DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
49 CFR PARTS 229, 234, 235, AND 236
[DOCKET NO. FRA-2006-0132, NOTICE NO. 1]
RIN 2130-AC03
POSITIVE TRAIN CONTROL SYSTEMS

ECONOMIC ANALYSIS

Frank D Roskind
Senior Industry Economist
Office of Safety Analysis
202 302 9704

July 10, 2009

Table of Contents

EXECUTIVE SUMMARY

The accompanying proposed rule provides new performance standards for the implementation and operation of Positive Train Control (PTC) systems as mandated by the Railroad Safety Improvement Act of 2008 (RSIA08) and as otherwise voluntarily applied. The proposed rule also details the process and identifies the documents that railroads and operators of passenger trains are to utilize and incorporate in their PTC implementation plans required by RSIA08. The proposal also details the process and procedure for obtaining FRA approval of such plans.

FRA is required to analyze the proposed rule under Executive Order 12866. FRA's analysis presents a 20-year analysis of the costs and benefits associated with FRA's proposed rule, using both 7 percent and 3 percent discount rates, including net present value (PV) and annualized value, which is the annuity required at the discount rate to yield the total over the analysis period. It also presents two types of sensitivity analyses. The first is associated with varying cost assumptions used for estimating PTC implementation costs. The second takes into account potential business benefits from realizing service efficiencies and related additional societal benefits from environmental attainment and an overall reduction in transportation risk from modal diversion.

Safety benefits include:

- Casualties (Value of a Statistical Life= $6 Million)
- Equipment Damage
- Track & Right-of-Way Damage
- Damage Off Right-of-Way
- Hazardous Material Cleanup
- Evacuation (e.g., Hazmat)
- Loss of Lading
- Wreck Clearing
- Train Delays

The 20-year total cost estimates are $10,008 million (PV, 7%) and $13,849 million (PV, 3%). Annualized costs are $945 million (PV, 7%) and $931 million (PV, 3%). Using high-cost assumptions, the 20-year total cost estimates would be $17,122 million (PV, 7%) and $23,761 million (PV, 3%). Using low-cost assumptions, the 20-year cost estimates would be $7,085 million (PV, 7%) and $9,837 million (PV, 3%). Twenty-year railroad safety (railroad accident reduction) benefit estimates associated with implementation of the proposed rule are $608 million (PV, 7%) and $931 million (PV, 3%). Approximately one third of the accident prevention benefits would accrue from avoided fatalities. Annualized benefits are $57 million (PV, 7%), and $63 million (PV, 3%). The costs would make the rule significant, and the costs would far exceed the benefits, but FRA is constrained by the requirements of RSIA08, which does not give FRA any latitude to avoid promulgating the proposed rule, or one which achieves the same ends.

Table E-1, Summary of Costs and benefits

Twenty Year Discounted Values

Discount Rate	3.00%	7.00%
Costs		
Central Office and Development	$283,025,904	$263,232,675
Wayside Equipment	$3,109,098,494	$2,586,453,456
On-Board Equipment	$1,643,839,209	$1,416,706,349
Maintenance	$8,812,624,111	$5,741,220,231
Total	$13,848,587,717	$10,007,612,712
Railroad Safety Benefits	$931,253,681	$607,711,640

FRA has taken several steps to avoid triggering unnecessary costs in the proposed rule. For instance, FRA is not proposing to require use of separate monitoring of switch position in signal territory or that the system be designed to determine the position of the end of the train. FRA also minimized costs by proposing a requirement to monitor derails protecting the mainline, but limiting it to derails connected to the signal system; and by proposing a requirement to monitor hazard detectors protecting the mainline, but limiting it to hazard detectors connected to the signal system. FRA also minimized costs related to diamond crossings, where a PTC equipped railroad crosses a non-PTC equipped railroad at grade; included exceptions to main track for passenger train operations, and proposed provisions that would permit some Class III railroad operation of trains not equipped with PTC over Class I freight lines equipped with PTC. All commuter operations connected to the general railroad system of transportation, which include all current commuter rail operations, would be subject to the proposed rule. Note that Port Authority Trans Hudson Railroad (PATH) is not physically connected to the general freight system yet is considered a commuter railroad for all purposes. PATH formerly was part of the general freight system and remains under FRA safety jurisdiction. Rapid transit systems, such as the Washington Metro Area Transit Authority (WMATA) and New York City Transit Authority (NYCTA), would not be impacted.

Some of the costs of PTC implementation, operation, and maintenance may be offset by business benefits, especially in the long run, although there is uncertainty regarding the timing and level of those benefits. Economic and technical feasibility of the necessary system refinements and modifications to yield the potential business benefits has not yet been demonstrated. Nevertheless, FRA believes that there is opportunity for significant business benefits to accrue several years after implementation once the systems have been refined to the degree necessary. Thus, FRA conducted a sensitivity analysis of potential business benefits from fuel savings attributable to train pacing, precision dispatch, and capacity enhancement.

Developing technology and rising fuel costs have caused the rail supply industry and the railroads to focus on additional means of conserving diesel fuel while minimizing in-train forces that can lead to derailments and delays from train separations (usually broken coupler knuckles). Further integrating this technology with PTC communications platforms and traffic planning capability could permit transmittal of “train pacing” information to the locomotive cab in order to conserve fuel. The diesel fuel use for road operations on the Class I railroads is approximately 3.5 billion gallons annually, which is $8.75 billion at $2.50 per gallon. If PTC helps to potentiate the growth and effective use of train pacing, fuel savings of 5% ($437,500,000 annually) or greater could very likely be achieved. Clearly, if the railroads are able to conserve use of fuel, they will also reduce emissions and contribute to environmental attainment, even before modal diversion occurs.

The improvements in dispatch and capacity have further implications. With those improvements railroads could improve the reliability of shipment arrival time, and thus dramatically increase the value of rail transportation to shippers, who in turn would divert certain shipments from highway to rail. Such diversion would yield greater overall transportation safety benefit since railroads have much lower accident risk than highways, on a point-to-point ton-mile basis.

At present, the PTC systems contemplated by the railroads, with the possible exception of one, would not increase capacity, at least not for some time. If the locomotive braking algorithms need to be made more conservative in order to ensure that trains do not exceed the limits of their authority, PTC may actually decrease rail capacity where applied in the early years. Further investment would be required to bring about the synergy that would result in capacity gains.

Diversion could result in very significant annual highway safety benefits. Of course, these benefits require that the productivity enhancing systems be added to PTC. Modal diversion would also yield environmental benefits. Modal diversion is highly sensitive to service quality. The sensitivity analysis performed by FRA indicates that realization of business benefits could yield benefits sufficient to close the gap between PTC implementation costs and rail accident reduction benefits within the first 20 years of the rule applying a 3% discount rate and by year 25 of the rule, applying a discount rate of 7%. The precise partition of business and societal benefits cannot be estimated with any certainty.

FRA recognizes that the likelihood of business benefits is uncertain and that the cost-to-benefit comparison of this rule, excluding any business benefits, is not favorable. However, FRA has taken measures to minimize the rule's adverse impacts and to provide as much flexibility as FRA is authorized to grant under RSIA08.

INTRODUCTION

The accompanying proposed rule provides new performance standards for the implementation and operation of Positive Train Control (PTC) systems as mandated by RSIA08 and as otherwise voluntarily applied. The proposed rule also details the process and identifies the documents that railroads and operators of passenger trains are to utilize and incorporate in their PTC implementation plans required by the Railroad Safety Improvement Act of 2008. 104, Pub. L. 110-432, 122 Stat. 4848, 4856, (Oct. 16, 2008) (codified at 49 U.S.C. 20157) (hereinafter RSIA08). The proposal also details the process and procedure for obtaining FRA approval of such plans.

FRA began the process of developing a proposed rule after RSIA08 was signed into law on October 16, 2008. While developing the proposed rule, FRA has applied to the rule the performance-based principles embodied in existing subpart H of part 236 to identify and remedy any weaknesses discovered in the subpart H regulatory approach, while exploiting lessons learned from products developed under subpart H. FRA has continued to make performance based safety decisions while supporting railroads in their development and implementation of PTC system technologies.

Development of the proposed rule was enhanced with the participation of the Railroad Safety Advisory Committee (RSAC), which tasked a PTC Working Group to provide advice regarding development of implementing regulations for PTC systems and their deployment that are required under RSIA08. The PTC Working Group made a number of consensus recommendations, which have been identified and included in this proposed rule. The preamble discusses the statutory background, the regulatory background, the RSAC proceedings, the alternatives considered and the rationale for the option selected, the proceedings to date, as well as the comments and conclusions on general issues. Other comments and resolutions are discussed within the corresponding section-by-section analysis.

BACKGROUND

THE NEED FOR POSITIVE TRAIN CONTROL TECHNOLOGY

Since the early 1920s, systems have been in use that can intervene in train operations by warning crews or causing trains to stop if they are not being operated safely because of inattention, misinterpretation of wayside signal indications, or incapacitation of the crew. Pursuant to orders of the Interstate Commerce Commission (ICC)—whose safety regulatory activities were later transferred to the Federal Railroad Administration (FRA) when the FRA was established in 1967—cab signal systems, automatic train control, and automatic train stop systems were deployed on a significant portion of the national rail system to supplement and enforce the indications of wayside signals and operating speed limitations. However, these systems were expensive to install and maintain, and with the decline of intercity passenger service following the Second World War, the ICC allowed many of these systems to be discontinued. During this period railroads were heavily regulated with respect to rates and service responsibilities. The development of the Interstate Highway System and other factors led to reductions in the railroads' revenues without regulatory relief, leading to bankruptcies, railroad mergers, and eventual abandonment of many rail lines. Consequently, railroad managers focused on fiscal survival and investments in expensive relay-based train control technology were economically out of reach. The removal of these train control systems, which had never been pervasively installed, permitted train collisions to continue, notwithstanding enforcement of railroad operating rules designed to prevent them.

As early as 1970, following its investigation of the August 20, 1969, head-on collision of two Penn Central Commuter trains near Darien, Connecticut, in which 4 people were killed and 45 people were injured, the National Transportation Safety Board (NTSB) asked the FRA to study the feasibility of requiring a form of automatic train control system to protect against operator error and prevent train collisions. Following the Darien accident, the Safety Board continued to investigate one railroad accident after another caused by human error. During the next two decades, the Board issued a number of safety recommendations asking for train control measures. Following its investigation of the May 7, 1986, rear-end collision involving a Boston and Maine Corporation commuter train and a Conrail freight train in which 153 people were injured, the Safety Board asked the FRA to promulgate standards to require the installation and operation of a train control system that would provide for positive train separation (R-87-16). When the NTSB first established its Most Wanted List of Transportation Safety Improvements in 1990, the issue of Positive Train Separation was among the improvements listed, and it remained on the list until just after enactment of the RSIA. The NTSB continues to follow the progress of implementation closely and participated through staff in the PTC Working Group deliberations.

Meanwhile, enactment of the Staggers Rail Act of 1980 signaled a shift in public policy that permitted the railroads to shed unprofitable lines, largely replace published "tariffs" with appropriately priced contract rates, and generally respond to marketplace realities, which increasingly demanded flexible service options responsive to customer needs. The advent of microprocessor-based electronic control systems and digital data radio technology during the mid-1980s led the freight railroad industry, through the Association of American Railroads (AAR) and the Railway Association of Canada, to explore the development of Advanced Train Control Systems (ATCS). With broad participation by suppliers, railroads, and the FRA, detailed specifications were developed for a multi-level "open" architecture that would permit participation by many suppliers while ensuring that systems deployed on various railroads would work in harmony as trains crossed corporate boundaries. ATCS was intended to serve a variety of business purposes, in addition to enhancing the safety of train operations.

Pilot versions of ATCS and a similar system known as Advanced Railroad Electronic Systems (ARES) were tested relatively successfully, but the systems were never deployed on a wide scale primarily due to cost. However, sub-elements of these systems were employed for various purposes, particularly for replacement of pole lines associated with signal systems.

Collisions, derailments, and incursions into work zones used by roadway workers continued as a result of the absence of effective enforcement systems designed to compensate for effects of fatigue and other human factors. Renewed emphasis on rules compliance and federal regulatory initiatives, including rules for control of alcohol and drug use in railroad operations, operating rules testing of rail employees, requirements for qualification and certification of locomotive engineers, and negotiated rules for roadway worker protection led to some reduction in risk, but the lack of an effective collision avoidance system still allowed the continued occurrence of accidents, some involving tragic losses of life and significant property damage.

EARLIER EFFORTS TO ENCOURAGE VOLUNTARY PTC IMPLEMENTATION

As the NTSB continued to highlight the opportunities for accident prevention associated with emerging train control technology through its investigations and findings, the Congress showed increasing interest, mandating three separate reports over the period of a decade. In 1994, the FRA reported to the Congress on this problem, calling for implementation of an action plan to deploy PTC systems (Railroad Communications and Train Control, July 1994 (hereinafter "1994 Report")). The 1994 Report forecasted substantial benefits of advanced train control technology to support a variety of business and safety purposes, but noted that an immediate regulatory mandate for PTC could not be currently justified based upon normal cost-benefit principals relying on direct safety benefits. The report outlined an aggressive Action Plan implementing a public-private sector partnership to explore technology potential, deploy systems for demonstration, and structure a regulatory framework to support emerging PTC initiatives.

Following through on the 1994 Report, FRA committed approximately $40 million through the Next Generation High Speed Rail Program and the Research and Development Program to support development, testing, and deployment of PTC prototype systems in the Pacific Northwest, Michigan, Illinois, Alaska, and the Eastern railroads. As called for in the Action Plan, FRA also initiated a comprehensive effort to structure an appropriate regulatory framework for facilitating voluntary implementation of PTC and for evaluating future safety needs and opportunities.

In September of 1997, the Federal Railroad Administrator asked the RSAC to address the issue of Positive Train Control. The RSAC accepted three tasks: Standards for New Train Control Systems (Task 1997-06), Positive Train Control Systems-Implementation Issues (Task 1997-05) and Positive Train Control Systems-Technologies, Definitions, and Capabilities (Task 1997-04) The PTC Working Group was established, comprised of representatives of labor organizations, suppliers, passenger and freight railroads, other federal agencies, and interested state departments of transportation. The PTC Working Group was supported by the FRA counsel and staff, analysts from the Volpe National Transportation Systems Center, and advisors from the NTSB staff.

In 1999, the PTC Working Group provided to the Federal Railroad Administrator a consensus report ("1999 Report") with an indication that it would be continuing its efforts. The report defined the PTC core functions to include: prevention of train-to-train collisions (positive train separation); enforcement of speed restrictions, including civil engineering restrictions (curves, bridges, etc.) and temporary slow orders; and protection for roadway workers and their equipment operating under specific authorities. The PTC Working Group identified additional safety functions that might be included in some PTC architectures: provide warning of on-track equipment operating outside the limits of authority; receive and act upon hazard information, when available, in a more timely or more secure manner (e.g., compromised bridge integrity, wayside detector data); and provide for future capability by generating data for transfer to highway users to enhance warning at highway-rail grade crossings. The PTC Working Group stressed that efforts to enhance highway-rail grade crossing safety must recognize the train's necessary right of way at grade crossings and that it is important that warning systems employed at highway-rail grade crossings be highly reliable and "fail-safe" in their design.

As the PTC Working Group's work continued, other collaborative efforts, including development of Passenger Equipment Safety Standards (including private standards through the American Public Transit Association), Passenger Train Emergency Preparedness rules, and proposals for improving locomotive crashworthiness (including improved fuel tank standards) have targeted reduction in collision and derailment consequences.

In 2003, in light of technological advances and potential increased cost and system savings related to prioritized deployment of these systems, the Appropriations Committees of the Congress requested FRA to update the costs and benefits for the deployment of PTC and related systems. As requested, FRA carried out a detailed analysis that was filed in August of 2004 ("2004 Report"), which indicated that under one set of highly controversial assumptions, substantial public benefits would likely flow from the installation of PTC systems on the railroad system. Further, the total amount of these benefits was subject to considerable controversy. While many of the other findings of the 2004 Report were disputed, there was no data submitted to challenge the 2004 Report finding that reaffirmed earlier conclusions that the safety benefits alone of PTC systems were relatively small in comparison to the large capital and maintenance costs. Accordingly, FRA continued to believe that an immediate regulatory mandate for widespread PTC implementation could not be justified based upon normal cost-benefit principles relying on direct railroad safety benefits.

Despite the economic infeasibility of PTC based on safety benefits alone, as outlined in the 1994, 1999, and 2004 Reports, FRA continued with regulatory and other efforts to facilitate and encourage the voluntary installation of PTC systems. As part of the High Speed Rail Initiative, and in conjunction with the National Railroad Passenger Corporation (Amtrak), the Association of American Railroads (AAR), the State of Illinois, and the Union Pacific Railroad Company (UP), FRA created the North American Joint Positive Train Control (NAJPTC) Program, which set out to describe a single standardized open source PTC architecture and associated standards. UP's line between Springfield and Mazonia, Illinois, was selected to initial installation of a train control system to support Amtrak operations up to 110 mph, and the system was installed and tested on portions of that line. Although the system did not prove viable as then conceived, the project hastened the development of PTC technology that was subsequently employed in other projects. Promised standards for interoperability of PTC systems also proved elusive.

In addition to financially supporting the NAJPTC Program, FRA continued to work with the rail carriers, rail labor, and suppliers on regulatory reforms to facilitate voluntary PTC implementation. The regulatory reform effort culminated when FRA issued a final rule on March 7, 2005, establishing a technology neutral safety-based performance standard for processor-based signal and train control systems. This new regulation, codified as subpart H to part 236 of title 49 of the Code of Federal Regulations (CFR), was carefully crafted to encourage the voluntary implementation and operation of processor-based signal and train control systems without impairing technological development. 70. Fed. Reg. 11052 (Mar. 7, 2005).

FRA intended for the final rule--developed in close cooperation with rail management, rail labor, and suppliers--to further facilitate individual railroad efforts to voluntarily develop and deploy cost effective PTC technologies that would make system-wide deployment more economically viable. It also appeared very possible that major railroads would elect to make voluntary investments in PTC to enhance safety, improve service quality and foster efficiency (e.g., better asset utilization, reduced fuel use through train pacing).

TECHNOLOGY ADOPTED BEFORE RSIA08

While FRA and RSAC worked to develop consensus on the regulations that would become subpart H, the railroads continued with PTC prototype development. The technology neutral, performance-based regulatory process established by subpart H proved to be very successful in facilitating the development of other PTC implementation approaches. Although the railroads prototype development efforts were generally technically successful and offered significant improvements in safety, costs of nationwide deployment continued to be untenable. Information gained from prototype efforts did little to reduce the estimated costs for widespread implementation of the core PTC safety functions on the nation's railroads.

Working under subpart H, UP, CSX Transportation, Inc. (CSX), the BNSF Railway Company (BNSF), and the Norfolk Southern Corporation (NS) undertook more aggressive design and implementation work. The new subpart H regulatory approach also made it feasible for smaller railroads such as the Alaska Railroad and the Ohio Central Railroad to begin voluntary design and implementation work on PTC systems that best suited their needs. FRA provided, and continues to provide, technical assistance and guidance regarding regulatory compliance to enable the railroads to more effectively design, install, and test their respective systems.

In December 2006, FRA approved the initial version of the Electronic Train Management System (ETMS) product for deployment on 35 of BNSF's subdivisions ("ETMS I Configuration") comprising single track territory which was either non-signaled or equipped with traffic control systems. In a separate proceeding, FRA agreed that ETMS could be installed in lieu of restoring a block signal system on a line for which discontinuance had been authorized followed by a significant increase in traffic. During the same period BNSF successfully demonstrated a Switch Point Monitoring System (SPMS)[1] and Track Integrity Warning System (TIWS)[2], a system that electronically reports to the railroad's central dispatching office or the crew of an approaching train if there are any breaks in the rail that might lead to derailments—both of which FRA believes are technologies that help to reduce risk in non-signaled territory and that are forward-compatible with PTC. To be forward-compatible, not to be confused with the similar concept of extensibility, a system must be able to gracefully accept input intended for use in later system versions. The introduction of a forward compatible technology implies that old devices can partly understand data generated by new devices. The concept can be applied to electrical interfaces, telecommunication signals, data communication protocols, file formats, and computer programming languages. A standard supports forward compatibility if older product versions can receive, read, view, play or execute the new standard.

In addition to scheduling the installation of the ETMS I Configuration as capital funding became available, BNSF voluntarily undertook the design and testing of complementary versions of ETMS that would support BNSF operations on more complex track configurations, at higher allowable train speeds, and with additional types of rail traffic. Meanwhile, CSXT was in the process of redesigning and relocating the test bed for it its Communications Based Train Management (CBTM) system, which it has tested for several years, and UP and NS were working on similar systems using vital on-board processing.

As congressional consideration of legislation that resulted in the RSIA commenced, all four major railroads had settled on the core technology developed for them by Wabtec Railway Electronics. As the legislation progressed, the railroads and Wabtec worked toward greater commonality in the basic functioning of the on-board system with a view toward interoperability. Accordingly, ETMS is now a generic architectural description of one type of PTC system. Examples of ETMS include the non-vital PTC systems of BNSF's ETMS I and ETMS II, CSXT's Communications

---

[1] Switch Point Monitoring Systems (SPMS) are systems that contain devices attached to switches that electronically report the position of the switches to the railroads central dispatching office and/or the crew of an approaching train.

[2] Track Integrity Warning Systems (TWIS) are systems that electronically report to the railroad's central dispatching office and/or the crew of an approaching train if there are any breaks in the rail that might lead to derailments.

