per year on average under the final rule.

for both THEERP operations and the performance-based (*i.e.*, comparator-panel) waiver.

In the case of waivers for THEERP operations, FRA has received and reviewed 23 waivers over 16 years, for a rate of 1.4 new waivers per year, which is rounded to 1.5 waivers for analysis. Therefore, over the 20-year period of analysis (years 2022 to 2041), FRA expects 30 new waiver petitions. Based on historical experience and FRA subject matter expert estimates, FRA has found that waiver extensions and renewals are subject to the following three conditions:

- Railroads or individual car owners will likely not operate overage equipment beyond 10 years.
- Railroads or individual car owners have not asked for renewals of waivers beyond 10 years.
- FRA has approved 15 out of 23 waivers for an approval rate of 65 percent (*i.e.*, 65 percent of 1.5 new waivers is about 1 new waiver per year). Moreover, there were seven dismissed or denied waivers, one double-counted waiver, and 1 additional waiver received in 2020 unaccounted for in the NPRM to complete the set of 23 THEERP waivers).

Applying these conditions to the number of new waivers, FRA estimated 15 waiver extensions over the period of analysis. As explanation, new waivers approved during years 1 through 5 of the period of analysis (from calendar years 2022 through 2026) will likely receive extensions during years 6 through 10 of the period of analysis (from calendar years 2027 through 2031) respectively, resulting in 5 extensions.⁶⁴ Similarly, new waivers approved during years 6 through 10 of the analysis will likely receive extensions during years 11 through 15 of the analysis (from 2032 through 2036) respectively, resulting in an additional 5 extensions. Finally, new waivers approved during years 11 through 15 of the analysis will likely receive extensions during years 16 through 20 of the analysis (from 2037 through 2041) respectively, resulting in five more extensions. In total, FRA expects 15 waiver extensions.

Also, THEERP operations that currently have waivers may request extensions resulting in an additional seven waiver extensions. Of the 15 approved THEERP waivers, four did not request a waiver renewal and expired before year 2022 (waiver docket numbers FRA-2010-0148, FRA-2010-0156, FRA-2008-0021, and FRA-2014-0082). Of the remaining 11 approved

⁶⁴ After 10 years, requests for waiver renewals are not likely under the first two conditions above.

THEERP waivers, one was potentially due for an extension in year one of the analysis, *i.e.*, calendar year 2022 (waiver docket number FRA-2016-0110—approved in 2017). Four approved waivers were potentially due for extensions in year three of the analysis, *i.e.*, year 2024 (waiver docket numbers FRA-2018-0026, FRA-2018-0086, FRA-2019-0008, FRA-2019-0047—all approved in 2019). Finally, two approved waivers are potentially due for extensions in year four of the analysis, *i.e.*, year 2025 (waiver docket numbers FRA-2020-0046 and FRA-2020-0023—both approved in 2020). In sum, FRA expects seven waiver extensions. Five of the 11 approved waivers may request waiver renewals during the period of analysis but are unlikely to do so based on the above conditions.

Thus, FRA expects THEERP operations to file 30 new waivers, 15 extensions of these new waivers, and seven extensions of existing waivers. FRA estimated each new THEERP waiver petition requires 40 hours of labor, and each extension requires eight hours of labor. Accounting for these labor hours at the STB Executives, Officials, & Staff Assistants burdened wage rate yields a new waiver cost of \$3,608 per waiver, and a corresponding cost of \$5,412 for 1.5 new waivers per year.⁶⁵ The cost for a waiver extension is \$722 per extension. The costs are scheduled according to the frequency of occurrence of new THEERP waivers (1.5 per year), new THEERP waiver extensions (one per year starting in year six of the analysis), and currently approved THEERP waiver extensions (one in year one of the analysis, four in year three, and two in year four). The cost schedule also accounts for extensions and renewals of the performance-based waiver at \$1,849 per extension or renewal (see below, one extension expected in year two of the analysis, and thereafter one renewal per each year in years seven, 12, and 17). As an example, in year two of the analysis, FRA expects 1.5 new THEERP waivers (\$5,412), and 1 alternative waiver extension (\$1,849), for a total estimated cost of \$7,261.

For regulated entities petitioning to use alternative methods to evaluate sheeting, FRA is not aware of any new methods in development and expects no new waiver filings. If a new performance-based waiver was filed, the cost to file such a waiver would be qualitatively high because it would likely involve extensive development

⁶⁵ Calculation: Cost for one waiver = 40 hrs. \times \$90.19 = \$3,608. Then 1.5 new waivers \times \$3,608 per waiver = \$5,412.

and in-service testing like the comparator panel. Given the research to develop the comparator panel, FRA expects AAR will continue to file for extensions and renewals to extend the waiver’s relief. Over the period of analysis, FRA estimated four extension and renewals, requiring 20.5 hours each at the same Executives, Officials, & Staff Assistants wage rate for a per-waiver cost of \$1,849. FRA estimated the performance-based waiver extension requires more labor time than the THEERP-operations waiver extension because Class I railroads’ operations are

more complex. (A THEERP-operations waiver renewal, however, may involve detailed descriptions of the subject equipment that may add to the time to file a potential renewal.)

Furthermore, the Federal Government expends resources to review these waiver petitions. Depending on the waiver, FRA’s review will involve legal personnel, subject matter experts, administrative personnel, and railroad inspectors. FRA estimated these costs using the same respective labor hours as for THEERP-operations waivers and performance-based waivers above. For

the wage rate, instead of using an average wage rate for the variety of personnel involved, FRA used a representative burdened wage rate for GS–14 step five employees of \$132.48 per hour. The resulting FRA costs are \$5,299 for a new THEERP-operations waiver, \$1,060 for a THEERP-operations waiver extension, and \$2,716 for the comparator-panel waiver extension and renewal.

The following table presents the estimated baseline scenario cost elements.

