DEPARTMENT OF TRANSPORTATION

Federal Railroad Administration

49 CFR Part 238

[Docket No. FRA–2006–25268, Notice No. 2]

RIN 2130–AB80

Passenger Equipment Safety Standards; Front End Strength of Cab Cars and Multiple-Unit Locomotives

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

ACTION: Final rule.

SUMMARY: This final rule is intended to further the safety of passenger train occupants by amending existing regulations to enhance requirements for the structural strength of the front end of cab cars and multiple-unit (MU) locomotives. These enhancements include the addition of requirements concerning structural deformation and energy absorption by collision posts and corner posts at the forward end of this equipment. The requirements are based on standards specified by the American Public Transportation Association (APTA). FRA is also making clarifying amendments to existing regulations for the structural strength of passenger equipment and is clarifying its views on the preemptive effect of this part.

DATES: *Effective Date:* This final rule is effective March 9, 2010. Petitions for reconsideration of this final rule must be received not later than February 22, 2010.

ADDRESSES: Any petition for reconsideration of the final rule should reference Docket No. FRA–2006–25268, Notice No. 2, and be submitted by any of the following methods:

- *Federal eRulemaking Portal.* Go to *http://www.regulations.gov*. Follow the online instructions for submitting comments.
- *Mail:* Docket Management Facility, U.S. Department of Transportation, 1200 New Jersey Avenue, SE., West Building Ground Floor, Room W12–140, Washington, DC 20590.
- *Hand Delivery:* Docket Management Facility, U.S. Department of Transportation, 1200 New Jersey Avenue, SE., West Building Ground Floor, Room W12–140, Washington, DC, between 9 a.m. and 5 p.m. Monday through Friday, except Federal holidays.
- *Fax:* 202–493–2251.

Instructions: Note that all petitions for reconsideration received will be posted without change to *http://www.regulations.gov*, including any personal information provided. Please *see* the Privacy Act heading, below.

Docket: For access to the docket to read background documents, comments, or petitions for reconsideration received, go to *http://www.regulations.gov* anytime, or to the Docket Management Facility, U.S. Department of Transportation, West Building Ground Floor, Room W12–140, 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. Follow the online instructions for accessing the dockets.

FOR FURTHER INFORMATION CONTACT: Gary G. Fairbanks, Specialist, Motive Power and Equipment Division, Office of Railroad Safety, RRS–14, Mail Stop 25, Federal Railroad Administration, 1200 New Jersey Avenue, SE., Washington, DC 20590 (telephone 202–493–6282); Eloy E. Martinez, Program Manager, Equipment and Operating Practices Division, Office of Railroad Development, Federal Railroad Administration, 55 Broadway, Cambridge, Massachusetts 02142 (telephone 617–494–2599); or Daniel L. Alpert, Trial Attorney, Office of Chief Counsel, Mail Stop 10, Federal Railroad Administration, 1200 New Jersey Avenue, SE., Washington, DC 20590 (telephone 202–493–6026).

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I. Statutory Background

In September of 1994, the Secretary of Transportation (Secretary) convened a meeting of representatives from all sectors of the rail industry with the goal of enhancing rail safety. As one of the initiatives arising from this Rail Safety

Summit, the Secretary announced that DOT would begin developing safety standards for rail passenger equipment over a five-year period. In November of 1994, Congress adopted the Secretary's schedule for implementing rail passenger equipment safety regulations and included it in the Federal Railroad Safety Authorization Act of 1994 (the Act), Public Law 103–440, 108 Stat. 4619, 4623–4624 (November 2, 1994). Congress also authorized the Secretary to consult with various organizations involved in passenger train operations for purposes of prescribing and amending these regulations, as well as issuing orders pursuant to them. Section 215 of the Act is codified at 49 U.S.C. 20133.

II. Proceedings to Date

A. Proceedings To Carry Out the Initial 1994 Rulemaking Mandate

The Secretary delegated these rulemaking responsibilities to the Administrator of the Federal Railroad Administration, *see* 49 CFR 1.49(m), and FRA formed the Passenger Equipment Safety Standards Working Group to provide FRA with advice in developing the regulations. On June 17, 1996, FRA published an advance notice of proposed rulemaking (ANPRM) concerning the establishment of comprehensive safety standards for railroad passenger equipment. *See* 61 FR 30672. The ANPRM provided background information on the need for such standards, offered preliminary ideas on approaching passenger safety issues, and presented questions on various passenger safety topics. Following consideration of comments received on the ANPRM and advice from FRA's Passenger Equipment Safety Standards Working Group, FRA published an NPRM on September 23, 1997, to establish comprehensive safety standards for railroad passenger equipment. *See* 62 FR 49728. In addition to requesting written comment on the NPRM, FRA also solicited oral comment at a public hearing held on November 21, 1997. FRA considered the comments received on the NPRM and prepared a final rule establishing comprehensive safety standards for passenger equipment, which was published on May 12, 1999. *See* 64 FR 25540.

After publication of the final rule, interested parties filed petitions seeking FRA's reconsideration of certain requirements contained in the rule. These petitions generally related to the following subject areas: Structural design; fire safety; training; inspection, testing, and maintenance; and movement of defective equipment. To address the petitions, FRA grouped issues together and published in the **Federal Register** three sets of amendments to the final rule. Each set of amendments summarized the petition requests at issue, explained what action, if any, FRA decided to take in response to the issues raised, and described FRA's justifications for its decisions and any action taken. Specifically, on July 3, 2000, FRA issued a response to the petitions for reconsideration relating to the inspection, testing, and maintenance of passenger equipment, the movement of defective passenger equipment, and other miscellaneous provisions related to mechanical issues contained in the final rule. *See* 65 FR 41284. On April 23, 2002, FRA responded to all remaining issues raised in the petitions for reconsideration, with the exception of those relating to fire safety. *See* 67 FR 19970. Finally, on June 25, 2002, FRA completed its response to the petitions for reconsideration by publishing a response to the petitions for reconsideration concerning the fire safety portion of the rule. *See* 67 FR 42892. (For more detailed information on the petitions for reconsideration and FRA's response to them, please *see* these three rulemaking documents.) The product of this rulemaking was codified primarily at 49 CFR part 238 and secondarily at 49 CFR parts 216, 223, 229, 231, and 232.

Meanwhile, another rulemaking on passenger train emergency preparedness produced a final rule codified at 49 CFR part 239. *See* 63 FR 24629 (May 4, 1998). The rule addresses passenger train emergencies of various kinds, including security situations, and requires the preparation, adoption, and implementation of emergency preparedness plans by railroads connected with the operation of passenger trains. The emergency preparedness plans must include elements such as communication, employee training and qualification, joint operations, tunnel safety, liaison with emergency responders, on-board emergency equipment, and passenger safety information. The rule requires each affected railroad to instruct its employees on the applicable provisions of its plan, and the plan adopted by each railroad is subject to formal review and approval by FRA. The rule also requires each railroad operating passenger train service to conduct emergency simulations to determine its capability to execute the emergency preparedness plan under the variety of emergency scenarios that could reasonably be expected to occur. In addition, in promulgating the rule, FRA established specific requirements for passenger train emergency systems, *e.g.,* to mark all emergency window exits and all windows intended for rescue access by emergency responders, to light or mark all door exits intended for egress, to mark all door exits intended for rescue access by emergency responders, and to provide instructions for the use of such exits and means of rescue access.

B. Key Issues Identified for Future Rulemaking

Although FRA had completed these rulemakings, FRA had identified various issues for possible future rulemaking, including those to be addressed following the completion of additional research, the gathering of additional operating experience, or the development of industry standards, or all three. One such issue concerned enhancing the requirements for corner posts on cab cars and MU locomotives. *See* 64 FR 25607. FRA requirements for corner posts were based on conventional industry practice at the time, which had not proven adequate in then-recent side swipe collisions with cab cars leading. *Id.* FRA explained that those requirements were being adopted as an interim measure to prevent the introduction of equipment not meeting the requirements, that FRA was assisting APTA in preparing an industry standard for corner post arrangements on cab cars and MU locomotives, and that adoption of a suitable Federal standard would be an immediate priority. *Id.* In broader terms, this issue concerned the behavior of cab car and MU locomotive end frames when overloaded, as during an impact with maintenance-of-way equipment or with a highway vehicle at a highway-rail grade crossing, and thus concerned collision post strength as well. FRA and interested industry members also began identifying other issues related to the passenger equipment safety standards and the passenger train emergency preparedness regulations. FRA decided to address these issues with the assistance of FRA's Railroad Safety Advisory Committee (RSAC).

C. RSAC Overview

In March 1996, FRA established RSAC, which provides a forum for developing consensus recommendations to FRA's Administrator on rulemakings and other safety program issues. The Committee includes representation from all of the agency's major stakeholders, including railroads, labor organizations, suppliers and manufacturers, and other interested parties. A list of member groups follows:

- American Association of Private Railroad Car Owners (AARPCO);
- American Association of State Highway and Transportation Officials (AASHTO);
- American Chemistry Council;
- American Petroleum Institute;
- APTA;
- American Short Line and Regional Railroad Association (ASLRRA);
- American Train Dispatchers Association;
- Association of American Railroads (AAR);
- Association of Railway Museums;
- Association of State Rail Safety Managers (ASRSM);
- Brotherhood of Locomotive Engineers and Trainmen (BLET);
- Brotherhood of Maintenance of Way Employes Division;
- Brotherhood of Railroad Signalmen (BRS);
- Chlorine Institute;
- Federal Transit Administration (FTA);*
- Fertilizer Institute;
- High Speed Ground Transportation Association (HSGTA);
- Institute of Makers of Explosives;
- International Association of Machinists and Aerospace Workers;
- International Brotherhood of Electrical Workers (IBEW);
- Labor Council for Latin American Advancement;*
- League of Railway Industry Women;*
- National Association of Railroad Passengers (NARP);
- National Association of Railway Business Women;*
- National Conference of Firemen & Oilers;
- National Railroad Construction and Maintenance Association;
- National Railroad Passenger Corporation (Amtrak);
- NTSB;*
- Railway Supply Institute (RSI);
- Safe Travel America (STA);
- Secretaria de Comunicaciones y Transporte;*
- Sheet Metal Workers International Association (SMWIA);
- Tourist Railway Association, Inc.;
- Transport Canada;*
- Transport Workers Union of America (TWU);
- Transportation Communications International Union/BRC (TCIU/BRC);
- Transportation Security Administration (TSA);* and
- United Transportation Union (UTU).

*Indicates associate, non-voting membership.

When appropriate, FRA assigns a task to RSAC, and after consideration and debate, RSAC may accept or reject the task. If the task is accepted, RSAC establishes a working group that possesses the appropriate expertise and representation of interests to develop recommendations to FRA for action on the task. These recommendations are developed by consensus. A working group may establish one or more task forces to develop facts and options on a particular aspect of a given task. The individual task force then provides that information to the working group for consideration. If a working group comes to unanimous consensus on recommendations for action, the package is presented to the full RSAC for a vote. If the proposal is accepted by a simple majority of RSAC, the proposal is formally recommended to FRA. FRA then determines what action to take on the recommendation. Because FRA staff play an active role at the working group level in discussing the issues and options and in drafting the language of the consensus proposal, FRA is often favorably inclined toward the RSAC recommendation. However, FRA is in no way bound to follow the recommendation, and the agency exercises its independent judgment on whether the recommendation achieves the agency's regulatory goal, is soundly supported, and is in accordance with policy and legal requirements. Often, FRA varies in some respects from the RSAC recommendation in developing an actual regulatory proposal or final rule. Any such variations would be noted and explained in the rulemaking document issued by FRA. If the working group or RSAC is unable to reach consensus on a recommendation for action, FRA moves ahead to resolve the issue(s) through traditional rulemaking proceedings or other action.

D. Establishment of the Passenger Safety Working Group in May 2003

On May 20, 2003, FRA presented, and RSAC accepted, the task of reviewing existing passenger equipment safety needs and programs and recommending consideration of specific actions that could be useful in advancing the safety of rail passenger service. RSAC established the Passenger Safety Working Group (Working Group) to handle this task and develop recommendations for the full RSAC body to consider. Members of the Working Group, in addition to FRA, include the following:

- AAR, including members from BNSF Railway Company (BNSF), CSX Transportation, Inc., and Union Pacific Railroad Company;
- AAPRCO;
- AASHTO;
- Amtrak;
- APTA, including members from Bombardier, Inc., LDK Engineering, Herzog Transit Services, Inc., Long Island Rail Road (LIRR), Metro—North Commuter Railroad Company (Metro-North), Northeast Illinois Regional Commuter Railroad Corporation (Metra), Southern California Regional Rail Authority (Metrolink), and Southeastern Pennsylvania Transportation Authority (SEPTA);
- BLET;
- BRS;
- FTA;
- HSGTA;
- IBEW;
- NARP;
- RSI;
- SMWIA;
- STA;
- TCIU/BRC;
- TWU; and
- UTU.

Staff from DOT's John A. Volpe National Transportation Systems Center (Volpe Center) attended all of the meetings and contributed to the technical discussions. In addition, staff from the NTSB met with the Working Group. The Working Group has held 13 meetings on the following dates and locations:

- September 9–10, 2003, in Washington, DC;
- November 6, 2003, in Philadelphia, PA;
- May 11, 2004, in Schaumburg, IL;
- October 26–27, 2004 in Linthicum/Baltimore, MD;
- March 9–10, 2005, in Ft. Lauderdale, FL;
- September 7, 2005 in Chicago, IL;
- March 21–22, 2006 in Ft. Lauderdale, FL;
- September 12–13, 2006 in Orlando, FL;
- April 17–18, 2007 in Orlando, FL;
- December 11, 2007 in Ft. Lauderdale, FL;
- June 18, 2008, in Baltimore, MD;
- November 13, 2008, in Washington, DC; and
- June 8, 2009, in Washington, DC.

At the meetings in Chicago and Ft. Lauderdale in 2005, FRA met with representatives of Tri-Rail (the South Florida Regional Transportation Authority) and Metra, respectively, and toured their passenger equipment. The visits were open to all members of the Working Group and FRA believes they have added to the collective understanding of the Group in identifying and addressing passenger equipment safety issues.

E. Establishment of the Crashworthiness/Glazing Task Force in November 2003

Due to the variety of issues involved, at its November 2003 meeting the Working Group established four task forces—smaller groups to develop recommendations on specific issues within each group's particular area of expertise. Members of the task forces included various representatives from the respective organizations that were part of the larger Working Group. One of these task forces was assigned the job of identifying and developing issues and recommendations specifically related to the inspection, testing, and operation of passenger equipment as well as concerns related to the attachment of safety appliances on passenger equipment. An NPRM on these topics was published on December 8, 2005, *see* 70 FR 73069, and a final rule was published on October 19, 2006, *see* 71 FR 61835. Another of these task forces was established to identify issues and develop recommendations related to emergency systems, procedures, and equipment, and helped to develop an NPRM on these topics that was published on August 24, 2006, *see* 71 FR 50276, and a final rule that was published on February 1, 2008, *see* 73 FR 6370. Another task force, the Crashworthiness/Glazing Task Force (Task Force), was assigned the job of developing recommendations related to glazing integrity, structural crashworthiness, and the protection of occupants during accidents and incidents. Specifically, this Task Force was charged with developing recommendations for glazing qualification testing and for cab car and MU locomotive end frame optimization. (Glazing and cab car/MU locomotive end frame issues are being handled separately, and glazing is not a subject of this final rule.) The Task Force was also given the responsibility of addressing a number of other issues related to glazing, structural crashworthiness, and occupant protection and recommending any research necessary to facilitate their resolution. Members of the Task Force, in addition to FRA, include the following:

- AAR;
- Amtrak;
- APTA, including members from Bombardier, Inc., General Electric Transportation Systems, General Motors–Electro-Motive Division, Kawasaki Rail Car, Inc., LDK Engineering, LIRR, LTK Engineering Services, Maryland Transit Administration, Massachusetts Bay Transportation Authority (MBTA), Metrolink, Metro-North, Northern Indiana Commuter Transportation District (NICTD), Hyundai Rotem Company, Saint Gobian Sully NA, San Diego Northern Commuter Railroad (Coaster), SEPTA, and STV, Inc.;
- BLET;
- California Department of Transportation (Caltrans);
- NARP;
- RSI; and
- UTU.

While not voting members of the Task Force, representatives from the NTSB attended meetings and contributed to the discussions of the Task Force. In addition, staff from the Volpe Center attended all of the meetings and contributed to the technical discussions.

The Task Force held seven meetings on the following dates and locations:

- March 17–18, 2004, in Cambridge, MA;
- May 13, 2004, in Schaumburg, IL;
- November 9, 2004, in Boston, MA;
- February 2–3, 2005, in Cambridge, MA;
- April 21–22, 2005, in Cambridge, MA;
- August 11, 2005, in Cambridge, MA; and
- September 9–10, 2008, in Cambridge, MA.

F. Development of the NPRM Published in August 2007

The NPRM was developed to address concerns raised and issues discussed about cab car and MU locomotive front end frame structures during the Task Force meetings and pertinent Working Group meetings. Minutes of each of these meetings have been made part of the docket in this proceeding and are available for public inspection. Except for one issue, which is discussed below, the Working Group reached consensus on the principal regulatory provisions contained in the NPRM at its meeting in September 2005. After the September 2005 meeting, the Working Group presented its recommendations to the full RSAC body for concurrence at its meeting in October 2005. All of the members of the full RSAC in attendance at its October 2005 meeting accepted the regulatory recommendations submitted by the Working Group. Thus, the Working Group's recommendations became the full RSAC's recommendations to FRA.

After reviewing the full RSAC's recommendations, FRA agreed that the recommendations provided a good basis for a proposed rule, but that test standards and performance criteria more suitable to cab cars and MU locomotives without flat forward ends or with energy absorbing structures used as part of a crash energy management design (CEM), or both, should be specified. The NPRM therefore provided an option for the dynamic testing of cab cars and MU locomotives as a means of demonstrating compliance with the rule. However, FRA made clear that the proposal was not the result of an RSAC recommendation. Otherwise, FRA adopted the RSAC's recommendations with generally minor changes for purposes of clarity and formatting in the **Federal Register**.

The NPRM was published in the **Federal Register** on August 1, 2007, *see* 72 FR 42016, and FRA solicited public comment on it. FRA notified the public of its option to submit written comments on the NPRM and to request a public, oral hearing on the NPRM. FRA also invited comment on a number of specific issues related to the proposed requirements for the purpose of developing the final rule.

G. Development of This Final Rule

This final rule is the product of FRA's review and consideration of the recommendations of the Task Force, Working Group, and full RSAC, and the written comments to the docket. FRA received written comments in response to the publication of the NPRM from a wide array of interested parties. Specifically, FRA received three separate comments from members of the U.S. Congress: (1) From Senator Kent Conrad, Senator Byron Dorgan, and Congressman Earl Pomeroy; (2) from Congressman James Oberstar, Chairman, House Committee on Transportation and Infrastructure, and Congressman Bennie Thompson, Chairman, House Committee on Homeland Security; and (3) from Congressman Adam Schiff. FRA also received comments from the AAR and APTA, which represent freight and passenger railroads, respectively, as well as comments from Caltrans and the Peninsula Corridor Joint Powers Board (Caltrain), which are involved in providing passenger rail service. The BLET and UTU submitted comments on behalf of the railroad employees whom they represent. In addition, FRA received comments from rail car manufacturers Bombardier and Colorado Railcar Manufacturing (CRM), as well as from the firm of Raul V. Bravo + Associates, Inc. (RVB). FRA also received comments from other interested parties: the American Association for Justice (AAJ), formerly known as the Association of Trial Lawyers of America, and the California Public Utilities Commission (CPUC). All Aboard Washington (AAWA), an advocacy organization for promoting rail service in the Pacific Northwest, and a private citizen also commented on the NPRM. At about the same time as the written comment period closed on October 1, 2007, management of DOT rulemaking dockets was transitioning from DOT to the Federal Docket Management System at *http://www.regulations.gov*. This transition led to some delay in the posting of comments to the Web site; however, FRA has considered all such comments in preparing this final rule.

FRA notes that Congressman Adam Schiff made a request that FRA hold public hearings to receive oral comment on the NPRM in Los Angeles or Glendale, CA, so that those who have a "deeply-felt" concern for rail safety could be heard. As stated in a January 30, 2008 letter to Congressman Schiff, FRA discussed this request with the Congressman's staff and was informed that the Congressman had decided to reserve his request that FRA convene public hearings on the NPRM. (A copy of this letter has been placed in the public docket for this rulemaking.) No public hearing was held in response to the NPRM.

Throughout the preamble discussion of this final rule, FRA refers to comments, views, suggestions, or recommendations made by members of the Task Force, Working Group, and full RSAC. FRA does so to show the origin of certain issues and the nature of discussions concerning those issues at the Task Force, Working Group, and full RSAC level. FRA believes this serves to illuminate factors that it has weighed in making its regulatory decisions, as well as the logic behind those decisions. The reader should keep in mind, of course, that only the full RSAC makes recommendations to FRA and that it is the consensus recommendation of the full RSAC on which FRA acts. However, as noted above, FRA is in no way bound to follow the recommendation, and the agency exercises its independent judgment on whether the recommended rule achieves the agency's regulatory goal, is soundly supported, and is in accordance with policy and legal requirements.

III. Technical Background

Transporting passengers by rail in the U.S. is very safe. Since the beginning of 1978, about 12.5 billion passengers have traveled by rail, based on reports filed monthly with FRA. The number of rail passengers has steadily increased over the years, and since the year 2000 has averaged more than 525 million passengers per year. On a passenger-mile basis, with an average of about 16.1 billion passenger-miles per year since 2000, rail travel is about as safe as scheduled airline service and intercity bus transportation, and it is far safer than private motor vehicle travel. Passenger rail accidents—while always to be avoided—have a very high passenger survival rate.

Yet, as in any form of transportation, there are risks inherent in passenger rail travel. For this reason, FRA continually works to improve the safety of passenger rail operations. FRA's efforts include sponsoring the research and development of safety technologies, providing technical support for industry specifications and standards, and engaging in cooperative rulemaking efforts with key industry stakeholders. FRA has focused in particular on enhancing the crashworthiness of passenger trains.

In a passenger train collision or derailment, the principal crashworthiness risks that occupants face are the loss of safe space inside the train from crushing of the train structure and, as the train decelerates, the risk of secondary impacts with interior surfaces. Therefore, the principal goals of the crashworthiness research sponsored by FRA are twofold: First, to preserve a safe space in which occupants can ride out the collision or derailment, and, then, to minimize the physical forces to which occupants are subjected when impacting surfaces inside a passenger train as the train decelerates. Though not a part of this final rule, other crashworthiness research focuses on related issues such as fuel tank safety, for equipment with a fuel tank, and the associated risk of fire if the fuel tank is breached during the collision or derailment.

The results of ongoing research on cab car and MU locomotive front end frame structures help demonstrate both the effectiveness and the practicality of the structural enhancements in this final rule to make this equipment more crashworthy. This research is discussed below, along with other technical information providing the background for this rulemaking.

A. Predominant Types of Passenger Rail Service

FRA's focus on cab car and MU locomotive crashworthiness should be considered in the context of the predominant types of passenger rail service in North America. The first involves operation of passenger trains with conventional locomotives in the lead, typically pulling consists of passenger coaches and other cars such as baggage cars, dining cars, and sleeping cars. Such trains are common on long-distance, intercity rail routes operated by Amtrak. On a daily basis, however, most passenger rail service is provided by commuter railroads, which typically operate one or both of the two most predominant types of service: Push-pull service and MU locomotive service.

Push-pull service is passenger train service typically operated, in one direction of travel, with a conventional locomotive in the rear of the train pushing the consist (the "push mode") and with a cab car in the lead position of the train; and, in the opposite direction of travel, the service is operated with the conventional locomotive in the lead position of the train pulling the consist (the "pull mode") and with the cab car in the rear of the train. (A cab car is both a passenger car, in that it has seats for passengers, and a locomotive, in that it has a control cab from which the engineer can operate the train.) Control cables run the length of the train, as do electrical lines providing power for heat, lights, and other purposes.

MU locomotive service is passenger rail service involving trains consisting of self-propelled electric or diesel MU locomotives. MU locomotives may operate individually but typically operate semi-permanently coupled together as a pair or triplet with a control cab at each end of the consist. During peak commuting hours, multiple pairs or triplets of MU locomotives, or a combination of both, are typically operated together as a single passenger train in MU service. This type of service does not make use of a conventional locomotive as a primary means of motive power. MU locomotive service is very similar to push-pull service as operated in the push mode with the cab car in the lead.

By focusing on enhancements to cab car and MU locomotive crashworthiness, FRA seeks to enhance the safety of the two most typical forms of passenger rail service in the U.S.

B. Front End Frame Structures of Cab Cars and MU Locomotives

Structurally, MU locomotives and cab cars built in the same period are very similar. Both are designed to be occupied by passengers and to operate as the lead units of passenger trains. The principal distinction is that cab cars do not have motors to propel themselves. Unlike MU locomotives and cab cars, conventional locomotives are not designed to be occupied by passengers—only by operating crewmembers. Concern has been raised about the safety of cab car-led and MU locomotive train service due to the closer proximity of the engineer and passengers to the leading end of the train than in conventional locomotive-led service.

The principal purpose of cab car and MU locomotive front end frame structures is to provide protection for the engineer and passengers in the event of a collision where the superstructure of the vehicle is directly engaged and the underframe is either not engaged or only indirectly engaged in the collision. In the event of impacts with objects above the underframe of a cab car or MU locomotive, the end frame members are the primary source of protection for the engineer and the passengers. There are various types of cab cars and MU locomotives in current use. As discussed below, flat-nosed, single-level cab cars have been used for purposes of FRA-sponsored crashworthiness research. (The cab cars were originally constructed as MU locomotives but had their traction motors removed for testing.) Flat-nosed designs are representative of a large portion of the cab car and MU locomotive fleet.

In a typical flat-nosed cab car, the end frame is composed of several structural elements that act together to resist inward deformations under load. The base of the end frame structure is composed of the end/buffer beam, which is directly connected to the draft sill of the vehicle. For cars that include stepwells, the side sills of the underframe generally do not directly connect to the end/buffer beam. There are four major vertical members connected to the end/buffer beam: two collision posts located approximately at the one-third points along the length of the beam; and two corner posts located at the outermost points of the beam. These structural elements are also connected together through two additional lateral members: a lateral member/shelf located just below the window frame structure; and an anti-telescoping plate at the top. The attachment of the end frame structure to the rest of the vehicle typically occurs at three locations. The first location is at the draft sill at the level of the underframe. This is the main connection where a majority of any longitudinal load applied to the end frame is reacted into the underframe of the vehicle. There are two other connections at the cant/roof rail located at each side of the car just below the level of the roof. When a longitudinal load is applied to the end frame, it is reacted by the draft sill and the cant rails into the main car body structure. A schematic of a typical arrangement is depicted in Figure 1 (although not every cab car or MU locomotive necessarily has every component shown).

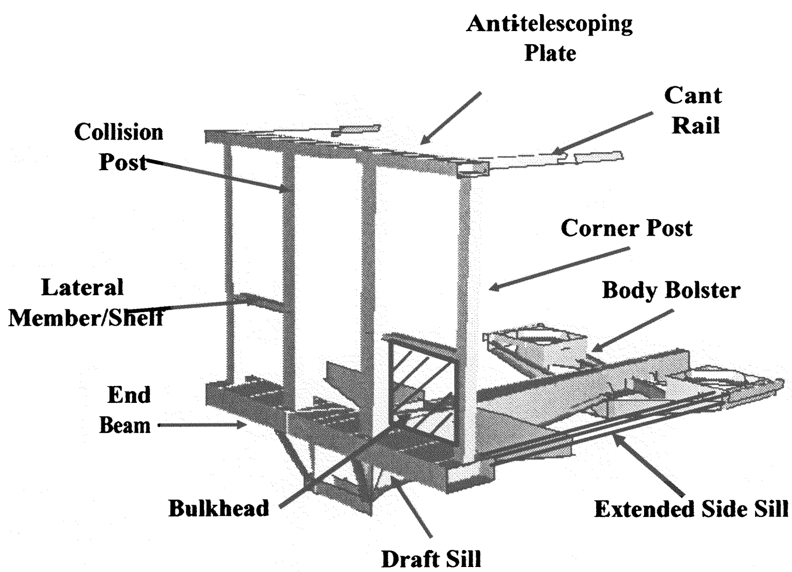


Figure 1. Schematic of the Main Structural Components of the Front End of a Typical, Flat-Nosed Cab Car and MU Locomotive

C. Accident History

In a collision involving the front end of a cab car or an MU locomotive, it is vitally important that the end frame behaves in a ductile manner, absorbing some of the collision energy in order to maintain sufficient space in which the engineer and passengers can ride out the event. Several collisions have occurred where the superstructure of a leading cab car has been loaded but the underframe of the car has not. These collisions demonstrate a need for better protecting the cab engineer and passengers from external threats. One example of a collision where the end frame did not effectively absorb collision energy occurred in Portage, IN, in 1998 when a NICTD train consisting of MU locomotives struck a tractor-tandem trailer carrying steel coils that had become immobilized on a grade crossing.[1] The leading MU locomotive impacted a steel coil at a point centered on one of its collision posts, the collision post failed, and the steel coil penetrated into the interior of the locomotive, resulting in three fatalities. Little of the collision energy was absorbed by the collision post, because the post had failed before it could deform in any significant way.

There are additional examples of incidents where the end frame of a cab car or an MU locomotive was engaged during a collision and a loss of survivable volume ensued due to the failure of end frame structures. In a collision in Secaucus, NJ, in 1996, a cab car-led New Jersey Transit Rail Operations (NJTR) train impacted a conventional locomotive-led NJTR

[1] National Transportation Safety Board, "Collision of Northern Indiana Commuter Transportation District Train 102 with a Tractor-Trailer Portage, Indiana, June 18, 1998," RAR–99–03, 07/26/1999. This report is available on the NTSB's Web site at: *http://www.ntsb.gov/publictn/1999/RAR9903.pdf.*

train.[2] At the collision interface, the conventional locomotive pushed in or tore loose the collision and corner posts of the cab car. The underframe of the cab car was not loaded. The engineers of both trains and one passenger in the cab car were fatally injured. Also in 1996 in Silver Spring, MD, a collision occurred between a cab car-led Maryland Area Rail Commuter (MARC) train and a conventional locomotive-led Amtrak train. In the collision, the front left collision and corner posts of the cab car were pushed in and torn loose. The underframe of the cab car was not loaded.[3] Three crewmembers and eight passengers on the MARC train were fatally injured as result of the collision and ensuing fire. Earlier, on January 18, 1993, near Gary, IN, two NICTD trains collided corner-to-corner on intersecting tracks that shared a bridge. One of the trains was at rest and the other had a speed estimated to be 32 mph. The left front corner posts and adjacent car body sidewall structures were destroyed on the leading MU locomotive of each train. Seven passengers were fatally injured.[4]

The preceding collisions were used to characterize types of loading conditions, which led to the development of a simplified, generalized test scenario, in furtherance of the goal of establishing methods for measuring the crashworthiness performance of end frame structures and developing strategies for incrementally improving their survivability under a range of impact conditions. Although the speeds associated with certain past events are greater than the speed at which full protection can currently be provided, and even though enhancements to passenger train emergency features and other requirements unrelated to crashworthiness, such as fire safety, may overall do as much or more to prevent or mitigate the consequences of these types of events, these collisions do provide indicative loading conditions for developing structural enhancements that can improve crashworthiness performance.

FRA also notes that on January 26, 2005, in Glendale, CA, a collision involving an unoccupied sport utility vehicle (SUV) (that was intentionally parked on the track by a private citizen), two Metrolink commuter trains, and a standing freight train resulted in 11 fatalities and numerous injuries. Eight of the fatalities occurred on a cab car-led commuter train, which derailed after striking the SUV, causing the cab car to be guided down a railroad siding, which resulted in an impact at an approximate speed of 49 mph with the standing freight train. After the collision with the standing freight train, the rear end of the lead cab car buckled laterally, obstructing the right-of-way of an oncoming, conventional locomotive-led commuter train. The rear end of the cab car raked the side of the conventional locomotive-led train, which was moving at an approximate speed of 51 mph, crushing occupied areas of that train. This incident involved enormous quantities of kinetic energy, and the underframe of the leading cab car crushed more than 20 feet inward. Because the strength of the end frame ultimately depends on the strength of the underframe, which failed here, stronger collision posts and corner posts on the front end of the leading cab car would have been, in themselves, of little benefit in absorbing the collision energy. For this reason, as discussed below, FRA has been exploring other crashworthiness strategies, such as CEM, to help mitigate the effects of collisions involving higher impact speeds. Nevertheless, CEM will also require proper end frame performance in order to function as intended.

D. FRA and Industry Standards for Front End Frame Structures of Cab Cars and MU Locomotives

Both the Federal government and the passenger railroad industry have been working together to improve the crashworthiness of cab cars and MU locomotives. As noted above, in 1999, after several years of development and in consultation with a working group comprised of key industry stakeholders, FRA promulgated the Passenger Equipment Safety Standards final rule. The rule included end frame structure requirements and additional crashworthiness-related requirements for cab cars, MU locomotives, and other passenger equipment. In particular, the final rule provided for strengthened collision posts for new cab cars and MU locomotives (*i.e.*, those ordered on or after September 8, 2000, or placed in service for the first time on or after September 9, 2002).

APTA also issued industry standards in 1999, in furtherance of its initiative to continue the development and maintenance of voluntary industry standards for the safety of railroad passenger equipment. In particular, APTA Safety Standard (SS)–C&S–013–99, Standard for Corner Post Structural Strength for Railroad Passenger Equipment, and SS–C&S–014–99, Standard for Collision Post Structural Strength for Railroad Passenger Equipment, included provisions on end frame designs for cab cars and MU locomotives. (Copies of these standards have been placed in the public docket for this rulemaking.) Specifically, these APTA standards included increased industry requirements for the strength of cab car and MU locomotive vertical end frame members—collision posts and corner posts. The 1999 APTA standards also included industry requirements for the deformation of these end frame vertical members, specifying that they must be able to sustain "severe deformation" before failure of the connections to the underframe and roof structures occurs.

In January 2000, APTA requested that FRA develop information on the effectiveness of APTA's then-recently introduced *Manual of Standards and Recommended Practices for Rail Passenger Equipment*, which included APTA SS–C&S–013–99 and APTA SS–C&S–014–99, and FRA's then-recently issued Passenger Equipment Safety Standards rule. This review was intended to look in particular at what increase in crashworthiness was obtained for cab cars and MU locomotives through the combination of these standards and regulations. FRA shared APTA's interest and included full-scale impact tests and associated planning and analysis activities in its overall research plan to gather this information. FRA then developed the details of the testing process in conjunction with APTA's Passenger Rail Equipment Safety Standards (PRESS) Construction and Structural (C&S) Subcommittee.

Around this same time, questions arose in the passenger rail industry in applying the APTA standards for collision posts and corner posts to new cab cars and MU locomotives. Views differed as to what the standards actually specified—namely, the meaning of "severe deformation" in the provisions calling for corner and collision posts to sustain "severe deformation" before failure of the posts' attachments. Consequently, there was not common agreement as to whether

[2] National Transportation Safety Board, "Near Head-On Collision and Derailment of Two New Jersey Transit Commuter Trains Near Secaucus, New Jersey, February 9, 1996," RAR–97–01, 03/25/1997. This report is available on the NTSB's Web site at: *http://www.ntsb.gov/publictn/1997/RAR9701.pdf*.

[3] National Transportation Safety Board, "Collision and Derailment of Maryland Rail Commuter *MARC* Train 286 and National Railroad Passenger Corporation *AMTRAK* Train 29 Near Silver Spring, Maryland, on February 16, 1996," RAR–97–02, 06/17/1997. This report is available on the NTSB's Web site at: *http://www.ntsb.gov/publictn/1997/RAR9702.pdf*.