CBTM UP's Vital Train Management System (VTMS) and NS's Optimized Train Control (OTC). Further work is been undertaken by BNSF to further the capability of ETMS by integrating Amtrak operations (ETMS III). For a description of system enhancements planned by BNSF as of the Product Safety Plan filing, see FRA Docket No. 2006-23687, Document 0017, at pp. 40-43 (at Regulations.gov).

While the freight railroads' efforts for developing and installing PTC systems progressed over a relatively long period of time, starting with demonstrations of ATCS and ARES in the late 1980s and culminating in the initial Product Safety Plan approval in December of 2006, the National Railroad Passenger Corporation (Amtrak) demonstrated its ability to turn on revenue-quality PTC systems on its own railroad in support of high speed rail.

Beginning in the early 1990's, Amtrak developed plans for enhanced high speed service on the Northeast Corridor (NEC), which included electrification and other improvements between New Haven and Boston and introduction of the Acela trainsets as the premium service from Washington to New York and New York to Boston. In connection with these improvements, which support train speeds up to 150 mph, Amtrak undertook to install the Advanced Civil Speed Enforcement System (ACSES) as a supplement to existing cab signals and automatic train control (speed control). Together, these systems deliver PTC core functionalities. In support of this effort, FRA issued an order for the installation of the system, which required all passenger and freight operators in the New Haven-Boston segment to equip their locomotives with ACSES (63 FR 39343; July 22, 1998). ACSES was installed between 2000 and 2002, and has functioned successfully between New Haven and Boston, and on selected high speed segments between Washington and New York for a number of years.

Amtrak voluntarily began development of an architecturally different PTC system, the Incremental Train Control System (ITCS), for installation on its Michigan Line. Amtrak developed and installed ITCS under waivers from specific sections of 49 CFR part 236, subparts A through G, granted by FRA. ITCS was applied to tenant NS locomotives as well as Amtrak locomotives traversing the route. Highway-rail grade crossings on the route were fitted with ITCS units to pre-start the warning systems for high-speed trains and to monitor crossing warning system health in real time. The system was tested extensively in the field for safety and reliability, and it was put in revenue service in 2001. As experience was gained, FRA authorized increases in speed to 95 mph; and FRA is currently awaiting final results of an independent assessment of verification and validation for the system with a view toward authorizing operations at the design speed of 110 mph.

Despite these successes, the widespread deployment of these various train control systems, particularly on the general freight system, remained very much constrained by prohibitive capital costs. While the railroads were committed to installing these new systems to enhance the safety afforded to the public and their employees, the railroad's actual widespread implementation remained forestalled due to an inability to generate sufficient funding for these new projects in excess of the capital expenditures necessary to cover the ongoing operating and maintenance costs. Accordingly, the railroads continued to plan very slow deployments of PTC system technologies.

THE RAIL SAFETY IMPROVEMENT ACT OF 2008

On May 1, 2007, the House of Representatives introduced H.R. 2095, which would, among other things, mandate the implementation and use of PTC systems. The bill passed the House on October 17, 2007, and passed the Senate after amendment on August 1, 2008. On September 24, 2008, the House concurred with the Senate amendment with another amendment pursuant to H. Res. 1492, and on October 1, 2008, the Senate concurred with the House amendment. When considering the House's amendment on October 1, various Senators made statements referencing earlier train accidents that were PTC-preventable. For instance, Senator Lautenberg (NJ) took notice of the collision at Graniteville, South Carolina in 2005, and Senators Lautenberg, Hutchinson (TX), Boxer (CA), Levin (MI), and Carper (DE) took notice of an accident at Chatsworth, California, on September 12, 2008. According to Senator Levin, federal investigators have said that a collision warning system could have prevented that crash and the subject legislation would require that new technology to prevent crashes be installed in high risk tracks. Senators Carper and Boxer made similar statements, indicating that PTC systems are designed to prevent train derailments and collisions, like the one in Chatsworth. Congressional Record 10283-10290, Oct. 1, 2008.

The Graniteville accident referenced by Senator Lautenberg was an early morning collision between two NS trains in non-signal (dark) territory near the Avondale Mills Textile plant. One of the trains—which was transporting chlorine gas, sodium hydroxide, and cresol—approached an improperly lined hand-operated switch. As the train diverged through the switch, it ran onto the siding track where it collided with a parked train. Various tank cars ruptured, releasing at least 90 tons of chlorine gas. Nine people died due to chlorine inhalation, and at least 250 people were treated for chlorine exposure. In addition, 5,400 residents within a mile of the crash site were forced to evacuate for nearly two weeks while hazardous materials (hazmat) teams and cleanup crews decontaminated the area.

The Chatsworth train collision occurred on the afternoon of September 12, 2008, when a Union Pacific freight train and a Metrolink commuter train collided head-on a single main track equipped with a Traffic Control System (TCS) in the Chatsworth district of Los Angeles, California. Although NTSB has not yet released its final report, evidence summarized at the NTSB's public hearing suggested that the Metrolink passenger train operated past a signal displaying a stop indication and entered a section of single track where the opposing UP freight train was operating on a signal indication permitting it to proceed over a switch and into a siding (after which the switch would have been lined for the Metrolink train to proceed). As a consequence of the accident, 25 people died and over 130 more were seriously injured.

Prior to the accidents in Graniteville and Chatsworth, the railroads' slow incremental deployment of PTC technologies—while not uniformly agreed upon by the railroads, FRA, and NTSB—was generally deemed acceptable by them in view of the tremendous costs involved. Partially as a consequence and severity of these very public accidents, coupled with a series of other less publicized accidents, Congress passed the RSIA08 into law on October 16, 2008, marking a public policy decision that, despite the implementation costs, railroad employee and general public safety warranted mandatory and accelerated installation and operation of PTC systems.

As immediately relevant to this rulemaking, the RSIA08 requires the installation and operation of PTC systems on all main lines, meaning all intercity passenger and commuter railroad lines—with limited exceptions entrusted to FRA—and on freight-only lines when they are owned by Class I railroads, carrying at least 5 million gross tons of freight annually, and carrying any amount of toxic by inhalation (TIH) materials.

In RSIA08, Congress established very aggressive dates for PTC system build-out completion. Each subject railroad must submit to FRA by April 16, 2010, an implementation plan indicating where and how it intends to install PTC systems by December 31, 2015. As a result of this accelerated PTC system deployment schedule, railroads must engage in a massive reprogramming of capital funds.

In light of timetable instituted by Congress, and to better support railroads with their installation while maintaining safety, FRA decided that it is appropriate for mandatory PTC systems to be reviewed by FRA differently than the regulatory approval process provided under subpart H. FRA believes that it is important to develop a process more suited specifically for PTC systems that would better facilitate railroad reuse of safety documentation and simplify the process of showing that the installation of the PTC system did not degrade safety. FRA also believes that subpart H does not clearly address the statutory mandates and that such lack of clarity would complicate railroad efforts to comply with the new statutory requirements. Accordingly, FRA is proposing to amend part 236 by modifying existing subpart H and adding a new subpart I.

RSAC

In March 1996, FRA established the RSAC, which provides a forum for collaborative rulemaking and program development. The Committee includes representation from all of the agency’s major customer groups, including railroads, labor organizations, suppliers and manufacturers, and other interested parties. When appropriate, FRA assigns a task to RSAC, and after consideration and debate, RSAC may accept or reject the task. If accepted, RSAC establishes a working group that possesses the appropriate expertise and representation of interests to develop recommendation to FRA for action on the task. These recommendations are developed by consensus. The working group may establish one or more task forces or other subgroups to develop facts and options on a particular aspect of a given task. The task force, or other subgroup, reports to the working group. If a working group comes to consensus on recommendations for action, the package is presented to the RSAC for a vote. If the proposal is accepted by a simple majority of the RSAC, the proposal is formally recommended to FRA. FRA then determines what action to take on the recommendation. Because FRA staff has played an active role at the working group and subgroup levels in discussing the issues and options and in drafting the language of the consensus proposal, and because the RSAC recommendation constitutes the consensus of some of the industry's leading experts on a given subject, FRA is generally 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 recommended rule achieves the agency's regulatory goals, is soundly supported, and was developed in accordance with the applicable policy and legal requirements. Often, FRA varies in some respects from the RSAC recommendation in developing the actual regulatory proposal.

In developing the proposed rulemaking, FRA adopted the RSAC PTC working group and task force approach to ensure that the new regulation is neither arbitrary nor capricious or exceeds its statutory authority. As part of this effort, FRA is working with the major stakeholders affected by this subpart in as much a collaborative manner as possible. FRA believes establishing a collaborative relationship early in not only the product development cycle, but the regulatory development cycle, can help to bridge the divide between the railroad carrier's management, railroad labor organizations, the suppliers, and the FRA by ensuring that all stakeholders are working with the same set of data and have a common understanding of product characteristics or their related processes production methods, including the regulatory provisions, with which compliance is mandatory. However, where the group fails to reach consensus on a recommendation proposed by the various stakeholders, FRA will resolve the issue on its own, attempting to reconcile as many of the divergent positions as possible through traditional rulemaking proceedings.

PTC WORKING GROUP

On December 10, 2008, the RSAC accepted a task (No. 08-04) entitled "Implementation of Positive Train Control Systems." The purpose of this task was defined as follows: "To provide advice regarding development of implementing regulations for Positive Train Control (PTC) systems and their deployment under the Rail Safety Improvement Act of 2008." The task called for the RSAC PTC Working Group to perform the following:

1. Review the mandates and objectives of the Act related to deployment of PTC systems;
2. Help to describe the specific functional attributes of systems meeting the statutory purposes in light of available technology;
3. Review impacts on small entities and ascertain how best to address them in harmony with the statutory requirements;
4. Help to describe the details that should be included in the implementation plans that railroads must file within 18 months of enactment of the Act;
5. Offer recommendations on the specific content of implementing regulations; and
6. The task also required the PTC Working Group to:
7. Report on the functionalities of PTC systems;
8. Describe the essential elements bearing on interoperability and the requirements for consultation with other railroads in joint operations; and
9. Determine how PTC systems will work with the operation of non-equipped trains.

From January to April 2009, FRA met with the entire PTC Working Group five times over the course of twelve days. During those meetings, in order to efficiently accomplish the tasks assigned to it, the PTC Working Group empowered three task forces to work concurrently. These task forces included the passenger, short line and regional railroad, and the radio and communications task forces. Each discussed issues specific to their particular interests and needs and produced proposed rule language for the PTC Working Group's consideration. The majority of the proposals were adopted into the proposed rule as agreed upon by the working group, with rule language related to a remaining few issues being further discussed and enhanced for inclusion into the rule by the PTC Working Group.

The passenger task force discussed testing issues relating to parts 236 and 238 and the definition of "main line" under the statute, including possible passenger terminal and limited operations exceptions to PTC implementation. Recommendations of the task force were presented to the Working Group, which adopted or refined each suggestion.

The short line and regional railroad task group was formed to address the questions pertaining to Class II and Class III railroads. Specifically, the group discussed issues regarding the trackage rights of Class II and III railroads using trains not equipped with PTC technology over a Class I railroad's PTC territory, passenger service over track owned by a Class II or Class III railroads where PTC would not otherwise be required, and railroad crossings at grade involving a Class I railroad's PTC equipped train and an Class II or III railroad's PTC unequipped train. After much discussion, there were no resolutions reached on any of the main issues raised. However, the discussion yielded insights utilized by FRA in preparing this proposed rule.

The radio and communications task force addressed wireless communications issues, particularly as they relate to communications security, and recommended language for proposed § 236.1033.

FRA staff worked with the PTC Working Group and its task forces. FRA gratefully acknowledges the participation and leadership of representatives who served on the PTC Working Group and its task forces. These points are discussed to show the origin of certain issues and the course of discussion on these issues at the task force and working group levels. We believe this helps illuminate the factors FRA weighed in making its regulatory decisions regarding this proposed rule and the logic behind those decisions.

In general, the PTC working group agreed on the process for implementing PTC under the statute, including decisional criteria to be applied by FRA in evaluating safety plans, adaptation of subpart H principles to support this mandatory implementation, and refinements to subpart H and the part 236 appendices necessary to dovetail the two regulatory regimes and take lessons from early implementation of subpart H, including most aspects of the training requirements. Notable accords were reached, as well, on major functionalities of PTC and on exceptions applicable to passenger service (terminal areas and main line exceptions). Major areas of disagreement included whether to allow non-equipped trains on PTC lines, extension of PTC to lines not within the statutory mandate, and whether to provide for additional displays when two or more persons are regularly assigned duties in the cab. Some additional areas of concern were discussed but could not be resolved in the time available. It was understood that where discussion did not yield agreement, FRA would make proposals and receive public comment.

In the section-by section analysis, FRA presents the actual proposal, but the main focus of this analysis is to show how FRA exercised its understanding of the railroad industry and the Congressional intent behind RSIA08 to arrive at a regulatory program that avoids unintended burdens where permitted under Congressional intent, yet delivers the level of safety which Congress intended. It is difficult, if not impossible, to estimate the contribution to total costs of each section separately. Even estimating the total costs of installing PTC requires some degree of speculation, as no entity is procuring PTC on the scale required by RSIA08, or on its aggressive installation timeline. In general, the less time an entity takes to make a major acquisition, the more it has to pay for it, because both supply elasticity and demand elasticity are lower with shorter timeframes. Further, any design difficulties will be exacerbated by the short timeframes. On the other hand, widespread acquisition of large number of units will allow development costs to be amortized over a large number of units, and the unit cost of development will be relatively lower, all else equal.

USE OF PERFORMANCE STANDARDS

Given the statutory mandate for the implementation of PTC systems, FRA intends the proposed rule to accelerate the promotion of, and not hinder, cost effective technological innovation by encouraging an efficient utilization of resources, an increased level of competition, and more innovative user applications and technological developments. FRA believes that, wherever possible, regulation must allow technologies the full freedom to exploit market opportunities, must support the challenges and opportunities resulting from the combination of emerging and varying technologies within an evolving marketplace, and should not discriminate between PTC systems vendors due to the technology or services provided.

Accordingly, wherever possible FRA has refrained from developing technical or design standards, or even requiring implementation of particular PTC technologies that may prevent technological innovation or the development of alternative means to achieve the statutorily defined PTC functions. If FRA were to implement specific technical standards, emerging technologies may render those standards obsolete, but nevertheless required. Implementation of systems by the railroads using new technologies that are not addressed by the standards would require railroads and FRA to manage the deployment using a cumbersome and time consuming waiver process. For the same reasons FRA expressed in the final rule implementing subpart H (70 Fed. Reg. 11052, 11055-11059 (Mar. 7, 2005)), FRA continues to believe that it is best to pursue a performance-based standard while providing sufficient basic parameters within which the system's architectures and functionalities must be developed, implemented, and maintained.

Like subpart H, the proposed subpart I provides for the same level of product confidence and versatility in determining what PTC technology a railroad may elect to implement and operate, even if the railroad chooses to modify its PTC system over time. Unlike subpart H, however, the proposed subpart I requires specific deployment of PTC while simplifying the application process, potentially reducing the size of the regulatory filings through facilitation of safety documentation reuse, and more narrowly defining the required performance targets based on railroad operations and in terms of more specific functional PTC behaviors. The approach under subpart I also reduces the likelihood of continually changing safety targets, which may vary based on each railroad's safety culture, and provides for incremental improvements in safety in coordination with FRA.

To ensure sufficient confidence in each PTC system implemented under subpart I, FRA expects that all safety- and risk-related data be supported by credible evidence or information. Such credible evidence or information may be developed through laboratory or field testing, augmented by appropriate analysis and inspection, which may be monitored or reviewed by FRA. FRA expects that as a practical matter, lab testing should be performed in the majority of cases. FRA does not believe it is necessary to require any railroad to lab test. However, field testing may be required in certain instances to test certain points of the PTC system in various conditions.

If the railroad or FRA determines that the complexity of the technology or the supporting safety case warrants, credibility of this information may also be evaluated through an assessment of Verification and Validation performed by an acceptable independent third party selected and paid for the railroad, subject to FRA approval. Ultimately, however, it is FRA's responsibility to determine whether each PTC system's performance results in an acceptable level of safety to railroad employees and the general public and whether any such system shall receive PTC System Certification, as required by statute.

In order to provide meaningful flexibility, FRA is prepared to consider use of alternative risk analysis methods and proposals regarding the extent to which a product exhibits fail-safe behavior. FRA still emphasizes that higher speed and higher risk rail service should be supported by more highly competent train control technology and analysis.

FRA recognizes that there may potentially be various PTC system configurations and a variety of operational scopes involved. FRA believes that the information requested under subpart I should be sufficient to permit FRA to predict whether the PTC system is fully adequate from a safety perspective. Subparts H and I require submission of similar technical data. Given the degree of uncertainty associated with the underlying analysis of a complex PTC system and its environs, subpart I—much like subpart H—requires application of FRA's judgment and expertise. Given the underlying analysis' complexity—and FRA's need to ensure an acceptable level of safety and analytical uniformity between functionally equivalent but architecturally different systems—it is incumbent upon the subject railroad, possibly in concert with the vendor, supplier, or manufacturer of its PTC system, to make a persuasive case in its filings that the applicable performance standards are met. Primarily, the risk assessments required by the proposed rule should provide an objective measure of the safety risk levels involved, which will be reviewed by FRA for comparison purposes. As such, FRA believes that each risk assessment should determine relative risk levels, rather than absolute risk levels, but against a clearly delineated base case acceptable to FRA under the proposed regulation.

The primary goal of the risk assessment required by this rule is to give an objective measure of the levels of safety risk involved for comparison purposes. As such, FRA believes the focus of the risk assessment ought to be the determination of relative risk levels, rather than absolute risk levels. Thus, this proposed rule attempts to emphasize the determination of relative risk. FRA believes that the guidelines captured in Appendix B adequately state the objectives and major considerations of any risk assessment it would expect to see submitted per subpart I. FRA also feels that these guidelines allow sufficient flexibility in the conduct of risk assessments, yet provide sufficient uniformity by helping to ensure final results are presented in familiar units of measurement.

One of the major characteristics of a risk assessment is determined by the extent to which it is performed using qualitative and quantitative methods. FRA continues to believe that both quantitative and qualitative risk assessment methods may be used, as well as combinations of the two. FRA expects that qualitative methods should be used only where appropriate, and only when accompanied by an explanation as to why the particular risk cannot be fairly quantified. FRA also continues to believe that railroads and suppliers should not be limited in the type of risk assessments they should be allowed to perform to demonstrate compliance with the minimum performance standard. The state of the art of risk assessment methods could potentially change more quickly than the regulatory process will allow, and not taking advantage of these innovations could slow the progress of implementation of safer signal and train control systems. Thus, as in subpart H, FRA is allowing risk assessment methods not meeting the guidelines of this rule, so long as it can be demonstrated to the satisfaction of the FRA Associate Administrator for Railroad Safety/Chief Safety Officer (hereinafter Associate Administrator) that the risk assessment method used is suitable in the context of the particular PTC system. FRA believes this determination is best left to the Associate Administrator because the FRA retains authority to ultimately prevent implementation of a system whose plans do not adequately demonstrate compliance with the performance standard under the proposed rule.

FRA is aware that some types of risk are more amenable to measurement by using certain methods rather than others because of the type and amount of data available. If a railroad does elect to use different risk assessment methods, FRA will consider this as a factor for PTC System Certification (see § 236.1015). Also, in such cases, when the margin of uncertainty has been inadequately described, FRA will be more likely to require FRA monitored field or laboratory testing (see § 236.1035) or an independent third-party assessment (see § 236.1017).

When FRA issued the final rule establishing subpart H, FRA considered the criteria of simplicity, relevancy, reliability, cost, and objectivity. FRA believes that these criteria remain applicable. FRA has attempted to make the requirements under subpart I simpler to the requirements of subpart H, so that railroads will be provided with a greater deal of flexibility to more easily demonstrate that its PTC system is certifiable by FRA. Like subpart H, subpart I focuses on the safety-relevant characteristics of systems and emphasizes all relevant aspects of product performance. FRA also drafted performance standards that can be applied reliably and precisely in a manner which should yield similar results each time it is applied to the same subject. Although RSIA08 appears to make cost a consideration secondary to safety, FRA believes that demonstrating compliance under subpart I should minimize those costs when not degrading the primary objective of public safety. FRA also believes that subpart I includes an objective performance standard whereas compliance can be determined through sound engineering analysis, testing, or investigation.

Although FRA generally prefers performance standards to specification standards, and has used a performance standard in the accompanying rulemaking, in this case, the preference is almost irrelevant, because FRA believes that it would not have been possible to develop a specification standard for PTC in the time allotted, and were such a standard developed, it would have been far more costly. Many of the provisions detailed below are those required to promulgate the performance standard. FRA gained significant experience in administering subpart H, and has, except where noted below, merely done what it can to transform a standard that could be applied if the railroad volunteered into a standard that could be applied in a mandatory program. The most obvious examples of this are minimum standards for what functions the systems must perform, and the level of safety at which these systems must perform those functions. Under subpart H there would not have been any problem implementing a system that performed just one of the core functions, as long as it yielded a net improvement in safety, but under subpart I it must perform all four core functions. Further, under subpart H it would have been acceptable to provide only a small improvement in safety, but under subpart I a system must either perform as well as a vital system or must yield an 80% reduction in risk. FRA believes that these standards are the least that would satisfy Congressional intent.