TABLE V–2—BASELINE SCENARIO COSTS (2024 DOLLARS) UNDER § 224.111 10-YEAR RENEWAL CYCLE

Baseline cost impact	Undiscounted	Present value 7%	Present value 3%	Annualized 7%	Annualized 3%
Visual Inspection & Replacement (§ 224.109)	\$217,545,315	\$115,233,908	\$161,826,248	\$10,877,266	\$10,877,266
10-Year Renewal (§ 224.111)	313,647,798	166,139,462	233,314,361	15,682,390	15,682,390
Transportation for Non-SCABT Cars	191,361,415	101,364,278	142,348,732	9,568,074	9,568,071
Waivers	131,503	70,321	98,227	6,638	6,602
Total Baseline	722,686,030	382,807,968	537,587,568	36,134,364	27,037,415
Government Costs for Waivers ⁶⁶	193,149	103,285	144,275	9,749	9,698

c. Final Rule Costs

The first substantive change under the final rule will add freight rolling stock used for THEERP operations to the list of excepted equipment under § 224.3. These operations will no longer need to file waivers and waiver extension requests with FRA and thus save the associated paperwork costs. The benefits would equal the baseline costs for waivers (when taken together with the similar type of benefits from codifying the comparator panel waiver).

The largest change under the final rule will be evaluating rail cars with a comparator panel instead of replacing sheeting under the 10-year renewal cycle. THEERP operations and other railroads to which the Reflectorization Standards apply will incur costs for the following requirements:

- Cost for inspection and replacement of missing, damaged, or obscured retroreflective sheeting under § 224.109. This requirement is unchanged from the baseline except for removing old implementation dates.
- Cost to evaluate and replace sheeting under § 224.111. The final rule retains the option to use the 10-year replacement cycle.
- Incidental cost for transporting rail cars that would not typically appear on a repair track or shop for an SCABT to renew sheeting under § 224.111. This cost occurs under the baseline too but is adjusted for relief from the 10-year

replacement cycle, and longer expected sheeting life.

- Small entities that may use the 10-year replacement cycle option under § 224.111 (estimated at 15 percent of small entities).

- Cost of the comparator panel.
- Cost to recalibrate the comparator panel under § 224.111.
- Employee training to use the comparator panel as described in AAR Field Manual Rule 66. (The comparator panel inspection of reflective sheeting will become part of the SCABT and annual locomotive inspection.)

These cost elements may be represented by the equation: final rule *Cost = Visual inspection & sheeting replacement + Periodic evaluation & sheeting replacement + Transport + 10-year renewal option estimated for small entities + Comparator panel + Comparator panel recalibration + Employee training.*

The cost for visual inspection and replacement of missing, damaged, or obscured sheeting remained the same as under the baseline scenario because FRA is only removing the references to the outdated implementation schedule. The substantive requirements remain the same.

The primary change will be evaluating the sheeting on rail cars with a comparator panel. The cost of using the comparator panels is determined by the number of cars undergoing an SCABT and evaluated with the comparator panel multiplied by the material and labor costs per car. Based

on data supplied by AAR, FRA estimated 571,750 cars will be evaluated, a preliminary inspection will require 2.8 minutes, cleaning will take 3.3 minutes, and the time to apply one sheet will require 9.3 minutes. AAR also found an average of 0.72 sheets renewed during their waiver at a cost of \$2.95 per sheet (base year cost of \$1.31 as updated and adjusted for 2024 dollars). FRA applied the STB Group 400 Maintenance of Equipment and Stores burdened employee wage rate to estimate a cost per car of \$20.50, and \$11,718,090 per year for the affected cars. In contrast, the estimated cost per car for sheeting renewal under the baseline scenario was \$101.38 per car.⁶⁷

The final rule also allows use of a handheld retroreflector to directly evaluate the performance of sheeting. The retroreflector may be easier to use than the comparator panel, but given its current high cost (\$10,000), its use will likely be minimal at this time.

As in the baseline scenario, some rail cars may incur a transportation cost to renew sheeting because they may not periodically undergo an SCABT at a repair shop or track or receive service from a mobile service agent. However, given the experience under the AAR comparator panel waiver showing

⁶⁷ Calculation: Material cost per car = 0.72 sheets × \$2.95 per sheet = \$2.14. Labor cost per car = (2.8 min. inspection + 3.3 min. cleaning + 9.3 min. first sheet application) × \$1.20 per min. burdened wage rate = \$18.36. Material and labor costs per car = \$2.14 + \$18.36 = \$20.50. Cost for evaluated cars = 571,750 cars × \$20.50 per car = \$11,718,090.

⁶⁶ The government costs are not included in the total baseline costs.

reflective sheeting can likely remain effective beyond 10 years, these cars would need to be transported less frequently. These cars would no longer be subject to the 10-year renewal cycle. FRA used the estimates from Preston (2014) of an average reflector service life of about 20 years to calculate the reduced impact of cars needing transport for reflective sheeting replacement under the NPRM. Using a 20-year service life reduced the probability that cars would need transport by half to five percent, and the resulting expected cost per car from \$416 to \$208. Given the same number of cars needing transport as under the baseline scenario (23,000 cars), yielded a transportation cost of \$4,784,035 per year.

The final rule contains an option for railroad car owners to continue using a 10-year replacement cycle for sheeting. FRA assumes that a portion of small entities will be most likely to choose this option to reduce their investment in the comparator panel and associated costs to implement it (such as training employees). FRA estimated 15 percent of small entities will use the 10-year replacement option. To count the number of rail cars owned by small entities, FRA subtracted Class I railroad owned cars in North America, Class II railroad owned cars, and privately-owned cars from all freight cars—to estimate Class III railroads own 54,766 rail cars on average (over the years 2016 to 2020). Thus, 15 percent of these Class III railroad cars is 8,215 cars. FRA used AAR *Railroad Facts* books and *Progressive Railroading* magazine “Fleet Stats” for various years to determine car ownership.⁶⁸ Using the same percent of cars that would need full renewal under the baseline scenario of 10 percent means about 821 cars per year would need sheeting renewal. FRA applied the

same cost per car for 10-year sheeting replacement as under the baseline scenario (\$101.38 per car) and estimated a cost of \$83,223 per year under the final rule.