[4] National Transportation Safety Board, "Collision between Northern Indiana Commuter Transportation District Eastbound Train 7 and Westbound Train 12 Near Gary, Indiana, on January 18, 1993," RAR–93–03, 12/7/1993.

particular designs met the standards. On May 22, 2003, APTA's PRESS Committee accepted the recommendation of its C&S Subcommittee to replace these provisions in the standards concerning "severe deformation" with a recommended practice that the corner and collision post attachments be able to sustain minimum prescribed loads with negligible deformation. APTA SS–C&S–013–99 and SS–C&S–014–99 were then incorporated in their entirety into APTA SS–C&S–034–99, Rev. 1, Standard for the Design and Construction of Passenger Railroad Rolling Stock. (A copy of APTA SS–C&S–034–99, Rev. 1, has been placed in the public docket for this rulemaking. As discussed below, the latest revision, Rev. 2, of APTA SS–C&S–034–99 is available on APTA's Web site at *http://www.aptastandards.com/portals/0/PRESS_pdfs/Construcstruct/construcstruct%20reaffirm/APTA%20SS-CS-034-99%20Rev%202-Approved.pdf*. The larger compilation of standards and recommended practices for rail passenger equipment of which this standard is a part, APTA's *Manual of Standards and Recommended Practices for Rail Passenger Equipment*, is available on APTA's Web site at *http://aptastandards.com/PublishedDocuments/PublishedStandards/PRESS/tabid/85/Default.aspx*.)

When the decision to turn the provisions concerning "severe deformation" into a recommended practice was made, ongoing research from full-scale impact tests was showing that a substantial increase in cab car and MU locomotive crashworthiness could be achieved by designing the posts to first deform and thereby absorb collision energy before failing.[5] As discussed below, in August 2005, APTA's PRESS C&S Subcommittee accepted a revised "severe deformation" standard for collision and corner posts. The standard includes requirements for minimum energy absorption and maximum deflection. The standard thereby eliminates a deficiency in the 1999 APTA standards by specifying test criteria to objectively measure "severe deformation" (or large deformation).

[5] Mayville, R., Johnson, K., Tyrell, D., Stringfellow, R., "Rail Vehicle Cab Car Collision and Corner Post Designs According to APTA S–034 Requirements," American Society of Mechanical Engineers, Paper No. IMECE2003–44114, November 2003. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2003/rail_cw_2003_11.pdf*. All of the published Volpe Center papers and reports on rail equipment crashworthiness can be found at: *http://www.volpe.dot.gov/sdd/pubs-crash.html*.

The NPRM in this rulemaking was based on APTA SS–C&S–034–99, Rev. 1, and proposed dynamic performance requirements in the alternative to the quasi-static, large deformation criteria in the APTA Standards. In response to the NPRM, members of industry disagreed with including FRA's proposed dynamic performance requirements in the rule and requested that FRA demonstrate actual compliance with both the quasi-static and the dynamic large deformation requirements that were proposed. As detailed below, these tests were performed in the spring and summer of 2008. FRA has sought to retain the dynamic performance requirements as an alternative to the quasi-static requirements, in particular because the dynamic performance requirements facilitate evaluation of equipment without a flat front-end or traditional corner or collision posts. After discussion within the Task Force, consensus was reached on including dynamic performance requirements in appendix F to part 238 as an alternative to the enhanced collision and corner post requirements in §§ 238.211 and 238.213 of this final rule. As discussed below, the enhanced requirements in §§ 238.211 and 238.213 essentially codify the current APTA standards.

E. Testing of Front End Frame Structures of Cab Cars and MU Locomotives

This section summarizes the work done by FRA and the passenger rail industry on developing the technical information to support regulations requiring that corner and collision posts in cab car and MU locomotive front end frames fail in a controlled manner when overloaded. Due to the collaborative work of FRA with the passenger rail industry, APTA's current passenger rail equipment standards include deformation requirements, which prescribe how these vertical members should perform when overloaded quasi-statically.

1. FRA-Sponsored Dynamic Testing in 2002

Two full-scale, grade-crossing impact tests were conducted in June 2002 as part of an ongoing series of FRA-sponsored crashworthiness tests of passenger rail equipment carried out with the support of the Volpe Center at FRA's Transportation Technology Center (TTC) in Pueblo, CO. The purpose of these two tests was to evaluate incremental improvements in the crashworthiness performance, in highway-rail grade-crossing collision scenarios, of modern corner and collision post designs when compared against the performance of older designs. The grade-crossing tests were intended to address the concern of occupant vulnerability to bulk crushing resulting from offset/oblique collisions where the primary load-resisting-structure is the equipment's end frame design.

a. Test Article Designs

Two end frame designs were developed. The first end frame design was representative of typical designs of passenger rail vehicles in the 1990s prior to 1999. The first end frame design is referred to as the "1990s design." The second end frame design incorporated all the enhancements required beginning in 1999 by FRA's Passenger Equipment Safety Standards in part 238 and also recommended beginning in 1999 by APTA's standards for corner post and collision post structures, respectively, SS–C&S–013–99 and SS–C&S–014–99. The second end frame design is referred to as the State-of-the-Art (SOA) design. The two end frame designs developed were then retrofitted onto two Budd Pioneer passenger rail cars for testing.

The SOA design differed principally from the 1990s design by having higher values for static loading of the end frame structure and by specifically addressing the performance of the collision and corner posts when overloaded. As noted above, the 1999 APTA standards for cab car and MU locomotive end frame structures included the following statement for both corner and collision posts:

> [The] post and its supporting structure shall be designed so that when it is overloaded * * * failure shall begin as bending or buckling in the post. The connections of the post to the supporting structure, and the supporting car body structure, shall support the post up to its ultimate capacity. The ultimate shear and tensile strength of the connecting fasteners or welds shall be sufficient to resist the forces causing the deformation, so that shear and tensile failure of the fasteners or welds shall not occur, even with severe deformation of the post and its connecting and supporting structural elements.

(*See* paragraph 4.1 of APTA SS–C&S–013–99, and paragraph 3.1 of APTA SS–C&S–014–99.) Although the term "severe deformation" was not specifically defined in the APTA standards, discussions with APTA technical staff led to specifying "severe deformation" in the SOA design as a horizontal crush of the corner and collisions posts for a distance equal to the posts' depth. Some failure of the parent material in the posts was allowable, but no failure would be allowed in the welded connections, as the integrity of the welded connections prevents complete separation of the posts from their connections.

An additional difference in the designs was the exclusion of the stepwells for the SOA design, to allow for extended side sills from the body bolster to the end/buffer beam. By bringing the side sills forward to support the end/buffer beam directly at the corners, the end/buffer beam can be developed to a size similar to the one for the 1990s design. In fact, recent cab car procurements have provided for elimination of the stepwells at the ends of the cars.

As compared to the 1990s design, the SOA design had the following enhancements: more substantial corner posts; a bulkhead sheet connecting the collision and corner posts, extending from the floor to the transverse member connecting the posts; and a longer side sill that extended along the engineer's compartment to the end beam, removing the presence of a stepwell. In addition to changes in the cross-sectional sizes and thickness of some structural members, another change in the SOA design was associated with the connection details for the corner posts. In comparison to the corner posts, the collision posts of both the 1990s and SOA designs penetrated both the top and bottom flanges of both the end/buffer beam and the anti-telescoping plate. This was based upon typical practice in the early 1990s for the 1990s design, and a provision in the APTA standard for the SOA design. Yet, the corner posts differed in that the corner posts for the 1990s design did not penetrate both the top and bottom flanges of the end/buffer and anti-telescoping beams, while those in the SOA design did. The SOA design therefore had a significantly stiffer connection that was better able to resist torsional loads transferred to the anti-telescoping plate.

b. Dynamic Impact Testing

As noted, two full-scale, grade-crossing impact tests were conducted in June 2002. In each test a single cab car impacted a 40,000-pound steel coil resting on a frangible table at a nominal speed of 14 mph. The steel coil was situated such that it impacted the corner post above the cab car's end sill. The principal difference between the two tests involved the end frame design tested: In one test, the cab car was fitted with the 1990s end frame design; in the other, the cab car was fitted with the SOA end frame design.

Prior to the tests, the crush behaviors of the cars and their dynamic responses were simulated with car crush and collision dynamics models. The car crush model was used to determine the force/crush characteristics of the corner posts, as well as their modes of deformation.[6] The collision dynamics model was used to predict the extent of crush of the corner posts as a function of impact velocity, as well as predict the three-dimensional accelerations, velocities, and displacements of the cars and coil.[7] Pre-test analyses of the models were used in determining the initial test conditions and instrumentation test requirements.

The impact speed of approximately 14 mph for both tests was chosen so that there would be significant intrusion (more than 12 inches) into the engineer's cab in the test of the 1990s design, and limited intrusion (less than 12 inches) in the test of the SOA design. This 12-inch deformation metric was chosen to demarcate the amount of intrusion that would leave sufficient space for the engineer to ride out the collision safely.

During the full-scale test of the 1990s design, the impact force transmitted to the end structure exceeded the corner post's predicted strength, and the corner post separated from its upper attachment. Upon impact, the corner post began to hinge near the contact point with the coil; subsequently, tearing at the upper connection occurred. The intensity of the impact ultimately resulted in the failure of the upper connection of the corner post to the anti-telescoping plate. More than 30 inches of deformation occurred and the survivable space for the engineer was lost.

By contrast, during the test of the SOA end frame design, the corner post remained attached. The maximum rearward deformation measured was approximately 9 inches. The results of this test showed that the SOA end frame design is sufficient to prevent the engineer from being crushed in such an impact.

c. Analysis

The SOA design performed very closely to pre-test predictions made by the finite element and collision dynamics models. *See* Figure 2, below. As noted, the SOA design crushed approximately 9 inches in the longitudinal direction.

[6] Martinez, E., Tyrell, D., Zolock, J., "Rail-Car Impact Tests with Steel Coil: Car Crush," American Society of Mechanical Engineers, Paper No. JRC2003–1656, April 2003. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2003/rail_cw_2003_4.pdf.*

[7] Jacobsen, K., Tyrell, D., Perlman, A.B., "Rail Car Impact Tests with Steel Coil: Collision Dynamics," American Society of Mechanical Engineers, Paper No. JRC2003–1655, April 2003. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2003/rail_cw_2003_3.pdf.*

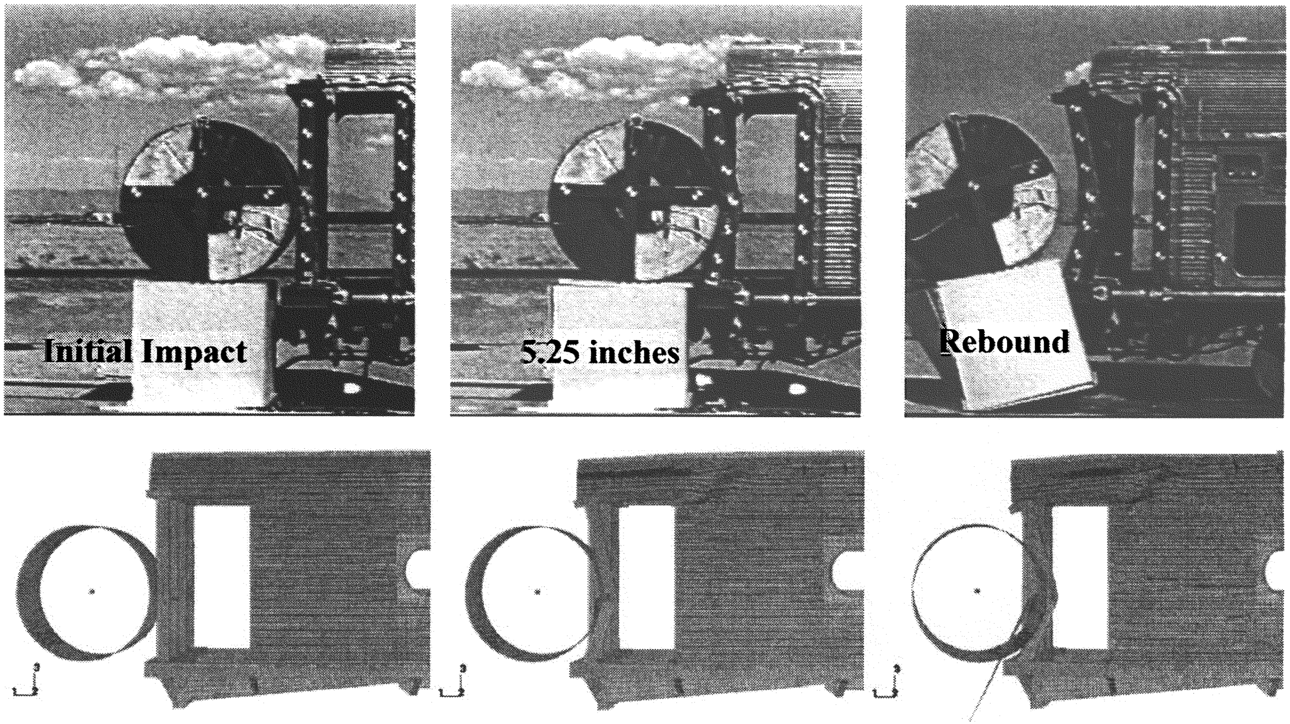


Figure 2. Photographs from the 2002 Dynamic Full-Scale Test of the SOA End Frame and Corresponding Depictions from the Dynamic Analysis

Pre-test analyses for the 1990s design using the car crush model and collision dynamics model were in close agreement with the measurements taken during the actual testing of the cab car end frame built to this design. The pre-test analyses also nearly overlay the test results for the force/crush characteristic of the SOA design. As a result, FRA believes that both sets of models are capable of predicting the modes of structural deformation and the total amount of energy consumed during a collision. Careful application of finite-element modeling allows accurate prediction of the crush behavior of rail car structures.

Both the methodologies used to design the cab car end frames and the results of the tests show that significant increases in rail passenger equipment crashworthiness can be achieved if greater consideration is given to the manner in which structural elements deform when overloaded. Modern methods of analysis can accurately predict structural crush (severe deformation) and consequently can be used with confidence to develop structures that collapse in a controlled manner. Modern testing techniques allow the verification of the crush behavior of such structures.

2. Industry-Sponsored Quasi-Static Testing in 2001

While FRA's full-scale, dynamic testing program was being planned and conducted with input from key industry representatives, several passenger railroads were incorporating in procurement specifications the then-newly promulgated Federal regulations and industry standards issued in 1999. Specifically, both LIRR and Metro-North had contracted with Bombardier for the development of a new MU locomotive design, the M7 series. Bombardier conducted a series of qualifying quasi-static tests on a mock-up, front-end structure of an M7, including a severe deformation test of the collision post. In addition to the severe deformation test, the other end frame members were also tested elastically at the enhanced loads specified in the APTA standards. The severe deformation qualification test was conducted on February 20, 2001.

a. Test Article Design

The mock-up test article was developed for the front end of an M7 cab car. The first 19.25 feet of the car was fabricated with great fidelity between the car's body bolster and the extreme most forward end. The mock-up contained all structural elements, but did not contain the corner post rub plates, the plymetal floor, any interior finishing, windows, doors, bonnet, or similar components.

b. Quasi-Static Testing

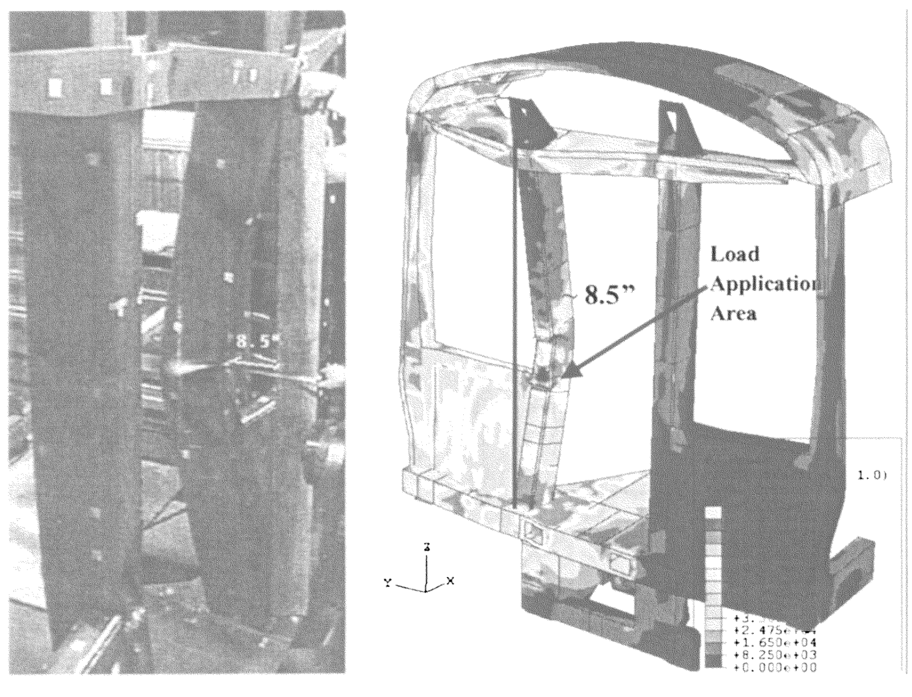
Load was applied at incrementally increasing levels with hydraulic jacks while being measured by load cells at the rear of the longitudinal end frame members. Initially, the elastic limit was determined for the post, and then the large deformation test was conducted. The test was stopped, for safety considerations, prior to full separation of the collision post with the end/buffer beam.

The maximum deflection in the collision post before yielding occurred at a position 42 inches above the end beam, near the top of the plates used to reinforce the collision post. The plastic shape the collision post acquired during testing was 'V'-shaped, with a plastic hinge occurring at 42 inches above the end beam. Some cracking and material failure occurred at the connection of the post with the end beam. The anti-telescoping plate was pulled down roughly three inches, and load was shed to the corner post via the shelf member and the bulkhead sheet. The shape that the collision post experienced was very similar to what was observed from the dynamic testing of the SOA corner post, as discussed above.

c. Analysis

Under FRA sponsorship, the Volpe Center, with cooperation from Bombardier, conducted non-linear, large deformation analyses to evaluate the performance of the cab car corner and collision posts of the SOA end frame design and the Bombardier M7 design under dynamic test conditions. One of the purposes of this research was to determine whether the level of crashworthiness demonstrated by the SOA prototype design could actually be achieved by a general production design—here, the M7 design. Pre-test analysis predictions of the dynamic performance of the SOA corner post closely matched test measurements.[8] A similar analysis of the corner post was performed on the M7 design, and the results compared closely with the SOA design test and analysis results. Overall, the crashworthiness performance of the collision posts of the SOA and M7 designs were found to be essentially the same, and the M7 corner post design was even found to perform better than the SOA corner post design. This latter difference in performance was attributable to the sidewall support in the M7 design, which was not present in the SOA design.

Having established the fidelity of the models and modeling approach, a number of comparative simulations were conducted of both the SOA end frame and the M7 end frame under both dynamic and quasi-static test conditions to assess the equivalency of the two different tests for demonstrating compliance with the severe deformation criteria. For both sets of tests, the modes of deformation were very similar at the same extent of longitudinal displacement, and the locations where material failure occurred were also similar. In addition, the predicted force-crush characteristics showed reasonable agreement within the repeatability of the tests. Figure 3, below, shows a comparison of the deformation mode for the M7's collision post, as observed from the quasi-static testing that was conducted and as predicted for the dynamic loading condition.



Quasi-Static Test Dynamic Analysis

Figure 3. Comparison of Quasi-Statically Tested and Dynamically-Predicted Mode of Deformation for the M7 MU Locomotive Collision Post

3. FRA-Sponsored Dynamic and Quasi-Static Testing in 2008

In 2008, a full-scale dynamic test and two quasi-static tests were performed on the posts of an SOA end frame. These tests were designed to evaluate the dynamic and quasi-static methods for demonstrating energy absorption of the collision and corner posts. The tests focused on the collision and corner posts individually because of their critical positions in protecting the engineer and passengers in a collision where only the superstructure, not the underframe, is loaded.

a. Test Article Design

The SOA design was originally developed for the Budd Pioneer car for the 2002 dynamic impact testing. For the testing in 2008, only a Budd M1 car was available, so the design had to be modified to fit a Budd M1. The design

[8] Martinez, E., Tyrell, D., Zolock, J. Brassard, J., "Review of Severe Deformation Recommended Practice Through Analyses—Comparison of Two Cab Car End Frame Designs," American Society of Mechanical Engineers, Paper No. RTD2005–70043, March 2005. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2005/rail_cw_2005_03.pdf.*

of an end frame for retrofit onto the cab end of a Budd Pioneer car was modified to account for differences between the two car designs. In addition, reinforcements to the M1 car body and connections from the end frame to the car body were designed and fabricated.

The design of the SOA end frame itself required only a few modifications to adapt to the M1 car body. Due to the rounded nature of the M1 car body as compared to the Pioneer car body, the lateral extent of the anti-telescoping beam was changed slightly so that it extended beyond the corner post by 1.5 inches, as compared to 1.0 inches for the Pioneer car.

b. Dynamic Testing of a Collision Post

For this test, a 14,000-pound cart impacted a standing car at a speed of 18.7 mph. The cart had a rigid coil shape mounted on the leading end that concentrated the impact load on the car's collision post. The test was conducted against the NPRM's proposed requirements for protecting the engineer's space—namely, that there be no more than 10 inches of permanent, longitudinal deformation and none of the attachments of any of the structural members separate.

During the test, the collision post deformed approximately 7.4 inches and absorbed approximately 138,000 foot-pounds of energy. The attachment between the post and the anti-telescoping beam remained intact. The connection between the post and the buffer beam did not completely separate; however, the forward flange and both side webs fractured. The post itself did not completely fail. There was material failure in the back and the sides of the post at the impact location. Overall, the end frame was successful in absorbing energy and preserving space for the engineer and the passengers. Figure 4 depicts three deformation states from the dynamic test: initial contact of the crash cart with the end frame, the greatest intrusion of the end frame, and the final deformation state.

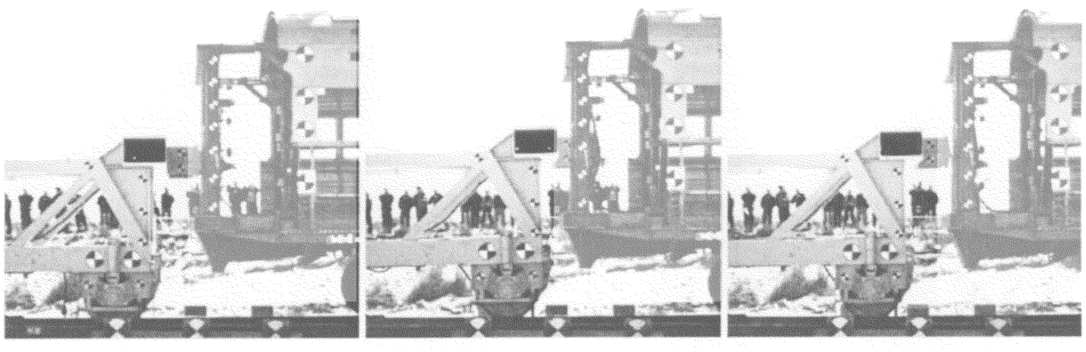


Figure 4. Photographs from the 2008 Full-Scale Dynamic Test of the SOA End Frame

c. Quasi-Static Testing of Collision and Corner Posts

A quasi-static collision post test was run to compare the quasi-static and the dynamic performance requirements proposed in the NPRM and to demonstrate the efficacy of the quasi-static test method. The NPRM proposed that the collision post absorb at least 135,000 foot-pounds of energy in no more than 10 inches of longitudinal, permanent deformation. Load was applied with the same fixture for the dynamic test. This fixture had a diameter of 48 inches and a width of 36 inches. The fixture was made of a thick, stiff material and reinforced so that it did not deform or absorb energy. Longitudinal string potentiometers at several locations recorded the deformation of the post. Four load cells, connected in parallel, measured the load being applied into the post. The force and the displacement were cross-plotted and the integral was used to calculate the energy absorbed during the test.

The test car was coupled to a reaction car. As the load from the hydraulic ram was introduced to the car through the collision post, it was reacted through the couplers. The mode of deformation in the quasi-static collision post test was very similar to the mode of deformation seen in the dynamic collision post test. The collision post pulled down on the anti-telescoping beam. The post was loaded past 15 inches of deformation and did eventually fail completely in the middle. The collision post fractured as it separated from the buffer beam. After 11 inches of crush, the post had absorbed 110,000 foot-pounds of energy. Based on the unloading characteristic measured during the test, 11 inches of crush is approximately equal to 10 inches of permanent deformation. Since the collision post and end frame were supposed to absorb 135,000 foot-pounds of energy in 10 inches of permanent deformation, but only absorbed 110,000 foot-pounds of energy for that distance, the test article did not pass the test requirements.

Design details warranted a closer look in determining why the test was unsuccessful. The specimens taken at the location of the fracture revealed that an internal gusset on the post coincided with an exterior shelf tab. The gusset locations were within specification for these posts. However, there is some flexibility with the location of the gusset relative to the location to the shelf tab. In both the dynamic and quasi-static tests, the fracture occurred at the location of both the gusset and the shelf welds. The rigid gusset did not allow the post to oval as it deformed, causing the fracture at the back of the post.

Attention turned to conducting a test of the corner post. The NPRM proposed that the corner post absorb at least 120,000 foot-pounds of energy with no more than 10 inches of permanent, longitudinal deformation. The same fixture was used for this test as for the collision post testing. The fixture was centered on the corner post. In response to the results of the quasi-static test of the collision post, the shelf was redesigned so that the tab was removed and the depth of the shelf was decreased. This reduced the number of welds at the corner and back of the post. However, because the corner post was not designed with internal gussets, gusset design details did not need to be addressed.

In the quasi-static corner post test, the end frame deformed as expected and absorbed energy while deforming. The anti-telescoping beam was pulled down significantly and the shelf and bulkhead were deformed. The connection between the corner post and the buffer beam fractured, but the post did not separate completely. Also, the connection between the shelf and the post fractured, but the post itself did not fracture. The post and end frame absorbed 136,000 foot-pounds of energy in 11 inches of crush. After elastic recoil, 11 inches of crush is the equivalent of 10 inches of permanent deformation; thus, the test was successful.

The testing program demonstrated repeatable methods for assessing the energy-absorbing capability of end frame structures. These methods include both dynamic and quasi-static tests where energy absorption and permanent deformation are used as limiting criteria. The tests also show the improved crashworthiness of the SOA design.

d. Analysis

Analysis is a crucial part of conducting a full-scale test. Based on the results of the 2002 full-scale dynamic test in which a heavy steel coil impacted the corner post of an SOA end frame design, some fracture was expected in certain key end frame components during the 2008 tests. For this reason, a material failure model, based on the Bao-Wierzbicki fracture criterion, was implemented in the finite element model of the car end frame using ABAQUS/Explicit. The finite element model with material failure was used to assess the effect of fracture on the deformation behavior of car end structures during quasi-static loading and dynamic impact and, in particular, the ability of such structures to absorb energy.

The material failure model was implemented in ABAQUS/Explicit for use with shell elements. A series of preliminary calculations was first conducted to assess the effects of element type and mesh refinement on the deformation and fracture behavior of structures similar to those found on cab car and MU locomotive end frames, and to demonstrate that the Bao-Wierzbicki failure model can be effectively applied using shell elements.

Model parameters were validated through comparison to the results of the 2002 testing. Material strength and failure parameters were derived from test data for A710 steel. The model was then used to simulate the three full-scale tests that were conducted during 2008 as part of the FRA program—dynamic impact testing of a collision post, and quasi-static load testing of a collision post and a corner post. Analysis of the results of the two collision post tests revealed the need for revisions to both the design of some key end frame components and to key material failure parameters. Using the revised model, pre-test predictions for the outcome of the corner post test were found to be in very good agreement with the actual test results.

Overall, the results of the tests in comparison with their pretest analyses show that, at this time, actual testing is necessary to demonstrate performance. However, as modeling methods improve and are shown to predict failure and energy absorption more accurately, there is the potential that use of analysis alone will in the future be acceptable for demonstrating crashworthiness performance.

F. Approaches for Specifying Large Deformation Requirements

As discussed above, APTA's initial "severe deformation" standard for corner and collision posts, published in 1999, did not contain specific methodologies or criteria for demonstrating compliance with the standard. Consequently, the dynamic tests performed by FRA and the Volpe Center, static tests performed by members of the rail industry, and analyses conducted by the Volpe Center and its contractors all helped to develop the base of information needed to identify the types of analyses and test methodologies to use. Further, evaluation of the test data, with the analyses providing a supporting framework, allowed development of appropriate criteria to demonstrate compliance.

The principal criteria developed involve energy absorption through end frame deformation and the maximum amount of that deformation. As shown by FRA and industry testing, energy can be imparted to conventional flat-nosed cab cars and MU locomotives either dynamically or quasi-statically. As shown by Volpe Center analyses, currently available engineering tools can be used to predict the results of such tests. Given the complexity of such analyses, and commensurate uncertainties, there is a benefit to maintaining dynamic testing as an alternative for evaluating compliance with any "severe deformation" standard.

There are tradeoffs between quasi-static and dynamic testing of cab car and MU locomotive end frames. Both sets of tests prescribe a minimum amount of energy for end frame deformation. However, the manner in which the energy is applied is different, and the setup of the two types of tests is different. As demonstrated by the tests conducted by Bombardier, quasi-static tests can be conducted by rail equipment manufacturers at their own facilities. Dynamic tests require a segment of railroad track with appropriate wayside facilities; there are few such test tracks available. Nevertheless, dynamic tests do not require detailed knowledge of the car structure to be tested, and allow for a wide range of structural designs. Quasi-static tests require intimate knowledge of the structure being tested, to assure appropriate support and loading conditions, and development of quasi-static test protocols requires assumptions about the layout of the structure, confining structural designs. In addition, dynamic tests more closely approximate accident conditions than quasi-static tests do.

In August 2005, APTA's PRESS C&S Subcommittee accepted a revised "severe deformation" standard for collision and corner posts. The standard includes requirements for minimum energy absorption and maximum deflection. The form of the standard is largely based on the testing done by Bombardier, and therefore is quasi-static. The standard eliminates a deficiency of the 1999 standard by specifying test criteria to objectively measure "severe deformation." The standard can be readily applied to conventional flat-nosed cab cars and MU locomotives but is more difficult to apply to shaped-nosed cab cars and MU locomotives or those with CEM designs, or both.

In addition, APTA as well as several equipment manufacturers have expressed an interest in maintaining the presence of a stairwell on the side of the cab car or MU locomotive opposite from where the locomotive engineer is situated. This feature enables multi-level boarding from both low and higher platforms. As such, FRA and the APTA PRESS C&S Subcommittee worked together to develop language associated with providing a safety equivalent to the requirements stipulated for cab car and MU locomotive corner posts in terms of energy absorption and end frame deformation. The Subcommittee agreed that for this arrangement there is sufficient protection afforded by the presence of two corner posts (an end corner post ahead of the stepwell and an internal corner post behind the stepwell) that are situated in front of the occupied space. The load requirements stipulated for such posts differ in that the longitudinal requirements are not equal to the transverse requirements.

This in effect changes the shape of these posts so that they are not equal in both width and height. For the end corner post ahead of the stepwell, the longitudinal loading requirements are smaller than the transverse ones. The opposite is true for the corner post behind the stepwell. It was agreed to allow for the combined contribution of both sets of corner posts, together, to provide an equivalent level of protection to that required for corner posts in standard cab car and MU locomotive configurations. *See* the discussion in the Section-by-Section Analysis on the structural requirements for cab cars and MU locomotives with a stairwell located on the side of the equipment opposite from where the locomotive engineer controls the train.

G. Crash Energy Management and the Design of Front End Frame Structures of Cab Cars and MU Locomotives

Research has shown that passenger rail equipment crashworthiness in train-to-train collisions can be significantly increased if the equipment structure is engineered to crush in a controlled manner. One manner of doing so is to design sacrificial crush zones into unoccupied locations in the equipment. These zones are designed to crush gracefully, with a lower initial force and increased average force. With such crush zones, energy absorption is shared by multiple cars during the collision, consequently helping to preserve the integrity of the occupied areas. While developed principally to protect occupants in train-to-train collisions, such crush zones can also potentially significantly increase crashworthiness in highway-rail grade-crossing collisions.[9]

The approach of including crush zones in passenger rail equipment is termed CEM, and it extends from current, conventional practice. Current practice for passenger equipment operated at speeds not exceeding 125 mph (*i.e.,* Tier I passenger equipment under part 238) requires that the equipment be able to support large loads without permanent deformation or failure, but does not specifically address how the equipment behaves when it crushes. CEM prescribes that car structures crush in a controlled manner when overloaded and absorb collision energy. In fact, for passenger equipment operating at speeds exceeding 125 mph but not exceeding 150 mph (*i.e.,* Tier II passenger equipment under part 238), the equipment must be designed with a CEM system to dissipate kinetic energy during a collision, *see* § 238.403, and Amtrak's Acela Express trainsets were designed with a CEM system complying with this requirement.

FRA notes that Metrolink is in the process of procuring a new fleet of cars utilizing CEM technology. As part of its response to the Glendale, CA train incident on January 26, 2005, Metrolink determined that CEM design specifications should be included in this planned procurement, and, in coordination with APTA, approached FRA and FTA to draft such specifications. In turn, FRA and FTA formed the ad hoc Crash Energy Management Working Group in May 2005. This working group included government engineers and participants from the rail industry, including passenger railroads, suppliers, labor organizations, and industry consultants, many of whom also participated in the Crashworthiness/Glazing Task Force. The working group developed a detailed technical specification for crush zones in passenger cars for Metrolink to include in its procurement specification, as well as for other passenger railroads to include in future procurements of their own. Metrolink released its specification as part of an invitation for bid, and then awarded the contract to manufacture the equipment to Rotem, a division of Hyundai, now Hyundai Rotem Company (Rotem).

Rotem has developed a shaped-nose, CEM design for new Metrolink cab cars. Because of the shaped-nose, it is more difficult to engineer structural members identifiable as full-height collision posts and corner posts that extend from the underframe to the cantrail or roofline at the front end, as specified in the current APTA standard. Consequently, to meet the APTA standard, Rotem has to locate the collision and corner posts inboard of the crush zone, rather than place them at the extreme front end of the cab car. Further, as currently written, the APTA quasi-static standard does not expressly take into account the energy-absorption capability of the crush zone, even if the crush zone would likely be engaged in a grade-crossing impact. Although the APTA standard acknowledges the use of shaped-nose and CEM designs, there remains uncertainty in the standard associated with demonstration of compliance by such designs. (The APTA standard does provide that on cars with CEM designs, compliance may be demonstrated either through analysis or testing as agreed to by the vehicle builder and purchaser, but no test methodology or criteria are provided.)

Dynamic performance criteria place fewer constraints on the layout of the cab car or MU locomotive end structure and allow the energy-absorption capability of the crush zone(s) to be expressly taken into account in the design of the collision and corner post structures. As noted, this final rule allows for the application of dynamic performance requirements for collision and corner post structures of cab cars and MU locomotives. FRA believes that the results of the crashworthiness research discussed above provide strong support for including dynamic performance requirements as alternatives to the quasi-static requirements for collision and post requirements in this rule, and that it is particularly necessary to address what FRA believes will be a growing number of cab cars and MU locomotives utilizing CEM designs.

H. European Standard EN 15227 FCD, Crashworthiness Requirements for Railway Vehicle Bodies

In the NPRM, FRA discussed that then-preliminary European standard prEN 15227 FCD, Crashworthiness Requirements for Railway Vehicle Bodies, included four collision scenarios. This standard is no longer preliminary and is consequently referred to throughout this document as EN 15227, without the preliminary "pr" designation. Collision Scenario 3 of the European standard involves a "train unit front end impact with a large road vehicle on a level crossing." The standard requires commuter and intercity trains to be able to sustain an impact with a deformable object weighing 33 kips (15,000 kg) at a speed up to 68 mph (110 kph). Calibration tests on components and numerical simulations of the scenario are recommended for showing compliance.