Another major difference in subpart I is the use of Type certification. Under subpart H each system would have needed approval on each railroad implementing it. Type approval has the potential to lessen that burden. FRA has learned from administering performance standards that it is not necessary to repeat proofs of performance on each railroad or line segment. This has become an issue in vehicle-track interaction standards under parts 213 and 238, and FRA is at present developing standards to ease that problem. The Type certification process would not add any new costs; it would probably reduce costs, make it easier to track PTC system performance across diverse railroads, and facilitate installation under the aggressive schedule mandated by RSIA08. The use of the Type certification process would be optional, but FRA believes that any new systems would take advantage of such process.

FRA did not analyze either an option with a lesser performance standard such as simply proving that the new system is at least as safe as what it replaces, the current subpart H standard as it would not meet Congressional intent, nor an option that would not permit use of Type certification.

SECTION-BY-SECTION ANALYSIS

Section 229.135 Event recorders

Advances in electronics and software technology have not only enabled the development of PTC systems, but have also resulted in changes to the implementation of locomotive control systems. These technological changes have provided for the introduction of new functional capabilities and the integration of different functions in ways that advance the building, operation, and maintenance of locomotive control systems. FRA also recognizes that advances in technology may further eliminate the traditional distinctions between locomotive control and train control functionalities. Indeed, technology advances may provide for opportunities for increased or improved functionalities in train control systems that run concurrent with locomotive control.

Train control and locomotive control, however, remain two fundamentally different operations with different objectives. FRA does not want to restrict the adoption of new locomotive control functions and technologies by imposing regulations on locomotive control systems intended to address safety issues associated with train control. Accordingly FRA is reviewing and enhancing the Locomotive Safety Standards (49 CFR part 229) to address the use of advanced electronics and software technologies to improve safe, efficient, and economical locomotive operations when a new or proposed locomotive control system function does not interfaces or comingles with a safety critical train control system. In the meantime, FRA proposes to amend § 229.135 to ensure its applicability to subpart I.

FRA believes that existing event recorders and PTC non-volatile memory will have sufficient capability to perform the functions required by this section at no additional cost.

Section 234.275 Processor-based systems

Section 234.275 of title 49 presently requires that each new or novel technology used for active warning at highway-rail grade crossings be qualified using the subpart H process, including approval of a Product Safety Plan. Particularly with respect to high speed rail, FRA anticipates that PTC systems will in some cases incorporate new or novel technology to provide for crossing pre-starts (reducing the length of approach circuits for high speed trains), verify crossing system health as between the wayside and approaching trains, or slow trains approaching locations where storage has been detected on a crossing, among other options. Indeed, each of these functions is presently incorporated in at least one train control system, and others may one day be feasible (including in-vehicle warning). There would appear to be no reason why such a functionality intended for inclusion in a PTC system mandated by subpart I could not be qualified with the rest of the PTC system under subpart I. On the other hand, care should be taken to set an appropriate safety standard taking into consideration road users, occupants of the high speed trains, and others potentially affected.

In fact, with new emphasis on high speed rail, FRA needs to consider the ability of PTC systems to integrate this type of new technology and thereby reduce risk associated with high speed rail service. Risk includes derailment of a high speed train with catastrophic consequences after encountering an obstacle at a highway-rail grade crossing. To avoid such consequences, as many crossings as possible should be eliminated. To that end, 49 CFR § 213.347 requires a warning and barrier plan to be approved for Class 7 track (speeds above 110 mph) and prohibits grade crossings on Class 8 and 9 track (above 125 mph). That leaves significant exposure on Class 5 and 6 track that is currently not addressed by regulation. Comment is requested on how best to approach this issue, ensuring that various FRA regulations, including subpart I, address this safety need effectively and in harmony with one another.

This section is permissive, and adds no costs.

Section 235.7 Changes not requiring filing of application

FRA proposes to amend this section of the regulation which allows specified changes within existing signal or train control systems be made without the necessity of filing an application. The amendment consists of adding allowance for a railroad to remove an intermittent automatic train stop system in conjunction with the implementation of a PTC system approved under subpart I of part 236.

The changes allowable under this section, without filing of an application, are those identified on the basis that the resultant condition will be at least no less safe than the previous condition. The required functions of PTC within subpart I provide a considerably higher level of functionality related to both alerting and enforcing necessary operating limitations than an intermediate automatic train stop system does. Additionally, in the event of the loss of PTC functionality (i.e., a failure en route), the operating restrictions required will provide the needed level of safety in lieu of the railroad being expected to keep and maintain an underlying system such as intermittent automatic train stop for only in such cases. FRA therefore believes that with the implementation of PTC under the requirements of subpart I, the safety value of any previously existing intermittent automatic train stop system is entirely obviated. There were no objections in the PTC Working Group to this amendment.

This section avoids an unnecessary requirement for paperwork, and does not add to costs.

Section 236.0 Applicability, minimum requirements, and penalties.

FRA proposes to amend this existing section of the regulation to remove manual block from the methods of operation permitting speeds of 50 miles per hour or greater for freight trains and 60 miles per hour or greater for passenger trains. Manual block rules do create a reasonably secure means of preventing train collisions. However, the attributes of block signal systems are not present, leaving the potential for misaligned switches, broken rails or fouling equipment to cause a train accident. FRA believes that contemporary expectations for safe operations require this adjustment, which also provides a more orderly foundation for the application of PTC to the subject territories. There were no objections in the RSAC to this proposed change.

In the interval between adoption of this provision and 2015 this might have applied to some passenger lines, however at the PTC Working Group, the affected railroads told FRA that they were eliminating this operation. The only affected railroads will be freight operations in manual block at speeds of 50 mph or greater. The costs of restricting train speed to 50 mph on a freight line would be minimal, and on most affected lines such restriction will be temporary since PTC will be installed by 2015. The benefits and costs of implementing this provision are negligible, especially in comparison to all of the other costs of implementing PTC systems.

Section 236.909 Minimum performance standard

FRA is proposing to modify existing § 236.909 to make the risk metric sensitivity analysis an integral part of the full risk assessment required to be submitted with a product safety plan in accordance with § 236.907(a)(7). The proposed amendment of this section would also eliminate an alternative option for a railroad to use a risk metric in which consequences of potential accidents are measured strictly in terms of fatalities.

Currently, § 236.909(e)(1) indicates how safety and risk should be measured for the full risk assessment, but does not accentuate the need for running a sensitivity analysis on chosen risk metrics to assure that the worst case scenarios for the proposed system failures or malfunctions are accounted for in the risk assessment. On the other hand, Appendix B to this part mandates that each risk metric for the proposed product must be expressed with an upper bound, as estimated with a sensitivity analysis. The FRA's experience gained while reviewing product safety plans submitted to FRA in accordance with subpart H, revealed that the railroad's did not understand a sensitivity analysis for the chosen risk metrics to be a mandatory requirement. Accordingly, to ensure clarity regarding FRA's expectations, FRA proposes to amend paragraph (e)(1) to explicitly require the performance of a sensitivity analysis for the chosen risk metrics. The language proposed in this rule explains the need for the sensitivity analysis and describes the key input parameters that must be analyzed.

The proposed modification to paragraph (e)(2) is intended to clarify how the exposure and its consequences, as main components of the risk computation formula, must be measured. Under the proposed rule text, the exposure must be measured in train miles per year over the relevant railroad infrastructure where a proposed system is to be implemented. When determining the consequences of potential accidents, the railroad must identify the total costs involved, including those relating to fatalities, injuries, property damage, and other incidentals. FRA proposes to eliminate the option of using an alternative risk metric, which would allow the measurement of consequences strictly in terms of fatalities. It is FRA's experience that measuring consequences of accidents strictly in term of fatalities did not serve as an adequate alternative to metrics of total cost of accidents for two main reasons. First, the statistical data on railroad accidents shows that accidents involving fatalities also cause injuries and significant damage to railroad property and infrastructure for both freight and especially passenger operations. Even though the cost of human life is always the highest component of monitory estimates of accident consequences, the dollar estimates of injuries, property losses, and damage to the environment associated with accidents involving fatalities cannot and should not be discounted in the risk analysis. Second, allowing fatalities to serve as the only risk metric of accident consequences confused the industry and the risk assessment analysts attempting to determine the overall risk associated with the use of certain types of train control systems. As a result, some risk analysts inappropriately converted injuries and property damages for observed accidents into relative estimates of fatalities. This method cannot be considered acceptable because, while distorting the overall picture of accident consequences, it also raises questions on appropriateness of conversion coefficients. Therefore, FRA considers it appropriate to eliminate from the rule the alternative option for consequences to be measured in fatalities only.

FRA does not believe that any railroads intended to use fatalities alone as a risk metric. FRA has seen some draft risk assessments where monetized costs were converted into fatality equivalents, defeating the original intent and value of having a single metric. This change is not expected to impact railroads.

Section 236.1001 Purpose and Scope

This section describes both the purpose and the scope of subpart I. Subpart I provides performance-based regulations for the development, test, installation, and maintenance of PTC systems, and the associated personnel training requirements, that are mandated for installation by the FRA.

Section 236.1003 Definitions

Given that a natural language such as English contains, at any given time, a finite number of words, any comprehensive list of definitions must either be circular or leave some terms undefined. In some cases, it is not possible and indeed not necessary to state a definition; rather, one simply comes to understand the use of the term. Where possible and practicable, FRA prefers to provide explicit definitions for terms and concepts rather than rely solely on a shared understanding of a term through use.

Paragraph (a) reinforces the applicability of existing definitions of subparts A through H. The definitions of subparts A through H are applicable to subpart I, unless otherwise modified by this part.

Paragraph (b) introduces definitions for a number of terms that have specific meanings within the context of subpart I.

While definitions are important to understanding a rule, they have no regulatory force by themselves, and therefore neither add benefits, nor costs.

Section 236.1005 Requirements for Positive Train Control systems

RSIA08 specifically requires that each PTC system be designed to prevent train-to-train collisions, overspeed derailments, incursions into established work zone limits, and the movement of a train through a switch left in the wrong position. Proposed section 236.1005 includes the minimum statutory requirements and provides amplifying information defining the necessary PTC functions and the situations under which PTC systems must be installed. Each PTC system must be reliable and perform the functions specified in RSIA08.

Train-to-train collisions. Paragraph (a)(1)(I) applies the statutory requirement that a mandatory PTC system must be designed to prevent train-to-train collisions. At this time, FRA understands this to mean head-to-head, rear-end, and side and raking collisions between trains on the same, converging, or intersecting tracks. PTC technology now available can meet these needs through guidance to the locomotive engineer that is current and continuous and through enforcement using predictive braking to stop short of known targets.

FRA also notes that the technology associated with currently available PTC systems may not completely eliminate all of these collisions risks. For instance, a PTC system mandated by this subpart is not required to prevent a collision caused by a train that derails and moves over an area not covered by track and onto a neighboring or adjacent track (known in common parlance as a “secondary collision”).

During discussions regarding available PTC technology, it has been noted that this technology also has inherent limitations with respect to prevention of certain collisions that might occur at restricted speed. In signal territory, there are circumstances under which trains may pass red signals, other than absolute signals, either at restricted speed or after stopping and then proceeding at restricted speed. Available PTC technology does not track the rear end of each train as a target but instead relies on the signal system to indicate the appropriate action. In this example, the PTC system would display "restricted speed" to the locomotive engineer as the action required and would enforce the upper limit of restricted speed (i.e., 15 or 20 miles per hour, depending on the railroad). This means that more serious rear end collisions will be prevented, because the upper limit of speed is enforced, and it also means that fewer low speed rear-end collisions will occur because a continuous reminder of the required action will be displayed to the locomotive engineer (rather than the engineer relying on the aspect displayed by the last signal, which may have been passed some time ago). However, some potential for a low-speed rear-end collision will remain in these cases, and the proposed rule is clear that this limitation would be accepted. Similar exposure may occur in non-signaled territory where trains are conducting switching operations or other activities under joint authorities. The PTC system can enforce the limits of the authority and the upper limit of restricted speed, but it cannot guarantee that the trains sharing the authority will not collide. Again, however, the likelihood and average severity of any potential collisions would be greatly reduced. However, FRA reserves the right to later modify subpart I to require PTC systems to prevent these and potentially other types of train-to-train collisions as technology becomes available.

The proposed rule text does, however, provide an example of a potential train-to-train collision that a PTC system should be designed to prevent. Rail-to-rail crossings-at-grade—otherwise known as diamond crossings—present a risk of side collisions. FRA recognizes that such intersecting lines may or may not require PTC system implementation and operation. Since a train operating with a PTC system cannot necessarily recognize a train not operating with a PTC system or moving on a track without a PTC system, the PTC system—no matter how intelligent—itself may not be able to prevent a train-to-train collision.

Accordingly, proposed paragraph (a)(1)(I) requires certain protections for such rail-to-rail crossings-at-grade. While these locations are specifically referenced in paragraph (a)(1)(I), their inclusion is merely illustrative and does not necessarily preclude any other type of potential train-to-train collision. Moreover, a host railroad may have alternative arrangements to the specific protections referenced in the associated table under paragraph (a)(1)(I), which it must submit in its PTC Safety Plan (PTCSP)—discussed in detail below—and receive a PTC System Certification associated with that PTCSP.

Rail-to-rail crossings-at-grade that have one or more PTC routes intersecting with one or more routes without a PTC system must have an interlocking signal arrangement in place developed in accordance with subparts A through G of part 236 and a PTC enforced stop on all PTC routes. FRA has also determined that the level of risk varies based upon the speeds at which the trains operate through such crossings, as well as the presence, or lack, of PTC equipped lines leading into the crossing. Accordingly, under a compromise accepted by the PTC Working Group, if the maximum speed on at least one of the intersecting tracks is more than 40 miles per hour, then the routes without a PTC system must also have either some type of positive stop enforcement or a split-point derail device on each approach to the crossing and incorporated into the signal system, and a permanent maximum speed limit of 20 miles per hour. FRA expects that these protections be instituted as far in advance of the crossing as is necessary to stop the train from entering the crossing. The 40 miles per hour threshold appears to be appropriate given three factors. First, the frequency of collisions at these rail intersections is low, because typically one of the routes is favored on a regular basis and train crews expect delays until signals clear for movement. Second, the special track work used at these intersections, known as crossing diamonds, experiences heavy wear; and railroads tend to limit speeds over these locations to no more than 40 miles per hour. Finally, FRA recognizes that for a train on either intersecting route, elevated speed will translate into higher kinetic energy available to do damage in a collision-induced derailment. Thus, for the relatively small number of rail crossings with one or more routes having an authorized train speed above 40 miles per hour, including higher speed passenger routes, it is particularly important that any collision be prevented. FRA appreciates that a more protective approach could be considered and welcomes any data or commentary that might bear on this issue.

FRA believes that these more aggressive measures are required to ensure train safety in the event the engineer does not stop a train before reaching the crossing when the engineer does not have a cleared route displayed by the interlocking signal system and higher speed operations are possible on the route intersected. The split-point derail device would prevent a collision in such a case by derailing the offending train onto the ground before it reaches the crossing. Where such derails are used, the slower speed at which the unequipped train is required to travel would minimize the damage to the unequipped train and potential affect on the surrounding area should it derail as a result of the failure of the crew to observe the signal indication. As an alternative to split-point derails, the non-PTC line may be outfitted with some other mechanism that ensures a positive stop of the unequipped crossing train.

If a PTC system or systems are installed and operated on all crossing lines, there are no speed restrictions other than those that might be enforced as part of a civil of temporary speed restriction. However, the crossing must be interlocked and the PTC system or systems must ensure that each of the crossing trains can be brought safely to a stop before reaching the crossing in the event that another train is already cleared through or occupying the crossing.

The costs and benefits of collision avoidance are included in the general cost and benefit sections presented below. The impacts of provisions regarding collision avoidance at at-grade crossings are included there as well. FRA acknowledges that those provisions have costs and benefits, but FRA believes that they are attributable to RSIA08. RSIA08 requires installation of PTC which prevents train-to-train collisions, and while FRA believes that it was not Congressional intent to regulate those collisions resulting from a train on one track derailing and fouling an adjacent track, FRA does believe that Congress, although not explicitly saying whether it did or did not intend the PTC systems to avoid collisions on at-grade crossings, intended to reduce train-to-train collisions occurring on at-grade crossings. FRA has merely described what avoidance of collisions entails.

Overspeed derailments. Proposed paragraph (a)(1)(ii) requires that PTC systems mandated under subpart I be designed to prevent overspeed derailments and addresses specialized requirements associated with such provision. FRA notes that a number of passenger accidents with significant numbers of casualties have been caused by trains exceeding the maximum allowable speed at turnouts and crossovers and upon entering stations. Accordingly, FRA emphasizes the importance of enforcement of turnout and crossover speed restrictions, as well as civil speed restrictions. For instance, in the Chicago region, two serious train accidents occurred on the same Metra commuter line when locomotive engineers operated trains at more than 60 miles per hour while traversing between tracks using crossovers, which were designed to be safely traversed at 10 miles per hour.

For illustrative purposes, the rule text makes clear that such derailments may be related to railroad civil engineering speed restrictions, slow orders, and excessive speeds over switches and through turnouts and these type speed restrictions are to be enforced by the system.

The costs and benefits of preventing overspeed derailments are included in the general analysis of costs and benefits below.

Roadway work zones. Proposed paragraph (a)(1)(iii) requires that PTC systems mandated under subpart I be designed to prevent incursions into established work zone limits. Work zone limits are defined by time and space. The length of time a work zone limit is applicable is determined by human elements. Working limits are obtained by contacting the train dispatcher, who will confirm an authority only after it has been transmitted to the PTC server. Paragraph (a)(1)(iii) emphasizes the importance of the PTC systems to provide positive protection for roadway workers working within the limits of their work zone.

Accordingly, once a work zone limit has been established, the PTC system must be notified. The PTC system must continue to enforce that limit until it is notified from the dispatcher or roadway worker in charge, with verification from the other, either that the limit is released and the train is authorized to enter or the roadway worker in charge authorizes movement of the train through the work zone.

To achieve this technological functionality, FRA's Office of Railroad Development has funded the development of a Roadway Worker Employee in Charge (EIC) Portable Terminal that allows the EIC to control the entry of trains into the work zone. While no rule includes the commonly used term EIC, FRA recognizes that it is the equivalent to the "Roadway Worker In Charge" as used in part 214. With the portable terminal, the EIC can directly control the entry of trains into the work zone and restrict the speed of the train through the work zone. If the EIC does not grant authority for the train to enter the work zone, the train is enforced to a stop prior to violating the work zone authority limits. If the EIC authorizes entry of the train into the work zone, the EIC may establish a maximum operating speed for the train consistent with the safety of the roadway work employees. This speed is then enforced on the train authorized to enter and pass through the work zone. The technology required for this terminal is significantly less complex than the technology associated with dispatching systems and the PTC onboard system. In view of this, FRA strongly encourages deployment of such portable terminals as opposed to current approaches which only require the locomotive engineer to in some manner "acknowledge" his authority to operate into or through the limits of the work zone (e.g., by pressing a soft key on the onboard display).

Pending the adoption of more secure technology such as the EIC Portable Terminal, FRA will scrutinize PTC Safety Plans to determine that they leave no opportunity for single point human failure in the enforcement of work zone limits. FRA notes that some approaches in the past have provided that the locomotive engineer could simply acknowledge a work zone warning, even if inappropriately, after which ,the train could proceed into the work zone. FRA proposes that more secure procedures be included in safety plans under new subpart I.

The costs and benefits of protecting roadway work zones are included in the general analysis of costs and benefits below. As with the costs and benefits associated with implementation of the collision avoidance and over-speed aspects, the costs and benefits associated with implementation of work zone protection are attributable to RSIA08.

Movement over main line switches. Proposed paragraph (a)(1)(iv) requires that PTC systems mandated under subpart I be designed to prevent the movement of a train through a main line switch in the improper position. Given the complicated nature of switches—especially when operating in concert with wayside, cab, or other similar signal systems—the proposed rule provides more specific requirements in paragraph (e) as discussed further below.

In numerous paragraphs, the proposed rule requires various operating requirements based primarily on signal indications. Normally, these indications are communicated to the locomotive engineer, who is then expected to operate the train in accordance with the indications and authorities provided. However, a technology that receives the same information does not necessarily have the wherewithal to respond unless it is programmed to do so. Thus, proposed paragraph (a)(2) requires PTC systems implemented under subpart I to obey and enforce all such indications and authorities provided by these safety-critical underlying systems. The integration of the delivery of the indication or authority with the PTC system's response to those communications must be described and justified in the PTC Development Plan (PTCDP)—further described below—and the PTCSP, as applicable, and then must comply with those descriptions and justifications.

The PTC Working Group had extensive discussions concerning the monitoring of main line switches and came to the following general conclusions:

First, signal systems do a good job of monitoring switch position, and enforcement of restrictions imposed in accordance with the signal system is the best approach within signal territory (main track and controlled sidings). As a general rule, the enforcement required for crossovers, junctions and entry into and departure from controlled sidings will be a positive stop, and the enforcement provided for other switches (providing access to industry tracks and non-signaled sidings and auxiliary tracks) will be display and enforcement of restricted speed. National Transportation Safety Board representatives were asked to evaluate whether this strategy meets the needs of safety from their perspective. They returned with a list of accidents caused by misaligned switches that the Board had investigated in recent years, none of which was in signal territory.