To estimate the number of comparator panels that may be purchased, FRA used the difference between the average number of shops and locations qualified to perform an SCABT and evaluate sheeting using a comparator panel, before and after the comparator panel waiver. AAR estimated an average of 1,570 shops and locations qualified for SCABTs before the waiver, and 1,063 shops and locations equipped with a comparator panel after the waiver; the difference of about 500 shops and locations represents the shops and locations that may purchase a comparator panel. AAR notes its estimates include shops and locations that performed five or more SCABT tests, so the actual counts may be higher. In addition, FRA internally estimated 300 shops and locations may need to purchase a comparator panel. FRA used an average of the two estimates for analysis, or 400 shops and locations. FRA assumed one comparator panel purchased per shop or location and applied the \$246 cost per panel (updated and adjusted from the NPRM cost of \$190 per panel) to estimate a marginal cost of \$98,291 for acquiring comparator panels. Furthermore, AAR offers these comparator panels may need replacement every four years (years one, five, nine, 13, and 17 of the 20-year period of analysis).

These comparator panels are also required to be periodically recalibrated (not later than two years) so that an accurate number of retroreflective sheets are replaced on rail cars. Given the four-year average life of a comparator panel, a comparator panel will be typically recalibrated one time during its useful

life. For example, if a comparator panel is purchased in year 1 of the period of analysis, it would be recalibrated in year three, and a new comparator panel purchased in year five. Over the period of analysis, recalibration would occur in years three, seven, 11, 15, and 19. In addition, AAR estimated a recalibration cost of \$95.09 per panel with a discount if multiple panels are recalibrated per shop (adjusted from 2020 base year cost of \$80 using U.S. Bureau of Economic Analysis, Table 1.1.9. Implicit Price Deflator). As FRA does not know how many shops own multiple comparator panels, the cost of recalibrating one panel was used to estimate a cost of \$38,035 for recalibrating 400 comparator panels.

Employees inspecting and replacing reflective material likely would need training and instruction in these procedures. Rule 66, Reflective Sheeting, of the AAR Field Manual contains instructions for inspecting sheeting using the comparator panels. A manufacturer of comparator panels also provides step-by-step instructions on its website.⁶⁹ FRA assumed these comparator panel instructions will be combined with existing training sessions on performing SCABTs and locomotive inspections. FRA estimated a marginal training cost using the same amount of time estimated to inspect reflective sheeting using a comparator panel of 2.8 minutes, applied to 17,537 STB Group 400 Maintenance of Equipment and Stores employees (in 2024) at their wage rate, to calculate a training cost of \$58,036. Only the first year of training is considered because the cost of subsequent training is covered under the training rule, 49 CFR part 243.⁷⁰

The following table presents the estimated final rule cost elements.

TABLE V-3—FINAL RULE COSTS
[2024 Dollars]

Final rule cost impact	Undiscounted	Present value 7%	Present value 3%	Annualized 7%	Annualized 3%
Visual Inspection & Replacement (\$224.109)	\$217,545,315	\$115,233,908	\$161,826,248	\$10,877,266	\$10,877,266
Periodic Evaluation & Sheeting Replacement (\$224.111) ..	234,361,799	124,141,612	174,335,589	11,718,090	11,718,800
Transportation for Non-SCABT Cars	95,680,707	50,682,139	71,174,366	4,784,035	4,784,035
10-Year Renewal Option est. for Small Entities	1,664,461	881,666	1,238,149	83,223	83,223
Comparator Panel	491,453	287,307	381,944	27,120	25,673
Comparator Panel Recalibration	190,173	97,106	117,210	7,712	7,878
Employee Training	58,036	54,239	56,345	5,120	3,787
Total Final Rule	549,991,943	291,377,977	409,151,953	27,504,020	27,501,438

⁶⁸ AAR, *Railroad Facts* (Washington: multiple editions 2017–2020) 65–80. Foran, Pat, & Stagl, Jeff, eds., “Fleet Stats,” *Progressive Railroading* (multiple editions 2016–2019, and 2021). Year 2020 not available, 2019 Railroad Car Owners data

carried over to 2020. Available: <https://www.progressiverailroading.com/keywords/keywords.aspx?id=0&keywords=Fleet+Stats&year=2017>. (May require log-in for some years.)

⁶⁹ Avery Dennison, available: [RR-Comparison-Panel-Kit-Overview.pdf](https://www.averydennison.com/RR-Comparison-Panel-Kit-Overview.pdf) (averydennison.com).

⁷⁰ Calculation: 2.8 min. marginal training time × \$1.20 per min. × 17,537 employees = \$58,036.

4. Alternatives

FRA considered a few regulatory alternatives before deciding to offer stakeholders the option of using the 10-year replacement cycle or the alternative methods (comparator panels or retroreflectometers). As a presumably lower-cost alternative, FRA considered eliminating the 10-year replacement cycle completely, given that most of the industry is using the comparator panel waiver. However, FRA assessed that some entities might incur higher costs for evaluating sheeting on MOW cars and other privately-owned cars using the comparator panel because these cars may not appear at a repair shop or on a repair track regularly for an SCABT. Some smaller entities with fewer cars may also find it easier to replace the retroreflective sheeting on their cars every 10 years. A pre-determined schedule for replacing sheeting provides regulatory simplicity for these entities and may be easier to implement than a comparator panel-based standard. Overall, including both alternatives increases regulatory flexibility for railroads and car owners.