FRA has noted key differences between the European standard and the dynamic testing collision scenarios that FRA proposed for both collision posts and corner posts, below, including the amount of energy involved and the character of the object. Assuming that the mass of the train is more than about 25 times as great as the mass of the object (in that the mass of the train roughly corresponds to the mass of a commuter train made up of a cab car, four coaches, and a locomotive; or made up of six MU locomotives), then the total energy dissipated in an EN 15227 Collision Scenario 3-impact is 5.0 million foot-pounds. The total energy absorbed in the collision scenarios included in this final rule are 135,000

[9] Tyrell, D.C., Perlman, A.B., "Evaluation of Rail Passenger Equipment Crashworthiness Strategies," Transportation Research Record 1825, pp. 8–14, National Academy Press, 2003. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2003/rail_cw_2003_12.pdf.*

foot-pounds for the collision post and 120,000 foot-pounds for the corner post. However, in the European standard, the impacted object is deformable and potentially absorbs a significant amount of the available energy; in the collision scenarios included in this final rule, the object is rigid, and virtually all of the energy is absorbed by the cab car or MU locomotive.

A recent paper describes the performance of the SOA end frame in both the FRA and the EN grade-crossing collision scenarios.[10] Specifically, testing and analysis of the SOA end frame's performance in appendix F's collision post test scenario was compared to an analysis of the SOA end frame's performance in EN15227's Collision Scenario 3.

Table 1

Table 1 summarizes a few key crashworthiness parameters and results from the testing and analysis conducted. Application of the FRA scenario involved only one car; whereas the EN 15227 scenario involved a complete consist or train unit. The difference in weight of one car, 80 kips, versus that of a complete consist, 767 kips, was an order of magnitude. In the FRA scenario, the 14-kip impact object was tested striking the car at 19 mph, resulting in 170 ft-kips of initial kinetic energy. Whereas in the EN 15227 scenario, the 767-kip consist was analyzed striking the deformable lorry at 53 mph, resulting in 72,000 ft-kips of initial kinetic energy. The difference in the amount of initial kinetic energy involved between the two scenarios was two orders of magnitude. Similarly, the impacting objects were quite different. As noted earlier, the FRA scenario provides for a rigid impact object; whereas in the EN 15227 scenario, the impact object is deformable. In the FRA scenario, this resulted in the energy being mostly absorbed by the impacted collision post, with virtually no energy absorbed by the impact object. Whereas in the EN 15227 scenario, both the first car and the impact object absorbed large amounts of energy, with very little energy absorbed by one collision post.

TABLE 1—COMPARISON OF SOA END FRAME PERFORMANCE APPLYING APPENDIX F COLLISION POST STANDARD AND EN 15227 COLLISION SCENARIO 3

Parameter	Application of Appendix F collision post standard	Application of EN 15227 collision scenario 3 specification
Type of Train	Single car: 80 kips	Complete train unit: 767 kips.
Impact Object	Rigid cart: 14 kips	Deformable lorry: 33 kips.
Impact Speed	19 mph (cart)	53 mph (consist).
Initial Kinetic Energy	170 ft-kips	72,000 ft-kips.
Energy Absorbed	End frame: 138 ft-kips; Cart: ~0; Collision post: 105 ft-kips.	Leading car: 1370 ft-kips; Lorry: 950 ft-kips; Collision post: 89 ft-kips.
Pass/Fail Criteria	Intrusion <= 10 in., no separation	Preserve survival spaces, mean deceleration <7.5g.

As the table shows in summary form, the key parameters of these two scenarios are very different, though they are both grade-crossing collision scenarios involving rail vehicles with impact objects. Additionally, comparing the complexity of the analysis required for each scenario, application of the FRA scenario is simpler to analyze. In analyzing the FRA scenario, fewer vehicles are involved, initial kinetic energy is lower, deformations are less, and the deformations that result are virtually all in the car and not the impact object.

Overall, FRA believes that the following conclusions can be drawn about the standards in appendix F and those specified in EN 15227's Collision Scenario 3. The appendix F standards concentrate the load on a single post, above the underframe; can be applied to both CEM and non-CEM equipment; and can potentially be used to demonstrate compliance either through analysis or testing. The EN 15227 grade-crossing collision specification distributes the load across the entire end structure; imparts a significant amount of load in the underframe and roof structure; assumes the use of CEM equipment; and can be used to demonstrate compliance through analysis only. Moreover, FRA believes that its dynamic collision scenario is not only easier to analyze, but easier to test than the EN 15227 scenario and imparts more energy to the impacted post than in the EN 15227 scenario.

IV. Discussion of Specific Comments and Conclusions

As noted above, FRA received written comments on the NPRM from representatives of government; various organizations, including railroad labor; railroads; railroad car manufacturers; railroad engineering firms; and as well as private citizens. The comments can principally be divided into two groups: comments of a technical nature affecting the substance of the requirements proposed, and comments as to the preemptive effect of the requirements proposed. FRA found that these groupings serve the organization of this final rule, even though some comments do not fit neatly into either grouping. Please note that certain comments are not discussed in either of these two groupings; instead, they are discussed directly in the Section-by-Section Analysis or in the Regulatory Impact and Notices portion of this final rule.

A. Technical Comments

This section contains the discussion of technical comments on the NPRM, as well as comments closely associated with these technical comments. FRA has endeavored to group the comments together by issue to the extent possible, rather than by commenter. Please note that the order in which the comments are discussed, whether by issue or by commenter, is not intended to reflect the significance of the comment raised or the standing of the commenter.

Please also note that following the submission of these written comments, FRA convened the Task Force and Working Group to consider and discuss the comments and to help achieve consensus on recommendations for this final rule. As a result, certain of these comments have been superseded by changes made in the rule text from the NPRM to this final rule, and they should not necessarily be understood to reflect the positions of the commenters with

[10] Llana, P., "Structural Crashworthiness Standards Comparison: Grade-Crossing Collision Scenarios," American Society of Mechanical Engineers, Paper No. RTDF2009–18030, October, 2009. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2009/09-18030.pdf*.

respect to the requirements of the final rule. Nevertheless, FRA is setting out all of the comments received and is responding to each of them here so that FRA's positions are clearly understood.

1. Crash Energy Management

Caltrans raised concern with FRA's mention of CEM designs in the NPRM, believing that no rail equipment that features a CEM design has been built, that including CEM in the preamble implied that the NPRM included a CEM requirement, and that the implication that CEM designs may provide for a higher level of safety would expose those railroads not employing CEM designs to litigation for not selecting the "safer" design as identified by FRA.

FRA notes that Amtrak's Acela Express trainsets use CEM, and CEM is used in European and other vehicles. FRA does believe that, all other things being equal, CEM designs are superior in crashworthiness to conventional designs. Yet, as FRA stated in the preamble to the NPRM, FRA's recognition that fuller application of CEM technologies to cab cars and MU locomotives could enhance their safety would not nullify the preemptive effect of the standards arising from the rulemaking. FRA continually strives to enhance railroad safety, has an active research program focused on doing so, and sets safety standards that it believes are necessary and appropriate for the time that they are issued with a view to amending those standards as circumstances change. FRA has imposed, and will continue to impose, the requirements that it deems necessary for the safe operation of cab cars and MU locomotives in all of the configurations in which they will be operated. FRA is not requiring CEM in this final rule.

RVB also raised concerns with the NPRM for its application to CEM designs. RVB asked why the "static strength" requirements had to be met if the CEM requirements for energy absorption are met. RVB stated that the required amount of energy can be absorbed by CEM structures using considerably smaller collision and corner posts.

FRA understands that there are potential alternative arrangements using CEM that may place the end frame structure outboard of the crush elements or behind the crush elements. If the end frame is situated outboard of the crush elements (or crash energy absorbers), then the end frame will likely serve as the means for assuring planar introduction of the load into the crush elements, allowing them to react in a progressive, controlled collapse. To accomplish this energy transfer to the crush elements, the end frame must be very rigid, which can make meeting the severe deformation requirements for the end frame more difficult to achieve. Nonetheless, as long as the system of structural and CEM elements protecting the occupied volume performs well under the dynamic performance requirements provided in appendix F of this final rule, FRA is confident that sufficient protection is provided to passengers and crewmembers alike. For end frame members inboard of the crush elements, it is likely that they will serve as the reaction points for the crush elements. As in the case of end frame members outboard of the crush elements, to support the load introduced by the crush elements the end frame may have to be very rigid. As a result, meeting the severe deformation requirements for the end frame may also be more difficult to achieve. Yet, again, as long as the system of structural and CEM elements protecting the occupied volume performs well under the dynamic performance requirements provided in appendix F of this final rule, FRA is confident that the system provides sufficient protection for passengers and crewmembers.

Additionally, FRA would like to make clear that the energy-absorption requirements in this rulemaking should not be confused with energy absorption as part of a CEM approach. While inclusion of energy-absorption requirements is consistent with FRA's approach to incrementally build on traditional crashworthiness requirements, and whereas CEM is an advanced crashworthiness approach, FRA did not intend that the energy-absorption requirements in this rulemaking be considered part of a CEM approach. Instead, FRA's inclusion of energy-absorption requirements in this rulemaking is intended to address traditional cab car and MU locomotive designs that have very strong underframes with relatively weaker superstructures, for which it is vitally important to provide protection to crewmembers and passengers in the event that the superstructure is impacted. FRA is incorporating mature technology and design practice to extend from linear-elastic requirements to elastic-plastic requirements together with descriptions of allowable deformations without complete failure of the system.

RVB additionally commented that in the NPRM the collision and corner posts must be designed for yield strength in the case where the posts are behind the CEM structure and used as support for the CEM structure. RVB believed that this proposed requirement conflicted with the allowance in the NPRM for the posts to resist loads up to their ultimate strength. RVB believed that, by requiring yield strength in such case, the ultimate strength of the post would be much greater than the amount specified.

FRA understands the complexities introduced by using a CEM design that behaves significantly differently than a conventional cab car or an MU locomotive because of its crush zone(s). This is one of the reasons FRA proposed the option to test such designs dynamically, and one of the reasons why FRA has included alternative, dynamic performance requirements in this final rule. FRA has modified the dynamic performance requirements in the final rule from those proposed in the NPRM, and FRA believes that these modifications will help to address concerns with applying the requirements to CEM designs.

RVB also commented that since, by definition, a CEM system requires a structure that facilitates controlled collapse of the crush zone(s), the proposal would result in a much higher load imparted to the underframe than by the 800,000-pound compression load requirement, exceeding the yield strength of the structure. RVB claimed that this was another area of significant over-design that was unaddressed in the NPRM. RVB added that by disallowing correction of static strength requirements as they are taken up by CEM systems, a vehicle would be heavier than it needs to be, use more energy to operate, and exert more force on wheels and rails that would increase maintenance costs for equipment and track.

FRA believes that the commenter is incorrect in its assertions. FRA agrees that for CEM designs the overall average load that the structure must resist may exceed 800,000 pounds. However, this load is typically spread over a significantly larger area than just the line of draft of the vehicle, as specified for vehicles not utilizing CEM designs. Because the capacity of a vehicle incorporating a CEM design to resist compression loads elastically may be taken into account, FRA does not believe that this will result in over-design of the vehicle. In addition, FRA wishes to dispel the belief that a heavier vehicle would be necessary to meet the requirements proposed in the NPRM and those contained in this final rule. Crashworthiness features from clean-sheet designs can occupy the same space as other material and not weigh in excess of the structure(s) being replaced. There is considerable leeway in designing such systems so that no additional weight is required. Moreover, the vehicle body structure itself typically accounts for only between 25 to 35 percent of the final weight of a vehicle, which minimizes the significance of any weight added to the vehicle to comply with the requirements of this final rule.

RVB further commented that one means of recognizing a CEM vehicle addressing the static end strength requirements would be for this part 238 to specify the minimum amount of energy that must be absorbed by each end of a vehicle in a train in a specified collision scenario. According to RVB, dynamic testing of the entire crush zone or testing of the critical crush zone elements, in conjunction with suitable analysis, would be required to confirm compliance, and acceptance criteria would include verification that (i) the required minimum energy has been absorbed, (ii) the occupied volume is not compromised, and (iii) climbing/telescoping does not occur under the collision scenario. For a CEM vehicle, RVB believed that this should be in place of the specific strength requirements for the collision and corner posts, and allow evaluation of the car ends as a system.

FRA recognizes the possibilities raised by the commenter. FRA intends to work with the APTA PRESS C&S Subcommittee to consolidate knowledge gained from the Metrolink CEM design effort to support development of such criteria. Inclusion of such criteria in this part 238 would be the subject of a separate rulemaking activity, however, and such criteria are not included in this final rule.

RVB additionally commented that the NPRM suggested that a manufacturer with a CEM system may choose to conduct two dynamic tests instead of conducting quasi-static tests on the individual components. RVB believed the practical situation is that the structure needed to support the CEM system would almost certainly meet the quasi-static requirements proposed in the NPRM. According to RVB, if a dynamic test were to be conducted for a CEM system, it would seem to serve the public better to conduct a dynamic test that verifies the performance of the entire CEM system, not just for how it protects against a steel coil.

As noted above, FRA plans on working with the industry to address the issue of more comprehensive requirements for CEM systems. However, with regard to specific application of the requirements of this final rule, a dynamic test of a CEM structural system as contemplated by the commenter may not in itself demonstrate that the superstructure has the strength to protect against the collision scenarios addressed in this rulemaking. In such a dynamic test of a CEM structural system, the entire end structure of the vehicle would potentially absorb all of the collision load. Yet, this final rule specifically targets grade-crossing collision scenarios where only portions of the superstructure are loaded. It is therefore believed that analysis and component testing, not a full-scale test alone, would be necessary to verify the design of a complete CEM system.

In its comments, RVB stated that the NPRM introduced requirements that would make manufacturers design to the actual strength of some components rather than rely on the yield stress as a measure of strength. RVB believed that this approach is sensible, particularly as CEM systems are introduced, in that such systems rely on controlled (plastic) deformation and operation at the maximum strength (load) capacity of structural members in collisions. Nevertheless, RVB believed that there are still numerous transportation requirements that are based on yield strength and that these impose constraints on the design of CEM members that may not be sensible, including the anti-climbing arrangement and the collision and corner post load cases for application points well above the underframe. According to RVB, FRA should consider moving to a true strength approach for all components as it stated is being done in much of the structural engineering community.

FRA notes that the commenter is focused on CEM systems for which the rule will probably not be applied for some time, and, if sooner, for systems FRA would have to review individually because such systems are sufficiently different from conventional designs. The requirements based on yield strength work well for non-CEM designs and facilitate their testing and use.

RVB also commented on FRA's statement in the NPRM that an energy-absorption requirement of 5 megajoules (MJ) will effectively prevent a cab car from being used in the lead position for Tier II equipment. RVB believed that this magnitude of energy absorption is feasible for cab cars.

FRA recognizes that advancements have been made in the ability of CEM systems to absorb energy. However, FRA continues to believe that for operational speeds in excess of 125 mph, as a rule of general applicability for our nation's railroads, no passengers should be allowed in the lead vehicle. Tier II passenger equipment can operate at speeds where the amount of energy required to be dissipated is too large for any vehicle design to survive a direct impact. Yet, with use of advanced system designs such as Positive Train Control (PTC) and CEM, the risk may potentially be minimized, and FRA would consider such cases individually in the context of the particular environment in which the equipment would operate.

In its comments on the NPRM, Caltrain stated that it would be far more appropriate for FRA to define a risk assessment methodology and prescriptions for addressing risk, letting designers provide alternatives such as CEM that deliver the required performance. Caltrain asked why a collision post inboard of a CEM system would be required to resist the same load as a collision post where there is no CEM system. Caltrain stated that presumably the load would be reduced as the CEM system performs its function, so that a substantially lighter collision post could be used to protect the passenger space, if the CEM system does not otherwise eliminate altogether the need for an interior collision post. Caltrain believed that if it is the intent of FRA to provide this level of flexibility, FRA should make this clear.

It is indeed FRA's intent to provide flexibility for vehicle designs with CEM features. In the final rule, FRA has added appendix F to part 238 to provide dynamic performance requirements as alternatives to both the collision and corner post quasi-static requirements. These dynamic performance requirements specify the performance of the end frame, were prepared with CEM designs in mind, and provide the designer leeway in choosing how that performance will be achieved. Nonetheless, FRA is not defining a risk assessment methodology and prescriptions for addressing risk, as an alternative to the collision and corner post quasi-static requirements. FRA believes that appendix F to part 238 provides the flexibility needed while assuring safety with more certainty than by performance of a risk assessment alone.

2. Dynamic Performance Requirements

FRA received a number of comments on its proposal to include dynamic performance requirements as an option to demonstrate compliance with the severe deformation requirements for collision and corner posts. In addition to inviting general comment on the proposal, FRA invited specific comment on the dynamic testing collision scenarios included in the proposed rule, including suggestions for any alternative collision scenario or way to address possible future designs. FRA also invited specific comment whether this final rule should provide for all cab cars and MU locomotives to be tested dynamically to demonstrate compliance—whether or not they have a shaped-nosed design or a CEM design—and, if so, whether the collision scenarios included in the proposed rule are appropriate or whether another collision scenario would be.

CPUC supported FRA's intent to allow full-scale crash testing as an alternative to quasi-static testing to determine the crashworthiness of a prototype cab car or MU locomotive. APTA expressed support for FRA's approach to bring the Federal structural requirements for cab cars and MU locomotives up to current industry standards, including quasi-static tests with specific pass/fail requirements to demonstrate the ability of collision and corner posts to undergo severe deformations prior to failure. (APTA did advise that FRA make sure to reference in the preamble and section-by-section analysis APTA's most current industry standard, APTA SS–C&S–034–99, Rev. 2—not Rev. 1.) APTA appreciated FRA's concern that future vehicles utilizing CEM designs may require different treatment in Federal structural regulations than those with traditional flat-nosed designs. However, APTA had several concerns about including the proposed dynamic test option to accommodate such designs in the final rule. Noting that FRA has conducted an extensive full-scale collision test program to gain confidence in predictive, finite element analysis models and to support development of industry standards and rulemaking, APTA believed that FRA should not include a dynamic test scenario in the regulation unless and until similar testing supports it. APTA urged FRA to conduct appropriate testing and defer inclusion of dynamic testing in the regulation, even as an option, until those test results are available and validate the model.

As discussed in the "Technical Background" portion of this preamble, the testing described by APTA has been completed. In 2008 a full-scale dynamic test and two full-scale quasi-static tests were performed on the posts of an SOA end frame. These tests were designed to evaluate the dynamic and quasi-static methods for demonstrating energy absorption by—and graceful deformation of—the collision and corner posts. FRA believes that these tests support inclusion of the quasi-static and dynamic performance requirements of this final rule and address APTA's concerns.

APTA also mentioned that in the NPRM FRA stated that alternative, dynamic performance requirements are necessary because shaped-nose designs may not have readily identifiable, full-height corner and collision posts. APTA stated that, although FRA referred to the CRM and Rotem designs as potential examples of shaped-nose designs, both these designs include easily identifiable, full-height collision and corner posts behind the shaped nose. According to APTA, all evidence points to having collision and corner posts up to their full height as key design features to protect the engineer and passengers from front-end collisions.

FRA believes that the dynamic performance requirements in this final rule allow in particular for innovative designs that protect the occupied volume for its full height, even without what would be identified as full-height collision and corner posts. Whether or not the Rotem and CRM designs have full-height collision and corner post structures does not address FRA's underlying concern that the requirements in this final rule would otherwise be too restrictive without the alternative standards based on dynamic testing. For instance, the Stadler Rail equipment procured by the Capital Metropolitan Transportation Authority (CMTA) in Austin, TX, has no readily identifiable collision or corner post structures and yet has been found to behave well under analysis using the dynamic performance requirements in this final rule. By not allowing for such design innovation, potential use of alternative designs that could demonstrate compliance would be unnecessarily restricted.

Further, APTA questioned the safety implications of allowing such key features as full-height collision and corner posts to be optional. APTA stated that all the full-scale testing done by FRA, all the model-validation testing, and all the knowledge gained of how the end frame performs in collisions pertain to equipment with these design features. Until such safety implications are better understood, APTA believed the inclusion of alternative, dynamic performance requirements to be premature. Overall, APTA was not convinced that the proper foundation has been established for adding these dynamic performance requirements to the final rule, nor was APTA convinced that a single dynamic test demonstrates full equivalency for the range of protections provided by traditional full-height collision and corner posts.

As provided in the final rule, FRA makes clear that the occupied volume must be protected for its full height, utilizing either the quasi-static or the dynamic performance requirements. FRA expects that for traditional flat-nosed designs, the occupied volume will be protected for its full height by means of full-height collision and corner posts. Yet, for other designs, this protection of the occupied volume for its full height could be achieved by the performance of the entire end frame acting together to prevent intrusion and absorb energy. FRA believes that there are many potential ways of providing protection for the full height of the occupied volume, and this is reflected in the final rule.

In its comments on the NPRM, RVB stated that use in dynamic testing of a proxy object that is essentially a steel coil has a historical basis resulting from only a few accidents. RVB believed that the European approach of using a proxy vehicle would be more sensible and that it was not clear why FRA would resist adopting aspects of that approach that are in widespread use in Europe and other countries.

As discussed earlier, FRA notes that use of a proxy object that deforms (a deformable lorry, *e.g.*) adds undue complexity to the analysis of impacts. In addition, development of a proxy object with a repeatable crush response is, in itself, a daunting task, and the cost of developing such an object for each car manufacturer is not cost beneficial. Nevertheless, FRA has modified from the NPRM the manner in which the dynamic testing is conducted, to address related concerns about use of the proxy object. Further, FRA believes that the grade-crossing collision scenarios on which the dynamic testing is based challenges the end frame members in a way that can clearly demonstrate the ability of the end frame to resist significant impact loads.

RVB also commented that it was unclear why FRA decided to position the proxy object 19 inches from the car center in the collision post dynamic test. RVB stated that not all collision posts are located 19 inches from the centerline, and believed it would seem better to center the proxy object at the post itself.

FRA notes that the location of the collision posts is dictated by the need to place the posts at the one-third points laterally, along the end of the vehicle. With this in mind, positioning the proxy object 19 inches from the car center is intended to engage the end frame where the collision post structure will be. Nevertheless, because the alternative, dynamic performance requirements more fully test the end frame as an integrated whole rather than as individual structural elements, and are not intended to test the strength of an individual element quasi-statically, it is not necessary to specify that the impact be centered on the collision post structure.

RVB further commented that the NPRM seemed to impose essentially the same energy-absorption requirements on both the collision and the corner posts in the alternative, dynamic performance requirements, and RVB was unclear if this was FRA's intent. RVB claimed that there is practically no difference between the 20 and 21 mph impact speeds that were proposed for the dynamic performance requirements, asserting that the target speeds used for actual testing would need to be higher than these values to ensure that the speeds are achieved.

FRA notes that in conducting a dynamic test there are alternative means of imparting impact energy into the front end of the cab car or MU locomotive. Speed is only one of the elements that make up impact energy. FRA has taken this fact into account in preparing the final rule and restated the dynamic performance requirements in terms of the amount of collision energy imparted. No specific test speeds are stated. Yet, the amount of collision energy is specific for each test of the two types of post structures, and each amount of collision energy was carefully chosen based upon input from industry stakeholders. FRA makes clear that it is not necessary to impart higher levels of energy than specified in this final rule to assure that the requirements are met. Of course, these requirements are minimum standards and may be exceeded by the manufacturer.

Additionally, RVB commented that the top of the deformable anti-climber of the FRA CEM-design is approximately 24 inches above the top of the underframe. RVB believed that an impact with a circular proxy object centered 30 inches above the top of the underframe, as proposed in the NPRM, could result in a ramp and alter the trajectory of the object in an undesirable manner. As a result, RVB believed it unclear how much energy would actually be imparted as intended to the structural elements, and that it may not be prudent to conduct a dynamic test in this manner for such a design to demonstrate its compliance.

FRA notes that the FRA CEM-design is intended to act as a complete system so that even if a ramp were to form on the deformable anti-climber, the end frame structure would be able to resist intrusion by the proxy object into the occupied space of the vehicle. The deformable anti-climber can absorb a significant amount of energy prior to bottoming out even when loaded in an offset manner. Nevertheless, to minimize the potential for off-axis rotations, FRA has reconsidered use of the standing proxy object specified in the NPRM to be struck by a moving cab car or MU locomotive, and has specified instead use of a proxy object connected to a moving crash cart to strike a standing cab car or MU locomotive.

In its comments on the NPRM, Caltrain raised concern with the testing performed by FRA to validate the effectiveness of the proposed collision and corner post requirements. Caltrain stated that the 1998 NICTD grade-crossing accident in Portage, IN, was recreated with a 40,000-pound steel coil at an impact test speed of 14 mph. Caltrain stated that the test speed used to recreate this accident was far lower than in most grade-crossing accidents, and that the test did not actually compare the proposed design to one that was compliant with part 238. Caltrain believed that data from a higher-speed test, using equipment that is compliant with part 238, would be more useful in evaluating potential solutions.

As discussed earlier, the SOA design is compliant with part 238 and has been tested. Further, the test cited by the commenter was carefully designed to overload only the structure of interest, and was not intended to replicate the actual collision speed. Moreover, FRA emphasizes that in this rulemaking the agency is taking an incremental approach to improving safety by enhancing the current end frame design of cab cars and MU locomotives. As noted, FRA is separately exploring the application of CEM to provide protection against even higher speed events.

In its comments on the NPRM, Caltrans stated that any dynamic testing requirement, even as an option, should be founded in actual testing and validation of the variables and proposed design criteria. Caltrans mentioned that although FRA has conducted tests that simulate a collision with a highway vehicle carrying a roll of coiled steel, the actual tests as conducted had significantly lower impact speeds and greater allowable deformation requirements. Caltrans maintained that until a real-time crash test has been conducted and analyzed by FRA that uses identical testing variables, inclusion of a standard for dynamic testing of end frame designs is premature.

FRA notes that the energy involved in the earlier testing supporting the NPRM was in fact equivalent to that proposed in the NPRM. Nevertheless, additional dynamic testing has been performed in support of the requirements in this final rule. Specifically, as discussed in the "Technical Background" section, a dynamic test was successfully conducted on April 16, 2008, and the dynamic performance requirements in this final rule are based on the actual test conditions and amount of collision energy imparted.

Caltrans also commented that FRA needs to clarify whether full-height collision and corner post tests are required if the alternative, dynamic performance requirements are used, and if not, whether FRA has performed a structural analysis showing that safety may be maintained in the absence of full-height posts. Caltrans cited FRA's statement that dynamic testing is essential as an option for validating car designs that feature non-flat front ends. Yet, Caltrans believed that current car designs that feature non-flat front ends, CRM's diesel MU locomotive and Metrolink's new Rotem cab car, both feature full-height collision and corner posts.

FRA makes clear that the fact that testing collision and corner posts dynamically is provided as an alternative in the final rule does not mean that protecting the full height of the occupied volume is optional under such circumstances. For traditional end frame designs (*i.e.,* flat-nosed designs) tested dynamically, full-height collision and corner posts are certainly not optional. Yet, FRA believes that the rule must continue to allow flexibility for other design approaches that may use different shapes and structures to protect the full height of the occupied volume. For example, FRA notes that novel designs may effectively prevent intrusion into the occupied volume through application of the concept of deflection—to deflect objects away from the vehicle. For such design approaches, full-height collision and corner posts are not necessarily required, provided, of course, that the occupied volume is nonetheless protected for its full height. FRA has conducted analysis to show that safety can be maintained in the absence of full-height collision and corner posts. Manufacturers attempting to meet the requirements of this final rule must perform the detailed structural analyses to show that safety is maintained in the absence of these structures.

In its comments on the NPRM, Bombardier raised a number of concerns with the proposal to include an option for a dynamic method of demonstrating compliance with the proposed severe-deformation requirements for collision and corner posts. Bombardier believed the proposal to be contrary to the recommendation of the Task Force in developing the NPRM. Bombardier stated that it supported the general industry consensus that such dynamic performance requirements should not be included as an option, contending that the proposed dynamic tests were impractical, had not been fully validated, did not adequately test a realistic production design end structure, raised safety concerns, and would be costly. FRA will address each comment in turn.

Bombardier stated that due to the significantly higher static load design requirements for collision posts (compared to corner posts), collision posts would be much more substantial in size and strength than corner posts. However, because the proposed dynamic test defined only a 1.0 mph difference between the impact speeds to test both collision and corner post structures, Bombardier believed this illustrated the sensitivity in the size of the post required to resist such a small increase in impact velocity. According to Bombardier, a 1.0 mph difference in test speeds would approach the accuracy achievable for a full-scale impact test, and, from a practical perspective, would create various technical and commercial problems, most likely require re-testing if the actual test speed were only marginally above or below the target speed. For instance, Bombardier claimed that if the actual impact speed during the test of a corner post were 1.0 mph above the target speed for corner posts (*i.e.,* at the impact speed required to qualify a collision post) there would be a high probability that the corner post would fail and a re-test of another production end frame would be required. Similarly, Bombardier maintained that if the post were tested at a speed slightly below the target value, it may not absorb the energy required in the proposed regulation and, again, a re-test would likely be required to verify compliance.

FRA notes that the dynamic performance requirements proposed in the NPRM were intended to be both practical and achievable, as illustrated by the fact that the proposed quasi-static requirements would have required the same levels of energy absorption. These levels of energy absorption were chosen after comparing the performance of the FRA-developed, SOA end frame with a production model tested by the commenter. Moreover, the commenter worked in conjunction with FRA and the Volpe Center to assess the degree of incremental improvement that is reasonably achievable for collision and corner posts, and a paper was published on this topic. (*See* "Review of Severe Deformation Recommended Practice Through Analyses—Comparison of Two Cab Car End Frame Designs," cited above.) There are various ways to achieve the impact speeds with the precision required for either the proposed collision post or corner post tests, and the speeds were intended to be minimum speeds that could be exceeded by the manufacturers (as FRA's requirements are safety minimums). Nonetheless, FRA has revised the dynamic performance requirements in this final rule to state the requirements in terms of collision energy rather than collision speed. Like the collision speeds proposed in the NPRM, the specified levels of collision energy may also be exceeded.

Bombardier also commented that, while FRA had conducted analysis to determine the severe deformation characteristics of a collision post, no dynamic testing had been conducted to verify the acceptability or practicality of the dynamic test proposed for collision posts. Bombardier stated that, while a dynamic test had been conducted on the SOA corner post, that test used a significantly different proxy object mass (40,000 lbs vs. 10,000 lbs) and different impact speed (14 mph vs. 21 mph) than that proposed in the NPRM. Bombardier maintained that, although FRA analysis showed these to be "equivalent" tests, the actual qualification test proposed in the NPRM had never been validated. Bombardier compared this situation to the proposed changes to the large-object impact test for forward-facing glazing, which the Task Force separately considered, stating that FRA predicted that a test based on energy using a different mass and impact speed would be equivalent to the current glazing requirements but that subsequent tests that were conducted at the request of industry to validate the proposed requirement confirmed that the proposed tests were not equivalent. Therefore, Bombardier contended that until FRA conducts and validates the proposed dynamic tests for both a collision post and a corner post on a production-model end frame, it would be premature to include such requirements in this part.

As discussed in the "Technical Background" section, FRA makes clear that the testing cited by the commenter was completed successfully on April 16, 2008, following submission of these comments. The collision post and the entire SOA end frame performed well under the impact conditions prescribed and maintained the requisite safe volume for the locomotive engineer. Equivalency of the testing has been validated.[11] With regard to glazing, FRA believes that a fuller discussion of glazing is necessary in a separate forum, including a discussion of the glazing testing cited by the commenter and the current glazing test requirements. Nevertheless, FRA does not believe that the agency is required to conduct such testing on a production design. FRA does have the responsibility to demonstrate that the rules to be imposed on the industry are achievable and do not impose undue economic costs. Yet, this can be accomplished in different ways, including engineering analysis, prototype testing, and analysis of information provided by the industry on its production designs. This process was followed in the development of the proposed performance standards supporting this final rule.

In addition, Bombardier commented that on several occasions industry members pointed out to FRA that, while the full-scale test of the SOA corner post design was valuable to validate specific design features and characteristics, the SOA design did not fully represent a production design. Bombardier stated that on a production-version end frame (flat-nosed), the corner post is set back from the collision post in the longitudinal direction by about 6 inches to accommodate car clearance during curve negotiation, and both the collision and corner posts are connected laterally by the lateral shelf and bulkhead. According to Bombardier, this arrangement would cause the proxy object to impact the structure between the collision and corner posts, rather than directly impact the corner post, in a dynamic test of a production-model corner post. Bombardier likewise believed that for a flat-nosed cab car, the proxy object would impact the structure between the collision and corner posts at 18 inches from the outside of the vehicle, instead of on the corner post (stating, *e.g.,* that the coil would contact the sheathing on a flat-nosed cab car about 4½; inches ahead of the corner post), and that this would be greater for a non-flat-nosed car. According to Bombardier, this would result in both the collision and corner posts sharing the impact load and that it would therefore be possible to design a structure with a weaker corner post than

[11] Priante, M., Llana, P., Jacobsen, K., Tyrell, D., Perlman, A.B., "A Dynamic Test of a Collision Post of a State-of-the-Art End Frame Design," American Society of Mechanical Engineers, Paper No. RTDF2008–74020, September 2008. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2008/08-74020.pdf.*

would be required to meet the quasi-static requirements.

As FRA has noted, FRA intends that the dynamic performance requirements be applicable to end frame designs that may not have identifiable corner post or collision post structures. For such designs, it is expected that the end frame will act more as an integrated whole in resisting an impact load, rather than having one structural element to resist the load by itself. Nonetheless, the final rule directs that the impact loads be applied to the end frame at the corner post and collision post locations. FRA does note that use of a crash cart to impart these loads is not specifically required by this final rule (even though FRA generally assumes that a cart will be used for purposes of the discussion in this preamble and in the examples provided in the rule text). Use of a crash cart is intended to help achieve a more repeatable testing methodology and better focus the impact loads than through use of the proxy object proposed in the NPRM, but allowance is provided for variation in the test set-up so that a car builder may tailor a test in a way that is best suited for a particular design within the requirements specified.

Bombardier further commented that, as FRA noted in the NPRM, industry members had raised concerns regarding the safety of conducting full-scale, dynamic testing of collision and corner posts. While these members acknowledged that all testing, including that required for quasi-static testing, requires attention to safety, Bombardier believed that it is much easier to manage the safety of a quasi-static test, which is conducted in a controlled lab/shop environment, than the type of dynamic tests proposed in the NPRM. Noting that during the dynamic test of the SOA corner post one side of the vehicle completely lifted off the rail, Bombardier raised concern about the potential likelihood and consequence of a derailment occurring in a dynamic test of a production-design vehicle at a higher speed, especially one with a shaped-nose. Bombardier believed that there would be particular safety concern in conducting the proposed dynamic test because the 10,000-pound proxy object would be positioned between the rails directly in front of the test vehicle and fall directly in front of the vehicle. Bombardier therefore stated that it would be premature to include the proposed dynamic tests in a Federal regulation, until FRA conducts and validates the safety of these tests on a collision post and a corner post for both a flat-nosed and a shaped-nose, production-model end frame.

As discussed earlier, FRA has modified the alternative, dynamic performance requirements in this final rule so that the testing methodology is safer and more repeatable. Specifically, FRA has modified the testing methodology so that the proxy object is set in motion to strike a standing cab car or MU locomotive. The resultant speed of the cab car or MU locomotive from being struck by the object is expected to be approximately 3 mph. Even if a cart connected to the proxy object should derail during the test, the cart is much lighter than a cab car or MU locomotive, and would present a much lesser safety hazard than would a derailment of those heavier vehicles. FRA believes that this revised test methodology sufficiently addresses the safety concerns raised by the commenter.

Bombardier also commented that while the NPRM indicated that a dynamic test option is needed to address cars with shaped noses or CEM designs, or both, all of the analysis and testing that had been conducted had been directed to assure that flat-nosed cab end structures undergo “graceful,” severe deformation and maximize the energy absorbed by the post structure before total failure of the top or bottom post connections occurs. Bombardier believed that utilizing a dynamic test to validate a shaped-nose design significantly deviates from the original intent of the severe-deformation requirements. According to Bombardier, shaped-nose designs would inherently be much stiffer than flat-nosed designs, and as a result would have a much greater tendency to deflect the proxy object rather than absorb the energy through severe structural deformation. Bombardier therefore maintained that the proposed dynamic test option would not be a measure of the severe-deformation performance of shaped-nose designs. Additionally, Bombardier stated that CEM designs would have well-defined, severe-deformation requirements that typically require significantly more energy absorption than that defined in the NPRM for collision and corner posts, and as such, requiring the proposed dynamic (severe-deformation) test option would be redundant. Consequently, Bombardier recommended that the proposed requirements for the dynamic test option be deleted and that the proposed quasi-static test requirements for the collision and corner posts be retained for only flat-nosed designs.