Second, switch monitoring functions of contemporary PTC systems provide an excellent approach to addressing this requirement in dark territory. However, it is important to ensure that switch position is determined with the same degree of integrity that one would expect within a signaling system (e.g., fail safe point detection and proper verification of adjustment). The Working Group puzzled over sidings in dark territory and how to handle the requirement for switch monitoring in connection with those situations. (While these are not “controlled” sidings, as such, they will often be mapped so that train movements into and out of the sidings are appropriately constrained.) At the final Working Group meeting, a proposal was accepted that would treat a siding as part of the main line track structure requiring monitoring of each switch off of the siding if the authorized train speed within the siding exceeds 20 mile per hour. This issue is more fully discussed below.

The costs and benefits of protecting movements over main line switches are included in the general analysis of costs and benefits below. As with the costs and benefits associated with implementation of the other PTC aspects discussed above, the costs and benefits associated with preventing movement of a train through a main line switch in the improper position are attributable to RSIA08.

Other functions. While FRA has included in § 236.1005 the core PTC system requirements, there is the possibility that other functions may be explicitly or implicitly required elsewhere in subpart I. Accordingly, under proposed paragraph (a)(3), each PTC system required by subpart I must also perform any other functions specified in Subpart I. According to 49 U.S.C. § 20157(g), FRA must prescribe regulations specifying in appropriate technical detail the essential functionalities of positive train control systems and the means by which those systems will be qualified.

In addition to the general performance standards required under paragraphs (a)(1)-(3), paragraph (a)(4) provides more prescriptive performance standards relating to the situations paragraphs (a)(1)-(3) intend to prevent. Paragraph (a)(4) defines certain particular situations where FRA has determined that specific warning and enforcement measures are necessary to provide for the safety of train operations, their crews, and the public and to accomplish the goals of the PTC system’s essential core functions. Under paragraph (a)(4)(I), FRA intends to prevent unintended movements onto PTC main lines and possible collisions at switches by ensuring proper integration and enforcement of the PTC system as it relates to derails and switches protecting access to the main line. Paragraph (a)(4)(ii) intends to account for operating restrictions associated with a highway-rail grade crossing active warning system that is in a reduced or non-operative state and unable to provide the required warning for the motoring public. In this situation, the PTC system must provide positive protection and enforcement related to the operational restrictions of alternative warning that must be issued to the crew of any train operating over such crossing in accordance with part 234. Paragraph (a)(4)(iii) concerns the movement of a PTC operated train in conjunction with the issuance of an after arrival mandatory directive. While FRA recognizes that the use of after arrival mandatory directives poses a risk that the train crew will misidentify one or more trains and proceed prematurely, PTC provides a means to intervene should that occur. Further such directives may sometimes be considered operationally useful. Accordingly, FRA fully expects that the PTC system will prevent collisions between the receiving trains and the train or trains to be waited upon.

FRA recognizes that movable bridges, including draw bridges, present an operational issue for PTC systems. Under subpart C, § 236.312 already governs the interlocking of signal appliances with movable bridge devices and FRA believes that this section should equally apply to PTC systems governing movement over such bridges. While subparts A through H apply to PTC systems—as stated in § 236.1001—paragraph (a)(4)(iv) seeks to make this abundantly clear.

Accordingly, in accordance with paragraph (a)(4)(iv) and § 232.312, movable bridges within a PTC route are equipped with an interlocked signal arrangement which is also to be integrated into the PTC system. A train shall be enforced to a stop prior to the bridge in the event that the bridge locking mechanism is not locked, or the locking device is out of position, or the bridge rails of the movable span are out of position vertically or horizontally from the rails of the fixed span. Effective locking of the bridge is necessary to assure that the bridge is properly seated thereby capable to support both the weight of the bridge and that of a passing train(s) and preventing possible derailment that could result in the train going into the water or other potential unsafe condition. Proper track rail alignment is also necessary to preclude derailments, which again could result in damage to the bridge or the train going into the water.

Proposed Paragraph (a)(4)(v) requires that hazard detectors integrated into the PTC system—as required by paragraph (c) of this section or the FRA approved PTCSP—must provide an appropriate warning and associated applicable enforcement through the PTC system. There are many types of hazard detection systems and devices. Each type has varying operational requirements, limitations, and warnings based on the types and levels of hazard indications and severities. FRA expects this enforcement to include a positive stop where necessary to protect the train (e.g., areas with high water, flood, rock slide, or track structure flaws) or to provide an appropriate warning with possible movement restriction be acknowledged (i.e., hot journal or flat wheel detection). The details of these warnings and associated required enforcements are to be specifically addressed within a PTCDP and PTCSP subject to FRA approval, and the PTC system functions are to be maintained in accordance with the system specifications. FRA does not expect that all hazard detectors be integrated into the PTC systems, but where they are, they must interact properly with the PTC system to protect the train from the hazard that the detector is monitoring.

Paragraph (a)(5) addresses the issue of broken rails, which is the leading cause of train derailments. For this reason, FRA will strictly limit the speed of passenger and freight operations in those areas where broken rail detection is not provided. Under § 236.0(c), as amended in this rule to sunset of the manual block allowance 24 months after the effective date of a final rule, freight trains operating at or above 50 miles per hour, and passenger trains operating at or above 60 miles per hour are required to have a block signal system. Since current technology for block signal systems relies on track circuits—which also provide for broken rail detection—FRA proposes limiting speeds where broken rail detection is not available to the maximums allowed under § 236.0 when a block signal system is not installed.

The costs and benefits of performing other functions are included in the general analysis of costs and benefits below. Even though these other functions were not specifically delineated in RSIA08, FRA believes that they were intended by Congress, and therefore the costs and benefits are attributable to RSIA08.

Deployment requirements. Proposed paragraph (b) regulates where and when PTC systems must be installed. Under RSIA08, each applicable railroad carrier must implement a PTC system in accordance with its PTC Implementation Plan (PTCIP)—as further discussed below—which must be submitted by April 16, 2010, and explain how the railroad or railroads intend to implement a PTC system by December 31, 2015. Essentially, a PTC system must be installed on certain tracks and onboard components required for and responsive to the system must be installed on each lead locomotive that operate over those tracks.

According to § 229.5, the lead locomotive means the first locomotive proceeding in the direction of movement. In addition to the head end unit locomotive that controls the train while moving in a forward direction, a PTC system must be installed on any rear end unit control cab locomotive that controls the train while it moves backwards. These requirements assume that locomotives controlling the train may be placed only at each end. At this time, FRA is unaware of any locomotives not placed at either end of the train that may independently control the train.

As a threshold matter, RSIA08 requires that a PTC system be installed on certain main lines of each entity required to file a PTCIP. According to the statute, a main line is, with certain exceptions, a Class I railroad track over which 5 million or more gross tons of railroad traffic is transported annually. Pursuant to the statute, FRA may also designate additional tracks as main line and may provide exceptions for intercity rail or commuter passenger transportation over track where limited or no freight railroad operations occur.

The statutory language does not indicate whether the phrase "main line" refers to the route used or actual trackage owned by the subject railroad. It is clear, however, that Congress intended to limit implementation and operation of PTC systems to the extent practicable on railroad tracks owned or used by Class I railroads for freight operations specifically designated by the statute.

For instance, by referencing Class I railroads—and not referencing any other type of freight railroad—FRA believes that Congress did not intend to have the smaller freight railroads incur the tremendous costs involved in PTC system implementation and operation. If a Class I railroad's main line is determined by its route, and that route goes over track owned by a Class II railroad, the Class II railroad may be forced to incur substantial costs to equip its track and locomotives with PTC technology. By specifically referencing Class I railroads in the statute, however, it is FRA's understanding that Congress intended to avoid such a result. Thus, FRA believes it was Congress' intent that for freight operations, PTC systems must be installed and operated based on freight density and consist only on Class I railroad owned track.

The Surface Transportation Board (STB) has established a statutory definition for Class I. II, and III railroads based on the reported revenues in 1992. A reference to Class I railroads in this subpart refers to those railroads that have been designated as such by the Surface Transportation Board (STB). According to STB, a Class I railroad has revenues greater than $250 million (adjusted annually for inflation); a Class II railroad has revenues ranging from $20 million to $250 million (adjusted annually for inflation); and a Class III railroad has revenues that are less than $20 million (adjusted annually for inflation). All switching and terminal railroads, regardless of revenue size, are Class III railroads. The STB railroad classification determines the amount of reporting which a carrier must file with the STB. Class I railroads are required to file an annual R-1 Report, a detailed income, expense, and operating data report, quarterly and annual freight carload commodity reports, and reports on types of employees and employee compensation (Wage Form A and B).

From time to time, as some Class II railroads approached the Class I railroad revenue threshold, these carriers petitioned the STB to remain as Class II railroads, so that these carriers would not be burdened with the additional reporting requirements. Generally the STB allowed this exemption. Accordingly, there may be some large railroads—including Montana Rail Link and Florida East Coast—that are Class II railroads "by waiver," thereby freeing them from having to file Class I railroad reports with the STB.

In drafts of this proposed rule provided to the RSAC PTC Working Group, it was suggested that a Class I railroad's main line be defined as track owned and controlled by the Class I railroad. By also including track "controlled" by the Class I railroad, FRA intended to include tracks not owned by Class I railroads, but used in a manner as if the Class I railroad did own that track. For instance, under the term "controlled," FRA intended that a track owned by a Class II or III railroad would be considered a main line if a Class I railroad had effective control over the Class II or III railroad or that specific track. Without the "control" requirement, Class I railroads may be free to divest themselves of track ownership while maintaining effective control for the purposes of avoiding PTC system implementation.

The American Short Line and Regional Railroad Association (ASLRRA), however, expressed concern with this provision, instead suggesting that a Class I railroad's main line include only those lines owned and operated by the Class I railroad. FRA believes that the underlying ASLRRA concern is the financial costs associated with PTC system installation would impose completely untenable costs on their member railroads, and result in many of these railroad out of business as a result. FRA agreed that, from the point of view of the congressional mandate, a narrower concept is appropriate.

To avoid confusion, FRA intends to define main line in the regulation by standards applicable to a single element. In its proposal to define a Class I railroad's main line as track owned and controlled by the Class I railroad, FRA focused the definition on the status of the track. To also focus on the issue of operations could raise confusion and irreconcilable understandings. Thus, FRA is not comfortable with ASLRRA's suggestion.

To accomplish FRA's goal and respond to ASLRRA's concerns, however, FRA has limited a Class I railroad's main lines to tracks and segments documented in current timetables filed by the Class I railroads with FRA under § 217.7 of this title over which 5 million or more gross tons of railroad traffic is transported annually. For railroads that are required to submit a PTCIP by April 16, 2010, the gross tonnage will be based on 2008 year traffic. To the extent rail traffic exceeds 5 million gross tons in any year after 2008, the tonnage shall be calculated for the preceding two calendar years in determining whether a PTCIP or its amendment is required.
\
The RSIA08 requires certain tracks to be considered main line where a certain amount of railroad traffic is transported. However, in certain yard or terminal locations, trains are prepared for transportation, but railroad traffic is not "transported." Moreover, FRA recognizes that in such locations, PTC system operation would be especially cumbersome and onerous and possibly resulting in a reduction of safety. Accordingly, in such locations, FRA may not consider the subject tracks as main line. For such locations that only include freight operations, FRA proposes to consider these tracks other than main line by definition if all trains in the location are limited to restricted speed.

However, for any tracks used by passenger trains, FRA proposes that any designation of track as other than main line should be performed on a case-by-case basis in accordance with § 236.1019.

Once a Class I railroad's main lines are determined, a PTC system must be installed and operated on those main line tracks over which passenger trains are operated, or any TIH materials are transported. As a corollary, PTC systems are not required on Class I railroad's main lines over which any TIH or passenger trains are not transported. In addition to an applicable Class I railroad's main lines, a PTC system must be implemented and operated on all railroads' main lines over which intercity rail passenger transportation or commuter rail passenger transportation, as defined by 49 U.S.C. § 24102, is regularly provided. However, FRA does not intend to require PTC systems over tracks that tourist and excursion operations operate.

According to 49 U.S.C. § 24102, "intercity rail passenger transportation" means rail passenger transportation, except commuter rail passenger transportation. 49 U.S.C. § 24102 defines commuter rail passenger transportation as "short-haul rail passenger transportation in metropolitan and suburban areas usually having reduced fare, multiple-ride, and commuter tickets and morning and evening peak period operations."

49 C.F.R. § 238.5 provides further guidance, defining a long-distance intercity passenger train as "a passenger train that provides service between large cities more than 125 miles apart and is not operated exclusively in the National Railroad Passenger Corporation's Northeast Corridor" and a commuter train as "a passenger train providing commuter service within an urban, suburban, or metropolitan area. The term includes a passenger train provided by an instrumentality of a State or a political subdivision of a State." Section 238.5 also defines passenger service as "a train or passenger equipment that is carrying, or available to carry, passengers. Passengers need not have paid a fare in order for the equipment to be considered in passenger or in revenue service." According to § 238.5, a passenger train is "a train that transports or is available to transport members of the general public. If a train is composed of a mixture of passenger and freight equipment, that train is a passenger train for purposes of this part."

While the statute generally limits PTC system implementation and operation to certain main lines―defined for freight purposes as track over which 5 million or more gross tons of railroad traffic is transported annually―FRA is required to define passenger main line by regulation. In that regard has determined that freight density, as such, is not a relevant factor (see 49 U.S.C. § 20157(i)(2)(B). FRA intends for intercity and commuter passenger service to have the same meaning for purposes of this part as has been applied under 49 CFR part 238 (Passenger Equipment Safety Standards). That is scheduled service for the purpose of transporting persons from one place to another is passenger service for purposes of defining the PTC route system, and can be distinguished on that basis from tourist, historic or excursion service. *See*, also, Appendix A to part 209.

As a corollary, after the implementation date no intercity or commuter passenger operations may operate on any track that does not have a PTC system installed, except as described in the proposed rule. A PTC system must be installed on any track―regardless of its ownership or the weight of annual traffic―before any passenger trains may operate. Thus, any passenger or freight track over which passenger trains operate must be PTC equipped.

RSIA08 requires each intercity and commuter railroad to implement PTC "on…its main line over which intercity rail passenger transportation or commuter rail passenger transportation, as defined in section 24102, is regularly provided." Section 24102 uses the terms "intercity" and "commuter" in essentially the same way FRA has used the terms for safety regulatory purposes. The single question that has been puzzling in considering this mandate has been the meaning of the possessive article, "its," before "main line." It appears clear from the course of congressional consideration that the expression was intended to apply to the passenger railroad's entire route system, regardless of ownership. Amtrak's route system includes predominately trackage owned or controlled by others. Many commuter railroads operate partially or even exclusively over lines owned by freight railroads. On the other hand, FRA is persuaded that the same intention does not apply as to Class I freight railroads. A Class I freight railroad might operate a train under trackage rights over a Class II or III railroad, but it does not appear that was intended to burden the smaller railroad with the responsibility to install PTC.

Accordingly, FRA is proposing to consider as passenger train main lines all tracks across the nation over which passenger trains are transported. For the purposes of passenger trains, a main line is determined regardless of the amount (i.e., 5 million or more gross tons annually) or frequency (i.e., regularly provided) of railroad traffic or the ownership of the track segment. Thus, if a passenger train is transported over a track, the track requires PTC implementation and operation, regardless of whether the track is owned by a passenger railroad entity, a Class I railroad, or any smaller freight railroads, including Class II and short line railroads.

This approach is consistent both with FRA's understanding of congressional intent and FRA's historical safety sensitivity to regulating passenger transportation and is permissible under 49 U.S.C. § 20157(a)(1)(C). For example, in the relatively recent final rule governing continuous welded rail, different schedules were developed for track inspection intervals associated with freight and passenger train operations. See 71 Fed. Reg. 59,677, 59,681 (Oct. 11, 2006). According to FRA, the different schedules for track inspection were developed to consider the potentially greater severity, especially in terms of loss of life, from possible future track-related passenger train accidents.

If FRA were to otherwise restrict PTC systems on passenger train main lines that are only owned by the passenger railroads, then PTC systems would only be required on 11% of all track used by the passenger railroads across the nation, which would mostly include only the Northeast Corridor (NEC) and some passenger lines in Michigan. Considering Congress' concern with accidents involving multiple passenger fatalities, which appears to be a significant impetus for Congress' final passage of RSIA08, FRA believes that Congress did not intend in 49 U.S.C. § 20157 to limit PTC system operation to this narrow passenger territory.

Nevertheless, while all passenger routes, including those over track owned by freight railroads, are automatically deemed main lines under the proposed rule, the proposed rule also provides an exception for those main lines that would not be main lines but for the existence of passenger trains and are not deemed by FRA main lines due to limited or no freight railroad operations. This exception is permissible pursuant to 49 U.S.C. § 20157(i)(2)(B). The proposed procedure for such exceptions can be found under §§ 236.1011 and 236.1019, as further discussed below.

In addition to determining which tracks require PTC system implementation and operation, paragraph (b) requires such installation be performed by the "host railroad." Subpart I makes a distinction between the railroad that has effective operating control over a segment of track, and a railroad that is simply passing its trains across the same segment of track. While the concept of actual ownership of the track segment plays a significant role in determining the host railroad, a PTC system may be required on a track segment that is not owned by a PTC railroad. To avoid confusion, FRA designates the host railroad as the railroad that exercises operational control of the movement of trains on the segment, irrespective of the actual ownership of the segment. This is in contrast to a tenant railroad, which is any railroad that uses a segment of track but does not exercise operational control of the movements of its trains. The terms "host railroad" and "tenant railroad" are defined as such in the definitions listed under § 235.1003.

FRA has analyzed the costs and benefits below based on the deployment requirements of RSIA08 discussed above.

Defining an enforceable system

On route segments which are not part of passenger main track, the two triggers that would require a Class I railroad to install PTC systems are freight traffic volume and whether the route is used to transport PIH/TIH materials. Railroads have some control (although limited by existing PHMSA regulations and their common carrier obligation) over both volume and PIH/TIH routing . Therefore, in order to develop a regulation that meets Congressional intent which may be enforceable, FRA needs to define the portion of the rail system that is covered, and can only do that by limiting changes to the system definition. Once a PTC system is installed, a railroad would not be permitted to remove or treat it as inoperative unless such discontinuance or modification is approved by FRA in accordance with § 236.1021, as discussed below. This is the case even if the track segment ceases to be defined as a main line in accordance with subpart I due to traffic pattern or consist changes, such as annual traffic levels possibly dipping below the 5 million gross ton threshold referenced in the statute and in §§ 236.1003 and 236.1005 or the rerouting of TIH traffic. This result is consistent with longstanding practice under 49 U.S.C. § 20502 (see 49 CFR part 235).

The requirements for PTC contained in RSIA08 pertaining to freight lines define the intended route structure by reference to the presence or absence of TIH traffic and the annual gross tonnage. The law requires installation and operation of a PTC system where it (1) is part of a Class I railroad system, (2) carries at least 5 million gross tons of rail traffic, and (3) carries at least some TIH traffic. Based upon information available to FRA, and assuming a level of rail operations consistent with normal economic conditions, these requirements describe approximately 45,000 miles of freight-only territory plus almost 18,000 miles where both TIH and passengers are carried. There are another 6,000 miles track owned by a Class I railroad and used for passenger service that would not otherwise be required to be equipped, for a total build-out of about 69,000 route miles. These lines basically describe the heart or “core” of the Class I freight network, albeit with some gaps.

However, the railroads carry only about 100,000 carloads of TIH products annually (approximately 0.3% of all rail traffic). Facing an extraordinary potential for tort liability associated with this traffic, the railroads have sought through various means to reduce the potential for release of these commodities through safety improvements; but they have also sought to be relieved of their common carrier obligation to carry them. The RSIA mandate, which entails an expenditure of billions of dollars, most of it nominally because the lines in question carry TIH, presents an additional enormous incentive for the Class I railroads to shed TIH traffic and, further, to concentrate the remaining TIH traffic on the fewest possible lines of railroad.

FRA is first concerned that TIH traffic could be diverted from the rail mode. Although the risks of transporting these commodities can be reduced by product substitution, by coordination of transportation that reduces length of haul, and by other means, and although the US Department of

Transportation continues to support these means where feasible, for the present there are still realistic and supportable demands for transportation of these TIH commodities that implicate the national interest in a very strong way. Hazardous materials are vital to maintaining the health of the economy of the United States and are essential to the well-being of its people. These materials are used in water purification, farming, manufacturing, and other industrial applications. The need for hazardous materials to support essential services means that transportation of hazardous materials is unavoidable. There are over 20 hazardous materials considered to be TIH that are shipped by rail in tank car quantities. In 2003, over 77,000 tank car loads of TIH materials were shipped by rail.

Examples of TIH materials include anhydrous ammonia and chlorine. Anhydrous ammonia is an important source of nitrogen fertilizer for crops and is used in the continuous cycle cooling units found in various appliances and vehicles and in the production of explosives and manufacturing of nitric acid and certain alkalis, pharmaceuticals, synthetic textile fibers, plastics, and latex stabilizers. Chlorine is used as an elemental disinfectant for over 84 percent of large drinking water systems (those serving more than 10,000 people), according to the American Water Works Association. For pharmaceuticals, chlorine chemistry is essential to manufacturing 85 percent of their products. Chlorine chemistry is also used in 25 percent of all medical plastics, and 70 percent of all disposable medical applications. The single largest use of chlorine is for the production of polyvinyl chloride (PVC), which is used for building and construction materials such as siding, windows, pipes, decks and fences.

The only effective modal alternative for transporting TIH materials is by road, and for the present insufficient capacity exists in the form of suitable packages (tank trucks, intermodal tanks). Further, diversion to highways would entail significantly higher societal costs, including adverse safety trade-offs from more trucks on the highways--even before the potential for accidental release of product or further security vulnerabilities are considered.