FRA also considered stricter alternatives that would help FRA enforce the Reflectorization Standards. For example, FRA could mandate railroads and private-car owners record and report when retroreflective sheeting is changed. FRA could also require the industry to report which standard for evaluation and replacement they are following (*i.e.*, either the alternative replacement or the 10-year replacement cycle). As noted in the Overview section above, under the approved waiver for using the comparator panel, the industry has not been consistently recording in UMLER when and why sheeting is replaced. That makes it difficult to determine how much of the sheeting was replaced because of damage, and how much because of the passage of time. Given the size of the fleet and frequency of SCABTs, the recordkeeping and reporting costs could be somewhat significant. Railroads would need to record and report

information that is not currently required, including when the sheeting is replaced, why it is replaced (obscured, damaged, or missing), and how much of the rail car sheeting was replaced. FRA estimates this would cost at least \$201,088 annually.⁷¹ In return, better records could facilitate FRA enforcement, for example, to check if the overall rate of sheeting replacement under the final rule is in-line with expectations for the service life of sheeting in various operations and environments. Given the low accident risk under the waivers historically, FRA has determined that a less costly alternative is appropriate; enforcement will generally rely on FRA inspectors visually inspecting sheeting and SCABT data. For example, if an inspector observes sheeting to be in poor condition and requests records from the railroad that list a recent SCABT, it will provide an indication the sheeting may not have been replaced when required.

5. Sensitivity Analysis

The cost and benefit estimates could change if the analysis's underlying assumptions or inputs were to change. The largest categories of costs presented in Table V-3 are the pre-existing requirements to inspect visually and replace sheeting (§ 224.109), periodically evaluate and replace sheeting (§ 224.111), and transport cars that would not typically appear on a repair track or shop for an SCABT. The costs to inspect visually and replace sheeting, and to evaluate periodically and replace sheeting, depend primarily on the number of cars. The number of cars is about 750,000 and 500,000 respectively for these cost estimates. If the number of cars used in calculating these estimates were to increase, then the estimated net business benefits would increase too. The number of active freight cars may increase if economic growth continues in the short run, likely increasing the demand for freight transportation. FRA used an average of recent freight cars counts

(2016–2020) as a reasonable estimate in its cost estimates.

Furthermore, for the cost to evaluate periodically and replace sheeting, if the cost for purchasing a retroreflectometer decreases over time, or a cheaper substitute method of directly measuring the reflectivity becomes available, the labor time to evaluate the sheeting on a car will decrease. The benefits from using an alternative method will then increase as well.

For the transportation cost, the cost per car is a significant factor. FRA applied the probability of sheeting renewal to estimate this cost. As the actual service life of sheeting in different railroad operations and environments becomes better known, the need to transport cars to replace sheeting may further decrease, reducing this cost. In addition, as mentioned, FRA used a proxy to estimate the number of cars that may need transportation, which is a source of uncertainty in the estimate, but conceptually represents the type of cars that may need transportation.

FRA also used STB wage rates in its estimates, based on the Class I railroads' reports to the STB. Using AAR wage rates will affect the scale of costs, but not the resources used in terms of capital (*i.e.*, the number of cars and comparator panels), and labor time used to comply with the regulation.

AAR commented that FRA's labor rate was much lower than the rate AAR provided (\$59.89 and \$140.38 respectively). FRA retains its labor rate as an input for the primary analysis as explained above. However, FRA recalculates the costs and benefits to illustrate the ways in which the results of the analysis change with respect to the labor rate. Though throughout the primary analysis FRA has updated its labor rates to 2024 dollars, FRA does not have information on the elements in AAR's labor rate beyond the straight-time wage rates reported to the STB to update the AAR labor rate. Therefore, for the sensitivity analysis below, the 2020 wage rates are used.

TABLE V-4—SUMMARY OF TOTAL BENEFITS OVER THE 20-YEAR PERIOD (2020 DOLLARS) USING AAR LABOR RATE *

Impact	Undiscounted	Present value 7%	Present value 3%	Annualized 7%	Annualized 3%
Baseline Cost	\$955,578,923	\$506,171,261	\$710,830,329	\$47,778,986	\$47,778,964
Final Rule Cost	879,222,742	465,795,626	654,071,216	43,967,812	43,963,860

⁷¹ The Paperwork Reduction Act (PRA) analysis for this final rule estimates a cost of \$201,088 for recording and reporting obscured, damaged, or missing sheeting under § 224.109. This analysis

assumes the stricter alternative would require railroads to record and report additional data. As an approximation, the additional burden is another 5 minutes, or \$201,088 annually. Also, Railinc

would incur a cost for programming changes to the UMLER database to accommodate the new data fields. FRA inspectors would also spend more time reviewing these more detailed records.

TABLE V-4—SUMMARY OF TOTAL BENEFITS OVER THE 20-YEAR PERIOD (2020 DOLLARS) USING AAR LABOR RATE *—Continued

Impact	Undiscounted	Present value 7%	Present value 3%	Annualized 7%	Annualized 3%
Net Benefits	76,356,181	40,375,635	56,759,114	3,811,174	3,815,104

* Uses AAR provided labor rate of \$140.38 per hour instead of FRA labor rate of \$59.89 per hour for STB Group 400 Maintenance of Equipment & Stores employees. Government Costs and Qualitative Benefit remain the same as in Table V-1 and are not duplicated here.

As presented in Table V-4, using AAR’s labor rate decreases estimated net benefits by about 30 percent when comparing the present values of costs using a seven percent interest rate (\$55.4 million using FRA’s rate to \$40.4 million using AAR’s rate). In addition, in the baseline scenario, the cost of the primary task of sheeting renewal under \$ 224.111 increases from \$68.21 per car (using FRA’s labor rate) to \$135.24 per car (using AAR’s labor rate), or about double. Similarly, the final rule’s cost for evaluating and applying retroreflective sheeting under \$ 224.111 by using the comparator panel increases from \$16.21 to \$36.74 per car. The resulting benefits increase from \$52 to \$98.50 per car, again, about double. To reiterate, the labor time to accomplish these tasks does not change.

6. Conclusion

As shown in Table V-1 above, FRA estimates the final rule results in net benefits with a present value of \$91 million using a seven percent discount rate and \$128 million using a three percent discount rate (over a 20-year period of analysis in 2024 dollars). In annualized terms, the net benefits are \$8.6 million per year using a seven percent discount rate and a similar \$8.6 million using a three percent discount rate. In addition, the Federal Government would save the cost of reviewing and analyzing waivers of about \$103,285 (present value, seven percent discount rate); \$144,275 (present value, three percent discount rate), or about \$9,700 (annualized, both seven and three percent discount rates).