FRA notes that the goal of dynamic testing is preservation of a survivable space for the train crew and passengers. Flat-nosed designs must be able to absorb energy and deform gracefully because these designs are inherently required to interact with objects that threaten the superstructure of the car. Yet, FRA disagrees with not allowing the industry the alternative to use dynamic performance requirements. A dynamic test does not have to be conducted—it is provided as an alternative to demonstrate compliance. There are certain designs for which it would be difficult, if not impossible, to test quasi-statically, such as the Stadler Rail equipment procured by the CMTA. Moreover, for a quasi-static test in which the front end of the car is not flat, or the post is not centered on the specified impact point, applying a high force could cause the impactor shape to shift vertically or laterally, when all it should do is move longitudinally. The benefit of a dynamic test as an alternative is that the force would be applied quickly and the test could be conducted properly, even if the cart moved laterally or vertically and derailed.

Bombardier also commented that it did not agree with the justifications outlined in the NPRM for including alternative, dynamic performance requirements. Bombardier stated that there was significant discussion in the NPRM about CEM and European standard EN 15227, Crashworthiness Requirements for Railway Vehicle Bodies, and its four collision scenarios. Bombardier believed that extreme care must be taken when comparing such a European standard with the severe-deformation requirements proposed in the NPRM and in the current APTA standards. According to Bombardier, FRA must clarify that EN 15227 is a standard for the qualification of a CEM system, where a large quantity of energy is absorbed, and not a severe deformation standard for collision and corner posts where a very small amount of energy absorption is required. However, Bombardier did agree that the approach in the European standard should be taken into consideration at the time when CEM standards are developed for North American application.

FRA believes that it was appropriate in the NPRM to reference the European standard and its adoption of dynamic test standards. FRA did not intend to indicate that the European standard was comparable to the dynamic performance requirements proposed in the NPRM, and FRA did highlight several differences between them. As noted above, FRA has made a more technical comparison of the European deformable-lorry requirements and the dynamic performance requirements in this final rule. This effort involved taking FRA's prototype end frame design and using finite element analysis to compare its performance with the European specification and the final rule's requirements. Significant differences were found between the rule's dynamic performance requirements and those described in the European standard, including: the safety of conducting such testing, the repeatability of the results obtained, the ease of analysis, and the focus on the performance of the superstructure of the cab car or MU locomotive. The FRA dynamic performance requirements entail lower amounts of collision energy designed to provide repeatable results under conditions that are readily analyzable with a clear means of assessing adequate performance. The same was not found to be true of the European standard.

In its comments on the NPRM, CRM raised concern with actual dynamic testing of collision and corner posts using curved-shaped equipment, believing that the curved shape can be addressed in a quasi-static test but that the results would likely differ with those from a dynamic test.

FRA notes that, although the manner of load application can vary, dynamic testing provides immediate feedback as to how the tested structure will perform in an actual collision. Quasi-static testing of a shaped structure has to simplify for how the load enters the structure and reacts; consequently, the test results may not be truly reflective of actual performance. For this reason, FRA believes that the alternative, dynamic performance requirements in this final rule are better applicable to non-traditionally-shaped cab cars and MU locomotives.

CRM also commented that the dynamic testing proposed for the corner post of an aerodynamically-shaped car would impart larger lateral and vertical loads on the corner post than on the collision post.

As FRA has noted, the dynamic performance requirements included in this final rule facilitate testing of end frame designs without readily identifiable collision or corner post structures. In this light, instead of focusing on whether an individual corner post or collision post structure is capable of resisting an applied load, the focus is more appropriately placed on the ability of the end frame structure as an integrated whole to withstand the impact. In fact, the end frame may be intentionally shaped to deflect a striking object, which would be an acceptable means of complying with the dynamic performance requirements.

Additionally, CRM raised concern about the repeatability of energy-absorbing testing, stating that it has found that physical properties, such as yield, can be 30-percent higher than the published minimum. CRM asked if FRA has experience in the repeatability of identical energy-absorption tests with substantially-varying material properties, noting that repeatability studies it had seen were for multiple test samples made with both the same heat and physical properties.

FRA recognizes that material variability is a concern. Manufacturers may need to request that specific material testing be conducted when ordering materials for constructing cab cars and MU locomotives in compliance with this rule. Nevertheless, differences in yield strength are not as important as differences in the elongation to failure of the material, because most of the performance of interest is associated with plastic deformations. FRA has conducted dynamic and quasi-static tests of nominally the same design with varied results in energy absorption. This experience has demonstrated the importance of validating analysis through testing. Small design details can have dramatic effects and should be considered carefully in highly loaded areas.

3. Alternative Corner Post Requirements for Designs With Stepwells

The BLET raised concern with the proposed corner post requirements for cab cars and MU locomotives utilizing low-level passenger boarding on the non-operating side of the cab end. The BLET believed that the proposed requirements for corner post resistance were significantly lower than those for the operating side. The BLET stated that it has consistently voiced the position that current crashworthiness protection for this equipment is so low that the only practical recourse a locomotive engineer has after realizing a collision is impending is to place the train's brakes in emergency and flee the operating cab, running through the car toward the rear. While the BLET did believe that the standards proposed in § 238.213(b) would mark a significant improvement for the engineer's immediate worksite, it believed that lesser, non-operating side requirements in § 238.213(c) would still create a Hobson's choice for a locomotive engineer in the seconds immediately preceding a collision. Claiming that there would be a much greater potential for the non-operating side of the car to deform in such a way as to provide insufficient survivability, the BLET stated that both sides of the equipment should be required to withstand the same level of force. The BLET added that it is noteworthy that the non-operating side of the equipment is typically located on the "railroad" side of the train and that, as a result, impacts on that side are more likely to involve railroad equipment, producing higher collision forces. Similarly, in a frontal raking collision between two trains made of up this equipment, the BLET believed that the two "weaker" corners would meet, with potentially catastrophic consequences for passengers and crewmembers alike. The BLET also stated that the Volpe Center had researched and tested stepwell configurations and determined that it was viable to design a stepwell that was capable of supporting the end/buffer beam so that the non-operating side of the cab could comply with proposed § 238.213(b).

FRA notes that, after a review and analysis of technical information, both FRA and APTA's PRESS C&S Subcommittee determined that the proposed alternative arrangement would provide a level of safety equivalent to that on locomotive engineer's side of the cab end. Moreover, the analysis did not show that an impact on the non-operating side of the cab end would be more likely to spread damage across the full width of the cab end as described by the commenter. Nevertheless, in light of the comments raised, FRA conducted a further review and analysis of the available technical information. That review and analysis reaffirmed FRA's determination that the engineer and other occupants would not be placed at greater risk as a result of the corner post arrangement on the non-operating side of the cab end. FRA has therefore decided to retain this provision in the final rule. However, the final rule contains an additional requirement that FRA review and approve plans for manufacturing cab cars and MU locomotives with this corner post design arrangement. Each plan must detail how the corner post requirements will be met, including what the acceptance criteria will be to evaluate compliance. FRA believes that this close oversight will help to alleviate concerns that the manufactured designs are in any way less safe for crewmembers and passengers to occupy.

Another commenter on the NPRM, Caltrans, expressed its support of the proposed requirement that car designs featuring low-level passenger boarding in an end vestibule opposite from the engineer's seating location have two corner posts on that non—operating side of the car. However, Caltrans stated that the rule must make clear that this requirement applies only to those cars with a passenger loading stepwell in the same vestibule as the engineer's control location. Caltrans believed that this provision should not encompass its car design where the engineer is located on the second level of the car and the side door is on the opposite side on the lower level.

FRA agrees with the comment raised by Caltrans and makes clear that the provision does not apply to a design where the stepwell and engineer's cab are not in the very same vestibule.

APTA's comments on the NPRM expressed support for the proposal to allow vehicle designs with two corner posts on the non-engineer's side of the cab end. According to APTA, this proposal would allow vehicles to continue to have stepwells for low-platform boarding, which APTA noted is an operational necessity for many passenger railroads. APTA did raise concern that neither the preamble nor the proposed rule text specifically acknowledged that the corner post ahead of the stepwell be allowed to fail when applying the loads to the corner post behind the stepwell. APTA believed that allowing a structural member to fail as part of a test or analysis is an unusual concept for a Federal regulation and that it warrants clear discussion in the preamble.

FRA agrees that testing a post all the way through to complete failure has safety implications and should not be done without thorough analysis first. As noted, FRA has modified this provision to require FRA review and approval of a plan, including acceptance criteria, to evaluate compliance with these corner post requirements. FRA believes that this oversight will help to address the concern raised by the commenter.

4. Use of Testing and Analysis To Demonstrate Compliance

FRA requested specific comment on whether and under what circumstances analysis and scale model or fixture testing might be acceptable to demonstrate compliance with the alternative, dynamic performance requirements. A number of comments were received in response to this request, and in addressing them FRA discusses their application to both the quasi-static and the dynamic performance requirements, as appropriate.

Bombardier commented that the severe-deformation requirements proposed in the NPRM (for either the quasi-static or the dynamic performance requirements) would result in a significant, added cost for cab cars and MU locomotives, particularly as a percentage of the overall procurement cost for small orders. Bombardier contended that if these severe-deformation requirements were truly considered to be safety requirements, then it is imperative that they be required for all new equipment, regardless of the size of the order. Bombardier noted that since the proposed quasi-static requirements were also contained in an APTA standard (APTA SS–C&S–034–99, Rev. 2), the quasi-static requirements would not impose a greater cost burden on the industry than what it already accepts. However, Bombardier maintained that the actual cost to conduct dynamic testing, which would be expected to be done at a location offsite of the manufacturer's facility, would most likely be much greater than for quasi-static testing. Consequently, before any dynamic performance requirements are included in the regulation, Bombardier believed that a proper cost-benefit analysis would be needed and that it was not evident from the information in the public docket that a valid cost-benefit analysis had been conducted. Bombardier noted that the section-by-section analysis seemed to imply that verification of compliance with either the quasi-static or dynamic performance requirements would require an actual test, while the preamble did state that modern methods of analysis can accurately predict structural crush (severe deformation) and consequently can be used with confidence to develop structures that collapse in a controlled manner. Bombardier added that the proposed rule text was itself silent as to whether an actual test would be required or whether analysis could be used to verify compliance with the severe-deformation requirements. Bombardier therefore believed that FRA should clarify what would be required to demonstrate compliance with the severe-deformation requirements and should include the associated costs in the cost-benefit analysis.

FRA notes that it did ask the commenter and other members of the Task Force to provide FRA with estimated costs for each testing alternative for FRA to review. FRA did not receive this specific cost information. FRA agrees with Bombardier that the cost of meeting the quasi-static test requirements is likely not to add to the costs of manufacturing or purchasing new passenger equipment. However, FRA does not agree that the costs of dynamic testing would be greater than the costs of quasi-static testing. Based upon the testing program sponsored by FRA at the TTC in Pueblo, CO, the overall cost of conducting either quasi-static or dynamic testing should be comparable. But even more important, FRA believes that dynamic testing provides at least the same level of confidence in the safety of the equipment tested as through quasi-static testing, and a manufacturer or railroad could voluntarily choose to conduct dynamic testing. The voluntary act of a manufacturer or railroad would provide sufficient evidence that dynamic testing does not materially add to costs, and no specific benefit-cost analysis is needed to provide a voluntary alternative. As FRA has noted, FRA does agree that actual physical testing should be required and that large orders, as well as small orders alike, should undergo actual testing. Yet, as discussed elsewhere in this preamble, FRA does not believe that actual physical testing of a complete, production-design vehicle is required, and FRA recognizes in particular the potential cost of doing so for small car orders.

CRM also raised concerns as to the cost of demonstrating compliance with the regulation to manufacturers of small orders of cab cars or MU locomotives. CRM believed that consideration needs to be given to these manufacturers to protect them from undue financial and schedule hardships.

FRA has taken into account the costs of this final rule to manufacturers of small orders of cab cars or MU locomotives. As noted, FRA believes that for both large and small orders, the manufacturer must perform actual physical testing. However, FRA does not believe that actual physical testing of a complete, production-design vehicle is required. FRA recognizes in particular the potential cost of doing so for small order sizes. Compliance may be demonstrated by a combination of engineering analysis and physical testing on a smaller scale.

CRM further commented that destructive testing could be very expensive. CRM stated that its customers generally order in small quantities, often in the range of two to three cars. According to CRM, producing a 19.25-foot long section of the end of a car for destructive testing would represent a considerable, additional expenditure. CRM therefore requested that FRA clarify that the test sample need not be a large end section of the car, noting that as the NPRM is focused on the post structure and its attachments, the test sample should be limited to just that. CRM nonetheless estimated the costs of quasi-static testing to be approximately $250,000 for each design after a capital expenditure of $75,000 for test fixtures.

FRA agrees that the entire car need not be tested. Bombardier has conducted quasi-static end frame tests where the end of the car was tested only to the body bolster; this would be appropriate. (*See* "Review of Severe Deformation Recommended Practice Through Analyses—Comparison of Two Cab Car End Frame Designs," cited above.) There are a variety of ways of testing the end frame structure that would not require production of a test specimen of the 19.25-foot size described. Current testing of end frames (both dynamically as well as a quasi-statically) is intended to ensure that the superstructure with some supporting structure can deform gracefully while not allowing permanent deformations in the car body structure too much of a distance behind the connection points. As a result, considerably smaller test articles may be used, provided of course that both the collision post and corner post structures are subject to actual testing. In addition, FRA believes that the costs estimated by CRM for testing are too high, absent more specific cost information from the commenter, and that any expenditure for test fixtures should be a one-time cost that could be spread over many orders.

In addition, CRM proposed that analysis be allowed in lieu of actual testing for orders of less than 50 cars, provided that the analysis methods have been validated by actual testing. In its comments on the NPRM, Caltrain also requested clarification whether actual testing is required to demonstrate compliance, or whether analysis would be acceptable. Caltrain believed that it had been decided that for purposes of complying with the APTA collision and corner posts standards on which this rulemaking is based, current computer finite element modeling methods were adequate to verify design performance, in part due to the cost associated with destructive testing.

FRA believes that there is no substitute for conducting actual testing, as we have seen from the quasi-static test of the collision post that did not meet the energy-absorbing requirement due to the location of a rigid gusset, even though the modeling showed that it would.[12] In particular, because there are always some uncertainties associated with new designs and materials, some degree of testing is required whether for material characterization or sub-assembly testing to confirm that the modes of deformation and failure are modeled appropriately. FRA recognizes that after several designs have been tested and approved, perhaps future designs that are very similar to the older designs could be accepted through analysis only. The individual car builder would still have to demonstrate good experience conducting large deformation analyses, including material failure.

APTA stated that FRA asked for specific comment on whether and under what circumstances analysis and scale model or fixture testing might be acceptable to demonstrate compliance with the dynamic performance requirements. APTA stated that this was a key question, noting that the rule text proposed that compliance "be demonstrated." APTA believed that either a test or analysis could apparently fulfill the requirement and that there was no indication or guidance of when analysis would suffice in lieu of testing. APTA recommended that, until the industry, in partnership with FRA, can reasonably describe under what circumstances a test must be done and when analysis alone is sufficient, the option for dynamic testing should not be included.

FRA notes that due to uncertainty associated with progression of material failure, some level of actual physical testing is necessary. But this uncertainty is not limited to demonstrating compliance with the dynamic performance requirements; it would also apply for demonstrating compliance with the quasi-static requirements. In this preamble to the final rule, FRA is providing additional guidance in response to similar comments received on the need for and extent of actual physical testing. In general, FRA believes that a combination of actual physical testing and analysis is appropriate to demonstrate compliance with the requirements in this final rule, and FRA encourages manufacturers to approach FRA should they have any questions or concerns about demonstrating the compliance of cab cars or MU locomotives they manufacture with this final rule's requirements.

5. Submission of Test Plans for FRA Review

In part because FRA recognized that questions may arise in applying the proposed dynamic performance requirements in situations not clearly anticipated today, FRA requested comment on whether this final rule should include either an option or a requirement that the test methodology be submitted for FRA review prior to the conduct of destructive testing.

APTA commented that it believed such pre-approval to be unwise. APTA stated that delay awaiting FRA approval would impact schedules, extend the already extensive procurement process, and expose car builders to liquidated damages should FRA review be delayed. Instead, if FRA were to impose a requirement to submit a test plan, APTA recommended that FRA include a presumption that the plan is approved by some reasonable time after submittal to FRA, to avoid increasing the commercial risk to car builders. Caltrans' comments raised similar concern with the inclusion of a requirement that test plans be submitted to FRA for approval, asserting a great possibility of project delay while the railroad or its contract equipment supplier is awaiting FRA's response. In addition, CRM commented that, while its involvement with Volpe Center staff in the analysis and testing of its equipment has been very informative and helpful, it did not recommend mandating the submittal of test plans. CRM believed that doing so would require FRA to budget for a staff to support this effort in a timely manner so that delivery schedules remain unaffected. Nonetheless, CRM recommended that FRA publish guidelines for preparing analyses and conducting tests so that manufacturers know to follow an approach with which FRA agrees.

In response to these comments, FRA makes clear that it welcomes the submittal of test plans for its review. For instance, if a manufacturer were to conduct a test without using appropriate instrumentation or without applying a load at the appropriate location, a new test would likely be costly and would likely have been avoided had a test plan been submitted to FRA for review. Nevertheless, FRA agrees with the commenters and, in general, is not imposing new submittal requirements. As noted, however, FRA is requiring the submission and approval of plans to ensure compliance with the alternative corner post requirements for the non-engineer's side of the cab end of vehicles with stepwells for low-level platform boarding. *See* § 238.213(c) and appendix F. FRA does encourage submission of other plans for the safety of new designs that are significantly different than conventional equipment, and FRA believes that manufacturers would benefit by approaching FRA before such designs are complete to prevent the need for redesign or retrofit. In this regard, FRA notes that § 238.111

[12] Muhlanger, M., Llana, P., Tyrell, D., "Dynamic and Quasi-Static Grade Crossing Collision Tests," American Society of Mechanical Engineers, Paper No. JRC2009–63035, March 2009. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2009/09-63035.pdf.*

(Pre-revenue service acceptance testing plan) contains specific requirements for the preparation and submittal of pre-revenue service acceptance testing plans for passenger equipment that has not been used in revenue service in the United States. Pursuant to § 238.111(b)(2), such plans must be submitted to FRA at least 30 days prior to conducting the testing, but FRA approval is required for Tier II passenger equipment only. Of course, it is within the purview of FRA to review the crashworthiness of all equipment prior to its placement in service, and to assess the compliance of all equipment with the requirements of the Federal railroad safety laws and regulations.

6. Whether the Requirements Affect Vehicle Weight

AWA commented that, while it stands firmly for rail safety, it was concerned with any policies or institutions that have the effect of limiting the development and operation of passenger trains and pushing existing or potential rail passengers onto already crowded highways and putting more people at greater risk. As stated in its comments, AWA believed the NPRM to be the latest in a series of FRA rules that attempt to enforce safety by adding yet more heavy metal to already massive passenger trains. AWA raised concern with increasing the weight of America's "uniquely bulky" passenger rail fleet compared with the "extremely safe, lighter" trains of Switzerland, Germany, Sweden, or Japan, and how the added monetary costs of such heavier trains in terms of purchase and greater energy consumption may discourage or inhibit passenger rail carriers from acquiring rail cars or running passenger trains. AWA recommended FRA reconsider its action and consider the impacts of mandating even heavier and costlier "steel-wheeled Hummers." AWA recommended that FRA look to harmonize passenger rail car construction and safety standards with the widely-accepted standards of the International Union of Railways (UIC), a worldwide organization for the promotion of rail transport and cooperation, so that rail agencies and operators can afford to provide more people with passenger rail service. Similarly, a private citizen principally commented that rather than increasing crashworthiness requirements and the weight of cab cars, FRA should first investigate whether existing UIC standards for end strength and buff strength would provide equal or better safety than the current FRA standards. The commenter believed that increasing the weight of passenger equipment should be a major concern from both an economic and an environmental point of view, causing greater wear on the track, increased energy consumption, and decreased operational performance. The commenter believed that reducing car weight and enabling use of European designs can reduce costs, and that there is a definite environmental and economic impact from having collision standards that differ from those in Europe or Asia.

As noted earlier, FRA wishes to dispel the belief that there is a meaningful correlation between an increase in a vehicle's crashworthiness and its weight. As FRA has stated, crashworthiness features from clean-sheet designs can occupy the same space as other material and not weigh in excess of the structure(s) being replaced. There is considerable leeway in designing such systems so that no additional weight is required, and the car body structure itself typically accounts for only between 25 to 35 percent of the final car weight. In fact, FRA found that the FRA/Volpe SOA end frame design added less than 500 pounds to vehicle weight. This difference is less than a one-percent increase in the weight of the vehicle over a typical 1990s design, but represents a considerable increase in improved crashworthiness performance. A vehicle with such a design was found capable of safely withstanding the same collision scenario at nearly a 50-percent greater collision speed—or more than double the amount of collision energy—as opposed to one without.

Further, the requirements in this final rule are performance-driven, similar to the new European standards calling for scenario-defined loading of the superstructure with energy and displacement evaluation criteria, as discussed above. In fact, the two are in much closer harmony when compared with FRA's more traditional requirements for cab cars and MU locomotives. The two sets of requirements differ principally in how compliance is demonstrated. FRA believes that the methods called for in this final rule are significantly less complicated than the methods provided in the European standards, while addressing similar concerns.

Nonetheless, as FRA has previously stated, the rail operating environment in the United States generally requires passenger equipment to operate commingled with very heavy and long freight trains, often over track with frequent highway-rail grade-crossings used by heavy highway equipment. European and Asian passenger operations, on the other hand, are generally intermingled with freight equipment of lesser weight, and in many cases highway-rail grade-crossings also pose lesser hazards to passenger trains in Europe and Asia due to lower highway vehicle weight. FRA is necessarily concerned with the level of safety provided by passenger equipment designed to European and other international standards when such equipment is intended to be operated in the United States and must ensure that the designs are appropriate for the nation's operating environment. FRA does believe that these new requirements for collision posts and corner posts will significantly enhance the performance of the posts in protecting occupants of cab cars and MU locomotives, while having little if any effect on total vehicle weight.

7. System Safety

Caltrain's comments on the NPRM raised issues not only on the NPRM itself but also on FRA's overall approach to regulation. Caltrain asserted that if the entire system, made up of components that may not be compliant with specific FRA regulations, can be shown to be as safe or safer than a system made up of components that individually meet FRA's regulations, then the true mission of both FRA and the railroad has been met. Caltrain recommended that FRA reword the NPRM so as not to discourage railroads from taking a systems-based approach to safety. In this regard, Caltrain recommended that FRA direct some of its research funds toward examining the safe use of CEM designs that do not have an inner structure compliant with part 238, to improve energy efficiency as well as international trade possibilities.

FRA notes that there are already procedures in place to allow the operation of equipment built to alternative standards. FRA permits such flexibility and has reviewed and approved the proposed operation of alternatively-designed equipment for CMTA. Moreover, FRA has established the Engineering Task Force of the Passenger Safety Working group to produce a set of technical evaluation criteria and procedures for passenger rail equipment built to alternative designs. The technical evaluation criteria and procedures are intended to provide an engineering-based method of comparing the crashworthiness of alternatively-designed equipment to the crashworthiness of equipment designed to the structural standards set forth in part 238. The initial focus of this effort will be on Tier I standards. When completed, the criteria and procedures would not only form a technical basis for making determinations concerning equivalent safety pursuant to § 238.201 but also provide a technical framework for presenting evidence to FRA in support of any request for waiver of the compressive (buff) strength requirement set forth in § 238.203. *See,* generally, 49 CFR part 211 (Rules of Practice). The criteria and procedures could be incorporated into part 238 at a later date after notice and opportunity for public comment.

However, FRA strongly believes that, based upon research already conducted on application of CEM to conventional passenger rail equipment, the prescribed occupied-volume strength is required to serve as the foundation against which crush elements can react and thereby achieve high levels of energy absorption in reasonable crush distances while not creating too severe an interior deceleration environment.

Caltrain raised additional concern with FRA's approach in the NPRM to mitigate risk by increasing the survivability of an incident rather than by implementing a broader, systems approach that would first take into account the railroad's efforts to avoid the incident altogether or lower its probability of occurrence. Caltrain cited and agreed with FRA's promotion of system safety planning in the railroad industry, but believed that FRA has applied system safety planning in too limited a way. Caltrain believed that the NPRM focuses on increasing the survivability of a low-probability event, and thus mandates the solution rather than encourage the railroad to avoid the incident altogether. Caltrain stated that focusing on safety at the component level provides a lower return on investment than by broadening that focus to the system level. Caltrain cited the Washington Metropolitan Area Transit Authority's (WMATA) approach to addressing the safety of its operations on tracks that parallel freight operations. Caltrain stated that after WMATA first mitigated the risk of derailing its own trains into the freight railroad's right-of-way by maintaining its vehicles and tracks to tight standards, WMATA ultimately decided to install an intrusion detection system to provide warning of freight train derailments fouling WMATA's tracks. Caltrain believed that if WMATA had taken the approach presented in the NPRM, however, rather than a system safety approach, WMATA would have bought larger and heavier vehicles, incurred additional and continuing costs as a result, and would nonetheless not have avoided the risk of injury to passengers and crewmembers should a collision occur.

As Caltrain noted, FRA does encourage railroads to engage in system safety planning, and FRA even proposed to make system safety planning a requirement for passenger railroads. *See* 62 FR 49728, 49800. Elements of system safety planning are a part of the Passenger Equipment Safety Standards, *see* discussion at 64 FR 25548–25550, and FRA is newly examining system safety requirements for passenger railroads in the Passenger Safety Working Group's Passenger Safety Task Force. Moreover, FRA has long followed a policy of focusing on both collision-mitigation and collision-avoidance measures, as both are necessary for safe railroading. Collision-mitigation measures alone do not eliminate the risk of injuries to passenger and crewmembers should a collision occur, but neither do collision-avoidance measures eliminate the risk of a collision in any currently-practical way given, *e.g.,* the potential (however remote) for a rail to suddenly break under a train and cause a derailment. FRA therefore applies complementary approaches to reducing overall risk, including tightening track safety standards and implementing PTC systems. (On July 21, 2009, FRA published an NPRM implementing a requirement of the Rail Safety Improvement Act of 2008 (RSIA of 2008), Div. A of Public Law 110–432; 122 Stat. 4848 *et seq.* (Oct. 16, 2008), that certain passenger and freight railroads install PTC systems, *see* 74 FR 35950.) It is nonetheless paramount to establish, in addition to collision-avoidance methods, a base minimum level of crashworthiness performance.

Here, as a regulatory agency issuing a rule of general applicability for passenger equipment that may be operated commingled with freight trains and over public highway-rail grade-crossings used by heavy highway vehicles, FRA believes that certain minimum enhancements to collision mitigation measures are necessary. These enhancements have been developed with the industry and can be readily met as a result of improvements and maturity in design techniques available to manufacturers. FRA notes that WMATA operates in a different environment as a rapid transit system not connected to the general railroad system, and WMATA is not subject to FRA's jurisdiction. But even WMATA cannot eliminate the risk of a collision altogether, and collisions of WMATA trains have resulted in significant loss of life and damage. On June 22, 2009, a WMATA train traveling in a curve struck the rear end of another WMATA train, which had stopped for a station. The lead car of the oncoming train telescoped and overrode the rear car of the stopped train by about 50 feet, resulting in 9 fatalities and numerous injuries. *See* letter dated September 22, 2009, from Deborah A.P. Hersman, Chairman, NTSB, to Joseph C. Szabo, Administrator, FRA, conveying Safety Recommendations R–09–20 and –21 (Urgent), and R–09–22. This letter is available on the NTSB's Web site at: *http://www.ntsb.gov/Recs/letters/2009/R09_20_21_22.pdf.* Four and a half years earlier, on November 3, 2004, a non-revenue WMATA train rolled backwards down a grade and struck a train that was in the process of discharging and loading passengers at a station. The car at the rear end of the striking train overrode the leading end of the first car of the stopped train and sustained a loss of about 34 linear feet of the passenger occupant volume, which was almost half the length of the passenger compartment. Had the passenger compartment not been empty, the loss of that length of occupant volume could have caused numerous fatalities. *See* "Collision Between Two Washington Metropolitan Area Transit Authority Trains at the Woodley Park-Zoo/Adams Morgan Station in Washington, DC, November 3, 2004," NTSB Report No. RAR–06–01, adopted on March 23, 2006. This report is available on the NTSB's Web site at: *http://www.ntsb.gov/publictn/2006/RAR0601.pdf.*

8. Other Comments

Bombardier commented that the structural loads (including those for severe deformation) defined in APTA SS–C&S–034–99, Rev. 2, specify requirements for collision and corner posts that act together with the supporting car body structure and intervening connections. To make this regulation consistent with the industry standard, therefore, Bombardier recommended that this final rule adopt the same approach.

FRA agrees with the commenter and has modified this final rule accordingly. The intent has always been to have the entire end frame act as a system and resist intrusion of objects that threaten the superstructure of the cab car or MU locomotive.

CRM sought to extend the effective date of the final rule so as not to impact existing orders. In addition, CPUC supported FRA's proposed applicability dates for the collision and corner post requirements as enhancements to safety while still allowing manufacturers and industry buyers adequate time to develop and provide the required additional cab car and MU locomotive strengthening.

FRA did not intend to impact existing orders. While this final rule may have an effective date of March 9, 2010 the new collision and corner posts requirements apply to cab cars and MU locomotives ordered on or after May 10, 2010, or placed in service for the first time March 8, 2012. This date range is consistent with other applicability dates imposed by FRA, and FRA believes they are achievable.

In other comments on the NPRM, the BLET expressed disappointment that the proposed rule did not include general cab standards. The BLET stated that, while the proposed rule would make significant and meaningful strides in improving crashworthiness, no consideration has been given to any other ergonomic issue, including cab size, vibration, noise, and seat construction. The BLET believed that equipment is evolving to the point where locomotive engineers are confined to essentially small cages, creating both safety and security risks that are foreseeable and avoidable.

FRA understands that this rule does not address general cab standards. Instead, this rule is focused on improving the crashworthiness of the front end structure of cab cars and MU locomotives in the event of an impact generating collision forces that overload the superstructure of the car. General cab standards include consideration of structural layout, ergonomics, and human factors, and would need to be addressed in a separate RSAC effort.

Caltrain commented on FRA's statement in the NPRM that FRA's crashworthiness research program focuses on two objectives: preservation of a safe space in which occupants can ride out a collision or derailment, and minimization of physical forces to which occupants are subjected when impacting surfaces inside a passenger train as the train decelerates. Caltrain did not believe that the NPRM adequately addressed the second objective. Caltrain stated that the amount of energy absorbed by the collision and corner posts will not significantly lower secondary-impact velocities.

FRA notes that for events that primarily load the superstructure (*i.e.*, end frame) of the cab car or MU locomotive, secondary-impact response for passengers is not a real concern. For example, since highway vehicles weigh much less than trains, a collision with a highway vehicle at a grade crossing would not impart dangerously high decelerations to the train or the train occupants but could impart significant loads to the end frame, making protection of the occupied volume paramount.

In addition, Caltrain commented that making the car body stronger seems secondary to preventive measures, and even contrary to FRA's stated objective of reducing secondary-impact velocities. Caltrain stated that in a train-to-train collision, rigid non-CEM vehicles will experience higher secondary-impact velocities than vehicles equipped with CEM and that by focusing on the specific approach in the NPRM, FRA may be overlooking more cost-effective solutions.

FRA notes that it is not necessarily true that use of CEM will result in lower secondary-impact forces in a train-to-train collision. Secondary-impact forces may actually be higher as part of a CEM-design that mitigates initial impact forces by dissipating the forces more evenly throughout the train. Test data has shown cars in a CEM-train to have higher secondary-impact velocities.

B. Preemption

A number of comments were filed on the topic of Federal preemption concerning the safety of operating a cab car or an MU locomotive as the leading unit of a passenger train, as well as concerning passenger equipment safety in general. Several of these comments were from members of Congress. These and other comments on the topic of Federal preemption are generally grouped by issue and are addressed below.

1. Whether FRA Characterized Its Views on Preemption as the RSAC Consensus

Several commenters raised the concern that FRA's statements in the NPRM wrongly conveyed the idea that a consensus had been expressed within RSAC on the preemptive effect of the rulemaking. Specifically, the BLET, which is an RSAC member and was a participant in RSAC meetings on the rulemaking, asserted that RSAC never addressed, much less reached consensus on, the preemptive effect of the proposed rule. The BLET contended that FRA erroneously claimed that RSAC agreed by consensus to the preemption provision espoused in the NPRM, stating that RSAC meeting documents reflect discussion of technical issues only. The UTU, which also is an RSAC member and was a participant in RSAC meetings on the rulemaking as well, similarly commented that it was never involved in any discussions regarding the preemption of State common law. The UTU disagreed with FRA's characterization of how federalism issues were addressed by RSAC, citing FRA's statement in the NPRM that FRA had received no indication of concerns about the federalism implications of the rulemaking. The CPUC also raised the same issue, referring to the UTU's comment that the UTU was not involved in any discussions regarding the preemption of State common law. The CPUC itself commented that the ASRSM's RSAC representative advised the CPUC that it too could not recall a discussion regarding the preemption of State law.

FRA makes clear that it did not intend to convey that RSAC had reached consensus on FRA's statements in the NPRM as to preemption. Indeed, FRA did not make preemption an issue within RSAC on which it sought consensus. Nonetheless, FRA believes that commenters have read too much into what FRA did say in the NPRM. In discussing the federalism implications of the rulemaking in Section V.A. of the NPRM's preamble, FRA stated the following:

> [F]ederalism concerns have been considered in the development of this NPRM both internally and through consultation within the RSAC forum, as described in Section II of this preamble, above. The full RSAC, which reached consensus on the proposal (with the exception discussed above concerning cab cars and MU locomotives without flat-ends or with CEM designs, or both) and then recommended it to FRA, has as permanent voting members two organizations representing State and local interests: AASHTO and ASRSM. As such, these State organizations concurred with the proposed requirements (again, with the exception noted above). The RSAC regularly provides recommendations to the FRA Administrator for solutions to regulatory issues that reflect significant input from its State members. To date, FRA has received no indication of concerns about the Federalism implications of this rulemaking from these representatives or from any other representative on the Committee.

72 FR 42036. FRA did state that RSAC, with one exception, had reached consensus on the proposed requirements. These requirements were the amendments to §§ 238.205 (Anti-climbing mechanism), 238.211 (Collision posts), and 238.213 (Corner posts). For this reason, FRA explicitly mentioned that consensus had not been reached on dynamic test standards for cab cars and MU locomotives. FRA should have made clearer that it did not intend to convey that RSAC's consensus included the proposed modification to § 238.13 (Preemptive effect), or any of FRA's views on preemption. FRA did not consider § 238.13 a proposed requirement, and FRA did not make it an issue for which consensus was

sought. To the extent that FRA had discussed preemption in RSAC, FRA had explained to RSAC members what it has told the public and continues to say regarding the permissibility of a railroad not to operate Tier I passenger trains in a push-pull configuration—in particular, the freedom of a State or local authority funding its own railroad to direct that its railroad not operate trains in push-pull fashion. (*See* below for a fuller discussion of this issue.)