FRA is also concerned that TIH traffic could be retained on the railroads but concentrated in such a way as to result in circuitous routings with greater exposure to derailment hazards and security threats. Although security concerns may be addressed to some extent by rerouting during periods of high alert in specified urban areas, these detour routes would inevitably be over lines not equipped with PTC systems. These are the kinds of unfavorable trade-offs that the recent amendments to PHMSA's rail security rule—based on a separate statutory mandate and developed in concert with FRA—were intended to prevent. See, e.g., 73 FR 20752 (April 16, 2008); 73 FR 72182 (Nov. 26, 2008).); 49 CFR § 172.820.

Finally, FRA believes that, while the presence of TIH traffic on the rail network was viewed by the Congress as a good proxy for risk sufficient to warrant PTC system installation and operation, FRA is not persuaded that it was the intent of Congress that TIH traffic be driven from the railroads or concentrated on a smaller number of lines with more circuitous routings. The final legislation constituting the RSIA emerged following the Chatsworth collision of September 12, 2008, which claimed 25 lives (one rail employee and 24 passengers). However, neither H.R. 2095, as initially passed by the House of Representatives on October 17, 2007, nor the Senate version of the bill passed on August 1, 2008, was limited to TIH routes. All versions of the bill, including that finally enacted, preserved FRA's ability to apply the technology to additional routes.

Although FRA recognizes that the congressional trade-offs in September 2008 were driven by the impending end of the 110th Congress, the Chatsworth accident, and the desire on the part of some senators to see a rapid deployment of PTC technology (more rapid, in fact, than provided in either the Senate- or House-enacted versions), FRA does not believe that the Congress intended an implementation that would create substantial incentives to drive TIH traffic off of the railroads or concentrate it in such a way that large urban areas would see an increase in volume above that expected using normal, direct routing of the shipments. Accordingly, FRA proposes to use its discretion in crafting implementing regulations to preserve the presumed congressional intent. FRA does this by proposing in paragraph (b) that implementation plans required to be filed by April 16, 2010, be based on 2008 traffic levels. Although rail traffic, including TIH traffic, declined in the second half of the year, 2008 constitutes a much more "normal" base year than 2009 is expected to be due to the current economic conditions. It was also the year during which the Congress enacted the subject mandate.

In taking this action, FRA departs from the RSAC consensus that 2009 be used as the base year. Since the RSAC initially took up this subject, rail traffic levels have continued to plummet, and that decision now appears to be inappropriate. FRA did advise that PTC Working Group that it reserved the right to "lock in" the PTC route structure as of passage of RSIA08 to prevent unintended consequences. From a technical standpoint, § 236.1005(b) attempts to do just that, but with ample room for adjustment in light of normal changes in market conditions.

Paragraph (b)(2) would require that the determination of Class I freight railroad main lines required to be equipped be initially established and reported as follows using a 2008 traffic base for gross tonnage and determine the presence of TIH traffic based on 2008 shipments and routings. If increases in traffic occur that require a line to be equipped and the PTCIP has already been filed, an amendment would be required. As suggested by the RSAC, gross tonnage would be measured over two years to avoid unusual spikes in traffic driving investments inappropriately. However, if the 5 million gross tons threshold was met based on the prior two years of traffic, and TIH was added to the route, the railroad would be required to promptly file a PTCIP amendment and thereafter equip the line by the end of December 31, 2015 or within two years, whichever is later.

Once a PTC system is installed, it cannot be removed or treated as inoperative unless such discontinuance or modification is approved by FRA in accordance with § 236.1021, as discussed below. This is the case even if the track segment ceases to be defined as a main line in accordance with subpart I due to traffic pattern or consist changes, such as annual traffic levels possibly dipping below the 5 million gross ton threshold referenced in the statute and in §§ 236.1003 and 236.1005 or the rerouting of TIH traffic. This result is consistent with longstanding practice under 49 U.S.C. § 20502 (see 49 CFR part 235). To the extent traffic levels decline or TIH traffic ceases prior to April 16, 2010, or during the implementation period, a railroad could ask FRA to except a line segment from the requirement that it be equipped. The railroad would need to provide estimated traffic projections for the next 5 years (e.g., as a result of planned rerouting, coordinations, location of new business on the line). Where the request involves prior or planned rerouting of TIH traffic, the railroad would be required to provide a supporting analysis that takes into consideration the requirements of the PHMSA rail routing rule, including any railroad-specific and interline routing impacts. For example, the request should include information where multiple railroad carriers may coordinate traffic, especially where there are parallel lines directing traffic in opposite directions. FRA could approve an exception if FRA finds that it would be consistent with safety and in the public interest.

There was discussion in the PTC Working Group regarding how to handle new passenger service. Amtrak in particular suggested that FRA might consider some leeway for new intercity service that could be instituted within a short period if the sponsor (most likely a state government) requested. FRA considered this contingency but concluded that new passenger service should be adequately planned and deliberately executed with safety as its first priority. The proposal in paragraph (b) states that, after December 31, 2015, no intercity or commuter rail passenger service could continue or commence until a PTC system has been installed and made operative. FRA requests comment on this proposal and on whether a new rail passenger service commenced after April 10, 2010, but before December 31, 2015, should be permitted any leeway for installation of PTC after 2015 and, if so, what special circumstances would warrant that treatment.

Paragraph (c) provides amplifying information regarding the installation and integration of hazard detectors into PTC systems. Paragraph (c)(1) reiterates FRA's position that any hazard detectors that are currently integrated into an existing signal and train control system must be integrated into mandatory PTC systems and that the PTC system will enforce as appropriately on receipt of a warning from the detector. Paragraph (c)(2) requires each PTCSP submitted by a railroad must also identify any additional hazard detector to provide warnings to the crew that a railroad may elect to install. The PTCSP must also clearly define the actions required by the crew upon receipt of the alarm or other warning or alert. FRA does not expect that railroads will install hazard detectors at every location where a hazard might possibly exist.

The preceding being identified, paragraph (c)(3) specifies, in the case of high speed service (as described in § 236.1007 as any service operating at speeds greater than 90 mph) that FRA will require the hazard analysis to address any hazards on the route, along with a reason why additional hazard detectors are not required to provide warning and enforcement for hazards not already protected by an existing hazard detector. The hazard analysis must clearly identify the risk associated with the hazard, and the mitigation(s) measures implemented if a hazard detector is not installed and interfacing with a PTC system. For instance, in the past large motor vehicles have left parallel or overhead structures and have fouled active passenger rail lines. Depending upon the circumstances, such events can cause catastrophic train accidents. Although not every such event can be prevented, detection of obstacles such as this may make it possible to prevent an accident.

Under paragraph (d), FRA proposes that each lead locomotive operating within a PTC system in operation be equipped with an operative event recorder that captures safety-critical data routed to the engineer's display that the engineer must obey, as well as the text of mandatory directives and authorized speeds. FRA intends that this information be available in the event of an accident with a PTC equipped system to determine root causes and the necessary actions that must be taken to prevent reoccurrence. Although FRA expects implemented PTC systems will prevent PTC-preventable accidents, in the event of system failure FRA believes it is necessary to capture available data relating to the event. Further, FRA sees value in capturing information regarding any accident that may occur outside of the control of a PTC system as it is currently designed―including the prevention of collisions with trains not equipped with PTC systems―and accidents that could otherwise have been prevented by PTC technology, but were unanticipated by the system developers, the employing railroad, or FRA.

The data may be captured in the locomotive event recorder, or a separate memory module. If the locomotive is placed in service on or after October 1, 2009, the event recorder and memory module, if used, shall be crashworthy, otherwise known as crash-hardened, in accordance with § 229.135. For locomotives built prior to that period, the data shall be protected to the maximum extent possible within the limits of the technology being used in the event recorder and memory module.

A PTC system required by subpart I must be designed to prevent the movement of a train through a main line switch in the wrong position. Paragraph (e) provides amplifying information on switch point monitoring, indication, warning of misalignment, and associated enforcement.

According to the statute, each PTC system must be designed to prevent "the movement of a train through a switch left in the wrong position." FRA understands "wrong position" to mean not in the position for the intended movement of the train. FRA believes that Congress' use of the phrase "left in the wrong position" was primarily directed at switches in non-signaled (dark) territory such as the switch involved in the aforementioned accident at Graniteville, South Carolina. FRA also believes that, in order to prevent potential derailment or divergence to an unintended route, it is critical that all switches be monitored by a PTC system in some manner to detect they are in their proper position for train movements. If a switch is misaligned, the PTC system shall provide an acceptable safe state of train operations.

Prior to the statute, FRA's concept of PTC, based on RSAC recommendations, provided for positive train separation, speed enforcement, and work zone protection. The addition of switch point monitoring and run through prevention would have eliminated the Graniteville, South Carolina accident where a misaligned switch resulted in the unintended divergence of a train operating on the main track onto a siding track and the collision of that train with another parked train on the siding. As noted earlier, the collision resulted in the release of chlorine gas, nine deaths, and required the evacuation of the entire town for two weeks while remediation efforts were in progress.

As discussed above, FRA considered requiring PTC systems to be interconnected with each main line switch and to individually monitor each switch's point position in such a manner as to provide for a positive stop short of any misalignment condition. However, after further consideration and discussion with the PTC Working Group, FRA believes that such an approach may be overly aggressive and very expensive in signal territory.

Under paragraph (e), FRA instead proposes to treat switches differently, depending upon whether they are within a wayside or cab signal system—or are provided other similar safeguards (i.e., distant switch indicators and associated locking circuitry) required to meet the applicable switch position standards and requirements of subparts A-G—or are within non-signaled (dark) territory.

While a PTC system in dark territory would be required to enforce a positive stop—as discussed in more detail below—a PTC system in signal territory would require a train to operate at restricted speed between the associated signal, over any switch in the block governed by the signal, and until reaching the next subsequent signal that is displaying a signal indication more permissive than proceed at restricted speed.

Signal territory includes various types of switches, including power-operated switches, hand-operated switches, spring switches, electrically-locked switches, electro-pneumatic switches, and hydra switches, to name the majority. Each type of switch pose different issues as it relates to PTC system enforcement. We look at power- and hand-operated switches as examples.

On a territory without a PTC system, if a power-operated switch at an interlocking or control point would be in a condition resulting in the signal system displaying a stop indication, an approaching train would have to stop generally only a few feet from the switch, and in the large majority of cases no more than several hundred feet. In contrast, in PTC territory adhering to the aforementioned overly aggressive requirement, a train would have to stop at the signal, which may be in close proximity to its associated switch, and operate at restricted speed to that switch, where it would have to stop again. FRA believes that, since the train would be required to stop at the signal, and must operate at restricted speed until it completely passes the switch (with the crew by rule watching for and prepared to stop short of, among other concerns, an improperly lined switch), another enforced stop at the switch would be unnecessarily redundant.

Operations using hand-operated switches would provide different, and arguably greater, difficulties and potential risks. Generally, in between each successive interlocking and control point, signal spacing along the right of way can approximately be 1 to 3 miles or more apart, determined by the usual length of track circuits and the sufficient number of indications that would provide optimal use for train operations. Each signal governs the movement through the entire associated block up to the next signal. Thus, a train approaching a hand-operated switch may encounter further difficulties since its governing signal may be much further away than one would be for a power-operated switch. If within signaled territory a hand-operated switch outside of an interlocking or control point would be in a condition resulting in the signal system displaying a restricted speed signal indication, an approaching train may be required to stop before entering the block governed by the signal and proceed at restricted speed, or to otherwise reduce its speed to restricted speed as it enters the block governed by the signal, and be operated at restricted speed until the train reaches the next signal displaying an indication more permissive than proceed at restricted speed, including while passing over any switch within the block. The governing signal, however, may be anywhere from a few feet to more than a mile from the hand-operated switch. For instance, if a signal governs a 3 mile long block, and there is a switch at 1.8 miles after passing the governing signal (stated in advance of the signal), and that switch is misaligned, the train would have to travel that 1.8 miles at restricted speed. Even if they were able to normal the misaligned switch, they would need to remain at restricted speed at least until the next signal (absent an upgrade of the cab signal indication).

In signaled territory, to require a PTC system to enforce a positive stop of an approaching train at each individual switch that is misaligned would be an unnecessary burden on the industry, particularly since movement beyond the governing signal would be enforced by the PTC system to restricted speed. Accordingly, in signal territory, FRA proposes in paragraph (e)(1) to require a PTC system to enforce restricted speed through the block. By definition, at restricted speed, the locomotive engineer must be prepared to stop within one-half the range of vision short of any misaligned switch or broken rail, etc., not to exceed 15 or 20 miles per hour depending on the operating rule of the railroad. Accordingly, if a PTC system is integrated with the signal system, and a train is enforced by the PTC system to move at restricted speed past a signal displaying a restricted speed indication, FRA feels comfortable that the PTC system will meet the statutory mandate by preventing the movement of the train through the switch left in the wrong position. While this solution would not completely eliminate human factors, it would significantly mitigate the risk of a train moving through a misaligned switch and would be much more cost effective. Moreover, it would be cost prohibitive to require the industry to equip individually each of the many thousands of hand-operated switches with a wayside interface unit (WIU) necessary to interconnect with a PTC system in order to provide a positive stop short of any such switch that may be misaligned. Currently each switch in signal territory has its position monitored by a switch circuit controller (SCC). When a switch is not in its normal position, the SCC opens a signal control circuit to set the signals governing movement over the switch location to display its most restrictive aspect (usually red). A train encountering a red signal at the entrance to a block will be required to operate at restricted speed through the entire block, which be several miles in length depending on signal spacing. The signal system is not capable of informing the train crew which switch, if any, in the block may be in an improper position since none of switches are equipped with an independent WIU. There could be many switches within the same block in a city or other congested area. Thus, there is a possibility that one or more switches may be not in its proper position and the signal system is unable to transmit which switch or switches are not in normal position. The governing signal could also be displaying a red aspect on account of a broken rail, broken bond wire, broken or wrapped line wire, bad insulated joint, bad insulated switch or gage rods, or other defective condition.

However, in dark territory, by definition, there are no signals available to provide any signal indication or to interconnect with the switches or PTC system. Without the benefit of a wayside or cab signal system, or other similar system of equivalent safety, the PTC system will have no signals to obey. In such a case, the PTC system may be designed to allow for virtual signals, that is waypoints in the track database that would correspond to the physical location of the signals had they existed. Accordingly, in dark territory where PTC systems are implemented and governed by this subpart, the PTC system must enforce a positive stop for each misaligned switch whereas the lead locomotive must be stopped short of the switch to preclude any fouling of the switch. Once the train stops, the railroad will have an opportunity to correct the switch's positioning and then continue its route as intended.

Unlike in signal territory, FRA expects that on lines requiring PTC in dark territory, each switch will be equipped with a WIU to monitor the switch's position. A Wayside Interface Unit is a device that aggregates control and status information from one or more trackside devices for transmission to a central office and/or an approaching train's onboard PTC equipment, as well as disaggregating received requests for information, and promulgates that request to the appropriate wayside device. Most of the switches in dark territory are hand-operated with a much smaller amount of them being spring and hydra switches. In dark territory, usually none of switches have their position monitored by a switch circuit controller and railroads have been relied on the proper handling of these switches by railroad personnel. When it is necessary to throw a main line switch from normal to reverse, an obligation arises under the railroad's rules to restore the switch upon completion of the authorized activity. Switch targets or banners are intended to provide minimal indication of the switch's position, but in the typical case trains are not required to operate at a speed permitting them to stop short of open switches. As evidenced by the issuance of Emergency Order No. 24 and the subsequent Railroad Operating Rules Final Rule (73 FR 8442; Feb. 13, 2008), proper handling of main line switches cannot be guaranteed in every case. However, now with the implementation and operation of PTC technology, if a switch is not in the normal position, that information will be transmitted to the locomotive. The PTC system will then know which switch is not in the normal position and require a positive stop at that switch location only. FRA acknowledges that regardless of a switch's position, and regardless of whether the switch is in dark or signaled territory, movement through the switch—even at low speeds—may still create an unacceptable risk of collision with another train.

FRA understands the term "unacceptable risk" to mean risk that cannot be tolerated by the managing activity. It is a type of identified risk that must be eliminated or controlled.
For instance, such an unacceptable risk may exist with a hand-operated crossover between the tracks or a hand-operated switch leading to a passing siding or access to another subdivision or branch line. The switches mentioned in (e)(1)(ii)(B) are in locations where, if the switch is left lined in the wrong position, a train would be allowed to traverse through the crossover and potentially into the path of another train operating on an adjoining main track, siding, or other route. Even if such switches were located within a signaled territory, the signal governing movements over the switch locations, for both tracks as may be applicable, would be displaying their most restrictive aspect (usually red). This restrictive signal indication would in turn allow both trains to approach the location at restricted speed where one or both of the crossover switches are lined in the reverse position. Since the PTC system is not capable of actually enforcing restricted speed other than its upper limits, the PTC system would enforce a 15 or 20 mile per hour speed limit dependent upon the operating rules of the railroad. However, there is normally up to as much as a 5 mile per hour tolerance allowed for each speed limit before the PTC system will actually enforce the applicable required speed. Thus, in reality, the PTC system would not enforce the restricted speed condition until each train obtained a speed of up to 25 miles per hour. In this scenario, it is conceivable that two trains both operating at a speed of 25 miles per hour could

collide with each other at a combined impact speed (closing speed) of up to 50 miles per hour. While these examples are provided in the rule text, they are merely illustrative and do not limit the universe of what FRA may consider an unacceptable risk for the purpose of paragraph (e). FRA emphasizes that FRA maintains the final determination as to what constitutes acceptable or unacceptable risk in accordance with paragraph (e)(1).

The PTC system must also enforce a positive stop short of any misaligned switch on a PTC controlled siding in dark territory where the allowable track speed is in excess of 20 miles per hour. Sidings are used for meeting and passing trains and where those siding movements are governed by the PTC system necessities the position of the switches located on them to be monitored in order to protect train movements operating on the siding. Conversely, on signaled sidings, train movements are governed and protected by the associated signal indications, track circuits, and monitored switches, none of which are present in dark territory.

Paragraph (e)(2) provides that the PTCSP include a safety analysis for PTC system enforcement associated with switch position and an identification and justification of any alternate means of protection other than that provided in this section shall be identified and justified. FRA recognizes that in certain circumstances this flexibility may allow the reasonable use of a track circuit in lieu of individually monitored switches.

Paragraph (e)(3) provides amplifying information regarding existing standards of subparts A through G related to switches, movable-point frogs, and derails in the route governed that are equally applicable to PTC systems unless otherwise provided in a PTCSP approved under this subpart. This paragraph explains the FRA required and accepted railroad industry standard types of components used to monitored switch point position and how those devices are required to function. This paragraph allows for some alternative method to be used to accomplish the same level of protection if it is identified and justified in a PTCSP approved under this subpart.

Paragraph (f) provides amplifying information for determining whether a PTC system is considered to be configured to prevent train-to-train collisions, as required under paragraph (a). Paragraph (f) spells out when a PTC system may be considered to provide the necessary protections to provide the statutory requirement for prevention of train-to-train collisions. FRA will consider the PTC system providing the required protection if the PTC system enforces the upper limits of restricted speed. These criteria will allow following trains to pass intermediate signals displaying a restricting aspect and will allow for the issuance of joint mandatory directives.

Where a wayside signal displays a “Stop,” “Stop and Proceed,” or “Restricted Proceed” indication, paragraph (f)(1)(i) requires the PTC system to enforce the signal indication accordingly. In the case of a “Stop” or “Stop and Proceed” indication, the train will be brought to a stop prior to passing the signal displaying the indication. The train may then proceed at 15 or 20 miles per hour, as applicable according to the host railroad’s operating rule(s) for restricted speed. In the case of a “Restricted Proceed” indication, the train would be allowed to pass the signal at 15 or 20 miles per hour. In either event, the speed restriction would be enforced until the train passes a more favorable signal indication. In dark territory where trains operate by mandatory directive, the PTC system would be expected to enforce restricted speed on a train when the train was allowed into a block already occupied by another preceding train traveling in the same direction. FRA would expect each PTC system to function in this way and that each railroad will test each system to ensure such proper functioning.

Paragraphs (g) through (k) all concern situations where temporary rerouting may be necessary and would affect application of the operational rules under subpart I. While the proposed rule attempts to reduce the opportunity for PTC and non-PTC trains to co-exist on the same track, FRA recognizes that this may not always be possible, especially when a track segment is out of service and a train must be rerouted in order to continue to destination. Accordingly, paragraph (g) allows for temporary rerouting of traffic between PTC equipped lines and lines not equipped with PTC systems. FRA anticipates two situations—emergencies and planned maintenance—that would justify such rerouting.

Paragraph (g) provides the preconditions and procedural rules to allow or otherwise effectuate a temporary rerouting in the event of an emergency or planned maintenance that would prevent usage of the regularly used track. Historically, FRA has dealt with temporary rerouting on an ad hoc basis. For instance, on November 12, 1996, FRA granted UP, under its application RS&I-AP-No. 1099, conditional approval for relief from the requirements of § 236.566, which required equipping controlling locomotives with an operative apparatus responsive to all automatic train stop, train control, or cab signal territory equipment. The conditional approval provided for "detour train movements necessitated by catastrophic occurrence such as derailment, flood, fire, or hurricane" on certain listed UP territories configured with automatic cab signals (ACS) or automatic train stop (ATS). Ultimately, the relief would allow trains not equipped with the apparatus required under § 236.566 to enter those ACS and ATS territories. However, the relief was conditional upon establishing an absolute block in advance of each train movement—as prescribed by General Code of Operating Rules (GCOR) 11.1 and 11.2—and notifying the applicable FRA Regional Headquarters. The detour would only be permissible for up to seven days and FRA could modify or rescind the relief for railroad non-compliance.