FRA also estimates there may be ancillary benefits of the final rule in terms of reduced environmental impact from disposing of reflective sheeting prematurely. Given reflective sheeting can remain effective more than 10 years, there would be less reflective sheeting replaced under this rule during the period of analysis. Based on the Preston (2014) study, if reflective sheeting lasts 15 to 20 years, then there would be 50 percent to 100 percent less reflective sheeting replaced and disposed of in comparison to the mandatory 10-year replacement. The benefit would be less waste. Though FRA has not quantified

this benefit, it could be important given the large number of rail cars affected. As in the regulation before this rulemaking, reflective sheeting will still need replacement earlier than 10 years if damaged or obscured. Also, in the long run, the reflective sheeting applied on all cars would need replacement and disposal eventually. FRA invited comment in the NPRM on these environmental benefits. As part of its comments to the NPRM, RSI concurred that the NPRM may have incidental environmental benefits.

B. E.O. 14192 (Unleashing Prosperity Through Deregulation)

E.O. 14192, Unleashing Prosperity Through Deregulation (90 FR 9065, Jan. 31, 2025), requires that for “each new [14192 regulatory action] issued, at least ten prior regulations be identified for elimination.”⁷² Implementation guidance for E.O. 14192 issued by OMB (Memorandum M-25-20, Mar. 26, 2025) defines two different types of E.O. 14192 actions: an E.O. 14192 deregulatory action, and an E.O. 14192 regulatory action.⁷³

An E.O. 14192 deregulatory action is defined as “an action that has been finalized and has total costs less than zero.” This final rulemaking is expected to have total costs less than zero, and therefore it would be considered an E.O. 14192 deregulatory action. This final rule will have an estimated cost savings of \$91 million at a seven percent discount rate over a 20-year span.

C. Regulatory Flexibility Act

The Regulatory Flexibility Act of 1980 (5 U.S.C. 601 *et seq.*) and E.O. 13272, “Proper Consideration of Small Entities in Agency Rulemaking,” (67 FR 53461 (Aug. 16, 2002)) require agency review of proposed and final rules to assess their impacts on small entities. An agency must prepare an Initial Regulatory Flexibility Analysis (IRFA) unless it certifies that a rule, if

promulgated, would not have a significant economic impact on a substantial number of small entities. To help the public comment on the potential small entity impacts of the rulemaking, FRA prepared an IRFA to accompany the NPRM.

In this final rule, FRA is codifying two types of waivers that entities have submitted for relief from the Reflectorization Standards. First, the rule excludes from the Reflectorization Standards those entities that operate rail freight rolling stock used exclusively in THEERP operations except for incidental freight service. FRA has found these operations do not operate their equipment under low-light conditions (*i.e.*, at night) over highway-rail grade crossings. Therefore, these operations pose a low safety risk in terms of grade crossing accidents/incidents preventable by retroreflective sheeting. Second, the final rule codifies a waiver granted to AAR to use alternative methods to determine when to replace retroreflective sheeting. Using the alternative methods allows retroreflective sheeting to be replaced as needed, instead of under a 10-year cycle, resulting in reduced costs and waste. The alternative methods may also result in greater safety by replacing degraded or otherwise substandard sheeting sooner than it would have been under the 10-year replacement cycle. The final rule retains the option to use the 10-year replacement cycle for retroreflective sheeting if an entity prefers to use that option.

FRA did not receive comments directly related to the IRFA. Considering comments received on the NPRM, FRA made changes to the final rule that will increase flexibility for all entities that use the comparator panel, including small entities. The final rule clarifies the process to evaluate retroreflective sheeting for properly trained and experienced employees and allows evaluations to be performed at the next closest effective distance where the recommended distance of 15 feet is not practicable.

⁷² Executive Office of the President. *Executive Order 14192, Unleashing Prosperity Through Deregulation*, 90 FR 9065–9067 (Feb. 6, 2025).

⁷³ Executive Office of the President, OMB, *Guidance Implementing Section 3 of Executive Order 14192, Titled “Unleashing Prosperity Through Deregulation,” Memorandum M-25-20* (Mar. 26, 2025).

Description of Small Entities Impacted by the Final Rule

Federal agencies may adopt their own size standards for small entities in consultation with SBA and in conjunction with public comment. Under that authority, FRA has published a final statement of agency policy that formally establishes “small entities” or “small businesses” as railroads, contractors, and hazardous materials shippers that meet the revenue requirements of a Class III railroad as set forth in 49 CFR part 1201, General Instruction 1–1, which is \$20 million or less in inflation-adjusted annual revenues; and commuter railroads or small governmental jurisdictions that serve populations of 50,000 or less.⁷⁴ The \$20 million limit is based on the STB’s revenue threshold for a Class III railroad carrier. The current threshold is \$47.3 million.⁷⁵ FRA is using this definition for the final rule.

Based on railroads that reported to FRA under 49 CFR part 225 (Railroad Accidents/Incidents) in 2024, FRA estimates the universe of small railroads consists of 745 Class III railroads. The final rule’s provision codifying waivers related to rail cars used in THEERP operations affects primarily the tourist railroads. FRA estimates there are 146 tourist railroads that are Class III railroads to which the final rule will apply. For the provision codifying the alternative method to evaluate retroreflective sheeting, FRA estimates 85 percent of the Class III railroads will use the comparator panel to evaluate sheeting and will be affected, or about 633 small railroads. Therefore, this rule will impact a substantial number of small railroads.

In addition, FRA knows of one manufacturer of comparator panels, specifically Avery Dennison Corp. Avery Dennison employs more than 750 persons, the SBA⁷⁶ benchmark for large businesses. There are other manufacturers of retroreflective sheeting; FRA is aware of ORAFOL Americas, Inc, a subsidiary of the ORAFOL Group, that has purchased Reflexite Corp., and the 3M Co. Both manufacturers currently do not make comparator panels and are large businesses.