FRA also believes that some confusion may have arisen from FRA's use of customary language discussing the federalism implications of its rulemaking actions in general and the consultation afforded through RSAC. Because FRA's rulemaking actions have preemptive effect by virtue of 49 U.S.C. 20106 (Section 20106), discussed further below, RSAC serves as a forum in which FRA can consult with State and local officials early in the process of developing proposed regulations in accordance with the executive order on federalism. FRA recognizes the value in such consultations and the ability of State and local interests to raise federalism concerns with proposed regulatory actions. Here, no federalism concerns had been raised in RSAC regarding the proposed requirements in the rulemaking—what would become national standards through a final rule—and FRA represented that fact using a customary formulation. FRA did not intend that representation to mean that RSAC members had no objections to any of FRA's statements on federalism in the NPRM. FRA makes clear that no such meaning or implication was intended.

2. Whether FRA's Views Are Consistent With 49 U.S.C. 20106, as Amended

A number of commenters, including members of Congress, raised concern that FRA's statements in the NPRM were not consistent with revisions made to 49 U.S.C. 20106 by the Implementing Recommendations of the 9/11 Commission Act of 2007 (9/11 Commission Act of 2007), Public Law 110–53, Aug. 3, 2007. Congressmen James Oberstar and Bennie Thompson jointly commented that they had strong concern over the preemption language included in the preamble. They requested that FRA issued a revised NPRM to delete portions of the preamble inconsistent with revisions made to Section 20106. In the alternative, the Congressmen believed that FRA should include a revised preemptive effect discussion in the preamble of the final rule to reflect Congress' intent that such regulations do not preempt State tort claims. The Congressmen commented that Congress did not intend that the Federal Railroad Safety Act of 1970 (FRSA) (formerly 45 U.S.C. 421 *et seq.*, now repealed and reenacted as positive law primarily in chapter 201 of title 49) would be interpreted to prevent injured victims from asserting their rights under common law, and raised concern that FRA's views on preemption may serve to immunize negligent railroad companies and prevent train derailment victims from holding these companies accountable for their injuries. The Congressmen stated that the 9/11 Commission Act of 2007 clarified that Section 20106 is intended as a limited preemption provision to prevent States from implementing their own rail safety regulations in certain instances and was not designed to preempt cases brought by victims of railroad derailments. The Congressmen believed that the law sends a loud and clear message that FRSA in no way preempts State common law claims and to the extent the U.S. Supreme Court has construed a Congressional intent to federally preempt State law claims against railroads Congress has cleared up any confusion. Accordingly, the Congressmen believed that statements in the preamble to the NPRM containing language attempting to preempt State common law standards contradicts Congressional intent and subverts the legislative determination that Congress does not want to leave victims of negligent railroads without any recourse.

Three other members of Congress also jointly commented on FRA's statements in the NPRM concerning preemption and requested that FRA revise its discussion in light of the revisions made to Section 20106 by the 9/11 Commission Act of 2007. Senators Kent Conrad and Byron Dorgan and Congressman Earl Pomeroy noted that section 1528 of the 9/11 Commission Act of 2007 clarified the intent of Congress with respect to the preemptive effect of FRSA but that, perhaps as a result of chronology, the preamble to the NPRM made no reference to the Congressional action. The Congressmen believed that certain statements in the preamble could be interpreted to contradict the language that Congress had just enacted and that it would be inappropriate to issue a final rule that does not accurately reflect current law. The Congressmen cited as an example the statement "FRA believes that it has preempted any State law, regulation, or order, including State common law." The Congressmen raised concern that this statement could be read to undermine the intent of Congress that FRSA not preclude victims of railroad accidents from seeking redress under State law for their injuries and losses, and could inform the interpretation of FRSA by the courts or other interested parties. The Congressmen requested that FRA revise the preamble to make explicit reference to the amendments to Section 20106 and make clear that FRSA does not prevent victims of railroad accidents from holding railroad companies to account for their actions in a court of law.

In addition to members of Congress, the AAJ commented that in the 9/11 Commission Act of 2007 Congress reiterated its intent to preserve State tort claims against negligent railroads. The AAJ asserted that section 1528 of this law sends a loud and clear message that Section 20106 in no way preempts State common law claims and that to the extent the U.S. Supreme Court has construed a Congressional intent in Section 20106 to preempt State law, Congress has cleared up any confusion. The AAJ concluded that there is no room for argument that the 9/11 Commission Act of 2007 does anything but restore the rights of victims to sue negligent railroads under State law. Finally, the BLET commented that it could not be clearer that Congress intended to preserve State common law causes of action in the circumstances defined in the 9/11 Commission Act of 2007. The BLET stated that the conference report on the legislation makes clear that Congress did not intend to preempt all State causes of action in every area where FRA has issued—or has considered but declined to issue—safety regulations. The BLET also commented that when FRA published the NPRM, the bill was on the President's desk.

FRA believes it important to address the comments raised as to why the NPRM does not reflect the changes made to Section 20106 by the 9/11 Commission Act of 2007. FRA believes that the timing of the NPRM's issuance has led to misunderstandings reflected in the comments. Although the NPRM was published on August 1, 2007, it was issued by FRA on July 26, 2007. At the time of the NPRM's issuance, Congress was still deliberating the legislation: the Senate agreed to it that same day, and the House passed it the following day, July 27, 2007. When Congress cleared the bill for the White House, the NPRM was being processed for publication at the **Federal Register.** Consequently, the NPRM did not reflect any changes made to Section 20106 by the 9/11 Commission Act of 2007, signed by the President on August 3, 2007.

As discussed elsewhere in this final rule, FRA is amending the existing preemption provision in this part, § 238.13 (Preemptive effect), to conform to the revisions made to Section 20106 by the 9/11 Commission Act of 2007. FRA makes clear that any statement in the NPRM that is contrary to Section 20106, as amended effective August 3, 2007, should be ignored. Nonetheless, FRA believes that its statements in the NPRM are consistent with the 9/11 Commission Act of 2007's clarification to Section 20106 and that there may have been misunderstandings as to the meaning of FRA's statements in the NPRM, relating in particular to what the commenters intend the terms "claim" and "standard" to mean. FRA believes that some of the comments overstate what FRA said in the NPRM about the preemptive effect of Section 20106, even prior to its amendment.

FRA was careful to convey that Federal preemption under Section 20106 applied to standards of care under State law—as opposed to claims (causes of action) under State law. They are different. As discussed further below, the 9/11 Commission Act of 2007 added new subsection (b) to Section 20106 to clarify the preemptive effect of FRSA so as not to restrict enumerated "causes of action" under State law. While FRA's regulations may preempt the standard of care, they do not preempt the underlying action in tort. In this regard, FRA did not make the broad statement by itself that "FRA believes that it has preempted any State law, regulation, or order, including State common law." FRA made that statement only in a fuller sentence that expressly limited its meaning: "FRA believes that it has preempted any State law, regulation, or order, including State common law, concerning the operation of a cab car or MU locomotive as the leading unit of a passenger train." *See* 72 FR 42036. In this instance, FRA did intend to convey that where a claim is based on a State standard concerning the operation of a cab car or MU locomotive, FRA has through its regulatory actions preempted any State standard that restricts the push-pull operation of a Tier I passenger train. However, FRA did not—and does not—find that any claim under State law is preempted merely because a train is operating in push-pull mode. FRA believes this to be consistent with the 9/11 Commission Act of 2007. A fuller discussion follows.

This rule preempts State common law standards of care. The Supreme Court has spoken clearly on the subject of preempting State common law by Section 20106. The question was squarely presented to the Court in *CSX Transp., Inc.* v. *Easterwood*, 507 U.S. 658 (1993), which involved a grade-crossing collision. One of the respondent's claims in the case was that, despite FRA's Track Safety Standards (49 CFR part 213) which permit a maximum speed of 60 m.p.h. over the Class Four track involved in the case and train speed at the collision being below 60 m.p.h., "petitioner [CSX] breached its common-law duty to operate its train at a moderate and safe rate of speed." *Id.* at 673. The Court's answer was "[w]e hold that, under the FRSA, Federal regulations adopted by the Secretary of Transportation pre-empt respondent's negligence action only insofar as it asserts that petitioner's train was traveling at an excessive speed." *Id.* at 676. In reaching that judgment, the Court reasoned that "[a]ccording to § [20106], applicable Federal regulations may pre-empt any state 'law, rule, regulation, order, or standard relating to railroad safety.' Legal duties imposed on railroads by the common law fall within the scope of these broad phrases." *Id.* at 664. The Supreme Court very plainly held that the State common law standard of care was preempted by FRA's Track Safety Standards, but that the underlying negligence action was not. That is completely in accord with the amendment Congress enacted to Section 20106 in section 1528 of the 9/11 Commission Act of 2007.

The Supreme Court's interpretation of Section 20106 was confirmed and further explained in a subsequent case involving a grade-crossing wreck in which the plaintiff had alleged that the railroad negligently failed to maintain adequate warning devices at the grade-crossing in question. The Supreme Court held:

> Sections 646.214(b)(3) and (4) [the Federal Highway Administration regulations mandating the installation of particular warning devices when certain conditions exist] "cover the subject matter" of the adequacy of warning devices installed with the participation of Federal funds. As a result, the FRSA pre-empts respondent's state tort claim that the advance warning signs and reflectorized crossbucks installed at the Oakwood Church Road crossing were inadequate. Because the TDOT [Tennessee Department of Transportation] used Federal funds for the signs' installation, §§ 646.214(b)(3) and (4) governed the selection and installation of the devices. And because the TDOT determined that warning devices other than automatic gates and flashing lights were appropriate, its decision was subject to the approval of the FHWA. *See* 23 CFR 646.214(b)(4). Once the FHWA approved the project and the signs were installed using Federal funds, the Federal standard for adequacy displaced Tennessee statutory and common law addressing the same subject, thereby pre-empting respondent's claim.

Norfolk Southern Ry. Co. v. *Shanklin*, 529 U.S. 344, 358–359 (2000). It could not be clearer that, before Congress amended Section 20106 in 2007, it provided for preemption of State common law by DOT regulations.

Congress was moved to amend Section 20106 by two court cases, *Lundeen* v. *Canadian Pacific Ry. Co.*, 507 F.Supp.2d 1006 (D.Minn. 2007), and *Mehl* v. *Canadian Pacific Ry., Ltd.*, 417 F.Supp.2d 1104 (D.N.D. 2006), which left without a legal remedy tort plaintiffs injured in a hazardous material release from a train wreck in Minot, ND. The judge's opinion in *Lundeen* said:

> Preemption bars private claims for FRA violations. Congress has given the Secretary of Transportation "exclusive authority" to impose civil penalties and request injunctions for violations of the railroad safety regulations. FN4 49 U.S.C. 20111(a); *Abate* v. *S. Pac. Transp. Co.*, 928 F.2d 167, 170 (5th Cir. 1991) ("The structure of the FRSA indicates that Congress intended to give Federal agencies, not private persons, the sole power of enforcement.").
>
> FN4. The single exception to the Secretary's exclusive authority exists when the Federal government fails to act promptly. In such cases, state government agencies can file suit, impose penalties, or seek injunctions. 49 U.S.C. 20113.
>
> Indeed, the FRSA has "absolved railroads from any common law liability for failure to comply with the safety regulations." *Mehl*, 417 F.Supp.2d at 1120. This is the regulatory scheme which Congress has imposed. And when Congress has clearly spoken, any relief from its regime must come from Congress rather than the Courts. Private actions against railroads based on Federal regulations are preempted.

Lundeen, supra at 1016.

The amendment to Section 20106 made by section 1528 of the 9/11 Commission Act of 2007 did not change the text the Supreme Court has interpreted. Instead, Congress enacted a very precise cure for the problem presented by *Lundeen* and *Mehl* by amending Section 20106 to redesignate the then-existing language of the section as subsection (a), and adding new subsections (b) and (c). Subsection (a) provides that a State may adopt or continue in force a law, regulation or order related to railroad safety or security, until the Secretary of Transportation (with respect to safety) or the Secretary of Homeland Security (with respect to security) has acted to cover the subject matter. Once there are Federal requirements covering a particular subject, a State may adopt or continue only an additional or more stringent law, regulation, or order if it is necessary to eliminate or reduce an essentially local safety or security hazard, is not incompatible with Federal law, and does not unreasonably burden interstate commerce. New subsection (b) clarifies that causes of action under State tort law may be available to injured parties if they are based on the violation of the Federal standard of care created by a Federal regulation or order, or violation of a plan required to be created by Federal regulation or order. New subsection (c) provides that nothing in the section creates a Federal cause of action or Federal question jurisdiction, so that tort cases can be heard in State court.

New subsection (b) to Section 20106 makes clear that, as the Supreme Court held in *Easterwood*, regulations or orders issued by the Secretary of Transportation preempt the State standard of care, but not the underlying cause of action in tort, thereby preserving the ability of injured parties to seek redress in court.

Since FRA's Track Safety Standards were involved in both *Easterwood* and *Lundeen,* they are especially apt for illuminating FRA's interpretation of the amended statute. The Track Safety Standards substantially subsume the subject matters of standards for railroad track and train speeds over it and, therefore, preempt State standards, both statutory and common law, pertaining to those subjects. Nevertheless, under Section 20106(b)(1)(A), a private plaintiff may bring a tort action for damages alleging injury as a result of violation of the Track Safety Standards, such as for train speed exceeding the maximum speed permitted under 49 CFR 213.9 over the class of track being traversed. Similarly, under Section 20106(b)(1)(B), a private plaintiff may bring a tort action for damages alleging injury as a result of violation of a railroad's continuous welded rail (CWR) plan required by the Track Safety Standards (the key issue in *Lundeen*). Provisions of a railroad's CWR plan that exceed the requirements of part 213 are not included in the Federal standard of care. Under Section 20106(b)(1)(C), a private plaintiff may bring a tort action for damages alleging injury as a result of violation of a State law, regulation, or order that is not incompatible with subsection (a)(2), such as Ohio's regulation of minimum track clearances in rail yards found not to be preempted in *Tyrrell* v. *Norfolk Southern Ry. Co.,* 248 F.3d 517 (6th Cir. 2001).

It is a settled principle of statutory construction that, if the statute is clear and unambiguous, it must be applied according to its terms. *Carcieri* v. *Salazar,* 129 S.Ct. 1058 (U.S., 2009). Read by itself, Section 20106(a) preempts State standards of care, but does not expressly say whether anything replaces the preempted standards of care for purposes of tort suits. The focus of that provision is clearly on who regulates railroad safety: the Federal government or the States. It is about improving railroad safety, for which Congress deems nationally uniform standards to be necessary in the great majority of cases. That purpose has collateral consequences for tort law which new Section 20106, subsections (b) and (c) address. New subsection (b)(1) creates three exceptions to the possible consequences flowing from subsection (a). One of those exceptions ((b)(1)(B)) precisely addresses an issue presented in *Lundeen* that Congress wished to rectify: it allows plaintiffs to sue a railroad in tort for violation of its own plan, rule, or standard that it created pursuant to a regulation or order issued by either of the Secretaries. None of those exceptions covers a plan, rule, or standard that a regulated entity creates for itself in order to produce a higher level of safety than Federal law requires, and such plans, rules, or standards were not at issue in *Lundeen.* The key concept of Section 20106(b) is permitting actions under State law seeking damages for personal injury, death, or property damage to proceed using a Federal standard of care. A plan, rule, or standard that a regulated entity creates pursuant to a Federal regulation logically fits the paradigm of a Federal standard of care—Federal law requires it and determines its adequacy. A plan, rule, or standard, or portions of one, that a regulated entity creates on its own in order to exceed the requirements of Federal law does not fit the paradigm of a Federal standard of care—Federal law does not require it and, past the point at which the requirements of Federal law are satisfied, says nothing about its adequacy. That is why FRA believes that Section 20106(b)(1)(B) covers the former, but not the latter. The basic purpose of the statute—improving railroad safety—is best served by encouraging regulated entities to do more than the law requires and would be disserved by increasing potential tort liability of regulated entities that choose to exceed Federal standards, which would discourage them from ever exceeding Federal standards again.

In this manner, Congress adroitly preserved its policy of national uniformity of railroad safety regulation expressed in Section 20106(a)(1) and assured plaintiffs in tort cases involving railroads, such as *Lundeen,* of their ability to pursue their cases by clarifying that Federal railroad safety regulations preempt the standard of care, not the underlying causes of action in tort. Under this interpretation, all parts of the statute are given meanings that work together effectively and serve the safety purposes of the statute. Because the language of the statute is clear, there is no need to resort to the legislative history to properly interpret the statute. *See Ratzlaf* v. *United States,* 510 U.S. 135, 147–148 (1994) ("[W]e do not resort to legislative history to cloud a statutory text that is clear.").

3. Whether FRA's Views on Preemption Affect Safety

The BLET commented that FRA's views on preemption serve to immunize the railroad industry for its actions or inactions, contrary to FRA's duties as a safety regulator. The BLET stated that immunizing railroads from liability in all cases except where a Federal regulation or statute is violated will diminish safety and increase costs to the public in the long run, asserting that the public will bear the cost of damages caused by private railroads who have acted negligently but not in violation of a Federal law or regulation. The BLET believed that FRA's views on preemption will make FRA's minimum safety standards a ceiling above which no railroad will venture, to avoid voluntary exposure to liability flowing from a failure to adhere to its own higher standard. The BLET maintained that, thereafter, higher standards will not come about except through rulemaking, which it viewed as a time-consuming and somewhat imprecise process. In addition, the BLET commented that even if FRA's views protect publicly-funded transportation agencies, the decision to do so should be a State one.

FRA believes that the BLET's comments minimize the significance of FRA's safety regulations. FRA has issued detailed safety regulations covering a broad range of areas, and has both ongoing and planned safety rulemaking activities on a variety of topics. It is not a small matter for a railroad to maintain compliance with every applicable safety regulation issued by FRA, and that responsibility continues only to increase. In particular, this responsibility is growing as FRA implements the numerous safety rulemaking mandates in the RSIA of 2008. Moreover, the RSIA of 2008 itself added to the body of railroad safety statutory laws with which railroads must comply. These efforts are all directed toward promoting safety—the safety of railroad employees, passengers, and the public, overall—in a systematic and comprehensive way.

The BLET is clearly incorrect in arguing that FRA is immunizing railroads from tort liability except where they violate a Federal safety standard. State law, both statutory and common law, is preempted only where FRA's regulations substantially subsume the subject matter of the State law and FRA's regulations, while extensive, are not encyclopedic. The BLET's contention that a railroad that complies with the Federal standard of care set by Federal law should nevertheless be held to be negligent *for the very behavior required by Federal law* would make a nullity of Federal railroad safety laws. If the BLET's view were to be adopted, the effective railroad safety standard would be set by the most recent jury verdict in each State and national uniformity of safety regulation would no longer exist. That is clearly inconsistent with the statute and the case law.

Nor does FRA believe that our views on preemption will preclude railroads from exceeding Federal railroad safety standards. Railroads regularly exceed these standards now. A railroad that abides only by the minimum Federal safety standards would constantly run the risk of incurring civil penalty liability. For example, because wheels wear from use, no freight railroad would logically operate its fleet of rail equipment at the very minimum Federal safety standards for wheels; any usage of the equipment would potentially wear the wheels out of compliance, rendering them defective *per se* under 49 CFR part 215. Similarly, no railroad would logically maintain its track to the very minimum standards allowed by FRA's Track Safety Standards, as the railroad should know that any usage of the track could potentially bring it out of compliance by, for example, widening the gage. *See* 49 CFR 213.9. Further, as discussed above, FRA believes that Congress has encouraged railroads to exceed Federal safety standards and that Section 20106 does not increase the potential tort liability of railroads that choose to do so.

In addition, FRA disagrees that its duties as a safety regulator preclude it from providing its views on the preemptive effect of its regulations. A variety of considerations go into setting safety standards, including their relationship to other safety laws and standards. For example, as noted in the NPRM, FRA has directed extensive efforts to provide for the safety of Tier I passenger-occupied equipment operated as the leading units of passenger trains, such as by providing for increased collision post strength for the forward ends of cab cars and MU locomotives in the 1999 final rule. Had FRA intended to impose restrictions in the 1999 final rule on operating this equipment in the lead, FRA may have acted differently in imposing the crashworthiness requirements that it did on this equipment. This very final rule FRA is issuing today will enhance crashworthiness requirements for cab cars and MU locomotives, specifically recognizing that this equipment is operated as the leading units of passenger trains.

Finally, FRA believes that the comments raised essentially disregard the possibility that FRA requirements may in fact be more restrictive than State law would be. In the original Passenger Equipment Safety Standards rulemaking, for example, FRA addressed a number of comments from State departments of transportation that applying the static end strength (or "buff" strength) requirements, § 238.203, to existing passenger equipment was too restrictive. *See* 64 FR 25544–25545. FRA also addressed similar comments on other provisions of the rule, such as from the Washington State Department of Transportation, which believed FRA had not justified the requirements for side structure, § 238.217. *See* 64 FR 25608–25609. Potentially, these States may have deemed less restrictive requirements appropriate.

4. Whether FRA's Views on Preemption Affect Recovery for Victims of Railroad Accidents

The AAJ asserted that Federal preemption would prevent victims of the 2005 Glendale, CA, Metrolink derailment from seeking justice, that common carriers like Metrolink owe the highest degree of care to their passengers, and that if a court affords deference to FRA's preamble, the NPRM would effectively render that obligation meaningless. Similar to other comments that have been raised, the AAJ commented that State common law should govern railroad safety issues in that they are unique to each community and therefore more effectively addressed under State law. The AAJ believed that Federal regulations cannot effectively ensure that the public is protected from hazards caused by a railroad's inability to follow operating rules. The AAJ maintained that Federal regulations are minimum standards and are not intended to provide maximum protection, asserting that the justice system offers a deterrent against railroad companies' violations of Federal, State, and local regulations. The AAJ stated that the public needs a mechanism to compensate individuals for losses suffered at the hands of negligent railroad operators or otherwise these injured individuals could become a burden to the public.

FRA notes that it has already addressed, above, comments that State common law should govern railroad safety issues. The 9/11 Commission Act of 2007 expressly clarified the criteria providing for State law causes of action but left untouched the provisions in Section 20106 governing national uniformity of regulation. Once the Secretary of Transportation has covered a subject matter through a regulation or order, and thus established a Federal standard of care, Section 20106 preempts State standards of care regarding this subject matter. Nonetheless, FRA believes it important to address specifically the AAJ's claim that FRA's views would prevent the victims of the Glendale incident from seeking justice.

The Glendale derailment was the result of a deliberate, criminal act. The perpetrator was found guilty of 11 counts of murder. Surely, nothing FRA has said about Federal preemption should be construed in any way to mean that victims of the Glendale derailment may not seek redress against the criminal perpetrator.

Nor should anything FRA has said about Federal preemption be construed to mean that these victims may not pursue negligence claims against Metrolink. As discussed elsewhere in this preamble, FRA agrees that railroads owe their passengers and employees a high degree of care and that victims of railroad accidents may hold railroads accountable in tort for their actions. Surely nothing FRA has said should be interpreted to preclude a claim for negligence based on a railroad's failure to comply with a Federal law, standard, or order or, where none of those apply, State law. In this regard, FRA believes that the AAJ's comments significantly minimize the degree to which railroads are in fact responsible for complying with a broad range of safety laws, regulations (such as this final rule), and orders, with a host of new requirements arising from the RSIA of 2008, as noted above. To a considerable degree, this reflects a difference of view over whether safety standards are better set by twelve jurors good and true, most of whom probably do not know anything about railroad safety, or by experts in railroad safety to whom Congress has assigned the task. Of course, those jurors can do a fine job of finding the facts and applying the legal standard to them. In a recent case involving Federal preemption under a U.S. Food and Drug Administration (FDA) regulation, the

Supreme Court eloquently explained why Congress's decision to preempt State common law makes sense:

> [I]n the context of this legislation excluding common-law duties from the scope of pre-emption would make little sense. State tort law that requires a manufacturer's catheters to be safer, but hence less effective, than the model the FDA has approved disrupts the federal scheme no less than state regulatory law to the same effect. Indeed, one would think that tort law, applied by juries under a negligence or strict-liability standard, is less deserving of preservation. A state statute, or a regulation adopted by a state agency, could at least be expected to apply cost-benefit analysis similar to that applied by the experts at the FDA: How many more lives will be saved by a device which, along with its greater effectiveness, brings a greater risk of harm? A jury, on the other hand, sees only the cost of a more dangerous design, and is not concerned with its benefits; the patients who reaped those benefits are not represented in court. As Justice BREYER explained in *Lohr,* it is implausible that the MDA [Medical Device Amendments] was meant to "grant greater power (to set state standards 'different from, or in addition to' federal standards) to a single state jury than to state officials acting through state administrative or legislative lawmaking processes." 518 U.S., at 504, 116 S.Ct. 2240. That perverse distinction is not required or even suggested by the broad language Congress chose in the MDA,[FN4] and we will not turn somersaults to create it.

Riegel v. *Medtronic, Inc.* 128 S.Ct. 999, 1008 (U.S., 2008). (Footnote omitted.)

The Supreme Court's logic is equally applicable to regulations under the Federal railroad safety laws, including this one.

5. How a State May Act as the Owner and Not the Regulator of a Railroad

FRA received comment from the CPUC indicating that there was confusion as to what FRA intended to convey by explaining the difference between a State acting as an "owner" of a railroad—in distinction to a regulator of a railroad—in directing a railroad's operations. The CPUC commented that it understood that FRA interprets Section 20106 so that States that own or control a passenger railroad may impose more stringent standards on their railroad(s) than those prescribed in the NPRM, as long as the more stringent State standards are not in conflict with the Federal standards and are wholly distinct and not derived from the statutory provision—*i.e.,* not a part of the State's regulatory authority over passenger railroads but resulting from its status as an owner of a passenger railroad. The CPUC then concluded that since FRA has "approved" of cab car-forward operations of Tier I passenger trains, States may not prohibit these operations on passenger railroads they own since such a restriction would conflict with the NPRM. Yet, the CPUC then understood that if the State wishes to increase the load-bearing capability of collision posts, corner posts and other structural elements, it may where it is the owner of the passenger railroad. The CPUC asserted that FRA was in effect establishing a Federal public safety policy that permits States to raise safety requirements above minimum Federal standards on railroads they own but limits States to the minimum standards on private railroads. The CPUC believed that this policy would severely limit State police powers even when State regulation neither conflicts with Federal law or regulation nor unreasonably burdens interstate commerce.

FRA appreciates the CPUC's comments for purposes of clarifying FRA's discussion in the NPRM concerning the application of preemption to the actions of a State or local entity in the role of "owner" of a railroad versus those of a State or local entity in the role of regulator of a railroad. FRA has pointed out that commuter rail service is typically provided by public benefit corporations chartered by State or local governments. This legal arrangement essentially places the State or local entity in the role of "owner" of the railroad, and FRA sought to make clear that when a State or local governmental entity acts in this capacity to direct that the railroad exceed FRA's standards, it is not acting as a regulator of railroad operations. Instead, it is effectively acting in a private capacity concerning the operation of its own railroad. The fact that it is a public entity does not somehow convert its action into a law, regulation, or order related to railroad safety that invokes the statutory provisions governing the preemptive effect of FRA's regulation of this area.

Specifically, FRA intended to make clear that when a State acts in this private capacity to direct its own railroad to exceed FRA's requirements or prohibit its own railroad from doing something FRA's requirements permit, it need not be concerned with satisfying Section 20106(a)'s three-part, "essentially local safety or security hazard" exception for State regulation, as the State's action is wholly distinct, and does not derive, from the exception provided in the statute. This latter point may not have been conveyed clearly enough in the NPRM; FRA is restating it here for clarity. Further, FRA makes clear that even though States and local entities may act in a private capacity concerning their own railroads, this fact does not alter in any way FRA's views as to the preemptive effect of FRA's comprehensive regulation of passenger equipment safety, and the safe operation of cab cars and MU locomotives in particular, when the State or local governmental entity is acting in a regulatory capacity. Nor does FRA mean in any way to suggest that because States and local entities may act in a private capacity concerning their own railroad, a State or local court or jury has the ability to decide how the railroad should have acted. FRA makes clear that its views on a State or local entity's ability to run its own railroad do not extend to a State or local court or jury's ability to apply a standard of care that deviates from the Federal standard of care established by an FRA regulation or order.

Additionally, FRA sought to make clear in the NPRM that even when the State or local governmental entity acts in this private capacity and directs that its passenger railroad operate in a manner more stringent than FRA's requirements, it may not direct that its railroad operate in a manner inconsistent with FRA's requirements. The CPUC's comments indicate that there may have been some confusion on this point, however. The CPUC believed that FRA has "approved" of cab car-forward operations of Tier I passenger trains, and that, as a result, States may not prohibit these operations on passenger railroads they own since such a restriction would conflict with the NPRM. FRA did not intend such conclusions to be drawn. First, FRA makes clear that our regulations permit but do not require cab car-forward operations of Tier I-compliant passenger trains; there is no FRA approval process. Moreover, the fact that FRA's regulations permit cab car-forward operations does not prohibit a State, acting in a private capacity as the owner of its own railroad, from deciding not to use cab car-forward operations. For example, in no way would a State's decision directing its own railroad to operate each of its trains with a conventional locomotive in the lead conflict with any regulatory decision FRA has made. Both methods of operation are permitted under FRA's regulations and operators are free to choose among permitted methods of operation. (*See* the separate discussion on push-pull train operations, below.) The CPUC's comments indicate that it understood the overall issue when it noted that if the State wishes to increase the load-bearing capability of collision posts, corner posts and other structural elements of its equipment, it may if it is the owner of the passenger railroad.

Indeed, that analysis applies in the same way to cab car-forward operations of Tier I passenger trains.

FRA also wishes to make clear that in no way did FRA intend to convey that freight railroads operate under less stringent safety standards—including those voluntarily imposed—because the railroads are typically owned by non-governmental entities. The CPUC additionally commented that the balance determined by FRA in weighing freight railroad safety with the business of freight railroading is heavily slanted towards the railroad industry at the expense of public safety since the public is subjected to "minimum" railroad safety regulations and the States are prohibited from requiring more stringent regulation. In the NPRM, FRA compared a State or local governmental entity's ability to act in a private capacity concerning the operation of its own railroad to that of a non-governmental entity that owns a freight railroad, for purposes of illustrating how the public entity is permitted to act in a private capacity to direct that its passenger railroad operate in a manner more stringent than FRA's requirements and not implicate preemption concerns. FRA believed this comparison particularly appropriate because freight railroads—like passenger railroads—regularly exceed FRA's safety standards as a matter of course, and they are encouraged to do so. Surely, a governmental entity that owns a freight railroad may choose to exceed FRA's requirements without concern for implicating the statutory provision governing preemption. While the CPUC's comment may not have been directed to this discussion in the NPRM, FRA believes that this clarification is helpful to place the discussion in a fuller context.

6. How State Regulation of Push-Pull Operations Is Preempted

Congressman Adam Schiff commented that FRA's views in the NPRM may have the effect of preempting State laws on pushing trains with cab cars in the lead. He stated that in response to the January 2005 Metrolink derailment in Glendale, CA, he had placed in the FY2006 transportation appropriations bill a measure that led FRA to conduct a historical study of push-pull passenger rail operations that found that derailments and general fatalities were somewhat higher when push-pull trains were operated in the push mode. He believed that FRA's views could threaten the authority of States to require a higher level of passenger train safety or to seek redress for a wide variety of unsafe railroad practices, stating that the role of FRA is to adopt regulations to protect the traveling public from injury and death because of unsafe railroad operations and that State and local regulators must be allowed to take further steps to ensure that public transportation is as safe as possible. He additionally commented that any regulatory action should be avoided that may preempt States and localities from regulating railroad safety in ways that do not affect interstate commerce but do improve passenger safety, and believed that preemption should seldom be employed but on those rare occasions when it is required and that it should be used to set a floor and never a ceiling on the public's safety and well-being. As a result, he requested that FRA clarify that Federal preemption will not affect local and State limitations on the use of cab cars as the leading units of passenger trains, asserting that such regulations are designed to increase public safety and will not affect the national operations of rail service providers or rail car manufacturers.

FRA notes first that the nature of Federal preemption under Section 20106, even as amended, is that States and localities are restricted from acting as regulators concerning the operation of trains with cab cars in the lead, given Federal regulation of the matter. Nonetheless, as discussed earlier, FRA believes that in fact States and localities have the capability to act in a non-regulatory way either as owners or funders of commuter rail systems to restrict the operation of trains with cab cars in the lead, and, preemption concerns aside, could seemingly do so more directly. FRA will use the example of Metrolink, which operates wholly within the State of California and is a joint powers authority comprised of five county transportation planning agencies: The Los Angeles County Metropolitan Transportation Authority, the Orange County Transportation Authority, the Riverside County Transportation Commission, San Bernardino Associated Governments, and the Ventura County Transportation Commission. FRA makes clear that the representatives of those California counties who are designated as members of Metrolink's board of directors are not preempted from directing that Metrolink not run trains with cab cars as the leading units. Nor would the State of California be preempted from conditioning any grant of State funds to Metrolink on its not running trains with cab cars as the leading units. Preemption does not apply in either situation.

While the authority does not apply in this situation, Congress has addressed Congressman Schiff's concerns in another way to some extent. The statute provides that States may regulate until the Secretary of Transportation prescribes a regulation or issues an order covering the subject matter of the State regulation. The statute also provides that a State may adopt or continue in force an additional or more stringent law, regulation, or order related to railroad safety or security when the law, regulation, or order is necessary to eliminate or reduce an essentially local safety hazard, is not incompatible with a law, regulation, or order of the United States Government, and does not unreasonably burden interstate commerce. Thus, while Congress prescribed national uniformity of railroad safety regulation, it also provided exceptions through which States can address matters Congress or FRA has not. Where FRA does regulate, the clear expectation is that the States will participate in the rulemaking process. If a State has a better idea or perceives a risk others have not seen, that State has several avenues through which it can get its concerns addressed. The State can petition FRA for rulemaking. The State can participate in RSAC and help formulate recommendations to the Administrator of FRA for regulatory action. The State can comment on notices of proposed rulemaking FRA issues. In these ways, State ideas and concerns can be embodied in uniform national regulations in keeping with the policy Congress established in the statute. The overwhelming majority of railroad safety issues are capable of being handled in uniform national regulations, and should be.

FRA also notes that although the study cited by Congressman Schiff tended to favor conventional locomotive-led train service over cab car- and MU locomotive-led train service for resistance to derailment in highway-rail grade-crossing collisions on the raw data, no statistically significant difference was found between the modes of operation. *See* "Report to the House and Senate Appropriations Committees: The Safety of Push-Pull and Multiple-Unit Locomotive Passenger Rail Operations," June 2006, available on FRA's Web site at: *http://www.fra.dot.gov/downloads/safety/062606FRAPushPullLetterandReport.pdf*. The accident record did show a higher fatality rate for occupants of cab car-led trains than occupants of conventional locomotive-led trains in commuter service, yet (passenger occupied) MU locomotive-led trains compiled a superior safety record and experienced fatality rates less than conventional locomotive-led trains or any competing mode of transportation. The report explained that FRA's broad approach to safety is to focus on areas of the highest risk and thus the greatest potential for safety gains and that, by contrast, a narrower focus on one aspect of the safety issues (cab car- or MU locomotive-led operations versus conventional locomotive-led operations) could result in simply shifting risk from one place to another. FRA noted that compared to cab car- or MU locomotive-led trains, conventional locomotive led-trains may reduce the number of fatalities due to loss of occupant volume at the colliding interface, but in more serious events the structural crush is passed back to other areas of the train, potentially increasing the risk to other train occupants. The September 12, 2008 head-on train collision in Chatsworth, CA, which resulted in the deaths of 25 people and the injury of numerous others, involved a conventional locomotive-led Metrolink train. The NTSB and FRA are currently investigating the collision and the NTSB has not yet determined the probable cause of the accident. Nevertheless, preliminary information indicates that most, if not all, of the passenger fatalities resulted from structural crush caused by collision energy passed through the locomotive. FRA has not evaluated the Chatsworth accident to determine whether the outcome would have been different had the cab car at the rear of the train been the leading unit. However, the Chatsworth accident tragically exemplifies that risks are inherent in any mode of passenger train operation and that the safety focus must necessarily be broader than just restricting cab cars from operating as the leading units of passenger trains.