On February 7, 2006, that relief was temporarily extended to include defined territory where approximately two months of extensive track improvements were necessary. Additional conditions for this relief included a maximum train speed of 65 miles per hour and notification to the FRA Region 8 Headquarters within 24 hours of the beginning of the non-equipped detour train movements and immediately upon any accident or incident. On February 27, 2007, FRA provided similar temporary relief for another three months on the same territory.

While the aforementioned conditional relief was provided on an ad hoc basis, FRA feels that codifying rules regulating temporary rerouting involving PTC system track or locomotive equipment is necessary due to the potential dangers of allowing mixed PTC and non-PTC traffic on the same track and the inevitable increased presence of PTC and PTC-like technologies. Moreover, FRA believes that the subject railroads and FRA would benefit from more regulatory flexibility to work more quickly and efficiently to provide for temporary rerouting to mitigate the problems associated with emergency situations and infrastructure maintenance.

Under the proposed rule, FRA is providing for temporary rerouting of non-PTC trains onto PTC track and PTC trains onto non-PTC track. (Please note that any train operated on a PTC line that is other than it's "normal route", which is equipped and functionally responsive to the PTC system over which it is subsequently operated; or any non-PTC train (not a passenger train or a freight train having any TIH) operated on a non-PTC line that is other than it's "normal route", are not considered being rerouted for purposes of the conditions set forth in this section.)

Paragraph (g) effectively provides temporary civil penalty immunity from various applicable requirements of this subpart, including paragraph (b) of this section as it relates to lead locomotives, similarly to how waivers from FRA have provided certain railroads immunity from § 236.566. FRA seeks comments on what other requirements under part 236 should also be included.

FRA expects that emergency rerouting will require some flexibility in order to respond to circumstances outside of the railroad's control—most notably changes in the weather, vandalism, and other unexpected occurrences—that would result in potential loss of life or property or prevent the train from continuing on its normal route. While paragraph (g) lists a number of possible emergency circumstances, they are primarily included for illustrative purposes and are not a limiting factor in determining whether an event rises to an emergency. For instance, FRA would also consider allowing rerouting in the event use of the track is prevented by vandalism or terrorism. While these events are not the primary reasons FRA proposes paragraph (g) to allow rerouting, FRA recognizes that they may fall outside of the railroad's control.

In the event of an emergency that would prevent usage of the track, temporary rerouting may occur instantly by the railroad without immediate FRA notice or approval. By contrast, the vast majority of maintenance activities can be predicted by railroad operators. While the proposed rule provides for temporary rerouting for such activities, the lack of exigent circumstances do not require the allowance of instantaneous rerouting without an appropriate request and, in cases where the request is for rerouting to exceed 30 days, FRA approval.

Accordingly, under paragraph (g), procedurally speaking, temporary rerouting for emergency circumstances will be treated differently than temporary rerouting for planned maintenance. While FRA continues to have an interest in monitoring all temporary rerouting to ensure that it is occurring as contemplated by FRA and within the confines of the rule, the timing of FRA notification and the approval procedures, reflect the aforementioned differences.

When an emergency circumstance occurs that would prevent usage of the regularly used track, and would require temporary rerouting, the subject railroad must notify FRA within one business day after the rerouting commences. To provide for communicative flexibility in emergency situations, the proposed rule provides for such notification to be made in writing or by telephone. FRA proposes that written notification may be accomplished via overnight mail, e-mail, or facsimile. In any event, the railroad should take the steps necessary for the method of notification selected to include confirmation that an appropriate person actually on duty with FRA receives the notification and FRA is duly aware of the situation. Such notification may be made to the National Response Center, clearly describing the actions taken, and the railroad point of contact s that FRA may follow up for additional information.

While telephone notification may provide for easy communications by the railroad, a mere phone call would not provide for documentation of information required under paragraph (g). Moreover, if for some reason the phone call is made at a time when the designated telephone operator is not on duty or if the caller is only able to leave a message with the FRA voice mail system, the possibility exists that the applicable FRA personnel would not be timely notified of the communication and its contents. Thus, while not in the proposed rules, FRA is considering requiring any telephonic notification performed in accordance with paragraph (g) to be followed up with written notification within 48 hours. FRA seeks comments on this issue.

If the National Response Center is not used to receive and distribute the notifications of emergency rerouting, FRA is considering using particular contact mail and e-mail addresses and telephone and facsimile numbers to be used exclusively for the notifications required by paragraph (g) as they relate to emergency rerouting. Otherwise, if a railroad would notify a particular member of the FRA staff in writing, and that staff member is unavailable (e.g., on annual or sick leave, working in the field, or otherwise indisposed), FRA would not be timely notified of the emergency situation and the rerouting actions that are occurring. If there is a singular contact address for each form of written notification, FRA could attempt to provide continuous personnel assignment to monitor incoming notifications. FRA seeks comments on this issue. FRA also seeks comments on the possible need to include requirements relating to confirmation of receipt of notifications required under paragraph (g).

Emergency rerouting can only occur without FRA approval for fourteen (14) consecutive calendar days. If the railroad requires more time, it must make a request to the Associate Administrator. The request must be made directly to the Associate Administrator and separately from the initial notification sometime before the 14-day emergency rerouting period expires. Unless the Associate Administrator notifies the railroad of his or her approval before the end of the allowable emergency rerouting timeframe, the civil penalty immunity provided by paragraph (g) will expire at the end of that timeframe.

While a mere notification is necessary to commence emergency rerouting, a request must be made, with subsequent FRA approval, to perform planned maintenance rerouting. The relative predictability of planned maintenance activities allows railroads to provide FRA with much more advanced request of any necessary rerouting and allows FRA to review that request. FRA proposes that the request must be made at least 10 calendar days before the planned maintenance rerouting commences.

To ensure a retrievable record, the request must be made in writing. It may be submitted to FRA by fax, email, or courier. Because of security protocols placed in effect after 9/11, regular mail undergoes irradiation to ensure that any pathogens have been destroyed prior to delivery. The irradiation process adds significant delay to FRA's receipt of the document, and the submitted document may be damaged due to the irradiation process. The lack of emergency circumstances makes telephonic communication less necessary and less preferable. Like notifications for emergency rerouting, the request for planned rerouting must include the number of days that the rerouting should occur. If the planned maintenance will require rerouting up to 30 days, then the request must be made with the Regional Administrator. If it will require rerouting for more than 30 days, then the request must be made with the Associate Administrator. These longer time periods reflects FRA's opportunity to review and approve the request. In other words, since FRA expects that the review and approval process will provide more confidence that a higher level of safety will be maintained, the rerouting period for planned maintenance activities may be more than the 14 days allotted for emergency rerouting.

Regardless of whether the temporary rerouting is the result of an emergency situation or planned maintenance, the communication to FRA required under paragraph (g) must include the information listed under paragraph letter (i). This information is necessary to provide FRA with context and details of the rerouting. To attempt to provide railroads with the flexibility intended under paragraph (g), and to attempt to prevent enforcement of the rules from which the railroad should be receiving civil penalty immunity, FRA must be able to coordinate with its inspectors and other personnel. This information may also eventually be important to FRA in developing statistical analyses and models, reevaluating its rules, and determining the actual level of danger inherent in mixing PTC and non-PTC traffic on the same tracks.

For emergency rerouting purposes, the information is also necessary for FRA to determine whether it should order the railroad or railroads to cease rerouting or provide additional conditions that differ from the standard conditions specified in paragraph (i). FRA recognizes the importance of allowing temporary rerouting to occur automatically in emergency circumstances. However, FRA must also maintain its responsibility of ensuring that such rerouting occurs lawfully and as intended by the rules. Accordingly, the proposed rules provide for the opportunity for FRA to review the information required by paragraph (g) to be submitted in accordance with paragraph letter (i) and order the railroad or railroads to cease rerouting if FRA finds that such rerouting is not appropriate or permissible in accordance with the requirements of paragraphs (g) through (i), and as may be so directed in accordance with paragraph (k), as discussed further below.

If FRA determines that an emergency rerouting should not have occurred, and that the railroad instituted the emergency rerouting knowing that it should not have been instituted, then the civil immunity intended under paragraph (g) would not apply. As a result, FRA may impose a civil penalty for each violation caused by rerouting performed during this period. FRA may also impose a civil penalty against the railroad for submitting to FRA a willfully fraudulent or incorrect emergency rerouting notification. Due to the "willful" requirement, FRA does not believe that this would chill railroads from genuinely rerouting in emergency situations and notifying FRA of such rerouting.

For rerouting due to planned maintenance, the information required under paragraph letter (i) is equally applicable and will be used to determine whether the railroad should not reroute at all. If the request for planned maintenance is for a period of up to 30 days, then the request and information must be sent in writing to the Regional Administrator of the region in which the temporary rerouting will occur. While such a request is self-executing—meaning that it will automatically be considered permissible if not otherwise responded to—the Regional Administrator may prevent the temporary rerouting from starting by simply notifying the railroad or railroads that its request is not approved. The Regional Administrator may otherwise provide conditional approval, request that further information be supplied to the Regional Administrator of Associate Administrator, or disapprove the request altogether. For instance, a Regional Administrator the Associate Administrator may prevent or adjust rerouting in the event he or she finds that the rerouting indicated by the railroad is unsuitable or not permissive, the rerouting conditions should differ, or if he or she believes that a better, safer route is available for rerouting the traffic.

If the railroad still seeks to reroute due to planned maintenance activities, it must provide the Regional Administrator or Associate Administrator, as applicable, the requested information. If the Regional Administrator requests further information, no planned maintenance rerouting may occur until the information is received and reviewed and the Regional Administrator provides his or her approval. Likewise, no planned maintenance rerouting may occur if the Regional Administrator disapproves of the request.

If the Regional Administrator does not provide notice preventing the temporary rerouting, then the planned maintenance rerouting may begin and occur as requested. However, once the planned maintenance rerouting begins, the Regional Administrator may at any time order the railroad or railroads to cease the rerouting in accordance with paragraph (k).

Requests for planned maintenance rerouting exceeding 30 days, however, must be made to the Associate Administrator and are not self-executing. No such rerouting may occur without Associate Administrator approval, even if the date passes on which the planned maintenance was scheduled to commence. Like the Regional Administrator, the Associate Administrator may provide conditional approval, request further information, or disapprove of the request to reroute. Once approved rerouting commences, the Associate Administrator may also order the rerouting to cease in accordance with paragraph (k).

Proposed paragraph (j) requires that, once temporary rerouting onto a non-PTC equipped line commences, regardless of whether it is for emergency or planned maintenance purposes, the track segments upon which the train will be rerouted must have an absolute block established in advance of each rerouted train movement and that each rerouted train movement shall not exceed 59 miles per hour for passenger and 49 miles per hour for freight

Moreover, as referenced in proposed paragraph (g) as it applies to both emergency and planned maintenance circumstances, the track upon which FRA expects the rerouting to occur would require certain mitigating protections listed under paragraph (j) in light of the mixed PTC and non-PTC traffic. While FRA purposefully intends paragraph (j) to apply similarly to § 236.567, FRA recognizes that § 236.567 does not account for the statutory mandates of interoperability and the core PTC safety functions. Accordingly, paragraph (j) must be more restrictive.

Section 236.567, which applies to territories where “an automatic train stop, train control, or cab signal device fails and/or is cut out en route,” requires trains to proceed at either restricted speed or, if an automatic block signal system is in operation according to signal indication, at no more than 40 miles per hour to the next available point of communication where report must be made to a designated officer. Where no automatic block signal system is in use, the train shall be permitted to proceed at restricted speed or where an automatic block signal system is in operation according to signal indication but not to exceed medium speed to a point where absolute block can be established. Where an absolute block is established in advance of the train on which the device is inoperative, train may proceed at not to exceed 79 miles per hour. Paragraph (j) utilizes that absolute block condition, which more actively engages the train dispatcher in managing movement of the train over the territory (in both signaled and non-signaled territory). Recognizing that re-routes under this section will occur in non-signaled territory, the maximum authorized speeds associated with such territory are used as limitations on the speed of re-routed trains. FRA agrees with the comments of labor representatives in the Working Group who contend that the PTC mandate alters to some extent what would otherwise be considered reasonable for these circumstances. FRA welcomes comments on whether restrictions associated with re-routing should vary depending on whether the actual train in question is a passenger train or includes cars containing TIH materials.

It should be noted that this paragraph (j) was added by FRA after further consideration of this issue and was no part of the RSAC consensus. FRA believes that special precautions may be appropriate given the heightened safety expectations suggested by the RSIA mandate. Comment is requested on the appropriateness of these restrictions, including any impact on other rail traffic.

Paragraph (k), as previously noted, provides the Regional Administrator with the ability to order the railroad or railroads to cease rerouting operations that were requested for up to 30 days. The Associate Administrator may order a railroad or railroads to cease rerouting operations regardless of the length of planned maintenance rerouting requested. FRA believes this is an important measure necessary to prevent rerouting performed not in accordance with the rules and FRA’s expectations based on the railroad’s communications and to ensure the protection of train crews and the public. However, FRA is confident that in the vast majority of cases railroads will utilize the afforded latitude reasonably and only under necessary circumstances.

FRA expects each host railroad to develop a plan to govern operations in the event rerouting is performed in accordance with this section. Thus, as noted further below in § 236.1015, FRA proposes each PTCSP to include a plan accounting for such rerouted operations.

FRA believes that were it not to add the rerouting procedures described in this section, that railroads would face extremely high costs. A line problem could shut down an entire system and damage a regional economy, if rerouting was not an allowable option. On the other hand, allowing unlimited rerouting would defeat the underlying purpose of the rule, and would not meet the intent of RSIA08. The costs and benefits are included in the general analysis of costs and benefits below. Although there are costs associated with the proposed rerouting procedures, in absence of such procedures rerouting could not occur at all and the negative cost impact to the railroad would be greater. Thus, this provision would add flexibility and minimize compliance costs.

Section 236.1006 Equipping locomotives operating in PTC territory.

The PTC working group discussed at great length the issues related to operation of PTC-equipped locomotives, and locomotives not equipped with PTC on-board apparatus, over lines equipped with PTC. The working group recognized that the typical rule with respect to train control territory is that all controlling locomotives must be equipped and the system must be operative (see § 236.566). It was also noted in the discussion that the Interstate Commerce Commission (FRA's predecessor agency in the regulation of this subject matter) and FRA have provided some relief from this requirement in discrete circumstances where safety exposure was considered relatively low and the hardship associated with equipping additional locomotives was considered substantial.

ASLRRA noted that its member railroads conduct limited operations over Class I railroad lines that will be required to be equipped with PTC in a substantial number of locations. These operations are principally related to the receipt and delivery of carload traffic in interchange. The small railroad service extends onto the Class I railroad in order to hold down costs and permit both the small railroad and the Class I to retain traffic that might be priced off the railroad if the Class I had to dispatch a crew to pick up or place the cars. This, in turn, supports competitive transportation options for small businesses, including marginal small businesses in rural areas.

ASLRRA advocated an exception that would permit the trains of its members and other small railroads to continue use of existing trackage rights and agreements without the necessity for equipping their locomotives with PTC. They suggested that any incremental risk be mitigated by requiring that such trains proceed subject to the requirement for an absolute block in advance (similar to operating rules consistent with § 236.567 applicable to trains with failed on-board train control systems). This position was consistently opposed both by the rail labor organizations and the Class I railroads. These organizations took the position that all trains should be equipped with PTC in order to gain the benefits sought by the congressional enactment and to provide the host railroad the full benefit of its investment in safety. Informal discussions suggested that Class I railroads might offer assistance to certain small railroads in equipping of their locomotives (either technical or financial), but that this would, of course, be done based on the corporate interest of the Class I railroad.

In the PTC working group and in informal discussions around the RSAC activities, Class I railroads indicated that they intended to take a strong position against non-equipped trains operating on their PTC lines, and that in order to enforce this restriction fairly they understood that their own locomotives would all need to be equipped (including older road switchers that might venture onto PTC-equipped lines only occasionally). However, during these discussions FRA was not able to develop a clear understanding regarding the extent to which the Class I railroads under previously executed private agreements enjoy the effective ability outside the scope of FRA regulations to enforce a requirement that all trains be equipped. FRA presumes for purposes of this proposal that there will be circumstances rooted in previously executed private agreements under which the Class I would be entitled to require the small railroad to use a controlling locomotive equipped with PTC as a condition of coming onto the property. FRA wishes to emphasize that, in making this regulatory proposal, FRA does not intend to influence the exercise of private rights or to suggest that public policy would disfavor an otherwise legitimate restriction on the use of unequipped locomotives on PTC lines. Rather, this proposal is intended to explore limited exceptions that might be acceptable from the point of view of safety, and helpful from the point of view of the public interest in rail service, where it might be compatible with prior rights of the railroads involved. FRA also notes that, in the absence of clear guidance on this issue, a substantial number of waiver requests could be expected that would have to be resolved without the benefit of decisional criteria previously examined and refined through the rulemaking process.

Paragraph (a) states that, as general rule, all trains operating over PTC territory must be PTC-equipped. In other words, paragraph (a) requires that each lead locomotive should be operated with a PTC onboard apparatus if it is controlling a train operating on a track equipped with a PTC system in accordance subpart I. The PTC onboard apparatus should operate and function in accordance with the PTCSP governing the particular territory. Accordingly, it must successfully and sufficiently interoperate with the host railroad's PTC system.

Generally, the four parts of each PTC system are office, wayside, communications, and onboard components. No need to invent new term. FRA recognizes that a PTC onboard apparatus for a lead locomotive owned and operated by one railroad may not be part of the PTC system upon which the locomotive operates. For example, a Class II railroad lead locomotive equipped with a PTC onboard apparatus may operate on a Class I railroad's PTC line. Throughout this rule, the use of the term "PTC system," depending upon its context, usually refers to the host railroad's PTC system, and not the tenant railroad's lead locomotive. When using the term, PTC onboard apparatus, however, FRA intends to cover all such mobile equipment, regardless of whether it on a locomotive owned or controlled by a host or tenant railroad.

Under paragraph (b), this is followed by a series of qualifications and exceptions.

First, it is understood that during the time PTC is being deployed, there will be unequipped movements over PTC lines. In general, Class I locomotives are used throughout the owning railroad's system and, under shared power agreements, on other railroads nationally. FRA anticipates that the gradual equipping of locomotives, which will occur at a relatively small number of specialized facilities and which will require a day or two out of service as well as time in transit, will extend well into the implementation period that ends on December 31, 2015. It will not be feasible to tie locomotives down to PTC lines, and the RSAC stakeholders fully understood that point. Labor organizations did urge that railroads make every effort to use equipped locomotives as controlling units, and FRA believes that in general railroads will do so in order to obtain the benefits of their investment.

Second, FRA has included a transitional provision related to PTC apparatus that fails upon attempted initialization that is specifically intended to encourage placement of PTC-equipped locomotives on the point during the period when reliability may be an issue. This provision would allow a stated, declining percentage of locomotives equipped with PTC to be dispatched even if the on-board apparatus fails. Although FRA agrees with the objective of rail labor's suggestion for "consist management" that puts equipped locomotives on the point, FRA also recognizes that a number of factors related to the age and condition of locomotives may influence this decision. Further, in the early stages of implementation, requiring that power units be switched if initialization fails could result in significant train delays and contribute to congestion in yards and terminals. Some "slack" in the system will be required to implement PTC intelligently and successfully. Of course, if FRA determines during implementation that good faith efforts are not being made to take advantage of PTC-equipped locomotives, FRA could step in with more prescriptive requirements after notice and opportunity for comment.

Recognizing that matching PTC lines with PTC-equipped controlling locomotives will be a key factor in obtaining the benefits of this technology in the period up to December 31, 2015, FRA requests comments on whether PTC Implementation Plans should be required to include power management elements describing how this will be accomplished to the degree feasible.

Third, the section provides a cross-reference to Section 236.1029 pertaining to PTC on-board apparatus failing en route.

Fourth, this provision includes exceptions for trains operated by Class II and III railroads, including a tourist or excursion railroads. The exceptions are limited to lines not carrying intercity or commuter passenger service, except where the Class I freight railroad and the passenger railroad have requested an exception in the PTC Implementation Plan's main line track exception addendum (MTEA) in accordance with § 236.1019 and FRA has approved that element of the plan. FRA believes that providing this flexibility is an important part of FRA's compliance with the Regulatory Flexibility Act.

FRA has considered whether to provide an exception for equipping Class II and Class III railroad locomotives operating over passenger routes equipped with PTC, but FRA has not been able to define conditions that would apparently be suitable in every case. FRA is open to consideration of exceptions within the context of a PTC Implementation Plan. To the extent that the host Class I or passenger railroad would need to be supportive of the exception, FRA recognizes that options may be foreclosed prior to FRA consideration. However, railroads have historically exercised substantial control of operations over track that they own or dispatch, and in this case those interests significantly parallel the apparent intent of the Congress to achieve a high level of safety in mixed freight and passenger operations. If FRA were to handle exceptions through PTC Implementation Plans, FRA seeks comments on how that should be accomplished. FRA also seeks comments on whether there should be an assumption that the lead locomotives not equipped with PTC onboard apparatus' on four unequipped Class II or III railroad trains will be permitted daily on a segment of PTC-equipped track and that variances from that are permitted in a PTC Implementation Plan. If so, FRA questions whether that should be subject to the agreement of both railroads. If agreement by the Class II or III railroad is not required, FRA seeks comments on what assurance there would be that the Class I railroad would not effectively shut out the Class II or III railroad's operation.