Economic Impacts on Small Entities

FRA determined that the impact on small entities affected by the final rule will not be significant but will result in cost savings. Small entities that operate rail freight rolling stock used in THEERP operations will no longer need to file waivers for relief from the Reflectorization Standards and save the cost associated with filing these waivers. In annualized terms using a seven percent discount rate, the final rule results in estimated paperwork reduction benefits of \$6,638 per year. When divided by the class of 146 tourist railroads, each tourist railroad would save \$45.46 per year.⁷⁷

For the provision of the final rule allowing use of an alternative method to evaluate and replace retroreflective sheeting, the compliance requirements for the small entities are the same as for all entities accounted for in the regulatory analysis above. The annualized cost for using a comparator panel was estimated at \$7.07 per car, in comparison to a baseline 10-year replacement cost of \$9.46 per car, a savings of about \$2.39 per car.⁷⁸ The costs for purchasing and recalibrating

the comparator panel are negligible when divided by the many cars in the fleet.

In annualized terms at seven percent, the estimated total compliance costs under the final rule are \$13.15 per car, compared to baseline costs (*i.e.*, without the final rule) of \$16.30 per car, a savings of \$3.155.20 per car. FRA estimated Class III railroads own 54,766 cars on average over the years 2016 through 2020. Thus, the estimated benefit for the small entities is \$285,099. When divided by the 633 railroads that would use the comparator panel method, each railroad would save about \$450 per year (inclusive of waiver savings). These costs were estimated on a per-car basis. The benefits per small entity depend on the number of cars it operates.

Certification

FRA has determined the impact of the final rule will be to allow small railroads to reduce costs by relieving them of the need to file waivers from the Reflectorization Standards. Furthermore, under the final rule, small railroads will reduce costs to evaluate and replace retroreflective sheeting. Accordingly, FRA certifies that this rule will not have a significant economic impact on a substantial number of small entities.

D. Paperwork Reduction Act

FRA is submitting the information collection requirements in this rule to OMB for approval under the Paperwork Reduction Act of 1995.⁷⁹ The sections that contain the new or revised information collection requirements and the estimated time to fulfill each requirement are as follows:⁸⁰

CFR section	Respondent universe	Total annual responses (A)	Average time per response (B)	Total annual burden (C = A * B)	Total cost equivalent in U.S. dollar (D = C * wage rates) ⁸⁰
224.7—Waivers (Revised requirement due to revision under § 224.3).	727 railroads and freight car owners.	1 petition	8 hours	8	\$721.52

⁷⁴ 68 FR 24891 (May 9, 2003) (codified at appendix C to 49 CFR part 209).

⁷⁵ The Class III railroad revenue threshold is \$48.2 million or less for 2024. (The Class II railroad threshold is between \$48.2 million and \$1.07 billion, and the Class I railroad threshold is \$1.07 billion or more.) See STB, *Data Issued in Regulatory Proceedings*. Revenue Deflators. Available: <https://www.stb.gov/reports-data/economic-data/>.

⁷⁶ North American Industry Classification System (NAICS) Code 326113 signifies the Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing firms that would be affected by this final rule. Per SBA, any firm under NAICS code 326113 that employs more than 750 employees

cannot qualify as a small business. U.S. SBA, *Table of Small Business Size Standards Matched to North American Industry Classification Codes* (Jan. 2019). Available: <https://www.sba.gov/document/support-table-size-standards>.

⁷⁷ Under the final rule, railroads that operate equipment used in THEERP operations would save the cost of evaluating and applying retroreflective sheeting to their rail cars too, but since FRA has historically approved the majority of these waivers, the analysis accounts primarily for the savings from not having to file waivers.

⁷⁸ Calculation: Final rule cost for § 224.111 = \$11,718,090/1,658,334 avg. cars per year = \$7.07 per car. Baseline cost (for 10-year replacement) =

\$15,682,390/1,658,334 = \$9.46. Savings = \$9.46 – \$7.07 = \$2.39 per car (annualized, 7 percent).

⁷⁹ 44 U.S.C. 3501 *et seq.*

⁸⁰ STB, *Quarterly Wage Form A&B Data* (2024). Compiled from Class I railroad data reported on Wage Form A&B for year 2024. Calculated as: Wage (\$/hour) = sum of compensation for time worked and paid for straight time rates (\$) for Class I railroads + sum of service hours for time worked and paid for straight time rates (hours) for Class I railroads. Available: <https://www.stb.gov/reports-data/economic-data/quarterly-wage-ab-data/>.

CFR section	Respondent universe	Total annual responses (A)	Average time per response (B)	Total annual burden (C = A * B)	Total cost equivalent in U.S. dollar (D = C * wage rates) ⁸⁰
224.15(b)—Special approval procedures—Petitions for special approval of alternative standard.	2 manufacturers	1 petition	40 hours	40	3,607.60
—(d)(3) Hearing on the petition in accordance with the procedures provided in § 211.25.	FRA does not believe that it will not need any additional information to consider any submitted petitions under the above requirement. Consequently, there is no burden associated with this provision.				
—(e) Disposition of petitions	Exempted from PRA under 5 CFR 1320.4(2).				
224.101—General requirements	The burden for this requirement is covered under § 224.15.				
224.103(d)—Characteristics retroreflective sheeting—Certification.	There would be no burden involved for new cars. In addition, the cost for stamping, etching, molding, printing is included as part of the manufacturing process and consequently there is no burden associated.				
224.103(e)—Characteristics retroreflective sheeting—Alternative standards.	The burden for this requirement is covered under § 224.15.				
224.109(a)—Inspection and replacement of missing, damaged, or obscured retroreflective sheeting—Railroad freight cars—Railroads notification to person responsible for reporting mark after visual inspection for presence and condition when freight car on either side has less than 80% reflective sheeting of the damaged, obscured, or missing sheeting (revised text, section heading).	AAR/400 car shops	33,510 notifications of defect and restriction.	5 minutes	2,793	201,087.93
—(b) Locomotive record of freight retroreflective sheeting defects found after inspection kept in locomotive cab or in railroad accessible electronic database that FRA can access upon request.	727 railroads and freight car owners.	2,460 records of defect and restriction.	5 minutes	205 hours	14,762.05
224.111(c)—Evaluation and replacement of 10-year-old or underperforming retroreflective sheeting—Performance-based replacement.	The burden for this requirement is covered under 49 CFR 232.305 (OMB Control Number 2130–0008), or a locomotive receives an annual inspection required by 49 CFR 229.27 (OMB Control Number 2130–0004).				
224.111(c)(1)(iv)—Evaluation and replacement—Labeling.	The cost of labeling is included as part of the manufacturing process and consequently there is no burden associated.				
Total ⁸¹	727 railroads and 400 car shops.	35,972 responses	N/A	3,046	220,179.10