7. Whether It Was Necessary To Discuss Preemption in the NPRM

The AAJ commented that inclusion of "overbroad" preemption analysis in the NPRM was unnecessary because it has no substantive effect on the regulation and is not binding on courts. Moreover, the AAJ claimed that FRA provided no reasoned explanation for what it believed was an unauthorized attempt to expand the reach of FRSA preemption. The AAJ also stated that FRA buried the preemption discussion within the text of the preamble without any mention of it in the summary of the NPRM, and believed that the title and summary of the NPRM hid the fact that FRA appeared to circumvent Congress and declare retroactive and future application of Federal preemption to the issue of pushing passenger trains with cab cars in the lead.

In response to these comments, which are also addressed in part below, FRA notes that it did explain why it was discussing preemption in the NPRM, stating that "since issues have arisen regarding the preemptive effect of this part on the safety of operating a cab car as the leading unit of a passenger train, FRA believes that clarification of its views on the matter is needed to address any misunderstanding." 72 FR 42028. In particular, in discussing the preemptive effect of part 238, FRA sought to distinguish preemption of State regulation from a State's ability to act in a private capacity to restrict cab cars from operating as the leading units of passenger trains, as discussed above, thereby effectively achieving the same result. In fact, despite FRA's efforts to clarify its views, comments on the NPRM demonstrate that there still is confusion as to FRA's views. By the statements in the preamble of this final rule, FRA hopes to definitively clear up this confusion so that FRA's views are understood as FRA intends that they be.

Moreover, FRA believes that a reading of the NPRM shows anything but an intent to hide its views on preemption concerning the operation of a cab car as the leading unit of a passenger train. The NPRM concerned the crashworthiness of cab cars and MU locomotives and was not that large a rulemaking document. The NPRM itself contained a table of contents, which identified where "Federalism Implications" were discussed in the preamble. *See* 72 FR 42017. The section on "Federalism Implications" in turn pointed the reader further to the discussion of § 238.13 (Preemptive effect) in the section-by-section analysis. Nonetheless, to the extent that a member of the public interested in the safety of cab cars and MU locomotives may not read beyond the Summary section of this final rule, FRA is stating in the Summary that this final rule clarifies FRA's views on the preemptive effect of this part.

8. Whether FRA Has Authority To Express Its Views on Preemption

The BLET stated that FRA's comments on preemption improperly address matters reserved for the Legislative and Judicial Branches and raise serious separation-of-powers questions. The BLET termed "troubling" that FRA's views were the latest in a series of similar actions by Executive Branch agencies. The BLET stated that Congress expresses its intent and that courts address questions about the intent, and that Congress can step in and overrule the judiciary as was done with passage of the 9/11 Commission Act of 2007.

Similarly, the AAJ commented that FRA does not have authority to regulate with force of law, absent a clear and express delegation of that authority from Congress. The AAJ stated that FRA may exercise preemptive authority if Congress has explicitly delegated the authority and does so in a way that is consistent with Congressional intent. The AAJ claimed that Congress has never delegated preemptive authority to FRA and has provided instead a very limited scope of preemption under FRSA, asserting that FRA is not permitted to adopt regulations which preempt an individual's common law tort remedies. The AAJ further commented that Congress has not shown any intent to preempt State tort law actions or to prevent causes of action based on Federal law and regulations, citing case law. The AAJ cited in particular to *Sprietsma* v. *Mercury Marine*, 537 U.S. 51 (2002), to support its assertion that any Congressional desire to achieve uniformity in transportation safety regulation does not justify preemption of common law claims.

FRA notes that some of these comments overlap with other comments that FRA has addressed. As to comments questioning FRA's authority to express its views on preemption, FRA believes its authority to do so arises out of its very authority to preempt State and local laws. There is no question that the Supremacy Clause of Article VI of the U.S. Constitution provides Congress with the power to preempt State law. "Preemption may result not only from action taken by Congress itself: A Federal agency acting within the scope of its congressionally delegated authority may preempt state regulation." *Louisiana Public Service Commission* v. *FCC*, 476 U.S. 355, 369 (1986). Since Congress provided that delegation very forthrightly in Section 20106 and the Supreme Court has interpreted the statute to provide for preemption of State law by FRA regulations, there can be no real question that FRA has authority to preempt State regulation. *See* the discussion elsewhere in this preamble of the *Easterwood* and *Shanklin* cases.

By virtue of FRA's authority to preempt State law and the President's direction in Executive Order 13132 that agencies discuss the preemptive effect of their rules in the preambles to those rules, FRA may express its views as to the preemptive effect of its regulations.

The BLET surely would expect FRA to do so if a State or locality were to pass a law, or a State or local court were to issue an order, that potentially endangered the safety of the BLET's members and which FRA believed was preempted by Federal law. In this regard, in providing for national uniformity of regulation, Section 20106 protects against the potential for ever-changing and conflicting State and local standards adopted by individual juries, which could compromise railroad safety. Moreover, it would be irrational to forbid FRA from expressing its views as to the preemptive effect of its regulations when such FRA views have in fact been found to merit deference. *See Union Pacific RR* v. *California Public Utilities Comm'n*, 346 F.3d 851, 867 (9th Cir. 2003). That case, in which FRA argued that some of its regulations are preemptive and some are not, also well illustrates the benefits for the courts of FRA clearly discussing what FRA intends to preempt and what it does not. The Supreme Court has made clear that it expects such agency discussions of preemption.

As we explained in *Hillsborough County* v. *Automated Medical Laboratories, Inc.*, 471 U.S. 707, 718, 105 S.Ct. 2371, 2377, 85 L.Ed.2d 714 (1985), it is appropriate to expect an administrative regulation to declare any intention to pre-empt state law with some specificity:

> "[B]ecause agencies normally address problems in a detailed manner and can speak through a variety of means, * * * we can expect that they will make their intentions clear if they intend for their regulations to be exclusive.

California Coastal Com'n v. *Granite Rock Co.* 480 U.S. 572, 583 (1987).

FRA notes in particular that the case cited by the AAJ, *Sprietsma* v. *Mercury Marine*, does not apply to national uniformity of railroad safety regulation or the preemption of State common law by such regulations. *Sprietsma* involved a different statute, the Federal Boat Safety Act, which contains an express savings clause stating that "[c]ompliance with this chapter [46 U.S.C. chapter 43] or standards, regulations, or orders prescribed under this chapter does not relieve a person from liability at common law or under State law." 46 U.S.C. 4311(g). Common law standards of care are not preempted under the Federal Boat Safety Act, because Congress expressly said otherwise. (The United States itself argued as *amicus curiae* in support of the Supreme Court's holding.) Congress has, however, expressly provided for Federal preemption in the railroad safety area when the Secretary of Transportation has issued a regulation or order covering a particular subject matter. *See* prior discussion of Section 20106.

9. What Impelled FRA's Views on Preemption

The BLET asserted that FRA's discussion of preemption in the NPRM was a "naked attempt" to influence the outcome of a judicial appeal in which a railroad appellant was the defendant. The BLET stated that FRA made the outstanding claim that the possibility that the 1999 final rule would be amended at some unspecified later date preempts all State law by the complete absence of a standard, which preemption FRA then activated retroactively by publishing the NPRM. In this regard, the BLET cited the following passage from the NPRM:

> FRA specifically stated in the final rule that additional effort needed to be made to enhance corner post safety standards for cab cars and MU locomotives—leading to the NPRM that FRA is issuing today. 64 FR at 25607. However, FRA made clear that the very fact that it identified the possibility of specifying additional regulations did not nullify the preemptive effect of the final rule, both in terms of the issues addressed by the specific requirements imposed, and those as to which FRA considered specific requirements but ultimately chose to allow a more flexible approach.

72 FR 42030. The BLET asserted its belief that FRA transformed the addition of security language to the rail safety preemption statute in 2002 into preemption of State common law pertaining to standards that were not imposed in 1999. The BLET commented that the 2002 amendment to then-existing Section 20106 did nothing more than extend current safety preemption to matters of rail security and, given that the NPRM is a proposed safety rule, the BLET contended that the mere fact that Congress extended preemption from safety to security matters provided no basis whatsoever for FRA to address the subject. Further, the BLET alleged that FRA "put its thumbs on the scale of justice" in stating that FRA had prohibited cab car-forward operations for Tier II but not for Tier I equipment and that FRA's choice was intended to be preemptive of State standards. The BLET maintained that there is substantial evidence that FRA published its preamble discussion to assist Metrolink in its appeal of a California court decision in which preemption relating to cab car-forward operations was an issue. The BLET stated that when the 1999 final rule was published, FRA never even suggested that the prohibition pertaining to cab car-forward operation of Tier II passenger equipment preempted all State and local law concerning the subject of cab car-forward operation of Tier I equipment, including common law.

FRA notes that the BLET's comments highlight an inadvertent error in the NPRM in which the verb "to make" was stated in the past tense rather than the present tense. In the passage set out above, FRA had intended to state the following:

> However, FRA makes clear that the very fact that it identified the possibility of specifying additional regulations did not nullify the preemptive effect of the final rule, both in terms of the issues addressed by the specific requirements imposed, and those as to which FRA considered specific requirements but ultimately chose to allow a more flexible approach.

Emphasis added. FRA does recognize that in stating "to make" in the past tense, the passage erroneously conveys that FRA made that explicit statement in the 1999 final rule. FRA did not make that statement in the 1999 final rule. Nonetheless, in a similarly-worded passage on the next page of the NPRM, the NPRM correctly stated the following:

> FRA's decision to revisit in this NPRM subjects addressed in the 1999 final rule does not change the preemptive effect of the comprehensive requirements imposed in that rule. As noted earlier, FRA's recognition in the 1999 final rule that additional work needed to be completed to enhance the crashworthiness of cab cars and MU locomotives does not nullify the preemptive effect of the standards then imposed for this equipment.

72 FR 42031. As this passage helps makes clear, FRA's point in citing the 1999 final rule was surely not to change what was stated in that final rule. FRA's point was to note that in promulgating the 1999 final rule FRA identified the possibility of specifying additional regulations to enhance safety after the completion of additional research efforts, but that identifying that possibility did not nullify the preemptive effect of that final rule on State or local standards. In the same way, FRA's recognition in this final rule that fuller application of CEM technologies to cab cars and MU locomotives could enhance their safety is not intended to nullify the preemptive effect of the standards arising from the rulemaking. FRA reiterates that it continually strives to enhance railroad safety, has an active research program focused on doing so, and sets safety standards that it believes are necessary and appropriate for the time that they are issued with a view to amending those standards as

circumstances change. If FRA's regulations were not accorded preemptive effect merely because FRA may amend its regulations at some point in the future, preemption would never apply, nor, it seems, would preemptive effect seemingly be accorded to any DOT regulation because DOT may amend any of its regulations in the future.

In addition, FRA believes that the BLET's comments make too much out of FRA's mention of the Homeland Security Act of 2002's amendment to 49 U.S.C. 20106 that added language concerning the preemptive effect of rail security regulations and orders. *See* 72 FR 42028. FRA noted that Section 20106 had been amended and FRA stated that it was proposing to amend § 238.13 (Preemptive effect) so that the regulatory section was more consistent with the revised statutory language addressing railroad security. *Id.* After doing so, FRA then explained as follows:

> In addition, since issues have arisen regarding the preemptive effect of this part on the safety of operating a cab car as the leading unit of a passenger train, FRA believes that clarification of its views on the matter is needed to address any misunderstanding. As described below, through a variety of initiatives spanning more than a decade, FRA has comprehensively and intentionally covered the subject matter of the requirements for passenger equipment, planning for the safe use of passenger equipment, and the manner in which passenger equipment is used.

Id. It is the discussion "described below" that resulted in virtually every comment made by the BLET on FRA's preemption views. FRA reiterates those views except as they are expressly changed in this final rule. FRA clearly separated mention of the 2002 statutory amendment from the rest of the discussion. FRA notes that it proposed amending § 238.13 in part to reflect expressly that FRA's Passenger Equipment Safety Standards have a role in rail security. For example, if a passenger train collision were caused by intentional terrorist act, FRA's crashworthiness requirements would help to protect survivable space for the train occupants, FRA's fire safety standards would help lessen the likelihood that a fire would result, FRA's passenger train emergency system requirements would help facilitate both passenger escape and rescue, and other FRA standards would likely help mitigate the consequences of the act.

While FRA has addressed the BLET comment as to what was said in the 1999 final rule, FRA again emphasizes that FRA is not only authorized to express its views as to the preemptive effect of its regulations and orders but has an obligation to do so when issues arise as to their preemptive effect. The NPRM was not the first occasion for FRA to express its views on the preemptive effect of this part on the safety of operating a cab car as the leading unit of a passenger train, and FRA clarified its views in light of misunderstandings that had arisen. That some confusion appears to have remained even after FRA did so in the NPRM is reason for FRA to believe that it may not have been clear enough, which has led FRA to be detailed in its responses to all of the preemption comments on the NPRM. Preemption is both complex and important; it merits extensive discussion when that is necessary to convey a complete understanding of the issues. It was necessary in this NPRM because the preemptive effect of FRA's actions had widely been misunderstood. FRA recognizes that the NPRM was published during ongoing litigation concerning the operation of a train with a cab car as the leading unit, but the underlying incident, other incidents, and concerns as to enhancing the end structure of cab cars and MU locomotives were the impetus for issuing the NPRM and for its timing. FRA cannot stand silent about the meaning and effect of its rules because litigation is underway. Litigation is often underway or imminent somewhere. If litigation were a bar to rulemaking or to full explanations of rules FRA issues, very little rulemaking would get done. FRA tries to explain its regulatory actions fully and clearly trusting that those explanations will assist the regulated community and the courts alike and believing that it is our job to do so. FRA does that to advance railroad safety. FRA is consistently an advocate for railroad safety, and its rules and interpretations of those rules are intended to protect and enhance the safety of railroad employees and passengers, and citizens in the vicinity of railroads, and the property of everyone within range. Of course, expressions of the agency's views are likely to help or hurt the case of some particular litigant, but that is not FRA's concern. As recited above, *Union Pacific RR* v. *California Public Utilities Comm'n*, 346 F.3d 851, 867 (9th Cir. 2003), well illustrates that FRA's forthright and clear expression of its views may help one litigant on some claims and the other side on other claims in the same case. FRA does not take or alter its positions based on who the litigants are.

When, however, it appears that a court or courts have misconstrued FRA's regulations, the agency has an obligation in the interest of safety to correct the record. After all, FRA issued the regulation or interpretation as it did because that represented FRA's best expert judgment concerning how to advance railroad safety. Necessarily, in the agency's view, a misconstruction of its regulations is likely to impair railroad safety and permitting that impairment to continue is unacceptable.

Both the technical aspects of railroad safety and preemption under 49 U.S.C. 20106 are arcane and difficult subjects on which the regulated community and courts, alike, are entitled to the best explanations the technical experts at FRA can provide. In the case that appears to concern the BLET, it seems that the discussion of preemption in the NPRM did assist a California appellate court, and that is entirely appropriate.

10. Whether FRA's Views on Preemption Affect FELA

The BLET asserted that FRA's views on preemption conflict with legislatively promulgated and judicially recognized rights under the Federal Employers' Liability Act (FELA), 45 U.S.C. 51 *et seq.* (FELA provides that employees of common carriers by railroad engaged in interstate or foreign commerce may recover for work-related injuries caused in whole or in part by their employer's negligence.) The BLET stated that FELA has been liberally construed and that juries are given great leeway to determine whether there has been negligence or not. The BLET noted that FRA did not mention whether its views on preemption extended to FELA, but the BLET believed that FRA has created unnecessary tension with FELA by limiting theories of liability to violations of positive regulation—and excluding from liability that which has not been regulated. The BLET recommended that FRA avoid creating any such conflict by essentially limiting FRA's statements on preemption to what the statute expressly states and referencing the statute.

As the BLET points out, FRA made no reference to FELA in FRA's discussion of preemption in the NPRM. FRA does not understand the basis for the BLET's concern that FRA is somehow "limiting theories of liability to violations of positive regulation—and excluding from liability that which has not been regulated." Neither the NPRM nor this final rule does that. The statute and the regulation plainly state that a Federal standard of care created by regulation displaces State standards of care covering the same subject matter. State standards of care covering other subject matter are not preempted. FRA's discussion was limited to Federal railroad safety laws, regulations, and orders for which FRA has responsibility to administer or enforce. FELA is a railroad labor law, which FRA neither administers nor enforces. FELA is also a Federal law and, therefore, not expressly a subject of preemption under 49 U.S.C. 20106. Occasionally, however, conflicts arise between Federal statutes and courts must resolve them. Courts have concluded that, in certain circumstances, Federal railroad safety laws may preclude some FELA claims.

Several courts have decided, for example, that the FRSA precludes an action under FELA where a railroad employee claims that he or she was injured because of a negligently excessive train speed, and where the train was not exceeding the speed limit set by FRSA regulations. These courts have reasoned that permitting such FELA claims would be contrary to "Congress' intent [in passing the FRSA] that railroad safety regulations be nationally uniform to the extent practicable." *Lane* v. *R.A. Sims, Jr., Inc.*, 241 F.3d 439, 443 (5th Cir. 2001); *see also Waymire* v. *Norfolk & W. Ry. Co.*, 218 F.3d 773, 776 (7th Cir. 2000); *Rice* v. *Cincinnati, New Orleans & Pac. Ry. Co.*, 955 F.Supp. 739, 740–41 (E.D.Ky. 1997); *Thirkill* v. *J.B. Hunt Transp., Inc.*, 950 F.Supp. 1105, 1107 (N.D.Ala. 1996). But *see Earwood* v. *Norfolk S. Ry. Co.*, 845 F.Supp. 880, 891 (N.D.Ga. 1993) (concluding that a FELA action based on excessive speed was not precluded by the FRSA).

Tufariello v. *Long Island R. Co.*, 458 F.3d 80, 86 (C.A.2 (N.Y.), 2006). Nothing in this final rule changes how courts resolve perceived conflicts between Federal railroad safety laws and FELA claims. As the examples cited above show, Federal courts were already applying preclusion analyses based on Section 20106 to reconcile Federal railroad safety laws, where they apply, and FELA. Courts regularly interpret Federal statutes that present potential conflicts, and FRA anticipates that courts hearing FELA cases will have little difficulty reconciling FELA and the current text of Section 20106.

11. Whether Preemption Applies Under the Locomotive (Boiler) Inspection Act

The AAR commented that FRA gave incomplete guidance on preemption by referring only to Section 20106 in the NPRM. While the AAR took no issue with what FRA stated regarding Section 20106, the AAR pointed out that preemption also applies under the Locomotive (Boiler) Inspection Act (LBIA) to requirements affecting locomotives and the NPRM would affect locomotive requirements. (The LBIA was repealed and reenacted as positive law in 49 U.S.C. ch. 207 (sections 20701–20703), "Locomotives," by Public Law 103–272 (July 5, 1994); FRA is nonetheless referring to these provisions by their former name as they are commonly known.) The AAR stated that the LBIA preempts all requirements pertaining to locomotives, regardless of whether there is a Federal requirement addressing the subject matter of a State requirement. According to the AAR, a requirement could be preempted by the LBIA even if it is not preempted under Section 20106. The AAR noted that FRA recognizes preemption under the LBIA, citing 49 CFR 230.5, the preemption provision for FRA's Steam Locomotive Inspection and Maintenance Standards, which states in part: "The Locomotive Boiler Inspection Act (49 U.S.C. 20701–20703) preempts all State laws or regulations concerning locomotive safety. *Napier* v. *Atlantic Coast Line R.R.*, 272 U.S. 605 (1926)."

The AAR added that in issuing this standard, FRA explained that while Section 20106 "would ordinarily set the standard for preemption of a rule issued under [49 U.S.C.] 20701, the broader field preemption provided by the LBIA (as interpreted by the courts) seems the more appropriate standard to apply in light of this rule's subject matter." 64 FR 62828, 62836 (Nov. 17, 1999). The AAR believed the same is true here and that to portray the scope of Federal preemption accurately, § 238.13 needs to refer to both Section 20106 and the LBIA. The AAR suggested amending § 238.13 by adding the above-referenced statement from § 230.5.

FRA believes that the AAR is correct and that preemption under the LBIA also applies to locomotives covered by part 238. FRA recognizes that the LBIA has been consistently interpreted as totally preempting the field of locomotive safety, extending to the design, the construction, and the material of every part of the locomotive and tender and all appurtenances thereof. Although the LBIA has no preemption provision, it has been held to preempt the entire field of locomotive safety. *See Napier* v. *Atlantic Coast R.R.*, 272 U.S. 605 (1926). The 1999 Passenger Equipment Safety Standards final rule was issued in part under the authority of the LBIA, sections 20701–20702, as was the NPRM in this rulemaking.

This rulemaking directly imposes requirements on locomotives, as both cab cars and MU locomotives are locomotives. They are also considered passenger cars under part 238. The subject matter of part 238 is broader than just locomotives and passenger cars, covering all passenger equipment, which includes baggage, private, and other cars. Because of the broad subject matter of part 238 and the fact that the (former) FRSA rulemaking authority now codified in 49 U.S.C. 20103 was a basis for the rule, FRA originally cited the FRSA preemption provision codified in 49 U.S.C. 20106. However, that action was not meant to exclude the possibility of preemption under the LBIA applying as well.

FRA has not been presented with an actual issue involving a passenger locomotive where FRA views on the effect of Federal preemption would differ depending on whether preemption under FRSA or the LBIA applies. Because the courts have consistently held since *Napier* in 1926 that the LBIA preempts the field of the design, the construction, and the material of every part of the locomotive and tender and all appurtenances thereof, FRA has presumed that preemption under the LBIA applies. Nevertheless, it is good regulatory practice to say so explicitly and FRA now does that. FRA amends § 238.13 at this time citing the LBIA.

V. Section-by-Section Analysis

Amendments to 49 CFR Part 238, Passenger Equipment Safety Standards

Subpart A—General

Section 238.13 Preemptive Effect

This section informs the public as to FRA's views regarding the preemptive effect of this part. As discussed above, FRA is amending this section to conform to the revisions made to Section 20106 by the 9/11 Commission Act of 2007.

FRA notes that its discussion of the comments raised on the NPRM provides detailed analysis of the preemptive effect of this part, and FRA is not repeating that discussion here. FRA also notes that the preemptive effect of this part is discussed in the section on "Federal Implications" in Section VI.D. of the preamble to this final rule.

Subpart C—Specific Requirements for Tier I Passenger Equipment

Section 238.205 Anti-Climbing Mechanism

In the NPRM, FRA proposed to amend paragraph (a) of this section to correct an error in the rule text. In relevant part, this paragraph stated that "all passenger equipment * * * shall have at both the forward and rear ends an anti-climbing mechanism capable of resisting an upward or downward vertical force of 100,000 pounds without failure.” However, FRA had intended that the words “without failure” actually read as “without permanent deformation,” as stated in the preamble accompanying the issuance of this paragraph. Specifically, FRA explained in the accompanying preamble that the anti-climbing mechanism must be capable of resisting an upward or downward vertical force of 100,000 pounds “without permanent deformation.” *See* 64 FR 25604; May 12, 1999. Use of the “without permanent deformation” criterion is consistent with North American industry practice, and FRA had not intended to relax that practice. Consequently, FRA had proposed to correct § 238.205(a) expressly to require that the anti-climbing mechanism be capable of resisting an upward or downward vertical force of 100,000 pounds without permanent deformation.

In comments on the NPRM, CRM was supportive of the clarification to this anti-climbing provision, but CRM raised concern about the precedent set by making the clarification retroactive. As a result, CRM wanted it made clear that the date for the change be stated prospectively in the CFR itself.

FRA brought this issue before the Task Force for its consideration. The consensus of the Task Force was to correct the rule text for all passenger equipment placed in service for the first time once the final rule takes effect, and to leave the rule text in its original for passenger equipment already placed in service. The Task Force could not cite an instance where passenger equipment subject to the requirements of this section and already placed in service had not been constructed with an anti-climbing mechanism capable of resisting an upward or downward vertical force of 100,000 pounds without permanent deformation. For this reason, the Task Force believed there was no real safety concern in leaving the rule text in its original for existing passenger equipment.

FRA agrees with the Task Force’s recommendation here and finds that, under the circumstances, it is appropriate to modify the rule text to apply the clarification to all passenger equipment placed in service for the first time on or after the effective date of the final rule. The rule text modification will take place immediately for such equipment newly placed in service, given that all equipment being placed in service now should meet this requirement.

FRA notes that it has set out the entire text of this section for ease of use, although FRA is amending paragraph (a) only. No change to paragraph (b) has been made or is intended.

Section 238.209 Forward End Structure of Locomotives, Including Cab Cars and MU Locomotives

FRA is principally amending this section by revising it and adding a new paragraph (b) so that the forward end structure of a cab car or an MU locomotive may comply with the requirements of appendix F to this part in lieu of the requirements of either § 238.211 (Collision posts) or § 238.213 (Corner posts), or both, provided that the end structure is designed to protect the occupied volume for its full height, from the underframe to the anti-telescoping plate (if used) or roof rails. *See* the discussion of §§ 238.211 and 238.213 and appendix F, below.

In part because of this change, FRA is amending the heading of this section to make clear that the requirements apply to cab cars and MU locomotives. Cab cars and MU locomotives are locomotives and have been subject to the requirements of this section since its issuance. FRA has also shortened “[f]orward-facing end structure” to “[f]orward end structure,” in the section heading. FRA believes that referring to the forward or front end structure is appropriate since this section already referred to the “forward end structure” in former paragraph (c) of the section, redesignated as paragraph (a)(1)(iii), and, as noted above, this section is being amended to expressly reference requirements for cab cars and MU locomotives that are stated in this final rule as applying to the forward end structure.

Nonetheless, FRA makes clear that it is not changing the original requirements of this section for the skin covering the forward-facing end of each locomotive; FRA has only redesignated these requirements as paragraph (a) of this section. FRA does note that an issue has arisen whether the skin must be made of steel plate, or whether a material of lesser yield strength may be used. FRA makes clear that the intent of this section has always been to allow for use of material of lesser yield strength that, due to its increased thickness, *e.g.,* provides strength at least equivalent to that for the steel plate specified. For instance, aluminum material of lesser yield strength may be used to comply with the requirements of paragraph (a) if it is of sufficient thickness to provide at least the strength equivalent to that of a steel plate that is ½-inch thick and has a yield strength of 25,000 pounds-per-square-inch.

Section 238.211 Collision Posts

This final rule enhances requirements for collision posts at the forward ends of cab cars and MU locomotives. The enhancements are based on the provisions of paragraphs (a) through (d) of section 5.3.1.3.1, Cab-end collision posts, of APTA SS–C&S–034–99, Rev. 2. FRA has modified the provisions of this APTA standard for purposes of their adoption as a Federal regulation.

FRA is setting out § 238.211 in its entirety in the rule text for ease of use. In the NPRM, FRA had elided paragraphs (a)(1) and (a)(2) and paragraph (b)(1) of this section, using asterisks to represent that the text of these paragraphs would be unchanged. However, FRA is including these paragraphs in this final rule so that this section, as amended, may be read more easily in its entirety.

Paragraph (b) formerly required that each locomotive, including a cab car and an MU locomotive, ordered on or after September 8, 2000, or placed in service for the first time on or after September 9, 2002, have two collision posts at its forward end, each post capable of withstanding a 500,000-pound longitudinal force at the point even with the top of the underframe and a 200,000-pound longitudinal force exerted 30 inches above the joint of the post to the underframe. These requirements were based on AAR Standard S–580, and had been the industry practice for all locomotives built since August 1990. *See* 64 FR 25606. Subsequently, industry standards for locomotive crashworthiness were enhanced, with APTA focusing on standards for passenger-occupied locomotives, *i.e.,* cab cars and MU locomotives, and the AAR focusing on standards for freight locomotives. The AAR’s efforts helped support development of the locomotive crashworthiness rulemaking, published as a final rule on June 28, 2006. *See* 71 FR 36887. That final rule specifically addresses the safety of conventional locomotives and does not apply to passenger-occupied locomotives. Nevertheless, FRA believes that conceptual approaches taken in the locomotive crashworthiness final rule are applicable to this rulemaking, as discussed below. To clearly delineate the relationship between the locomotive crashworthiness final rule and part 238, FRA has inserted a cross-reference in the introductory text of paragraph (b) to indicate that since the locomotive requirements for collision posts in subpart D of part 229 became effective for locomotives manufactured on or after January 1, 2009, those more stringent requirements—and not the requirements of this paragraph—apply to conventional locomotives.

In the NPRM, FRA proposed correcting paragraph (b)(2) so that the rule text is consistent with the clear intent of the provision. As explained in the preamble accompanying the issuance of this paragraph in the May 12, 1999 final rule, paragraph (b)(2) provides for the use of an equivalent end structure in place of the two forward collision posts described in paragraph (b)—specifically, paragraphs (b)(1)(i) and (b)(1)(ii). *See* 64 FR 25606. However, the rule text made express reference only to the collision posts in "paragraph (b)(1)(i) of this section." This provision was not intended to be limited to the collision posts described in paragraph (b)(1)(i) alone, but instead to the collision posts described in paragraph (b)(1) as a whole—both paragraphs (b)(1)(i) and (b)(1)(ii). As a result, FRA proposed to correct this clear error in the rule text.

In its comments on the NPRM, the BLET raised concern with this provision, first noting the purpose of collision posts as explained by FRA in the final rule governing the crashworthiness of freight locomotives. According to the BLET, because the height and positioning of the collision posts are what creates the survivable space during an accident, FRA imposes strict standards if a railroad wants to deviate from the AAR S–580 standard in the locomotive crashworthiness final rule. The BLET therefore found problematic that paragraph (b)(2) would provide for an equivalent end structure that could withstand the sum of the forces each collision post must withstand, in lieu of the two collision posts. The BLET believed that the level of protection provided by two collision posts is greater than the sum of the forces because of added energy dissipation provided by the outer sheeting of the locomotive superstructure. Additionally, the BLET believed that a differently-designed end structure that meets the equivalency requirement may or may not—depending upon its design and construction—provide the same amount of survivable space during an accident. Accordingly, the BLET urged FRA to revise paragraph (b)(2) in a way that addresses both of these concerns.

As FRA discussed in the NPRM, FRA proposed to correct paragraph (b)(2) of this section so that use of an equivalent end structure would be allowed only in place of the two forward collision posts described in paragraphs (b)(1)(i) and (b)(1)(ii) of this section—not paragraph (b)(1)(i) alone. FRA sought to clear up a discrepancy between the rule text and the preamble explaining the provision, as well a lack of consistency within this paragraph (b) as a whole. FRA has interpreted this provision in accordance with the preamble to the May 12, 1999 final rule, and would not consider any locomotive front end structures constructed otherwise to be compliant.

FRA understands the BLET to be concerned that, even given this background, an end structure built in accordance with this corrected paragraph would present safety concerns. In large part for reasons discussed elsewhere in this final rule in support of new paragraph (c) of this section, FRA disagrees. Paragraph (c) of this section is essentially the counterpart to—and an enhancement of—the requirements of this paragraph (b) for new cab cars and MU locomotives. New paragraph (c) of this section applies to all cab cars and MU locomotives ordered on or after May 10, 2010, or placed in service for the first time on or after March 8, 2012. Further, as noted earlier, as a result of FRA's locomotive crashworthiness final rule cited by the BLET, paragraph (b) does not apply to conventional passenger locomotives that are manufactured on or after January 1, 2009, as they are subject to the requirements of subpart D of part 229. Paragraph (b) of this section therefore has limited applicability for new passenger locomotives, essentially only those new cab cars and MU locomotives ordered prior to May 10, 2010, and placed in service for the first time prior to March 8, 2012.

FRA notes that paragraph (b)(2) is intended to assure a minimum level of overall end frame performance that prevents intrusions into the occupied volume, including the locomotive engineer's cab. End frames designed compliant with paragraph (b)(2) are intended to act as a system to help keep objects out of the cab. FRA wishes to allow for design innovation where alternative structures can be utilized that will provide equivalent levels of protection. There are examples of alternative, end frame arrangements that provide equivalent protection and are shaped so as to help deflect the object as the end frame deforms, thereby preventing intrusion into the cab area. FRA does not believe that use of structures designed compliant with paragraph (b)(2) places engineers at greater risk than use of traditional collision post structures compliant with paragraph (b)(1).

FRA has redesignated former paragraph (c) as paragraph (d), revised it, and added a new paragraph (c) in its place. New paragraphs (c)(2)(i) and (c)(2)(ii) are similar to paragraphs (b)(1)(i) and (b)(1)(ii) of this section. One principal difference is that the final rule requires that each collision post be able to support the specified forces for angles up to 15 degrees from the longitudinal. In effect, this requires each post to support a significant lateral load, and is intended to reflect the uncertainty in the direction that a load is imparted during an impact. The requirement is also intended to encourage the use of collision posts with closed (*e.g.,* rectangular) cross-sections, rather than with open (*e.g.,* I-beam) cross-sections. Beams with open cross-sections tend to twist and bend across the weaker axis when overloaded, regardless of the direction of load. Beams with closed cross-sections are less likely to twist when overloaded, and are more likely to sustain a higher load as they deform, absorbing more energy.

Paragraph (c)(2)(iii) does not have a counterpart in paragraph (b). This paragraph requires that the collision post be able to support a 60,000-pound horizontal force applied anywhere along its length, from its attachment to floor-level structure up to its attachment to roof-level structure. This requirement is intended to provide a minimum level of collision post strength at any point along its full height—not only at its connection to the underframe or at 30 inches above that point. The requirement must also be met for any angle within 15 degrees of the longitudinal axis.

FRA notes that the forces specified in paragraph (c)(2) that the collision posts are required to withstand are more appropriately described as horizontal forces, not merely longitudinal forces, as they are applied at any angle within 15 degrees of the longitudinal axis, the same as provided in Section 5.3.1.3.1 of APTA SS–C&S–034–99, Rev. 2, on which this paragraph is based. Although the proposed rule text in the NPRM did not explicitly describe these forces as "horizontal forces," FRA is doing so in this final rule to be consistent with the APTA standard and to make the rule text more clear.

As discussed earlier, FRA received a number of comments on paragraph (c)(3), originally proposed as paragraph (c)(2) in the NPRM. FRA has modified this paragraph as a result, and this paragraph represents the consensus recommendation of RSAC. FRA had proposed that each collision post also be able to absorb a prescribed amount of energy while deforming and without separating from its supporting structure. This proposed requirement was intended to provide a level of protection similar to the SOA end frame design, as discussed earlier in the Technical Background section of the preamble, above. To comply with this requirement, the NPRM proposed that a quasi-static test, such as the test conducted by Bombardier on the M7 design, be used to show compliance. The NPRM also presented the option of dynamic testing to demonstrate compliance.

As discussed earlier, FRA believes that dynamic performance requirements have been sufficiently validated and that dynamic testing should be included as an alternative for demonstrating compliance. However, FRA agrees with the Task Force in developing the final rule that instead of including in this paragraph an option for the dynamic testing of cab cars and MU locomotives, as was proposed in the NPRM, alternative requirements based on dynamic testing be included in appendix F to this part. Although FRA believes that the dynamic performance requirements will be applied to shaped-nose designs or CEM designs, or designs with both, these requirements may also be applied to conventional flat-nosed designs. Please *see* the "Discussion of Specific Comments and Conclusions" portion of the preamble, above, for additional guidance on the requirements of paragraph (c)(3).

As proposed in the NPRM, FRA has redesignated existing paragraph (c) as paragraph (d) of this section. No other change is intended.

There is no paragraph (e) in this final rule. In the NPRM, FRA cited examples of shaped-nosed designs that place the engineer back from the extreme forward end of the vehicle and offer the potential for significantly increased protection for the engineer in collisions. In this regard, FRA had proposed to add a paragraph (e) to provide relief from utilization of a traditional end frame structure, provided that an equivalent level of protection is afforded occupants by the components of a CEM system. *See* 72 FR 42038. The intent was to recognize that an equivalent level of protection may be provided against intrusion into occupied space, and that end frame structures could be set back from the very end of the cab car or MU locomotive as part of a CEM system. In the FRA CEM design tested in March 2006, the end frame structure was reinforced in order to support the loads introduced through the deformable anti-climber. Significantly more energy was absorbed in the deformation of the crush zone elements than the combined requirements outlined for both collision and corner posts while preserving all space for the locomotive engineer and passengers.[13] In the CEM design being procured by Metrolink, an equivalent end frame structure is placed outboard of occupied space with crush elements between the very end of the nose and the equivalent end frame structure of the cab car. For a grade-crossing collision above the underframe of the cab car, it is expected that perhaps an order of magnitude or larger of collision energy will be absorbed prior to any deformations into occupied space.