FRA recognizes that most of the justifications stated for these proposed exceptions pertain to short movements for interchange that would constitute a small portion of the movements over the PTC-equipped line. The accident/incident data show that the risk related to these movements is small. A review of the last seven years of accident data covering 3,312 accidents that were potentially preventable by PTC showed that only two of those accidents involved a Class I railroad and a Class II or Class III railroad's train. FRA believes that the low level of risk revealed by these statistics justifies an exception for Class II and III railroad trains traversing a PTC-equipped line for a short distance. FRA notes that the cost of equipping those trains would be high when viewed in the context of the financial strength of the Class II or III railroad and the marginal safety benefits would be relatively low in those cases where a small volume of traffic is moved over the PTC-equipped line.

FRA also believes that it is clearly desirable to eventually have every locomotive using PTC-equipped lines equipped with PTC. However, FRA seeks comments on the length of time the exception should last and a justification of that length of time. Other considerations aside, FRA seeks comments on whether FRA should not require a Class II or III railroad locomotive used on a PTC-equipped line to be equipped with PTC when it is rebuilt or replaced (i.e., when the cost of equipping a locomotive is lowest). In other cases, the Class II or III railroad has dedicated locomotives serving the line to be equipped with PTC. From the facts presently available to FRA, it appears to be appropriate for those locomotives to be equipped with PTC. Moreover, FRA is aware of other cases where Class II and III railroads have rather more extensive operations over Class I railroad lines; and, in these cases, the risks incurred could be more substantial. Further, in some of these cases the smaller railroads are aligned with the Class I railroads over which they operate or may even be under common ownership and control. For purposes of prompting a more complete public dialogue on this issue, FRA is proposing to limit unequipped movements by any single Class II or III railroad to not more than 4 trains per day over any given track segment on a PTC-equipped line. A train moving from the small railroad to the point of interchange and back within the same calendar day would count as two trains.

To the extent the movements in question did not exceed 20 miles, this exception would be available at least until FRA next considered the issue of PTC deployment. Information available to FRA indicates that this would accommodate a substantial majority of the affected operations.

In the preamble FRA asks how it should apply if the small railroad's locomotives were equipped for PTC.

To the extent the movements in question exceeded 20 miles, the exception would be available only until December 31, 2020. In some cases, small railroads operate over Class I railroads for over one hundred miles, and these operations may be integral to their service plans (e.g., permitting them to reach lines branching off from the Class I route structure for which the smaller railroad provides local service). FRA recognizes that in these circumstances the smaller railroads would face overwhelming competition for supplier attention as well as significant challenges related to pricing that will attend the initial period of implementation. Accordingly, FRA proposes to provide additional time for these railroads to equip the necessary locomotives. In conjunction with this latitude, FRA would ask for progress reports to focus the attention of the railroads' management teams and ensure that the agency could not be presented with unreasonable demands for further extensions at the end of the extended implementation period.

FRA recognizes that small railroads carry a wide variety of commodities, including TIH traffic. FRA invites comments on whether the small railroad exceptions for freight operations that FRA is proposing should be altered if the small railroad is transporting TIH traffic on PTC equipped track through a densely populated area. Commenters are requested to detail any alternative standards they believe should be adopted to address such a situation.

The costs and benefits of this section are included in the general analysis below. The added flexibility this may provide for small entities is a key part of FRA's compliance with the Regulatory Flexibility Act, as discussed below.

Section 236.1007 Additional Requirements for High Speed Service

Since the early 1990's, there has been an interest centered around designated high speed corridors for the introduction of high speed rail, and a number of States have made progress in preparing rail corridors through safety improvements at highway-rail grade crossings, investments in track structure, and other improvements. FRA has administered limited programs of assistance using appropriated funds. With the passage of the American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009), which provides $8 billion in capital assistance for high speed rail corridors and intercity passenger rail service, and the President's announcement of a *Vision for High Speed Rail in America* in April of 2009, FRA expects those efforts to increase considerably. FRA believes that railroads conducting high speed operations in the United States can provide a world class service as safe as, or better than, any high speed operations being conducted elsewhere.

In anticipation of such service, and to ensure public safety, FRA has developed for PTC systems three tiers of requirements. The performance thresholds are intended to increase safety performance targets as the maximum speed limits increase to compensate for increased risks, including the potential frequency and adverse consequences of a collision or derailment.

Section 236.1007 proposes setting the intervals for the high speed safety performance targets for operations with: maximum speeds at or greater than 60 and 50 miles per hour for passenger service and freight operations, respectively, under paragraph (a); maximum speeds greater than 90 miles per hour under paragraph (b); and maximum speeds greater than 125 miles per hour under paragraph (c) and maximum speeds greater than 150 mph in paragraph (d). The reader should note that the requirements are additive as speed rises. So, for instance, requirements above 90 miles per hour apply equally above 125 miles per hour and above 150 miles per hour.

Paragraph (a) addresses the PTC system requirements for territories where speeds are greater than 59 miles per hour for passenger service and 49 miles per hour for freight service. Under existing regulations (49 CFR § 236.0), block signal systems are required at these speeds (unless a manual block system is in place, an option that this proposal would phase out). The proposed rule expects covered operations moving at these speeds to have implemented a PTC system that provides, either directly or with another technology, all of the statutory PTC system functions along with the safety-critical functions of a block signal system. Track circuits assist in broken rail detection and unintended track occupancies (equipment rolling out). Fouling circuits can identify equipment that is intruding on the clearance envelope and may prevent raking collisions.

FRA recognizes that advances in technology may render current block signal, fouling, and broken rail detection systems obsolete and FRA does not want to preclude the introduction of suitable and appropriate advanced technologies. Accordingly, FRA believes that alternative mechanisms providing the same functionality are entirely acceptable and FRA encourages their development and use to the extent they do not have an adverse impact on the level of safety.

Proposed paragraph (b) addresses system requirements for territories where operating speeds are greater than 90 miles per hour. At these higher speeds, the implemented PTC system must not only comply with paragraph (a), but also be shown to be fail-safe (as defined in Appendix C) and prevent entry of rail traffic onto the higher speed line operating with a PTC system. FRA intends this concept of fail-safe application to be understood in its commonplace meaning, i.e., that insofar as feasible the system is designed to fail to a safe state, which normally means that trains will be brought to a stop.

Further, FRA understands that there are aspects of current system design and operation that may create a remote opportunity for a “wrong-side” or unsafe failure and that these issues would be described in the PTCSP and mitigations would be provided. FRA recognizes that, as applied in the general freight system, this proposal could create a significant challenge related to interoperability of freight equipment operating over the same territory. Accordingly FRA requests comment on whether, where operations do not exceed 125 miles per hour or some other value, the requirement for compliance with Appendix C safety assurance principles might be limited to the passenger trains involved, with “non-vital” on-board processing permitted for the intermingled freight trains.

As speed increases, it also becomes more important that inadvertent incursions on the PTC-equipped track be prevented. FRA proposes that this be done by effective means that might include use of split-point derails properly placed, equipping of tracks providing entry with PTC, or arrangement of tracks and switches in such a way as to divert an approaching movement which is not authorized to enter onto the PTC line. The protection mechanism on the slower speed line must be integrated with the PTC system on the higher speed line in a manner to provide appropriate control of trains operating on the higher speed line if a violation is not prevented for whatever reason.

Paragraph (c) addresses very high speed rail operations exceeding 125 miles per hour, which is the maximum speed for Class 7 track under § 213.307. At these higher speeds, the consequences of a derailment or collision are significantly greater than at lower speeds due to the involved vehicle's increased kinetic energy. In such circumstances, in addition to meeting the requirements under paragraphs (a) and (b), including having a fail-safe PTC system, the entity operating above 125 miles per hour must provide an additional safety analysis (the HSR-125) providing suitable evidence to the Associate Administrator that the PTC system can support a level of safety equivalent to, or better than, the best level of safety of comparable rail service in either the United States or a foreign country over the 5 year period preceding the submission of the PTCSP.

Additionally, PTC systems on these high speed lines must provide the capability, as appropriate, to detect incursion from outside the right of way and provide warnings to trains. Each subject railroad is free to suggest in its HSR-125 any method to the Associate Administrator that ensures that the subject high speed lines are corridors effectively sealed and protected from such incursions (see § 213.347 of this title), including such hazards as large motor vehicles falling on the track structure from highway bridges.

Paragraph (d) addresses the highest speeds existing or contemplated for rail operations exceeding 150 miles per hour. FRA expects these operations to be governed by a Rule of Particular Applicability and the HSR-125 required by paragraph (c) shall be developed as part of an overall system safety plan approved by the Associate Administrator.

The quantitative risk showing required above 125 miles per hour is not required to include consideration of acts of deliberate violence. The reason for this exclusion is simply to remove speculate or extraordinary considerations from the analysis. FRA and the Department of Homeland Security will of course expect that security considerations are taken into account in system planning.

FRA does not believe that this section creates any new costs or benefits, as any high-speed system would have had a very reliable version of PTC.

Section 236.1009 Procedural requirements.

RSIA08 and the proposed rule require that by April 16, 2010, each Class I railroad carrier and each entity providing regularly scheduled intercity or commuter rail passenger transportation develop and submit to FRA a plan for implementing a PTC system by December 31, 2015, and that FRA shall not permit the installation of any PTC system or component in revenue service unless the

Administrator has certified them through the approval process set forth in, and complies with the requirements of part 236.

As noted earlier, current subpart H provides a technically sound procedure suitable to provide FRA approval for various processor-based signal and train control systems. However, as based on experience gained during BNSF's ETMS 1 project, FRA believes that its process does not support rapid FRA review and decision making and requires redundant submission of information common to multiple railroads. FRA also believes that although the risk analysis required by subpart H fully reflects operational parameters associated with the different type of operations, it is excessively cumbersome and overly time consuming for the purposes of deploying PTC system technologies at the rate required under RSIA08.

Moreover, subpart H does not require an implementation plan and does not provide for "certification." Arguably FRA could simply amend subpart H to include requirements relating to implementation plans and to modify the language to equate "approval" under Subpart H with "certification" under the statute. However, FRA believes that such a resultant amended Subpart H would remain unsuitable for a PTC system certification process in light of the congressional mandates. Those potential amendments alone would not remedy subpart H's inability to provide quick and efficient FRA review.

Accordingly, for PTC system implementation, certification, and build-out completion to occur within the very aggressive dates set by Congress, FRA is proposing a new subpart I, with some minor modifications to subpart H. Under subpart I, § 236.1007 establishes and explains the process by which each railroad may ultimately receive PTC System Certification for its PTC system. Under § 236.1007, FRA intends to avoid procedural redundancy, provide sufficient procedural flexibility to accompany the varying needs of those seeking certification, mitigate the financial risk associated with technological investment necessary to comply with the regulatory requirements, and otherwise develop a streamlined process to provide for quick review and resolution of the issues leading to certification.

Generally speaking, there are three major elements of the PTC System Certification process: PTCIP submission and approval, receipt or use of a Type Approval number—which may be provided with approval of a PTCDP—and PTCSP submission to receive PTC System Certification. While § 236.1007 provides for the procedural requirements for this process, the contents for the applicable filings are provided for under §§ 236.1009, 236.1011, and 236.1013. The PTCIP is the written plan that defines the specific details of how and when the railroad will implement the PTC system. The PTCDP provides a detailed discussion of specific elements of the proposed technology and product that will be used to implement PTC as required by RSIA08. Approval of the PTCDP comes in the form of a Type Approval number that applies to the subject PTC system. The PTCSP provides the railroad-specific elements demonstrating that the system, as installed, meets the required safety performance objectives. Approval of the PTCSP comes in the form of a PTC System Certification.

Under paragraph (a), the April 16, 2010, PTCIP submission deadline applies to all host railroads required to install a PTC system on each wayside—as defined in § 236.1003 and further discussed above in the analysis of § 236.1005(b)—that exist at that time. FRA believes that the railroad that maintains operational control over a particular track segment is in the best position to develop and submit the PTCIP, since that railroad is more knowledgeable of the conditions of and operations over its track.

Under paragraph (a), FRA expects that a PTCIP will be filed by railroads that are host railroads to track upon which passenger trains traverse and thus require PTC installation and operation. FRA recognizes that the statute requires timely submission of a PTCIP by each Class I railroad and each entity providing regularly scheduled intercity or commuter rail passenger transportation. Class II and III railroads that host intercity or commuter rail service will need to file implementation plans, whether or not they directly procure or manage installation of the PTC system.

The tenant passenger railroad will need to file jointly with the Class I, II or III railroad. This is consistent with RSIA, which requires each subject passenger railroad to file an implementation plan. In the case of an intercity or commuter railroad providing service over a Class I railroad, it may be sufficient for the passenger railroad to file a letter associating itself with the Class I's plan to the extent it impacts the passenger service. FRA does not propose any requirement for joint filing in the more common case where another railroad has freight trackage rights over a Class I railroad's PTC line. However, the Class I railroad will, of course, address the issue of interoperability in its plan as required by law.

If a host freight railroad and tenant passenger railroad cannot come to an agreement on a PTCIP to jointly file by April 16, 2010, they must instead each file a PTCIP separately with a notification separate from the PTCIP to the Associate Administrator indicating that a joint filing was not possible and an explanation of why the subject railroads could not agree upon a final PTCIP draft for joint filing. Under such a circumstance, each subject railroad may still be subject to a civil penalty assessed for each day past the deadline that a PTCIP is not jointly filed. FRA believes that these measures are necessary to ensure timely PTC system implementation and operation under the statute and in the interest of public safety. Once each railroad separately files its PTCIP, with a notification and explanation why joint filing was not possible, then the railroads must confer with the Associate Administrator. The Associate Administrator may use any means to mediate the dispute so that the railroads may submit a mutually acceptable PTCIP.

If a PTCIP or request for amendment (RFA) must be submitted in accordance with the rule after April 16, 2010, paragraph (a) does not provide the subject railroads with an opportunity to file separately. Since there would be no statutory or regulatory deadline for such submissions, FRA does not believe it is necessary for the Associate Administrator to mediate the dispute. If a railroad intends to use track that would require the installation of a PTC system in accordance with paragraph (a)(3), then such usage would merely be delayed until the parties come to a mutually acceptable PTCIP for joint filing.

Paragraph (b) provides the process for receiving a Type Approval number for a particular PTC system. Under the proposed rule, each PTC system must receive a Type Approval number.   The Type Approval is a number assigned to a particular on-the-shelf PTC system product—described in a PTCDP in accordance with § 236.1013—indicating FRA's belief that the product could fulfill the requirements of subpart I. FRA's issuance of a Type Approval does not mean that the product will meet the requirements of subpart I. The Type Approval applies to the technology designed and developed, but not yet implemented, and does bestow any ownership or other similar interests or rights to any railroad. Each Type Approval number remains under the control of the FRA, which can issue or revoke in accordance with the rules.

FRA expects the proposed Type Approval process to provide a variety of benefits to FRA and the industry. If a railroad submits a PTC Development Plan (PTCDP)—discussed in more detail below—describing a PTC system, and the PTC system receives a Type Approval, then other railroads, under paragraph (b)(1), may simply rely on the Type Approval number without having to file a separate PTCDP, if the railroad intends to use the same PTC system without certain variances. While the railroad filing the PTCDP must expend resources to develop and submit the PTCDP, all other railroads would not. This would not only provide significant cost and time savings for a number of railroads, but will remove a significant level of redundancy from the approval process that is inherent in subpart H.

If, however, a railroad intends to use a modified version of a PTC system that has already received a Type Approval number, and the variances between the two systems are safety-critical, the railroad must submit a new PTCDP. The new PTCDP can either fully comply with the content requirements under § 236.1011 or supply a Type Approval number for the other PTC system upon which the modified PTC system will rely and a document fulfilling the content requirements under § 236.1011 as it applies to the safety-critical variances.

In any event, to receive a new Type Approval number, the railroad must submit to FRA a PTCDP, drafted in accordance with § 236.1011, no later than when it submits its PTCIP. While the PTCDP may be drafted by the PTC system vendor, FRA believes it is the railroads' regulatory responsibility and duty to submit its PTCIP to FRA. FRA believes that requiring the submission of the PTCDP with the PTCIP would facilitate a reduction in regulatory activities, thus maximizing the time available for the railroads to carry out the necessary activities to complete PTC implementation within the 65 months available between April 2010, and December 2015. During that time, the each railroad is expected to carry out all of the required actions necessary to complete design, manufacture, test, and complete installation of the PTC office, onboard, and wayside subsystems.   FRA believes that the process defined by paragraph (b) provides the railroads greater flexibility.

By requiring that a railroad's PTCDP be submitted no later than its PTCIP, FRA intends to ensure that FRA has the opportunity early in the regulatory approval process to review and determine whether the proposed technical solution in the PTCDP has the potential to satisfy the statutory requirements. If a PTCDP is submitted at a later time, the length of time available to the railroad to perform a complete PTC implementation will be decreased even further.

Many issues relating to FRA's review of the railroad's PTCDP may also cause further delays, thus reducing the time between the receipt of a Type Approval and the statutory deadline of December 15, 2015, upon which the PTC system must be installed and operating. For instance, FRA may find that the PTCDP does not adequately conform to the rules or otherwise has insufficient information to justify approval. FRA may also determine that there are issues raised by the PTCDP that would adversely affect the ability of FRA to eventually certify the system. If such a situation were to arise, the railroad and its vendor would need to address the issues, and resubmit the PTCDP for FRA approval.

Given the magnitude of the tasks faced by the railroads, any additional delays beyond April 16, 2010, will increase the risk of the railroad failing to meet the December 31, 2015, completion date required by RSIA08 and the length of time that the risk to the public and railroad employees remains unmitigated by PTC technologies. More specifically, FRA recognizes that any loss of time would make it more difficult for a railroad to perform the installation, testing, and analyses necessary to submit its PTCSP for PTC System Certification. Such installation, testing, and analyses cannot occur until the railroad knows the PTC system that it may use, as identified by a Type Approval number. Accordingly, paragraph (b) proposes that each PTCDP be filed no later than when its associated PTCIP is submitted in order to preserve as much time as possible to ensure that each railroad meets the statutory deadline and that Congress' intent is not otherwise frustrated.

FRA believes that the existence of certain overlapping issues in each PTCDP and PTCIP also requires their contemporaneous submission. FRA strongly believes that a meaningful implementation plan cannot be created if the railroad has not identified and understands the technology they propose to implement. Without an understanding of the technology, and the issues associated with the design, test, and implementation, any schedules developed by the railroad would be meaningless. Unless there is an understanding of the PTC system it hopes to use, and how it expects to implement that system, evaluation of a deployment schedule can not be undertaken.

Moreover, the PTCIP requires that the railroad address the issue of interoperability with other PTC systems. Any meaningful discussion regarding interoperability requires that the railroad have a clear understanding of the technical capabilities of the system that it proposes to implement before it can make an informed judgment of how the system will interoperate with other systems. The information required in the PTCDP provides the implementing railroad, other railroads with which the implementing railroad interfaces, and FRA with an understanding of the technical requirements necessary for interoperability. FRA believes that early identification of technical capabilities of the proposed PTC systems will allow the concerned parties to make more timely design adjustments to facilitate interoperability, reducing any delays that may increase the level of risk of the railroad meeting its statutory deadline.

FRA also believes that the process defined by paragraph (b) would also reduce each railroad's financial risk involved in implementing a technological system that requires governmental approval. Members of the PTC Working Group expressed concern about having to expend significant resources to implement and test a PTC system prior to submitting a PTCSP reflecting its findings and in order to receive PTC System Certification. FRA believes that paragraphs (b) and (e) together addresses this concern. By requiring submission of a PTCDP earlier in the process, FRA intends to be involved in the implementation process from the beginning. After contemporaneously reviewing a railroad's PTCIP and PTCDP, FRA may be able to predetermine, and share with the railroad, an appropriate course of action to adequately address the various issues specific to the railroad and related to drafting a successful PTCSP. Moreover, in accordance with paragraph (e)―as discussed further below―each subject railroad may have the benefit of FRA monitoring its progress in implementing its PTC system. With FRA's involvement in the process, each subject railroad's risk of not having a sufficient and suitable PTCSP will be mitigated.

While FRA expects each subject railroad to submit its PTCDP with its PTCIP, the proposed rule does not preclude a railroad from submitting its PTCDP beforehand for FRA review and approval. FRA encourages an earlier submission of the PTCDP so as to further reduce the required regulatory effort necessary to review the PTCIP and PTCDP if submitted together. More importantly, it would present an opportunity for FRA to issue a Type Approval for the proposed PTC system before April 16, 2010, thus providing other railroads intending to use the same or similar PTC system the opportunity to leverage off of the work already accomplished by simply submitting the Type Approval―and a much less burdensome PTCDP in the event of variances. FRA also believes that the regulatory procedure may create an incentive for railroads using the same or similar PTC system to jointly develop and submit a PTCDP, thus further reducing the paperwork burden on FRA and the industry as a whole and increasing confidence in the interoperability between systems.

Under proposed paragraph (c), in order to receive PTC System Certification―as required by statute prior to PTC system installation in revenue service―each subject railroad must either file a Request for Expedited Certification (REC) or submit an approved PTCIP and a PTCSP developed in accordance with § 236.1015.

A REC applies only to PTC systems that have already been in revenue service and meet the criteria of § 236.1031(a), as further discussed below. If a PTC system is not eligible for expedited certification, its must submit a PTCSP. As required under proposed § 236.1015, the PTCSP must include information relating to the operation and safety of the PTC system as defined in the PTCDP and as applied to the railroad's actual territory. To determine the sufficiency of the PTC system's applicability on the railroad's territory, the railroad may be required, as referenced in paragraph (e), to perform laboratory or field testing or have an independent assessment performed.