All estimates include the time for reviewing instructions; searching existing data sources; gathering or maintaining the needed data; and reviewing the information. For information or a copy of the paperwork package submitted to OMB, contact Ms. Arlette Mussington, Information Collection Clearance Officer, at 571–609–1285 or Ms. Joanne Swafford, Information Collection Clearance Officer, at 757–897–9908.

OMB is required to make a decision concerning the collection of information requirements contained in this rule between 30 and 60 days after publication of this document in the **Federal Register**. Therefore, a comment to OMB is best assured of having its full effect if OMB receives it within 30 days of publication.

FRA is not authorized to impose a penalty on persons for violating information collection requirements that do not display a current OMB control number, if required. The current OMB control number is 2130–0566.

E. Federalism Implications

This final rule will not have a substantial effect 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. Thus, in accordance with E.O. 13132, “Federalism” (64 FR 43255, Aug. 10, 1999), preparation of a Federalism Assessment is not warranted.

F. International Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the U.S. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. This rulemaking is purely domestic in nature and is not expected to affect trade opportunities for U.S. firms doing business overseas or for foreign firms doing business in the U.S.

G. Environmental Assessment

FRA has analyzed this rule for the purposes of the National Environmental Policy Act of 1969 (NEPA). In accordance with 42 U.S.C. 4336 and DOT NEPA Order 5610.1D, FRA has determined that this rule is categorically excluded pursuant to 23 CFR 771.116(c)(15). There are no unusual or extraordinary circumstances present in connection with this rulemaking.

H. E.O. 13175 (Tribal Consultation)

FRA has evaluated this final rule in accordance with the principles and criteria contained in E.O. 13175, Consultation and Coordination with Indian Tribal Governments, (Nov. 6, 2000). The final rule would not have a substantial direct effect on one or more Indian tribes, would not impose substantial direct compliance costs on Indian tribal governments, and would not preempt tribal laws. Therefore, the funding and consultation requirements of E.O. 13175 do not apply, and a tribal summary impact statement is not required.

⁸¹Totals may not add due to rounding.

I. Unfunded Mandates Reform Act of 1995

This final rule will not result in the expenditure, in the aggregate, of \$100,000,000 or more, adjusted for inflation, in any one year by State, local, or Indian Tribal governments, or the private sector. Thus, consistent with section 202 of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4, 2 U.S.C. 1532), FRA is not required to prepare a written statement detailing the effect of such an expenditure.

J. Energy Impact

E.O. 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (66 FR 28355, May 22, 2001), requires Federal agencies to prepare a Statement of Energy Effects for any “significant energy action.” FRA has evaluated this rule in accordance with E.O. 13211 and determined that this rule is not a “significant energy action” within the meaning of E.O. 13211.

List of Subjects in 49 CFR Part 224

Penalties, Railroad safety, Reflectorization standards.

The Final Rule

For the reasons stated above, FRA amends part 224 of chapter II, subtitle B of title 49, Code of Federal Regulations, as follows:

PART 224—REFLECTORIZATION OF RAIL FREIGHT ROLLING STOCK

■ 1. The authority citation for part 224 continues to read as follows:

Authority: 49 U.S.C. 20103, 20107, 20148 and 21301; 28 U.S.C. 2461 note; and 49 CFR 1.89.

■ 2. Amend § 224.3 by revising paragraphs (c) and (d) and adding paragraph (e) to read as follows:

§ 224.3 Applicability.

* * * * *

(c) Locomotives and passenger cars used exclusively in passenger service;

(d) Freight rolling stock that is subject to a reflectorization requirement promulgated by another Federal agency; or

(e) Freight rolling stock used for only for tourist, historic, excursion, educational, recreational, or private purposes, except for incidental freight service.

§ 224.107 [Removed and Reserved]

■ 3. Remove and reserve § 224.107.

■ 4. Revise § 224.109 to read as follows:

§ 224.109 Inspection and replacement of missing, damaged, or obscured retroreflective sheeting.

(a) *Railroad freight cars.*

Retroreflective sheeting on railroad freight cars subject to this part must be visually inspected for presence and condition whenever a car undergoes a single car air brake test required under 49 CFR 232.305. If at the time of inspection less than 80 percent of the amount of sheeting required under § 224.105 on either side of a car is present, not damaged, and not obscured, the inspecting railroad or contractor shall promptly notify the person responsible for the reporting mark, as indicated in the Universal Machine Language Equipment Register, of the damaged, obscured, or missing sheeting (unless the inspecting railroad or contractor is the person responsible for the reporting mark). The inspecting railroad or contractor shall retain a written or electronic copy of each such notification made for at least two years from the date of the notice and shall make these records available for inspection and copying by the FRA upon request. Any person notified of a defect under this section shall have nine months (270 calendar days) from the date of notification to repair or replace the damaged, obscured, or missing sheeting. Where the inspecting railroad or contractor is the person responsible for the reporting mark, the person shall have nine months (270 calendar days) from the date of the inspection to repair or replace the damaged, obscured, or missing sheeting.

(b) *Locomotives.* Retroreflective sheeting must be visually inspected for presence and condition when the locomotive receives the annual inspection required under 49 CFR 229.27. If at the time of inspection, less than 80 percent of the amount of sheeting required under § 224.105 on either side of a locomotive is present, not damaged, and not obscured, the damaged, obscured, or missing sheeting must be repaired or replaced within nine months (270 calendar days) from the date of inspection, provided a record of the defect is maintained in the locomotive cab or in a secure and accessible electronic database to which FRA is provided access on request.