Nonetheless, FRA has decided that proposed paragraph (e) is not necessary to retain in this final rule. Dynamic performance requirements are provided as alternative requirements in appendix F to this part, and are therefore available to apply to cab cars and MU locomotives with CEM designs. The ability to apply dynamic performance requirements to the end frame structure provides the relief that was intended by the addition of proposed paragraph (e), and this final rule will help to facilitate the introduction of cab cars and MU locomotive with CEM designs.

Section 238.213 Corner Posts

This final rule enhances requirements for corner posts at the forward ends of cab cars and MU locomotives. The enhancements are based on the provisions of paragraphs (a) through (d) of Section 5.3.2.3.1, Cab end corner posts, and Section 5.3.2.3.3, Cab end-non-operator side of cab-alternate requirements of APTA SS–C&S–034–99, Rev. 2. FRA has modified the provisions of this APTA standard for purposes of their adoption as a Federal regulation. Together with the enhanced requirements for collision posts, this action will increase the strength of the front end structure of cab cars and MU locomotives up to what the main structure can support, and also require explicit consideration of the behavior of the front end structure when overloaded.

As proposed in the NPRM, FRA has revised this section in its entirety. FRA has revised this section by re-designating former paragraph (b) as paragraph (a)(2), making conforming changes to paragraph (a), and adding new paragraphs (b) and (c). FRA has made conforming changes to paragraph (a) so that it is consistent with this section in its entirety, as revised. In particular, FRA has re-stated the corner post requirements in terms of "force" resisted, rather than "load" resisted. However, FRA makes clear that no change is intended to the formerly stated requirements; on the contrary, FRA is using the same terminology throughout this section so as to minimize any confusion that may result from using different terms when the same meaning is intended.

Paragraph (b) is intended to augment the requirements of paragraph (a) for cab cars and MU locomotives ordered on or after May 10, 2010, or placed in service for the first time on or after March 8, 2012. Paragraph (b)(2) therefore requires that higher loads be resisted at the specified locations than its counterpart in paragraph (a).

Paragraph (b)(3) includes quasi-static performance requirements for demonstrating that the corner posts absorb energy while deforming. In the NPRM, proposed paragraph (b)(2)(i) contained quasi-static test requirements for demonstrating energy absorption and deformation. The proposed requirements were intended to provide a level of protection similar to the SOA end frame design, as described in the Technical Background portion of the preamble, above. A quasi-static test, similar to the test conducted by Bombardier on the M7, would be appropriate to demonstrate compliance. Additionally, proposed paragraph (b)(2)(ii) provided for dynamic qualification of the energy absorption and deformation requirements, as an alternative to demonstrating compliance quasi-statically. FRA proposed that the end structure would need to be capable of withstanding a frontal impact with a proxy object intended to approximate lading carried by a highway vehicle under specific conditions.

As discussed earlier, FRA believes that dynamic performance requirements have been sufficiently validated and that dynamic testing should be included as an alternative for demonstrating compliance. However, FRA agrees with the Task Force in developing the final rule that instead of including in this paragraph an option for the dynamic testing of cab cars and MU locomotives, as was proposed in the NPRM, alternative requirements based on dynamic testing be included in appendix F to this part. Although FRA believes that the dynamic performance requirements will be applied to shaped-nose designs or CEM designs, or designs with both, the requirements may also be applied to conventional flat-nosed designs. Please *see* the "Discussion of Specific Comments and Conclusions" portion of the preamble, above, for

[13] Tyrell, D., Jacobsen, K., Martinez, E., "A Train-to-Train Impact Test of Crash Energy Management Passenger Rail Equipment: Structural Results," American Society of Mechanical Engineers, Paper No. IMECE2006–13597, November 2006. This document is available on the Volpe Center's Web site at: *http://www.volpe.dot.gov/sdd/docs/2006/rail_cw_2006_07.pdf.*

additional guidance on the requirements of paragraph (b)(3).

FRA notes that collision posts have more available space and a stronger support structure than corner posts due to their location in the middle of the end frame. Hence, they can absorb more energy than corner posts, and the energy absorption requirements specified for collision posts in this final rule are greater than those specified for corner posts, as a result. Nevertheless, these new requirements for corner posts more than double the amount of energy required for the posts to fail, when compared to the 1990s end frame design.

Paragraph (c) prescribes the requirements for corner posts in cab cars and MU locomotives ordered on or after May 10, 2010, or placed in service for the first time on or after March 8, 2012, utilizing low-level passenger boarding on the side of the equipment opposite from where the locomotive engineer is seated. A graphical description of the forward end of a cab car or an MU locomotive utilizing low-level passenger boarding on the non-operating side of the cab end is provided in Figure 1 to subpart C. In this arrangement, the non-operating side of the vehicle is protected by two corner posts (an end corner post ahead of the stepwell and an internal corner post behind the stepwell) that are situated in front of the occupied space and provide protection for the occupied space; the rule allows for the combined contribution of both sets of corner posts to provide an equivalent level of protection to that required for the corner post design arrangement in other configurations.

As discussed earlier, FRA received a number of comments on this provision as proposed in the NPRM. In particular, the BLET raised concern that this provision could lead to a diminution of safety by designing the corner post ahead of the stepwell to be weaker than the one behind the stepwell. Although FRA has explained that safety is not diminished, the final rule contains an additional requirement that FRA review and approve plans for manufacturing cab cars and MU locomotives with this corner post design arrangement. Each plan must detail how the corner post requirements will be met, including what the acceptance criteria will be to evaluate compliance. FRA believes that this close oversight will help to alleviate concerns that the manufactured designs are in any way less safe for crewmembers and passengers to occupy.

Specifically, paragraph (c) requires that the corner post load requirements of paragraph (b) be met for the corner post on the operating side of the cab. The requirements for the two corner posts on the side opposite from the engineer's control stand are described in paragraphs (c)(2) and (c)(3). The structural requirements for the end corner post ahead of the stepwell are described in paragraph (c)(2). The higher magnitude forces applied in the longitudinal direction will result in a corner post that is wider than it is deep. The structural load requirements for the corner post behind the stepwell are described in paragraph (c)(3). The higher magnitude forces applied in the transverse direction will result in a corner post that is deeper than it is wide.

In paragraph (c)(4), FRA is also requiring that the combination of the corner post ahead of the stepwell and the corner post behind the stepwell be capable of absorbing collision energy while deforming. The requirements of this paragraph are virtually identical to those for corner ports subject to paragraph (b)(3). In the NPRM, proposed paragraph (c)(3)(i) contained quasi static test requirements for demonstrating energy absorption and deformation. Additionally, proposed paragraph (c)(3)(ii) provided for dynamic qualification of the energy absorption and deformation requirements, as an alternative to demonstrating compliance quasi-statically. As noted earlier, FRA agreed with the Task Force in developing this final rule that instead of including in this paragraph an option for the dynamic testing of cab cars and MU locomotives, as was proposed in the NPRM, alternative requirements based on dynamic testing be included in appendix F to this part. This has been done.

There is no paragraph (d) in this final rule. Similar to the proposed addition of § 238.211(e), discussed above, FRA had proposed to add a paragraph (d) to provide relief from utilization of a traditional end frame structure, provided that an equivalent level of protection is afforded occupants by the components of a CEM system. *See* 72 FR 42038. The intent was to recognize that an equivalent level of protection may be provided against intrusion into occupied space, and that end frame structures could be set back from the very end of the cab car or MU locomotive as part of a CEM system. In the FRA CEM design tested in March 2006, the end frame structure was reinforced in order to support the loads introduced through the deformable anti-climber. Significantly more energy was absorbed in the deformation of the deformable anti-climber than the combined requirements outlined for both collision and corner posts while preserving all space for the locomotive engineer and passengers. *Id.* In the CEM design being procured by Metrolink, an equivalent end frame structure is placed outboard of occupied space with crush elements between the very end of the nose and the equivalent end frame structure of the cab car. For a grade-crossing collision above the underframe of the cab car, it is expected that perhaps an order of magnitude or larger of collision energy will be absorbed prior to any deformations into occupied space.

Nonetheless, FRA has decided that proposed paragraph (d) is not necessary to retain in this final rule. Dynamic performance requirements are provided as alternative requirements in appendix F to this part, and are therefore available to apply to cab cars and MU locomotives with CEM designs. The ability to apply dynamic performance requirements to the end frame structure provides the relief that was intended by the addition of proposed paragraph (d), and this final rule will help to facilitate the introduction of cab cars and MU locomotive with CEM designs.

Appendix A to Part 238—Schedule of Civil Penalties

This appendix contains a schedule of civil penalties to be used in connection with this part. Because such penalty schedules are statements of agency policy, notice and comment are not required prior to their issuance. *See* 5 U.S.C. 553(b)(3)(A). Nevertheless, FRA invited comment on the proposed penalty schedule in light of the proposed changes to part 238. No comment was received.

FRA does not find it necessary to amend the penalty schedule as a result of the changes made to part 238 by this final rule. This final rule amends existing sections of part 238 for which guideline penalty amounts are already provided in the penalty schedule. As a result, the penalty schedule remains unchanged.

As noted in the NPRM, in December 2006 FRA published proposed statements of agency policy that would amend the schedules of civil penalties issued as appendixes to FRA's safety regulations, including part 238. *See* 71 FR 70589; Dec. 5, 2006. The proposed revisions are intended to reflect more accurately the safety risks associated with violations of the rail safety laws and regulations, as well as to make sure that the civil penalty amounts are consistent across all safety regulations. Although the schedules are statements of agency policy, and FRA has authority to issue the revisions without having to follow the notice and comment procedures of the Administrative Procedure Act, FRA provided members and representatives of the general public an opportunity to comment on the proposed revisions before amending them. FRA has evaluated all of the comments received in preparing final statements of agency policy, and the schedule of civil penalties to part 238 may be revised as a result of that separate proceeding, independent of this rulemaking.

Appendix F to Part 238—Alternative Dynamic Performance Requirements for Front End Structures of Cab Cars and MU Locomotives

FRA is adding appendix F to part 238 to provide alternatives to the requirements of §§ 238.211 and 238.213. Cab cars and MU locomotives are not required to comply with both the requirements of those sections and the requirements of this appendix. Either set of requirements is adequate for the purpose, depending on the technical challenge(s) presented.

As specified in § 238.209(b), the forward end of a cab car or an MU locomotive may comply with the requirements of this appendix in lieu of the requirements of either § 238.211 or § 238.213, or both. The requirements of this appendix are intended to be equivalent to the requirements of those sections and allow for the application of dynamic performance criteria to cab cars and MU locomotives as an alternative to the requirements of those sections. The alternative dynamic performance requirements are applicable to all cab cars and MU locomotives and may, in particular, be helpful for evaluating the compliance of cab cars and MU locomotives with shaped-noses or CEM designs, or both. In any case, the end structure must be designed to protect the occupied volume for its full height, from the underframe to the anti-telescoping plate (if used) or roof rails.

FRA notes that, in developing the NPRM, concern was raised as to the safety of conducting full-scale, dynamic testing; the technical tradeoffs between quasi-static test requirements and dynamic test requirements were discussed in the Technical Background section of the preamble to the NPRM. FRA explained that there are safety concerns associated with both quasi-static and dynamic testing, and in a quasi-static test particular care must be taken due to the potential for the sudden release of stored energy should there be material failure. Proper planning and execution of each test are required. Nonetheless, FRA has revised the dynamic performance requirements to minimize safety concerns, as discussed earlier in the preamble to this final rule. (Again, by noting that caution must be exercised in planning and executing the tests, FRA does not intend in any way to oust the jurisdiction of the Occupational Safety and Health Administration of the U.S. Department of Labor with regard to the safety of employees performing the tests.)

FRA notes that the approach in this appendix is similar to that followed in the locomotive crashworthiness final rule, in which the front end structure requirements are principally stated in the form of performance criteria for given collision scenarios. *See* appendix E to part 229; 71 FR 36915. In that final rule, FRA adopted performance criteria, rather than more prescriptive design standards, to allow for greater flexibility in the design of locomotives and better encourage innovation in locomotive designs. *See* 71 FR 36895–36898. Of course, the requirements in §§ 238.211 and 238.213 are forms of performance criteria; the distinction is that the performance criteria relate to quasi-static loading conditions—instead of dynamic loading conditions.

Please *see* the "Discussion of Specific Comments and Conclusions" section in the preamble, above, for additional guidance on the requirements of this appendix and of paragraph (b)(3) in particular for cab cars and MU locomotives utilizing low-level passenger boarding on the non-operating side of the cab.

VI. Regulatory Impact and Notices

A. Executive Order 12866 and DOT Regulatory Policies and Procedures

This final rule has been evaluated in accordance with existing policies and procedures, and it has been determined not to be significant under either Executive Order 12866 or DOT policies and procedures (44 FR 11034; Feb. 26, 1979). FRA has prepared and placed in the docket a regulatory evaluation addressing the economic impact of this final rule. Document inspection and copying facilities are available at the Docket Management Facility, U.S. Department of Transportation, West Building Ground Floor, Room W12–140, 1200 New Jersey Avenue, SE., Washington, DC 20590. Docket material is also available for inspection on the Internet at *http://www.regulations.gov*. Photocopies may also be obtained by submitting a written request to the FRA Docket Clerk at Office of Chief Counsel, Mail Stop 10, Federal Railroad Administration, 1200 New Jersey Avenue, SE., Washington, DC 20590; please refer to Docket No. FRA–2006–25268.

Through this final rule, FRA is enhancing its minimum requirements for the performance of collision posts and corner posts on cab cars and MU locomotives. These requirements apply only to newly constructed passenger equipment used as cab cars or MU locomotives. The requirements are based on current industry standards for front end frame structures, which, to FRA's knowledge, every cab car or MU locomotive currently in production for operation in the United States already meets. As such, the requirements are not expected to affect any units in production or planned for production for operation in the United States. This rule essentially codifies these industry standards and will likely not cause railroads to incur costs beyond those they already incur voluntarily. In this regard, it is also likely that this rule will lead to no additional safety benefits, because, as previously mentioned, industry already makes cab cars and MU locomotives that meet these requirements and is assumed to do so in the absence of this final rule.

The rule's requirements may affect cab cars and MU locomotives from other potential manufacturers of equipment for operation in the United States if the equipment is of a design that does not meet current industry standards. However unlikely this scenario, FRA's analysis considers the hypothetical costs and benefits of requiring equipment subject to this final rule from a non-compliant design to be made compliant with the rule's requirements. Since there are alternative methods to meet the requirements of this final rule, the level of cost burden would depend on the method used. For purposes of analysis, FRA selected a method that would serve as a reasonable proxy. The analysis assumes that costs would stem from slightly higher costs of producing the equipment and slightly higher energy costs resulting from operating the equipment in proportion to its assumed additional weight. (FRA notes that although the analysis assumes that the additional weight would be one quarter of one percent (0.25%) of the weight of the equipment, FRA is not making a finding that a cab car or MU locomotive would necessarily be heavier as a result of manufacturing it in compliance with this final rule.) At the same time, the analysis assumes that benefits would arise from increased safety for passengers and crewmembers—safety that is provided by a more crashworthy end frame structure that is assumed to result both in some fatalities avoided and in injuries avoided.

In particular, assuming the number of new cab cars and MU locomotives that would not be built to these requirements and that therefore would be affected by this rule increases by 3 percent annually for the 20 years following implementation of this rule, FRA's analysis finds that, at a 7 percent discount rate, adopting this rule would cost $4,056,265 in 2007 dollars over the 20-year period. The analysis further assumes that it would not be unreasonable to attain total safety benefits for the 20-year period of $16,334,389 in 2007 dollars at a 7 percent discount rate, meaning that net benefits at a 7 percent discount rate would be $12,278,124. Analyzed at an incremental level, this rule would then result in an average cost of $1,304 per unit in 2007 dollars and would yield average benefits of $5,252 per unit in 2007 dollars. Average net benefits for each unit constructed in compliance with this rule would then be $3,948 in 2007 dollars. At a 3 percent discount rate, adopting this rule would then cost $7,367,882 in 2007 dollars and would yield total benefits of $22,081,319 in 2007 dollars. Net benefits at a 3 percent discount rate would then be $14,713,437 in 2007 dollars. Calculated at the per unit basis at a 3 percent discount rate, adopting this rule would then cost $2,369 on average per unit in 2007 dollars and would result in benefits of $7,100 on average per unit in 2007 dollars. Thus, average net benefits per unit at a 3 percent discount rate would then be $4,731 in 2007 dollars.

B. Regulatory Flexibility Act and Executive Order 13272

To ensure that the potential impact of this rule on small entities was properly considered, FRA developed this rule in accordance with Executive Order 13272 ("Proper Consideration of Small Entities in Agency Rulemaking") and DOT's policies and procedures to promote compliance with the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*). The Regulatory Flexibility Act requires an agency to review regulations to assess their impact on small entities. An agency must conduct a regulatory flexibility analysis unless it determines and certifies that a rule is not expected to have a significant impact on a substantial number of small entities.

As discussed in earlier sections of this preamble, the principal goals of crashworthiness rules promulgated by FRA are twofold: first, preserve a safe space for occupants, and, next, minimize the forces that occupants are subjected to when impacting interior surfaces. The APTA standards developed in 1999, and revised in 2003 and 2006, provide that new cab cars and MU locomotives have front end structures with corner and collision posts able to sustain minimum prescribed loads and absorb collision energy. This rule codifies these industry standards, which are based on quasi-static performance criteria. This rule also includes dynamic performance criteria that can be applied to any type of front end structure design (shaped-nose, CEM, flat-nosed, or otherwise) in lieu of the quasi-static performance criteria, which should reduce the uncertainty involved in demonstrating compliance. Inclusion of these alternative criteria should also enable car builders to more easily incorporate alternative, front end structure designs, which may lead to safer, less costly, or otherwise improved cab cars and MU locomotives.

FRA notes that the crashworthiness requirements proposed in the NPRM and contained in this final rule were developed in consultation with a working group that includes Amtrak, individual commuter railroads, individual passenger car manufacturers, and APTA, which represents commuter railroads and passenger car manufacturers in rulemaking matters. As discussed in earlier sections of this preamble, the quasi-static performance criteria in the final rule are basically unchanged from the NPRM, while FRA has restated the alternative, dynamic performance criteria principally to make the criteria easier to apply.

FRA has considered all of the comments submitted to the rulemaking docket and appreciates the information provided by the many parties. No comments were received specifically regarding FRA's initial analysis of the impact of this rule on small entities. As discussed below, FRA is certifying that this final rule will result in "no significant economic impact on a substantial number of small entities."

The universe of the entities considered by FRA comprises only those small entities that can reasonably be expected to be directly affected by the provisions of this rule. "Small entity" is defined in 5 U.S.C. 601(3) as having the same meaning as "small business concern" under section 3 of the Small Business Act. This includes any small business concern that is independently owned and operated, and is not dominant in its field of operation. Section 601(4) likewise includes within the definition of "small entities" not-for-profit enterprises that are independently owned and operated, and are not dominant in their field of operations. The U.S. Small Business Administration (SBA) stipulates "size standards" for small entities. It provides that the largest a for-profit railroad business firm may be (and still classify as a "small entity") is 1,500 employees for "Line-Haul Operating" railroads, and 500 employees for "Short-Line Operating" railroads. Additionally, section 601(5) defines as "small entities" governments of cities, counties, towns, townships, villages, school districts, or special districts with populations less than 50,000.

SBA size standards may be altered by Federal agencies in consultation with SBA, and in conjunction with public comment. Pursuant to the authority provided to it by SBA, FRA has published a final policy, which formally establishes small entities as railroads that meet the line haulage revenue requirements of a Class III railroad. Currently, the revenue requirements are $20 million or less in annual operating revenue, adjusted annually for inflation. The $20 million limit (adjusted annually for inflation) is based on the Surface Transportation Board's threshold of a Class III railroad carrier, which is adjusted by applying the railroad revenue deflator adjustment.

The principal entities subject to this rule by application of § 238.3(a)(1) are governmental jurisdictions or transit authorities that provide commuter rail service—none of which is small for purposes of the SBA (*i.e.,* no entity serves a locality with a population less than 50,000). These entities also receive Federal transportation funds. Intercity rail service providers Amtrak and the Alaska Railroad Corporation are also subject to this rule under § 238.3(a)(1), but they are not small entities and likewise receive Federal transportation funds. While other railroads are subject to this final rule by the application of § 238.3, FRA is not aware of any railroad subject to this rule that is a small entity that will be impacted by this rule. For example, railroads that provide short-haul rail passenger train service in a metropolitan or suburban area as specified in § 238.3(a)(2) are subject to this rule, but FRA is not aware that any railroad in existence that would fall in this category (and is not otherwise a commuter railroad) operates with cab cars or MU locomotives, or intends to acquire any new cab cars or MU locomotives that would be subject to the requirements of this final rule, or both. Tourist, scenic, excursion, and historic passenger railroad operations are exempt from part 238; therefore, these smaller operations would not incur any costs from this final rule.

Having made these determinations, FRA certifies that this final rule will not have a significant economic impact on a substantial number of small entities under the Regulatory Flexibility Act or Executive Order 13272.

C. Paperwork Reduction Act

The information collection requirements in this final rule have been submitted to the Office of Management and Budget (OMB) for review and approval in accordance with the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*). The section that contains a new information collection requirement (49 CFR 238.213) and the estimated time to fulfill that requirement are both summarized in the following table. The table summarizes the information collection requirements arising out of the May 12, 1999 Passenger Equipment Safety Standards final rule, 64 FR 25540. Please note that the table does not include those information collection requirements added by the February 1, 2008 Passenger Train Emergency Systems final rule, 73 FR 6370, as they are covered under a separate approval, OMB No. 2130–0576, which is current until March 31, 2011.

CFR section	Respondent universe	Total annual responses	Average time per response	Total annual burden hours
216.14—Special Notice for Repairs—Passenger Equipment.	27 railroads	9 forms	5 minutes	1
229.47—Emergency Brake Valve.				
—Marking Brake Pipe Valve as Such	27 railroads	30 markings	1 minute	1
—MU, Cab Car Locomotives—Marking Emergency Brake Valve as Such.	27 railroads	5 markings	1 minute	.08
238.7—Waivers	27 railroads	5 waivers	2 hours	10
238.15—Movement of Passenger Equipment with Power Brake Defects.				
—Defects Found at Inspection Point	27 railroads	1,000 tags	3 minutes	50
—Defects Developed en Route	27 railroads	288 tags	3 minutes	14
—Conditional requirement—Notification.	27 railroads	144 notifications	3 minutes	7
238.17—Movement of Passenger Equipment with Other Than Power Brake Defects.				
—Defects Found at Inspection Point	27 railroads	200 tags	3 minutes	10
—Defects Developed en Route	27 railroads	76 tags	3 minutes	4
—Special Requisites—Movement of Passenger Equipment with Safety Appliance Defect—Crewmember Notifications.	27 railroads	38 notifications	30 seconds	.32
238.21—Petitions for Special Approval of Alternative Standards.	27 railroads	1 petition	16 hours	16
—Petitions for Special Approval of Alternative Compliance.	27 railroads	1 petition	120 hours	120
—Petitions for Special Approval of Pre-Revenue Service Acceptance Testing Plan.	27 railroads	10 petitions	40 hours	400
—Comments on petitions	public/railroad industry	4 comments	1 hour	4
238.103—Fire Safety.				
—Procuring New Pass. Equipment—Fire Safety Analysis.	2 new railroads	2 analyses	150 hours	300
—Existing Equipment—Final Fire Safety Analysis.	27 railroads	1 analysis	40 hours	40
—Transferring/Changing Existing Equipment—Revised Fire Safety Analysis.	27 railroads	3 analyses	20 hours	60
238.107—Inspection, Testing, and Maintenance Plans—Review by Railroads.	27 railroads	12 reviews	60 hours	720
238.109—Employee/Contractor Training.				
—Training Employees and Contractors—Mech. Inspection.	7,500 employees/contractors.	2,500 employees/contractors/100 trainers.	1.33 hours	3,458
—Recordkeeping—Employee/Contractor Current Qualifications.	27 railroads	2,500 records	3 minutes	125
238.111—Pre-Revenue Service Acceptance Testing Plan.				
—Passenger Equipment That Has Previously Been Used in Revenue Service in the U.S.	9 equipment manufacturers.	2 plans	16 hours	32
—Passenger Equipment That Has Not Been Previously Used in Revenue Service in the U.S.	9 equipment manufacturers.	2 plans	192 hours	384
—Subsequent Equipment Orders	9 equipment manufacturers.	2 plans	60 hours	120
238.213—Corner Posts—Plans (New Requirement).	27 railroads	10 plans	40 hours	400
238.229—Safety Appliances.				
—Welded Safety Appliances Considered Defective: Lists.	27 railroads	27 lists	1 hour	27
—Lists Identifying Equipment with Welded Safety Appliances.	27 railroads	27 lists	1 hour	27
—Defective Welded Safety Appliances—Tags.	27 railroads	4 tags	3 minutes	.20
—Notification to Crewmembers about Non-Compliant Equipment.	27 railroads	2 notifications	1 minute	.0333
—Inspection Plans	27 railroads	27 plans	16 hours	432
—Inspection Personnel—Training	27 railroads	54 employees	4 hours	216

CFR section	Respondent universe	Total annual responses	Average time per response	Total annual burden hours
—Remedial action: Defect/Crack in Weld—Record.	27 railroads	1 record	2.25 hours	2
—Petitions for Special Approval of Alternative Compliance—Impractical Equipment Design.	27 railroads	15 petitions	4 hours	60
—Records of Inspection/Repair of Welded Safety Appliance Brackets/ Supports.	27 railroads	3,054 records	12 minutes	611
238.230—Safety Appliances—New Equipment.				
—Inspection Record of Welded Equipment by Qualified Employee.	27 railroads	100 records	6 minutes	10
—Welded Safety Appliances: Documentation for Equipment Impractically Designed to Mechanically Fasten Safety Appliance Support.	27 railroads	15 documents	4 hours	60
238.231—Brake System.				
—Inspection and Repair of Hand/Parking Brake: Records.	27 railroads	2,500 forms	21 minutes	875
—Procedures Verifying Hold of Hand/ Parking Brake.	27 railroads	27 procedures	2 hours	54
238.237—Automated Monitoring.				
—Documentation for Alerter/Deadman Control Timing.	27 railroads	3 documents	2 hours	6
—Defective Alerter/Deadman Control: Tagging.	27 railroads	25 tags	3 minutes	1
238.303—Exterior Calendar Day Mechanical Inspection of Passenger Equipment.				
—Notice of Previous Inspection for Added Equipment.	27 railroads	25 notices	1 minute	1
—Dynamic Brakes Not in Operating Mode: Tag.	27 railroads	50 tags	3 minutes	3
—Conventional Locomotives Equipped with Inoperative Dynamic Brakes: Tagging.	27 railroads	50 tags	3 minutes	3
—MU Passenger Equipment Found with Inoperative/Ineffective Air Compressor at Exterior Calendar Day Inspection: Documents.	27 railroads	4 documents	2 hours	8
—Written Notice to Train Crew about Inoperative/Ineffective Air Compressors.	27 railroads	100 notices	3 minutes	5
—Records of Inoperative Air Compressors.	27 railroads	100 records	2 minutes	3
—Record of Exterior Calendar Day Mechanical Inspection.	27 railroads	2,376,920 records	10 minutes + 1 minute	435,769
238.305—Interior Calendar Day Mechanical Inspection of Passenger Cars.				
—Tagging of Defective End/Side Doors.	27 railroads	540 tags	1 minute	9
—Records of Interior Calendar Day Inspection.	27 railroads	1,968,980 records	5 minutes + 1 minute	196,898
238.307—Periodic Mechanical Inspection of Passenger Cars and Unpowered Vehicles.				
—Alternative Inspection Intervals: Notifications.	27 railroads	2 notifications	5 hours	10
—Notice of Seats/Seat Attachments Broken or Loose.	27 railroads	200 notices	2 minutes	7
—Records of Each Periodic Mechanical Inspection.	27 railroads	19,284 records	200 hours/2 minutes	3,857,443
—Detailed Documentation of Reliability Assessments as Basis for Alternative Inspection Interval.	27 railroads	5 documents	100 hours	500
238.311—Single Car Test.				
—Tagging to Indicate Need for Single Car Test.	27 railroads	50 tags	3 minutes	3
238.313—Class I Brake Test.				
—Record for Additional Inspection for Passenger Equipment That Does Not Comply with § 238.231(b)(1).	27 railroads	15,600 records	30 minutes	7,800
238.315—Class IA Brake Test.				
—Notice to Train Crew That Test Has Been Performed.	27 railroads	18,250 verbal notices	5 seconds	25
—Communicating Signal Tested and Operating.	27 railroads	365,000 tests	15 seconds	1,521
238.317—Class II Brake Test.				
—Communicating Signal Tested and Operating.	27 railroads	365,000 tests	15 seconds	1,521
238.321—Out-of-Service Credit.				
—Passenger Car: Out-of-Use Notation	27 railroads	1,250 notes	2 minutes	42
238.445—Automated Monitoring.				

CFR section	Respondent universe	Total annual responses	Average time per response	Total annual burden hours
—Performance Monitoring: Alerters/Alarms.	1 railroad	10,000 alerts	10 seconds	28
—Monitoring System: Self-Test Feature: Notifications.	1 railroad	21,900 notifications	20 seconds	122
238.503—Inspection, Testing, and Maintenance Requirements—Plans.	1 railroad	1 plan	1,200 hours	1,200
238.505—Program Approval Procedures.				
—Submission of Program/Plans and Comments on Programs.	rail industry	3 comments	3 hours	9

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 Mr. Robert Brogan, Office of Safety Information Clearance Officer, at 202–493–6292 or via e-mail at *robert.brogan@dot.gov;* or Ms. Kimberly Toone, Office of Administration Information Clearance Officer, at 202–493–6132 or via e-mail at *kimberly.toone@dot.gov.*

Organizations and individuals desiring to submit comments on the collection of information requirements should direct them to the Office of Management and Budget, 725 17th St., NW., Washington, DC 20590, Attn: FRA OMB Desk Officer, or via e-mail at *oira_submissions@omb.eop.gov.* OMB is required to make a decision concerning the collection of information requirements contained in this final rule between 30 and 60 days after publication of this final rule 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 which do not display a current OMB control number, if required. FRA intends to obtain current OMB control numbers for any new information collection requirements resulting from this rulemaking action prior to the effective date of the final rule. The OMB control number, when assigned, will be announced by separate notice in the **Federal Register.**

D. Federalism Implications

This final rule has been analyzed in accordance with the principles and criteria contained in Executive Order 13132, "Federalism" (64 FR 43255, Aug. 10, 1999). Executive Order 13132 requires FRA to develop an accountable process to ensure "meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" are defined in the Executive Order to include regulations that have "substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government." Under Executive Order 13132, the agency may not issue a regulation with federalism implications that imposes substantial direct compliance costs and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments, the agency consults with State and local governments, or the agency consults with State and local government officials early in the process of developing the regulation. Where a regulation has federalism implications and preempts State law, the agency seeks to consult with State and local officials in the process of developing the regulation.

FRA has determined that this final rule will not have substantial direct effects on the States, on the relationship between the national government and the States, nor on the distribution of power and responsibilities among the various levels of government. In addition, FRA has determined that this final rule will not impose substantial direct compliance costs on State and local governments. Therefore, the consultation and funding requirements of Executive Order 13132 do not apply.

However, this final rule has preemptive effect. As discussed earlier, FRA is clarifying the preemptive effect of this final rule and the underlying regulations it is proposing to amend. Section 20106 provides that States may not adopt or continue in effect any law, regulation, or order related to railroad safety or security that covers the subject matter of a regulation prescribed or issued by the Secretary of Transportation (with respect to railroad safety matters) or the Secretary of Homeland Security (with respect to railroad security matters), except when the State law, regulation, or order qualifies under the "essentially local safety or security hazard" exception to Section 20106. The intent of Section 20106 is to promote national uniformity in railroad safety and security standards. 49 U.S.C. 20106(a)(1). This intent was expressed even more specifically in 49 U.S.C. 20133, which mandated that the Secretary of Transportation prescribe "regulations establishing minimum standards for the safety of cars used by railroad carriers to transport passengers" and consider such matters as "the crashworthiness of the cars" before prescribing the regulations. This final rule is intended to add to and enhance these regulations, originally issued on May 12, 1999, pursuant to 49 U.S.C. 20133. Thus, subject to a limited exception for essentially local safety or security hazards, this final rule establishes a uniform Federal safety standard that must be met, and State requirements covering the same subject matter are displaced, whether those State requirements are in the form of a State law, including common law, regulation, or order. In particular, FRA believes that it has preempted any State law, regulation, or order, including State common law standards of care, concerning the operation of a cab car or MU locomotive as the leading unit of a passenger train.

As discussed earlier, FRA notes that RSAC, which endorsed and recommended adoption of the requirements of this final rule, has as permanent members two organizations representing State and local interests: AASHTO and ASRSM. Both of these State organizations concurred with the RSAC recommendation endorsing the requirements of this final rule. RSAC regularly provides recommendations to the Administrator of FRA for solutions to regulatory issues that reflect significant input from its State members. As discussed earlier, FRA has received federalism concerns in comments on the NPRM from members of RSAC, from the CPUC, and from other commenters. FRA again makes clear that the RSAC recommendation to the Administrator on the NPRM neither contained a preemption provision in the rule text, nor did it include the interpretive discussion in the preamble to the NPRM. Nor did RSAC, which includes AASHTO and ASRSM, address the comments raised on preemption in developing this final rule. Nonetheless, FRA believes that this final rule is in accordance with the principles and criteria contained in Executive Order 13132, which says "where national standards are required by Federal statutes, consult with appropriate State and local officials in developing those standards." The standards are embodied in the rule text, and the rule text was the subject of the consultations that focused principally on what the substantive requirements of the rule should be.

FRA notes that the BLET commented that FRA, in developing the NPRM, did not consult with any truly local interests, asserting that AASHTO and ASRSM are comprised of State—not local—executive branch representatives. Further, the BLET commented that there was no evidence that FRA had consulted with any member of a State or local legislative or judicial branch, or a State's attorney general. The BLET contended that FRA's preamble comments created a significant Federal question and required consultation under Executive Order 13132 that had not been performed.

FRA believes that local interests are sufficiently represented through RSAC for purposes of the consultations required to be undertaken by FRA in developing proposed regulations under Executive Order 13132. For instance, FRA understands that while all State departments of transportation are active members of AASHTO, several sub-State transportation agencies are associate members, including local transportation officials. Further, even though ASRSM is comprised of State officials, FRA has not relied on the fact that another RSAC member, APTA, itself has as members local government agencies and metropolitan planning organizations. APTA took no issue with FRA's views on preemption. Instead, APTA "applaud[ed] FRA's strong leadership on the issues surrounding Federal preemption of State and local regulation," stating in particular that "consistent standards are absolutely vital to the safe, efficient operation of the nation's rail system." Further, FRA believes it fair to consider commuter railroads on RSAC to represent local interests in part as they are generally the products of local governments for providing rail service for the benefit of their local metropolitan areas. For example, as noted earlier, Metrolink is a joint powers authority comprised of five county transportation planning agencies in southern California. These local transportation agencies are surely local interests with the meaning of Executive Order 13132 and are the appropriate ones to consult because they are the only local interests likely to have the relevant technical knowledge. Moreover, FRA did not receive any adverse comment from any local official on FRA's views as to the preemptive effect of the rulemaking. (The CPUC of course commented adversely on behalf of the State of California.) It is also worth noting in this context that local governments have no role at all under the Federal railroad safety laws in regulating railroad safety—that which is not done by the Federal Government is reserved to the States. FRA believes that it has satisfied the consultation requirements in the Executive Order.