■ 5. Revise § 224.111 to read as follows:

§ 224.111 Evaluation and replacement of 10-year-old or underperforming retroreflective sheeting.

(a) *Replacement process.*

Retroreflective sheeting required by this part shall comply with the replacement process in either paragraph (b) or (c) of this section.

(b) *10-year replacement cycle.* Regardless of condition, retroreflective sheeting required by this part shall be replaced with new, ungraded, sheeting no later than 10 years after the initial installation date. At the time of replacement, it is not necessary to remove the previously installed sheeting unless it interferes with the placement of the replacement sheeting, as required by § 224.106, but the previously installed sheeting shall not be considered in calculating the required minimum area of retroreflective material required as shown in Table 2 to this subpart.

(c) *Replacement based on retroreflective comparator panel.* Except as provided in paragraphs (c)(2)(ii) and (c)(3) of this section, retroreflective sheeting shall be evaluated using a properly calibrated comparator panel, manufactured to the specifications outlined under paragraph (c)(1) of this section, whenever a car undergoes a single car air brake test required by 49 CFR 232.305, or a locomotive receives an annual inspection required by 49 CFR 229.27.

(1) *Retroreflective comparator panel specifications—(i) Retroreflectivity.* Retroreflective comparator panels shall have the minimum (and maximum, if applicable) retroreflectivity values as outlined in Table 1 to paragraph (c)(1)(iv) of this section.

(ii) *Color.* Retroreflective comparator panels shall be yellow or white as outlined in § 224.103(b).

(iii) *Construction.* Retroreflective comparator panels shall be 4 inches wide by 4 inches high, be constructed with glass-beaded material or other material that displays uniform appearance when rotated and viewed with a light source, and have a magnetic backing so that the panel can be attached to rail freight rolling stock.

(iv) *Labeling.* Retroreflective comparator panels shall have a waterproof and dust-proof label affixed to the backing. The label shall contain: the phrase “Retroreflective Comparator Panel—Yellow” or “Retroreflective Comparator Panel—White;” and the name of the manufacturer, the part, model, or serial number, the date the panel was manufactured, the target retroreflectivity level to which the panel was manufactured (measured in cd/lx/m²), and a space provided for the certified recalibration date. Retroreflective comparator panels shall be recalibrated at least every two years and the date of a panel’s most recent recalibration must appear in the space provided on the label.

TABLE 1 TO § 224.111(c)(1)(iv)—RETROREFLECTIVE COMPARATOR PANEL REQUIREMENTS
[Retroreflective Comparator Panel Requirements]

Color	Required retroreflectivity (cd/lx/m ²) at -4° entrance and of 0.2° observation angles		Required retroreflectivity (cd/lx/m ²) at 30° entrance and of 0.5° observation angles
	Minimum	Maximum	Minimum
White	250	285	60
Yellow	150	170	35

(2) *Retroreflective comparator panel evaluation process and criteria.* Each retroreflective sheeting on rail freight rolling stock shall be evaluated on its performance. The evaluation procedure shall consist of the following:

(i) Retroreflective sheeting shall be visually evaluated with the use of a light source. The light source must be of sufficient intensity to illuminate and overcome ambient lighting conditions. A brighter light source (LED) is recommended in daylight conditions.

(ii) Properly trained and experienced persons may pass sheeting that they determine to be obviously compliant and fail sheeting they determine to be obviously noncompliant (including obscured) based on their initial visual inspection. Any sheeting that they do not determine to be obviously compliant or noncompliant, shall be evaluated using a retroreflective comparator panel comparison.

(iii) Retroreflective comparator panels shall conform to the requirements outlined in paragraph (c)(1) of this section, and the panel's color shall match the color of the installed sheeting being evaluated.

(iv) The comparator panel shall be placed directly adjacent to, or overlapping, the retroreflective sheeting being evaluated. The retroreflective sheeting shall also be cleaned, as necessary, before the evaluation begins.

(v) Retroreflective sheeting and the comparator panel shall be evaluated from a position perpendicular to the installed sheeting, preferably from a distance of 15 feet from the installed sheeting and the comparator panel. In the event conducting the evaluation from 15 feet away is not practicable, the evaluation may be conducted from the next closest alternative distance that still permits effective evaluation.

(vi) The light source shall be positioned adjacent to the inspector's eye (left or right) and directed at the sheeting and comparator panel, and a comparison of the reflected light intensity of the entire installed sheeting to that of the comparator panel shall be made. The installed sheeting shall pass or fail based on the following criteria:

(A) If the perceived reflected light intensity of the entire installed sheeting appears brighter than that of the comparator panel, the installed sheeting passes the evaluation.

(B) If the perceived reflected light intensity of the entire installed sheeting does not appear brighter than that of the comparator panel, or if it cannot be discerned if one is brighter than the other, the sheeting fails the evaluation and shall be replaced prior to the equipment returning to service.

(C) Installed sheeting that is damaged, obscured, or missing, cannot be evaluated with the comparator panel

and shall be replaced prior to the equipment returning to service.

(3) *Handheld retroreflectometers.* A properly calibrated handheld retroreflectometer may be used in lieu of a comparator panel, subject to the following conditions:

(i) The handheld retroreflectometer shall be an annular device. A single measurement on a strip of sheeting shall suffice with an annular device, provided that the sheeting is not damaged, obscured, or missing.

(ii) The handheld device shall be placed directly against the reflective sheeting, and the measurement shall be made based on the device manufacturer's recommendation.

(iii) The minimum allowable retroreflective value is 150 cd/lx/m² for yellow sheeting and 250 cd/lx/m² for white sheeting, when measured at the -4° entrance angle and 0.2° observation angle configuration. Sheetings that does not meet these minimum allowable retroreflectivity values shall be replaced prior to the equipment returning to service.

Issued in Washington, DC.

Robert Andrew Feeley,
Deputy Administrator.

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