In sum, FRA has analyzed this final rule in accordance with the principles and criteria contained in Executive Order 13132. As explained above, FRA has determined that this final rule has no federalism implications, other than the preemption of State laws covering the subject matter of this final rule, which occurs by operation of law under Section 20106 whenever FRA issues a rule or order, and under the LBIA (49 U.S.C. 20701–20703) by its terms. Accordingly, FRA has determined that preparation of a federalism summary impact statement for this final rule is not required.

E. Environmental Impact

FRA has evaluated this final rule in accordance with its "Procedures for Considering Environmental Impacts" (FRA's Procedures) (*see* 64 FR 28545 (May 26, 1999)) as required by the National Environmental Policy Act (*see* 42 U.S.C. 4321 *et seq.*), other environmental statutes, Executive Orders, and related regulatory requirements. FRA has determined that this final rule is not a major FRA action (requiring the preparation of an environmental impact statement or environmental assessment) because it is categorically excluded from detailed environmental review pursuant to section 4(c)(20) of FRA's Procedures. *See* 64 FR 28547 (May 26, 1999). In accordance with section 4(c) and (e) of FRA's Procedures, the agency has further concluded that no extraordinary circumstances exist with respect to this regulation that might trigger the need for a more detailed environmental review. As a result, FRA finds that this final rule is not a major Federal action significantly affecting the quality of the human environment.

F. Unfunded Mandates Reform Act of 1995

Pursuant to Section 201 of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4, 2 U.S.C. 1531), each Federal agency "shall, unless otherwise prohibited by law, assess the effects of Federal regulatory actions on State, local, and Tribal governments, and the private sector (other than to the extent that such regulations incorporate requirements specifically set forth in law)." Section 202 of the Act (2 U.S.C. 1532) further requires that "before promulgating any general notice of proposed rulemaking that is likely to result in the promulgation of any rule that includes any Federal mandate that may result in expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100,000,000 or more (adjusted annually for inflation) in any 1 year, and before promulgating any final rule for which a general notice of proposed rulemaking was published, the agency shall prepare a written statement" detailing the effect on State, local, and Tribal governments and the private sector. The final rule will not result in the expenditure, in the aggregate, of $100,000,000 or more (as adjusted annually for inflation) in any one year, and thus preparation of such a statement is not required.

G. Energy Impact

Executive Order 13211 requires Federal agencies to prepare a Statement of Energy Effects for any "significant energy action." *See* 66 FR 28355 (May 22, 2001). Under the Executive Order, a "significant energy action" is defined as any action by an agency (normally published in the **Federal Register**) that promulgates or is expected to lead to the promulgation of a final rule or regulation, including notices of inquiry, advance notices of proposed rulemaking, and notices of proposed rulemaking: (1)(i) That is a significant regulatory action under Executive Order 12866 or any successor order, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action.

FRA stated in the NPRM that it had evaluated this rulemaking in accordance with Executive Order 13211 and had determined that the rulemaking is not likely to have a significant adverse effect on the supply, distribution, or use of energy. In comments on the NPRM, however, some commenters disagreed with FRA's determination. In sum, the commenters claimed that this rulemaking would increase the weight of passenger rail equipment and would adversely affect energy usage because heavier railcars require more energy to operate.

FRA continues to find that this regulatory action is not a "significant energy action" within the meaning of Executive Order 13211. As discussed above, the requirements in this final rule are based on current industry standards for front end frame structures, which, to FRA's knowledge, every cab car and MU locomotive currently in production for operation in the United States already meets. As such, the standards are not expected to affect any units in production or planned for production for operation in the United States. This rule essentially codifies these industry standards and will likely not cause railroads to incur costs beyond those that they already incur voluntarily.

Moreover, even when FRA has assumed that a cab car or MU locomotive would be heavier as a result of manufacturing it to comply with the requirements of this final rule, operation of the slightly heavier cab car or MU locomotive is assumed to result in only a slightly higher energy cost. This assumed energy cost is minimal and in proportion to the assumed additional weight of the equipment—increases of one quarter of one percent (0.25%) in both the energy cost and equipment weight. Nonetheless, FRA has not made a finding that a cab car or MU locomotive would necessarily be heavier as a result of manufacturing it in compliance with this final rule.

H. Trade Impact

The Trade Agreements Act of 1979 (Pub. L. 96–39, 19 U.S.C. 2501 *et seq.*) prohibits Federal agencies from engaging in any standards or related activities that create unnecessary obstacles to the foreign commerce of the United States. 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.

In issuing the NPRM, FRA assessed the potential effect of this rulemaking on foreign commerce and believed that the proposed requirements would be consistent with the Trade Agreements Act. FRA noted that the proposed requirements are safety standards, which are not considered unnecessary obstacles to trade. Moreover, FRA sought, to the extent practicable, to state the requirements in terms of the performance desired, rather than in more narrow terms restricted to a particular design, so as not to limit different, compliant designs by any manufacturer—foreign or domestic.

In commenting on the NPRM, the CPUC concurred with FRA that the safety of passenger cars is paramount and that legitimate safety objectives are not considered unnecessary obstacles to the foreign commerce of the United States. In its comments, however, Caltrain disagreed with FRA's assertions and asked that FRA reconsider its proposal. Caltrain recommended that FRA allow alternative, proven designs to be considered when presented as components of an entire system, rather than requiring the alternative designs to meet the requirements of the regulation as written for any vehicle on any railroad.

FRA maintains that its actions in this rulemaking are consistent with the Trade Agreements Act. This final rule is a rule of general applicability, intended to apply to Tier I passenger vehicles in general use. The alternative performance requirements in appendix F provide flexibility in vehicle design for use on any railroad. FRA did not intend to specify requirements for vehicles operating under particular conditions on a particular railroad. Nonetheless, existing FRA regulations provide separate processes for considering the safety of vehicles in such circumstances, and they are also neutral with respect to the country of origin of the vehicles.

For related discussion on the international effects of part 238, please *see* the preamble to the May 12, 1999 Passenger Equipment Safety Standards final rule on the topic of "United States international treaty obligations." *See* 64 FR 25545.

I. Privacy Act

Anyone is able to search the electronic form of all comments or petitions for reconsideration received into any of FRA's dockets by the name of the individual submitting the comment or petition for reconsideration (or signing the comment or petition for reconsideration, if submitted on behalf of an association, business, labor union, *etc.*). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477–78), or you may visit *http://DocketsInfo.dot.gov*.

List of Subjects in 49 CFR Part 238

Passenger equipment, Penalties, Railroad safety, Reporting and recordkeeping requirements.

The Rule

For the reasons discussed in the preamble, FRA amends part 238 of chapter II, subtitle B of title 49, Code of Federal Regulations, as follows:

PART 238—[AMENDED]

1. The authority citation for part 238 continues to read as follows:

Authority: 49 U.S.C. 20103, 20107, 20133, 20141, 20302–20303, 20306, 20701–20702, 21301–21302, 21304; 28 U.S.C. 2461, note; and 49 CFR 1.49.

Subpart A—General

2. Revise § 238.13 to read as follows:

§ 238.13 Preemptive effect.

(a) Under 49 U.S.C. 20106, issuance of these regulations preempts any State law, regulation, or order covering the same subject matter, except an additional or more stringent law, regulation, or order that is necessary to eliminate or reduce an essentially local safety or security hazard; is not incompatible with a law, regulation, or order of the United States Government; and does not unreasonably burden interstate commerce.

(b) This part establishes Federal standards of care for railroad passenger equipment. This part does not preempt an action under State law seeking damages for personal injury, death, or property damage alleging that a party has failed to comply with the Federal standard of care established by this part, including a plan or program required by this part. Provisions of a plan or program that exceed the requirements of this part are not included in the Federal standard of care.

(c) Under 49 U.S.C. 20701–20703 (formerly the Locomotive (Boiler) Inspection Act), the field of locomotive safety is preempted, extending to the design, the construction, and the material of every part of the locomotive and tender and all appurtenances thereof. To the extent that the regulations in this part establish requirements affecting locomotive safety, the scope of preemption is provided by 49 U.S.C. 20701–20703.

Subpart C—Specific Requirements for Tier I Passenger Equipment

3. Revise § 238.205 to read as follows:

§ 238.205 Anti-climbing mechanism.

(a) Except as provided in paragraph (b) of this section, all passenger equipment placed in service for the first time on or after September 8, 2000, and prior to March 9, 2010, shall have at both the forward and rear ends an anti-climbing mechanism capable of resisting an upward or downward vertical force of 100,000 pounds without failure. All passenger equipment placed in service for the first time on or after March 9, 2010, shall have at both the forward and rear ends an anti-climbing mechanism capable of resisting an upward or downward vertical force of 100,000 pounds without permanent deformation. When coupled together in any combination to join two vehicles, AAR Type H and Type F tight-lock couplers satisfy the requirements of this paragraph (a).

(b) Except for a cab car or an MU locomotive, each locomotive ordered on or after September 8, 2000, or placed in service for the first time on or after September 9, 2002, shall have an anti-climbing mechanism at its forward end capable of resisting both an upward and downward vertical force of 200,000 pounds without failure. Locomotives required to be constructed in accordance with subpart D of part 229 of this chapter shall have an anti-climbing mechanism in compliance with § 229.206 of this chapter, in lieu of the requirements of this paragraph.

4. Revise § 238.209 to read as follows:

§ 238.209 Forward end structure of locomotives, including cab cars and MU locomotives.

(a)(1) The skin covering the forward-facing end of each locomotive, including a cab car and an MU locomotive, shall be:

(i) Equivalent to a ½-inch steel plate with a yield strength of 25,000 pounds-per-square-inch—material of a higher yield strength may be used to decrease the required thickness of the material provided at least an equivalent level of strength is maintained;

(ii) Designed to inhibit the entry of fluids into the occupied cab area of the equipment; and

(iii) Affixed to the collision posts or other main vertical structural members of the forward end structure so as to add to the strength of the end structure.

(2) As used in this paragraph (a), the term "skin" does not include forward-facing windows and doors.

(b) The forward end structure of a cab car or an MU locomotive may comply with the requirements of appendix F to this part in lieu of the requirements of either § 238.211 (Collision posts) or § 238.213 (Corner posts), or both, provided that the end structure is designed to protect the occupied volume for its full height, from the underframe to the anti-telescoping plate (if used) or roof rails.

5. Revise § 238.211 to read as follows:

§ 238.211 Collision posts.

(a) Except as further specified in this paragraph, paragraphs (b) through (d) of this section, and § 238.209(b)—

(1) All passenger equipment placed in service for the first time on or after September 8, 2000, shall have either:

(i) Two full-height collision posts, located at approximately the one-third points laterally, at each end. Each collision post shall have an ultimate longitudinal shear strength of not less than 300,000 pounds at a point even with the top of the underframe member to which it is attached. If reinforcement is used to provide the shear value, the reinforcement shall have full value for a distance of 18 inches up from the underframe connection and then taper to a point approximately 30 inches above the underframe connection; or

(ii) An equivalent end structure that can withstand the sum of forces that each collision post in paragraph (a)(1)(i) of this section is required to withstand. For analysis purposes, the required forces may be assumed to be evenly distributed at the end structure at the underframe joint.

(2) The requirements of this paragraph (a) do not apply to unoccupied passenger equipment operating in a passenger train, or to the rear end of a locomotive if the end is unoccupied by design.

(b) Except for a locomotive that is constructed on or after January 1, 2009, and is subject to the requirements of subpart D of part 229 of this chapter, each locomotive, including a cab car and an MU locomotive, ordered on or after September 8, 2000, or placed in service for the first time on or after September 9, 2002, shall have at its forward end, in lieu of the structural protection described in paragraph (a) of this section, either:

(1) Two forward collision posts, located at approximately the one-third points laterally, each capable of withstanding:

(i) A 500,000-pound longitudinal force at the point even with the top of the underframe, without exceeding the ultimate strength of the joint; and

(ii) A 200,000-pound longitudinal force exerted 30 inches above the joint of the post to the underframe, without exceeding the ultimate strength; or

(2) An equivalent end structure that can withstand the sum of the forces that each collision post in paragraph (b)(1) of this section is required to withstand.

(c)(1) Each cab car and MU locomotive ordered on or after May 10, 2010, or placed in service for the first time on or after March 8, 2012, shall have at its forward end, in lieu of the structural protection described in paragraphs (a) and (b) of this section, two forward collision posts, located at approximately the one-third points laterally, meeting the requirements set forth in paragraphs (c)(2) and (c)(3) of this section:

(2) Each collision post acting together with its supporting car body structure shall be capable of withstanding the following loads individually applied at any angle within 15 degrees of the longitudinal axis:

(i) A 500,000-pound horizontal force applied at a point even with the top of the underframe, without exceeding the ultimate strength of either the post or its supporting car body structure;

(ii) A 200,000-pound horizontal force applied at a point 30 inches above the top of the underframe, without exceeding the ultimate strength of either the post or its supporting car body structure; and

(iii) A 60,000-pound horizontal force applied at any height along the post above the top of the underframe, without permanent deformation of either the post or its supporting car body structure.

(3) Prior to or during structural deformation, each collision post acting together with its supporting car body structure shall be capable of absorbing a minimum of 135,000 foot-pounds of energy (0.18 megajoule) with no more than 10 inches of longitudinal, permanent deformation into the occupied volume, in accordance with the following:

(i) The collision post shall be loaded longitudinally at a height of 30 inches above the top of the underframe;

(ii) The load shall be applied with a fixture, or its equivalent, having a width sufficient to distribute the load directly into the webs of the post, but of no more than 36 inches, and either:

(A) A flat plate with a height of 6 inches; or

(B) A curved surface with a diameter of no more than 48 inches; and

(iii) There shall be no complete separation of the post, its connection to the underframe, its connection to either the roof structure or anti-telescoping plate (if used), or of its supporting car body structure.

(d) The end structure requirements of this section apply only to the ends of a semi-permanently coupled consist of articulated units, provided that:

(1) The railroad submits to FRA under the procedures specified in § 238.21 a documented engineering analysis establishing that the articulated connection is capable of preventing disengagement and telescoping to the same extent as equipment satisfying the anti-climbing and collision post

requirements contained in this subpart; and

(2) FRA finds the analysis persuasive.

6. Revise § 238.213 to read as follows:

§ 238.213 Corner posts.

(a)(1) Except as further specified in paragraphs (b) and (c) of this section and § 238.209(b), each passenger car shall have at each end of the car, placed ahead of the occupied volume, two full-height corner posts, each capable of resisting together with its supporting car body structure:

(i) A 150,000-pound horizontal force applied at a point even with the top of the underframe, without exceeding the ultimate strength of either the post or its supporting car body structure;

(ii) A 20,000-pound horizontal force applied at the point of attachment to the roof structure, without exceeding the ultimate strength of either the post or its supporting car body structure; and

(iii) A 30,000-pound horizontal force applied at a point 18 inches above the top of the underframe, without permanent deformation of either the post or its supporting car body structure.

(2) For purposes of this paragraph (a), the orientation of the applied horizontal forces shall range from longitudinal inward to lateral inward.

(b)(1) Except as provided in paragraph (c) of this section, each cab car and MU locomotive ordered on or after May 10, 2010, or placed in service for the first time on or after March 8, 2012, shall have at its forward end, in lieu of the structural protection described in paragraph (a) of this section, two corner posts ahead of the occupied volume, meeting all of the requirements set forth in paragraphs (b)(2) and (b)(3) of this section:

(2) Each corner post acting together with its supporting car body structure shall be capable of withstanding the following loads individually applied toward the inside of the vehicle at all angles in the range from longitudinal to lateral:

(i) A 300,000-pound horizontal force applied at a point even with the top of the underframe, without exceeding the ultimate strength of either the post or its supporting car body structure;

(ii) A 100,000-pound horizontal force applied at a point 18 inches above the top of the underframe, without permanent deformation of either the post or its supporting car body structure; and

(iii) A 45,000-pound horizontal force applied at any height along the post above the top of the underframe, without permanent deformation of either the post or its supporting car body structure.

(3) Prior to or during structural deformation, each corner post acting together with its supporting car body structure shall be capable of absorbing a minimum of 120,000 foot-pounds of energy (0.16 megajoule) with no more than 10 inches of longitudinal, permanent deformation into the occupied volume, in accordance with the following:

(i) The corner post shall be loaded longitudinally at a height of 30 inches above the top of the underframe;

(ii) The load shall be applied with a fixture, or its equivalent, having a width sufficient to distribute the load directly into the webs of the post, but of no more than 36 inches and either:

(A) A flat plate with a height of 6 inches; or

(B) A curved surface with a diameter of no more than 48 inches; and

(iii) There shall be no complete separation of the post, its connection to the underframe, its connection to either the roof structure or anti-telescoping plate (if used), or of its supporting car body structure.

(c)(1) Each cab car and MU locomotive ordered on or after May 10, 2010, or placed in service for the first time on or after March 8, 2012, utilizing low-level passenger boarding on the non-operating side of the cab end shall meet the corner post requirements of paragraph (b) of this section for the corner post on the side of the cab containing the control stand. In lieu of the requirements of paragraph (b) of this section, and after FRA review and approval of a plan, including acceptance criteria, to evaluate compliance with this paragraph (c), each such cab car and MU locomotive may have two corner posts on the opposite (non-operating) side of the cab from the control stand meeting all of the requirements set forth in paragraphs (c)(2) through (c)(4) of this section:

(2) One corner post shall be located ahead of the stepwell and, acting together with its supporting car body structure, shall be capable of withstanding the following horizontal loads individually applied toward the inside of the vehicle:

(i) A 150,000-pound longitudinal force applied at a point even with the top of the underframe, without exceeding the ultimate strength of either the post or its supporting car body structure;

(ii) A 30,000-pound longitudinal force applied at a point 18 inches above the top of the underframe, without permanent deformation of either the post or its supporting car body structure;

(iii) A 30,000-pound longitudinal force applied at the point of attachment to the roof structure, without permanent deformation of either the post or its supporting car body structure;

(iv) A 20,000-pound longitudinal force applied at any height along the post above the top of the underframe, without permanent deformation of either the post or its supporting car body structure;

(v) A 300,000-pound lateral force applied at a point even with the top of the underframe, without exceeding the ultimate strength of either the post or its supporting car body structure;

(vi) A 100,000-pound lateral force applied at a point 18 inches above the top of underframe, without permanent deformation of either the post or its supporting car body structure; and

(vii) A 45,000-pound lateral force applied at any height along the post above the top of the underframe, without permanent deformation of either the post or its supporting car body structure.

(3) A second corner post shall be located behind the stepwell and, acting together with its supporting car body structure, shall be capable of withstanding the following horizontal loads individually applied toward the inside of the vehicle:

(i) A 300,000-pound longitudinal force applied at a point even with the top of the underframe, without exceeding the ultimate strength of either the post or its supporting car body structure;

(ii) A 100,000-pound longitudinal force applied at a point 18 inches above the top of the underframe, without permanent deformation of either the post or its supporting car body structure;

(iii) A 45,000-pound longitudinal force applied at any height along the post above the top of the underframe, without permanent deformation of either the post or its supporting car body structure;

(iv) A 100,000-pound lateral force applied at a point even with the top of the underframe, without exceeding the ultimate strength of either the post or its supporting car body structure;

(v) A 30,000-pound lateral force applied at a point 18 inches above the top of the underframe, without permanent deformation of either the post or its supporting car body structure; and

(vi) A 20,000-pound lateral force applied at any height along the post above the top of the underframe, without permanent deformation of either the post or its supporting car body structure.

(4) Prior to or during structural deformation, the two posts in combination acting together with their supporting body structure shall be capable of absorbing a minimum of 120,000 foot-pounds of energy (0.16 megajoule) in accordance with the following:

(i) The corner posts shall be loaded longitudinally at a height of 30 inches above the top of the underframe;

(ii) The load shall be applied with a fixture, or its equivalent, having a width sufficient to distribute the load directly into the webs of the post, but of no more than 36 inches and either:

(A) A flat plate with a height of 6 inches; or

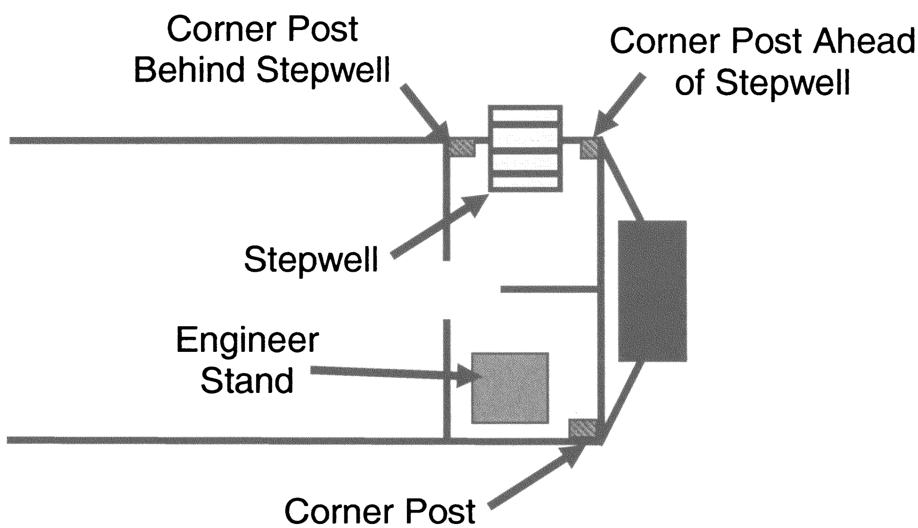
(B) A curved surface with a diameter of no more than 48 inches; and

(iii) The corner post located behind the stepwell shall have no more than 10 inches of longitudinal, permanent deformation. There shall be no complete separation of the corner post located behind the stepwell, its connection to the underframe, its connection to either the roof structure or anti-telescoping plate (if used), or of its supporting car body structure. The corner post ahead of the stepwell is permitted to fail. (A graphical description of the forward end of a cab car or an MU locomotive utilizing low-level passenger boarding on the non-operating side of the cab end is provided in Figure 1 to subpart C of this part.)

7. Add Figure 1 to Subpart C of Part 238 to read as follows:

Figure 1 to Subpart C of Part 238—

DEPICTION OF CORNER POSTS AT FORWARD END OF CAB CAR OR MU LOCOMOTIVE UTILIZING LOW-LEVEL PASSENGER BOARDING ON THE NON-OPERATING SIDE OF THE CAB END



8. Add appendix F to part 238 to read as follows:

Appendix F to Part 238—Alternative Dynamic Performance Requirements for Front End Structures of Cab Cars and MU Locomotives

As specified in § 238.209(b), the forward end of a cab car or an MU locomotive may comply with the requirements of this appendix in lieu of the requirements of either § 238.211 (Collision posts) or § 238.213 (Corner posts), or both. The requirements of this appendix are intended to be equivalent to the requirements of those sections and allow for the application of dynamic performance criteria to cab cars and MU locomotives as an alternative to the requirements of those sections. The alternative dynamic performance requirements are applicable to all cab cars and MU locomotives, and may in particular be helpful for evaluating the compliance of cab cars and MU locomotives with shaped-noses or crash energy management designs, or both. In any case, the end structure must be designed to protect the occupied volume for its full height, from the underframe to the anti-telescoping plate (if used) or roof rails.

The requirements of this appendix are provided only as alternatives to the requirements of §§ 238.211 and 238.213, not in addition to the requirements of those sections. Cab cars and MU locomotives are not required to comply with both the requirements of those sections and the requirements of this appendix, together.

Alternative Requirements for Collision Posts

(a)(1) In lieu of meeting the requirements of § 238.211, the front end frame acting together with its supporting car body structure shall be capable of absorbing a minimum of 135,000 foot-pounds of energy (0.18 megajoule) prior to or during structural deformation by withstanding a frontal impact with a rigid object in accordance with all of the requirements set forth in paragraphs (a)(2) through (a)(4) of this appendix:

(2)(i) The striking surface of the object shall be centered at a height of 30 inches above the top of the underframe;

(ii) The striking surface of the object shall have a width of no more than 36 inches and a diameter of no more than 48 inches;

(iii) The center of the striking surface shall be offset by 19 inches laterally from the center of the cab car or MU locomotive, and on the weaker side of the end frame if the end frame's strength is not symmetrical; and

(iv) Only the striking surface of the object interacts with the end frame structure.

(3) As a result of the impact, there shall be no more than 10 inches of longitudinal, permanent deformation into the occupied volume. There shall also be no complete separation of the post, its connection to the underframe, its connection to either the roof structure or the anti-telescoping plate (if used), or of its supporting car body structure. (A graphical description of the frontal impact is provided in Figure 1 to this appendix.)

(4) The nominal weights of the object and the cab car or MU locomotive, as ballasted, and the speed of the object may be adjusted

to impart the minimum of 135,000 foot-pounds of energy (0.18 megajoule) to be absorbed (Ea), in accordance with the following formula: $E_a = E_0 - E_f$

Where:

E_0 = Energy of initially moving object at impact = ½ $m_1 * V_0^2$.
E_f = Energy after impact = ½ $(m_1 + m_2) * V_f^2$.
V_0 = Speed of initially moving object at impact.
V_f = Speed of both objects after collision = $m_1 * V_0/(m_1 + m_2)$.
m_1 = Mass of initially moving object.
m_2 = Mass of initially standing object.

(Figure 1 shows as an example a cab car or an MU locomotive having a weight of 100,000 pounds and the impact object having a weight of 14,000 pounds, so that a minimum speed of 18.2 mph would satisfy the collision-energy requirement.)

Alternative Requirements for Corner Posts

(b)(1) In lieu of meeting the requirements of § 238.213, the front end frame acting together with its supporting car body structure shall be capable of absorbing a minimum of 120,000 foot-pounds of energy (0.16 megajoule) prior to or during structural deformation by withstanding a frontal impact with a rigid object in accordance with all of the requirements set forth in paragraphs (b)(2) through (b)(4) of this appendix:

(2)(i) The striking surface of the object shall be centered at a height of 30 inches above the top of the underframe;

(ii) The striking surface of the object shall have a width of no more than 36 inches and a diameter of no more than 48 inches;

(iii) The center of the striking surface shall be aligned with the outboard edge of the cab car or MU locomotive, and on the weaker side of the end frame if the end frame's strength is not symmetrical; and

(iv) Only the striking surface of the object interacts with the end frame structure.

(3)(i) Except as provided in paragraph (b)(3)(ii) of this appendix, as a result of the impact, there shall be no more than 10 inches of longitudinal, permanent deformation into the occupied volume. There shall also be no complete separation of the post, its connection to the underframe, its connection to either the roof structure or the anti-telescoping plate (if used), or of its supporting car body structure. (A graphical description of the frontal impact is provided in Figure 2 to this appendix.); and

(ii) After FRA review and approval of a plan, including acceptance criteria, to evaluate compliance with this paragraph (b), cab cars and MU locomotives utilizing low-level passenger boarding on the non-operating side of the cab may have two, full-height corner posts on that side, one post located ahead of the stepwell and one located behind it, so that the corner post located ahead of the stepwell is permitted to fail provided that—

(A) The corner post located behind the stepwell shall have no more than 10 inches of longitudinal, permanent deformation; and

(B) There shall be no complete separation of that post, its connection to the underframe, its connection to either the roof structure or the anti-telescoping plate (if used), or of its supporting car body structure.

(4) The nominal weights of the object and the cab car or MU locomotive, as ballasted, and the speed of the object may be adjusted to impart the minimum of 120,000 foot-pounds of energy (0.16 megajoule) to be absorbed (Ea), in accordance with the following formula: $E_a = E_0 - E_f$

Where:

E_0 = Energy of initially moving object at impact = ½ $m_1 * V_0^2$.
E_f = Energy after impact = ½ $(m_1 + m_2) * V_f^2$.
V_0 = Speed of initially moving object at impact.
V_f = Speed of both objects after collision = $m_1 * V_0/(m_1 + m_2)$.
m_1 = Mass of initially moving object.
m_2 = Mass of initially standing object.

(Figure 2 shows as an example a cab car or an MU locomotive having a weight of 100,000 pounds and the impact object having a weight of 14,000 pounds, so that a minimum speed of 17.1 mph would satisfy the collision-energy requirement.)

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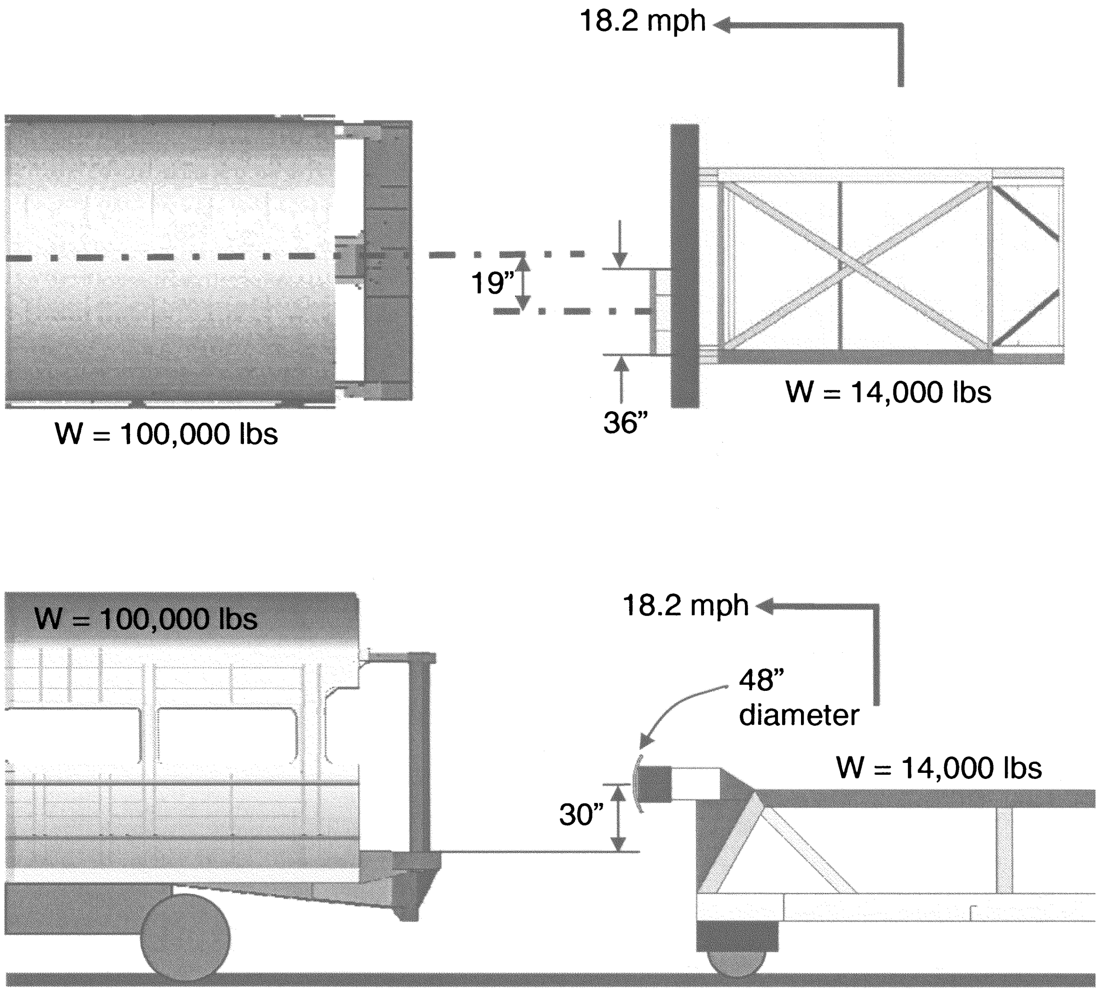
FIGURE 1 TO APPENDIX F OF PART 238–

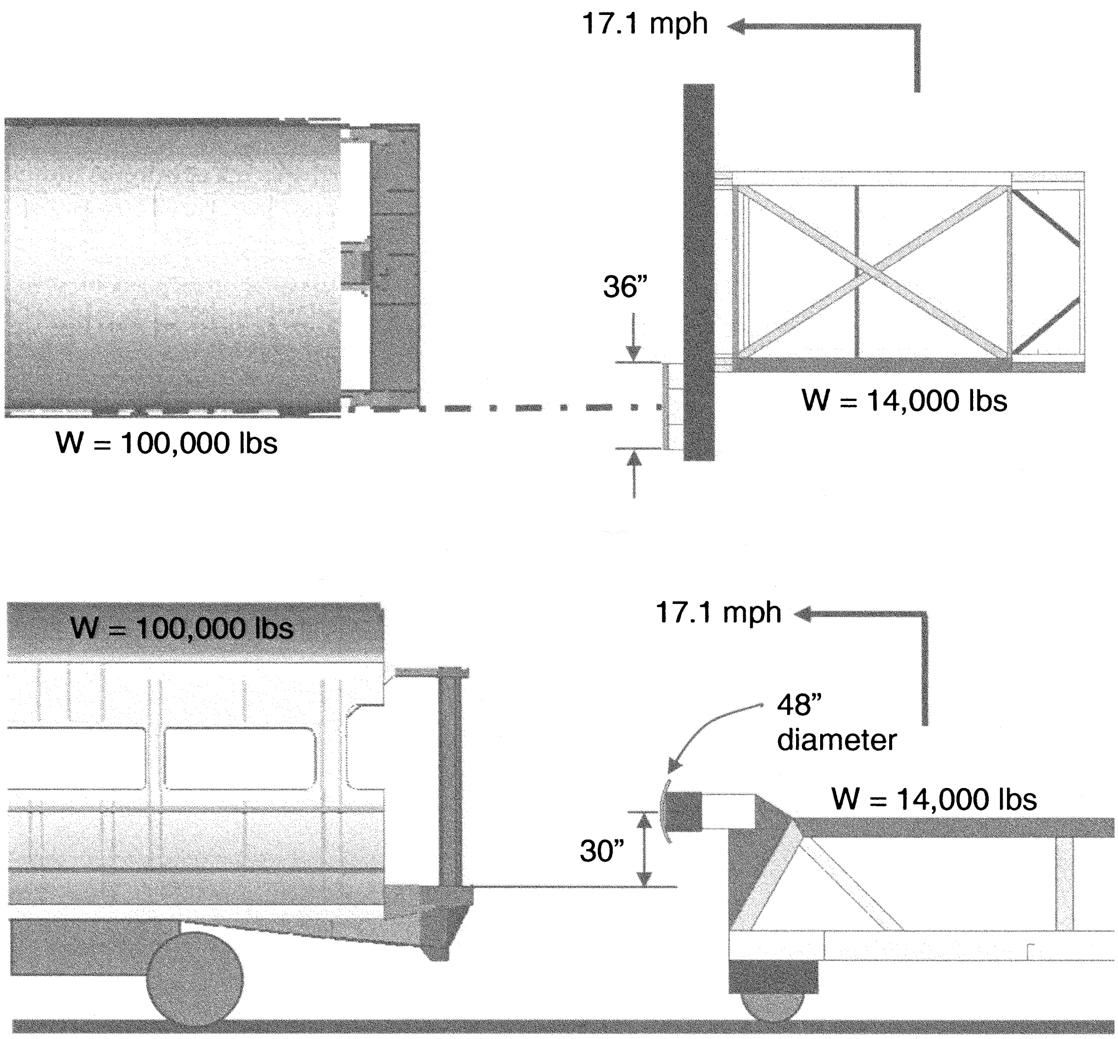
EXAMPLE OF FORWARD END OF CAB CAR OR MU LOCOMOTIVE AT IMPACT WITH PROXY OBJECT TO DEMONSTRATE COMPLIANCE WITH ALTERNATIVE, COLLISION POST PERFORMANCE STANDARD—TOP AND SIDE VIEWS



” = inches.
lbs = pounds.

FIGURE 2 TO APPENDIX F OF PART 238–

EXAMPLE OF FORWARD END OF CAB CAR OR MU LOCOMOTIVE AT IMPACT WITH PROXY OBJECT TO DEMONSTRATE COMPLIANCE WITH ALTERNATIVE, CORNER POST PERFORMANCE STANDARD—TOP AND SIDE VIEWS



” = inches.
lbs = pounds.

Issued in Washington, DC, on December 31, 2009.

Karen J. Rae,

Deputy Administrator.

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