Ultimately, PTC System Certification―issued by FRA based on a review and approval of the PTCSP―is FRA's formal recognition that the PTC system, as described and implemented, meets the statutory requirements of subpart I and the terms of the regulation. It does not imply FRA endorsement of the PTC system itself.

To be clear, proposed paragraph (d) requires that each PTCIP, PTCDP, and PTCSP must comply with the content requirements under §§ 236.1011, 236.1013, and 236.1015, respectively. If the submissions do not comply with their respective regulatory requirements, then they may not be approved. Without approval, a PTC system may not receive a Type Approval or PTC System Certification.

Paragraph (d) also requires that the contents of the submitted plans be understood by FRA personnel. In the interest of an open market, FRA does not want to preclude the ability of PTC system suppliers outside of the United States from manufacturing or selling PTC systems to the subject railroads. However, in order to ensure the safety and reliability of those systems, FRA needs to adequately review the submitted plans. Accordingly, FRA proposes to require that all materials submitted in accordance with this subpart be in the English language, or have been translated into the English language and certified as true and correct. FRA seeks comments on this proposal and whether any additional requirements are necessary to ensure FRA's adequate understanding of the submissions.

Under subpart H, a railroad may seek confidential treatment for certain information required to be submitted under that subpart. According to § 236.901(c), a railroad may label that information as confidential—if it deems it to be trade secrets, or commercial or financial information that is privileged or confidential under Exemption 4 of the Freedom of Information Act, 5 U.S.C. 552(b)(4)—and submit the information in accordance with § 209.11. FRA believes that the same concept should be applied to materials submitted in accordance with subpart I. FRA continues to believe that the referenced information should receive the protections under the Freedom of Information Act (FOIA) (5 U.S.C. § 552) and the Trade Secrets Act (18 U.S.C. § 1905). FRA also continues to believe that it cannot make any flat pronouncements about the confidentiality of information it has not yet received. Should a FOIA request be made for information submitted under this rule that the submitting party as claimed should be withheld, the submitting company will be notified of the request in accordance with the submitter consultation provisions of the Department's FOIA regulations (§ 7.17) and will be afforded the opportunity to submit detailed written objections to the release of information protected by exemption 4 as provided for in § 7.17(a). Since FRA proposes to place in a docket for public comment the redacted versions of the submitted plans, FRA strongly encourages submitting parties to request protection from withholding only for those portions of documents that truly justify such treatment (trade secrets, security sensitive information).

While FRA continues to believe that there is no need at this time to substantially revise § 209.11, FRA proposes in subpart I to require an additional document to assist FRA in efficiently and correctly reviewing confidential information. Under § 209.11, a redacted and an unredacted copy of the same document must be submitted. When FRA review is required to determine confidentiality, FRA personnel must painstakingly compare side-by-side the two versions to determine what information has been redacted. To reduce this burden, FRA proposes that any material submitted for confidential treatment under subpart I and § 209.11 must include a third version that would indicate, without fully obscuring, the redacted portions. For instance, to this end, such a submission may use color or light gray highlighting, underlining, or strikethrough functions of its word processing program. This document will also be treated as confidential under

§ 209.11. While FRA could instead amend § 209.11 to include this requirement, FRA does not believe it to be necessary at this time. If more regulatory procedures in other subparts or parts provide for confidential treatment under § 209.11, FRA will then consider whether amendment of § 209.11 would be appropriate at that time.

As discussed more specifically below, FRA is considering requiring the submission of an adequate GIS shapefile to fulfill some of the PTCIP content requirements under § 236.1011. Redacting word processing documents includes the simple task of blocking the text wished to be deemed confidential. However, in a GIS shapefile, which includes primarily map data, visually blocking out the information would defeat the purpose. For instance, a black dot over a particular map location, or a black line over a particular route, would actually reveal the location. FRA expects that a railroad seeking confidentiality for portions of a GIS shapefile will submit three versions of the shapefile to comply with paragraph (d). FRA expects that the version for public consumption would merely not include the confidential information. FRA seeks comments on this proposal. FRA also seeks comments on how a third version of the GIS shapefile would indicate, without fully obscuring, the confidential portions.

As previously noted, FRA expects that FRA-monitored laboratory or field testing or an independent third party assessment may be necessary to support conclusions made and included in a railroad's submitted PTCDP or PTCSP. This issue is initially addressed in paragraph (e). The procedural requirements to effectuate either of those requirements can be found in §§ 236.1035 and § 236.1017, respectively.

Paragraph (f) makes clear that FRA approval of a plan submitted under subpart I may be contingent upon any number of factors and that once the plan is approved, FRA maintains the authority to modify or revoke the resulting Type Approval or PTC System Certification.

Under paragraph (f)(1), FRA's would reserve the right to attach additional requirements as a condition for approval of a PTCIP, PTCDP, or PTCSP. A risk-informed and performance-based approach is one in which the risk insights, and engineering analysis and performance history, are used to: (1) focus attention on the most important activities; (2) establish objective criteria based upon risk insights for evaluating performance; (3) develop measurable or calculable parameters for monitoring systems performance; and (4) focus on the results as the primary basis of regulatory decision-making. To accomplish these tasks, it is necessary to identify, analyze, assess, and control hazards and risks within all components of a system -- including people, cultures and attitudes, procedures, materials, tools, equipment, facilities and software. In the preparation of any of these plans, railroads may have inadvertently failed to fully address hazards and risks associated with all of these components.

FRA believes that proposed paragraph (f)(1) will provide make the regulatory process more efficient and stable. Rather than reject a railroads plan completely, and consequently delay the railroad's implementation of its PTC system, FRA would prefer to add additional conditions during the approval process to address these oversights. When determining whether to attach conditions to plan approval, FRA will consider whether : (1) the plan includes there is a well-defined and discrete technical or security issue that affects system safety; (2) the risk/ or safety significance of an issue can be adequately determined; (3) the issue affects public health and safety; (4) the issue is not already being processed under an existing program or process; and (5) the issue cannot be readily addressed through other regulatory programs and processes, existing regulations, policies, guidance, or voluntary industry initiatives.

Paragraph (f)(2) provides FRA the right to withdraw a Type Approval or a PTC System Certification as a consequence of the discovery of new information regarding system safety that was not previously identified. FRA issuance of each Type Approval or PTC System Certification under performance-based regulations assumes that the model of the train control system and its associated probabilistic data adequately accounts for the behavior of all design features of the system that could contribute to system risk. Different system design approaches may result in different levels of detail introducing different approximations/errors associated with the safety performance. There are some characteristics for which modeling methods may not fully capture the behavior of the system, or there may be elements of the system for which historical performance data may not be currently available. These potential inconsistencies in the failure analysis could introduce significant variations in the predicted performance from the actual performance. Because of the design complexity associated with train control systems, FRA recognizes that these inconsistencies are not the results of deliberate acts by any individuals or organizations, but simply reflects the level of detail of the analysis, the availability of comprehensive information as well as the qualification and experience of the team of analysts, and the resource limitations of both the railroad and FRA.

In paragraph (f)(3), FRA indicates that the railroad may be allowed to continue operations using the system, although such continued operations may have special conditions attached to mitigate any adverse consequences. It is FRA's intent, to the maximum extent possible and when consistent with safety, to assist railroads in keeping the systems in operation. FRA expects that if it places a condition on PTC system operations, each railroad will have a predefined process and procedure in place that would allow continued railroad operations, albeit under reduced capability, until appropriate mitigations are in place, and the system can be restored to full operation. In certain dire situations, FRA may actually order the suspension or discontinuation of operations until the root cause of the situation is understood and adequate mitigations are in place. FRA believes that suspending a Type Approval or a PTC System Certification pending a more detailed analysis of the situation may be appropriate, and that any such suspension must be done without prejudice. FRA expects to take such an action only in the most extreme circumstances and after consultation with the affected parties.

After reconsidering its issuance of a Type Approval or PTC System Certification, under paragraph (f)(4), FRA may either dismiss its reconsideration, continue to recognize the existing FRA approved Type Approval, allow continued operations with certain conditions attached, or order the railroad to cease applicable operations by revoking its Type Approval or PTC System Certification. If FRA dismisses its reconsideration or continue to recognize the Type Approval, any conditions required during the reconsideration period would no longer be applicable. If FRA will allow continued operations, FRA may order that the same or other conditions apply. FRA expects that revocation of a Type Approval or PTC System Certification may occur in very narrow circumstances, where the risks to safety appear insurmountable. Regrettably, there may be a few situations in which the inconsistencies are the result of deliberate fraudulent representations. In such situations, FRA may also seek criminal or civil penalties against the entities involved.

Paragraph (g) enables FRA to engage in the proper inspection to ensure that a railroad is in compliance with subpart I. FRA inspections may be required to determine whether a particular railroad has not implemented a PTC system where necessary. For instance, FRA may need to confirm whether a track segment has traversing over it 5 million gross tons or more of annual railroad traffic, TIH materials, or passenger traffic. FRA may also need to inspect locomotives to determine whether they are equipped with an onboard PTC apparatus or locomotive logs to determine whether it has entered PTC territory. Paragraph (g) provides FRA with the power to inspect the railroads and gather information necessary to enforce subpart I.

As noted above, in order to maintain an open marketplace, the proposed rule has been drafted to allow domestic railroads to purchase PTC systems from outside of the United States. FRA recognizes that PTC systems have been used in revenue service across the globe and that acceptable products may be available in other countries. FRA also recognizes that such use may come under a regulatory entity much like FRA. Accordingly, under paragraph (h), in the event information relating to a particular PTC system has been certified under the auspices of a regulatory entity in a foreign government, FRA is willing to consider that information as independently Verified and Validated in accordance with the proposed rule to support the railroad's PTCSP development. The phrase "under the auspices" intends to reflect the possibility of certification contractually performed by a private entity on behalf of a foreign government agency. However, the foreign regulatory entity must be one recognized by the Associate Administrator. A railroad seeking to enjoy the benefits of paragraph (h) must communicate that interest in its PTCSP.

The costs and benefits of this section are included in the general analysis below. FRA believes that the submission and approval costs associated with meeting the requirements of proposed subpart I are significantly less onerous than the submission and approval costs associated with meeting requirements equivalent to those in subpart H. Thus, FRA has attempted to minimize the procedural cost burden associated with obtaining PTC system certification.

Section 236.1011 PTC Implementation Plan content requirements

This section describes the minimum required contents of a PTC Implementation Plan. A PTCIP is a railroad's plan for complying with the installation of mandatory PTC systems required by RSIA08 and administered by the Federal Railroad Administrator. The PTCIP consists of implementation schedules, narratives, rules, technical documentation, and relevant excerpts of agreements that an individual railroad will use to complete mandatory PTC implementation.

A PTCIP is an engineering document that must establish the railroad's commitment regarding how it will meet the PTC implementation requirements under RSIA08. FRA will measure the railroad's progress in meeting the required implementation date based on the schedule and other information in the PTCIP. While the proposed rule does not specify or mandate any format for the PTCIP, it must at least clearly indicate which portions intend to address compliance with the various plan requirements under § 236.1011.

To facilitate timely and successful submittals, FRA, through assistance from a PTCIP Task Force drawn from the PTC Working Group, is developing a template that could be used to format the documents that must be submitted. FRA, however, wishes to emphasize that the use of such a template is strictly voluntary, and encourages railroads to prepare and submit the documents in whatever structure that is most economical for the railroad. FRA does not choose to require that the railroads expend their limited resources in reformatting of documents when such an activity adds no real value. However, while the template may be a useful tool, and in light of the various forms a PTCIP may be required to take due to the system the railroad intends to implement, complete adherence to the template may not necessarily guarantee FRA approval of the submitted PTCIP.

FRA expects each PTCIP to include various highly specific and descriptive elements relating to each railroad's infrastructure and operations. FRA recognizes that to manually assemble each piece of data into a PTCIP may be exceptionally onerous and time consuming and may make the PTCIP prone to errors. In light of the foregoing and of the statutory requirement that Congress be apprised on the progress of the railroad carriers in implementing their PTC systems, FRA believes that electronic submission of much of this information may be warranted and preferred. To facilitate collection of this data, FRA proposes to require submission of this data in electronic format. Such electronic submission would fulfill the requirements under § 236.1011 to which they apply.

FRA believes that the preferred, least costly, and least error-prone method to comply with § 236.1011 is for railroads to submit an electronic geographic digital system map containing the aforementioned segment attribute information in shapefile format, which is a data format structure compatible with most Geographic Information System (GIS) software packages. Using a GIS provides an efficient means for organizing basic transportation-related geographic data to facilitate the input, analysis, and display of transport networks. Railways around the world rely on GIS to manage key information for rail operations, maintenance, asset management, and decision support systems. FRA believes that the railroads may have already identified track segments, and their physical and operational characteristics, in shapefile format. For instance, FRA believes that it may be preferable that for each track segment, a shapefile should provide the following identifiable information: owning railroad(s); distance; signal system; track class; subdivision; number and location of sidings; maximum allowable speed; number and location of mainline tracks; annual volume of gross tonnage; annual number of cars carrying hazmat; annual number of cars carrying TIH; passenger traffic volume; average daily through trains; WIUs; switches; and at-grade rail-to-rail crossings. The requirements under paragraph (a) may be changed to accommodate any of these informational elements. FRA seeks comments on this proposal.

Paragraph (a)(1) requires that the railroad describe the technology that will be employed. Here, FRA intends to use the term "technology" broadly to include all applicable tools, machines, methods, and techniques.

Under paragraph (a)(2), FRA addresses the statutory requirements that the PTCIP shall describe how the PTC system will provide interoperability with movements of trains of other railroad carriers over its lines. Practically speaking, this means that each locomotive operating within PTC territory must be able to communicate with the PTC systems installed on that territory's track and signal system and on each locomotive operating on that territory, except in limited situations established elsewhere in this proposed rule.

Interoperability means the ability of diverse systems and organizations to work together (inter-operate), taking into account the technical, operational, and organizational factors that may impact system-to-system performance. FRA expects each PTC system required by subpart I to exhibit syntactic interoperability—so that it may successfully communicate and exchange data with other PTC systems—and semantic interoperability—so that it may automatically, accurately, and meaningfully interpret the exchanged information to prove useful to the end user of each communicating PTC system. To achieve semantic interoperability, both sides must defer to a common information exchange reference model. In other words, the content of the information sent must be the same as what is received and understood. Taking syntactic and semantic interoperability together, FRA expects each PTC system to provide services to, and accept services from, other PTC systems and to use those services exchanged to enable the PTC systems to operate effectively together and to provide the intended results. The degree of interoperability should be defined in the PTCIP when referring to specific cases.

Interoperability is achieved through four interrelated means: product testing, industry and community partnership, common technology and intellectual property, and standard implementation.

Product testing includes conformance testing and product comparison. Conformance testing ensures that the product complies with an appropriate standard. FRA recognizes that certain standards attempt to create a framework that would result in the development of the same end product. However, many standards apply only to core elements and allow developers to enhance or otherwise modify products as long as they adhere to those core elements. Thus, if an end product is developed in different ways to conform to the same standard, there may still be discrepancies between each instantiation of the end product due to the existence of those variables. Accordingly, FRA believes that comparison testing must also occur to ensure that each instantiation of the same product, regardless of the means upon which it is created to meet the same standard, is ultimately identical. In regards to PTC systems, such comparison testing must occur on all portions that relate to each system's interoperability with other systems. Thus, it is also important that the PTC system be formally tested in a production scenario—as they will be finally implemented—to ensure that it will actually will intercommunicate and interoperate with other PTC systems as advertised and intended.

To reach interoperability between the various applicable PTC systems, each PTCDP must also show that the systems share common product engineering. Product engineering refers to the common standard, or a sub-profile thereof, as defined by the industry/community partnerships, specifically intended to achieve interoperability. Without common product engineering, the systems will be unable to intercommunicate or otherwise interact as necessary to comply with the proposed rule.

FRA expects that each interoperability standard for PTC systems will be developed by a partnership between various industry participants. Industry and community partnerships, either domestic or international, usually sponsor standard workgroups to define a common standard to provide system intercommunications for a specific purpose. At times, an industry or community will sub-profile an existing standard produced by another organization to reduce options and thus making interoperability more achievable. Thus, in each PTCDP, the railroad must discuss how it developed or adopted a standard commonly accepted by that partnership.

Means of achieving interoperability include having the various entities involved using the same PTC system product or obtaining its components from the same developer. While FRA does not necessarily require this approach—since the agency seeks to maintain an open and competitive marketplace—FRA believes that this is a suitable means to achieve interoperability. This technique may provide similar technical results when using PTC system products from different vendors relying on the same intellectual property. FRA recognizes that certain developers with an intellectual property interest in a particular technology may provide a non-exclusive license of its intellectual property to another entity so that the licensee may introduce into the marketplace a substantially similar product reliant on that intellectual property. In such a case, FRA foresees that the use of a common PTC system technology—even if it is proprietary to a single or multiple entities and licensed to railroads—could reduce the variability between components, thus providing for a more efficient means to achieve interoperability.

In order for interoperability to actually occur between multiple entities' PTC systems, there must be some standard by which they all adhere to. Thus, FRA also expects that each PTCDP will provide assurances of a common interoperability standard agreed to between all entities using PTC systems that must interoperate.

Since each of these interrelated means has an important role in reducing variability in intercommunication, each railroad's PTCIP must clearly describe the elements required under paragraph (a)(1)-(3).

Much of the remaining information required in a PTCIP under the proposed rule relies on the location, length, and characteristics of each track segment. Therefore, a common understanding of a track segment is necessary. A track is the main designation for describing a physical linear portion of the network. Each track has a station location referencing system, which serves to locate inventory features and defects along the length of the track. Because some tracks can be very long, track segments are established to divide the track into smaller "management units." Typically, segment's boundaries are established at point of switch (POS) locations, but may also be located at mile markers, grade crossings, or other readily identifiable locations. Inspection, condition assessment, and maintenance planning is performed individually on each segment. After the track network hierarchy is established, the attribute information associated with each track is defined. This attribute information describes the track layout (e.g., curves and grades), the track structure (e.g., rail weights and tie specifications), track clearance issues, and other track related items such as turnouts, rail crossings, grade crossings, drainage culverts, and bridges. Inventory information about these track attributes can be quite detailed. The benefits of a complete and accurate track inventory provides a record of the track network's properties and information about the existing track materials at the specific locations when maintenance or repair is necessary.

Paragraphs (a)(4) and (a)(5) together require the railroad to put its entire implementation plan into an understandable context, primarily as it relates to the sequence and schedule of line segment implementation events. Under RSIA08, Congress requires each subject railroad, in its PTCIP, to describe how it shall, to the extent practical, implement the PTC system in a manner that addresses areas of greater risk before areas of lesser risk. Accordingly, the PTCIP must discuss the railroad's areas of risk and the criteria by which these risks were evaluated and prioritized for PTC system implementation. To this end, the railroad must clearly identify all track segments that must be equipped, the basis for that decision for each segment (which might be done by categories of segments), and the implementation date for each segment will be completed, taking into account the time necessary to fulfill the procedural requirements related to PTCSP submission, review, and approval. At a minimum, the deployment decisions must be based on segment traffic characteristics such as passenger and freight traffic volumes, the quantity of TIH and other hazardous materials, current methods of operations, existence of block signals and other traditional train control technologies, the number and class of tracks, authorized and allowable speeds for each segment, and other unusual characteristics that may adversely impact safety, such as unusual ruling grades and other track geometries. In cases where deployment of the PTC system cannot be accomplished in order of areas with the greatest risk to areas with the least risk, the railroad must explain why such a deployment was not practical and the steps that will be taken to minimize adverse consequences to the public until the line segment can be equipped.

Paragraphs (a)(6) and (a)(7) require the PTCIP to include information regarding the rolling stock and wayside devices that will be equipped with the appropriate PTC technology. For a PTC system to work as intended, PTC system components must be installed and operated in all applicable offices and on all applicable onboard and wayside subsystems. Accordingly, the PTCIP must identify which technologies will be installed on each subsystem and when they are scheduled to be installed.

Under paragraph (a)(6), each host railroad filing the PTCIP must include a comprehensive list of all rolling stock upon which a PTC onboard apparatus must be operative. FRA understands that in most situations, the rolling stock referenced in paragraph (a)(6) may only apply to lead locomotives. However, in the interest of not hindering creative technological innovations, FRA presumes the possibility that PTC system technology may also be attached to additional rolling stock to provide other functions, including determining train capacity and length or providing certain acceptable and novel train controls. To be kept apprised of these possibilities, FRA is proposing in paragraph (a)(6) that each PTCIP include a list of all rolling stock equipped with PTC technology.

FRA understands that a host railroad may not receive cooperation from a tenant railroad in collecting the necessary rolling stock information. Nevertheless, FRA expects each host railroad to make a good faith effort. Identification of those tenant railroads that the host railroad attempted to obtain the requisite and applicable information from and that failed to address a host railroad's written request may establish a good faith effort by the host railroad.

Paragraph (a)(7) requires the PTCIP to provide a detailed schedule of and the railroad to subsequently report WIU installation. The selection and identification of a technology selected as part of the PTCIP will also, to a great extent, determine the distribution of the functional behaviors of each of the PTC subsystems (e.g., office, wayside, communications, and back office). The WIU is a type of remote terminal unit (RTU) that is part of a larger PTC system, which is a type of Supervisory Control and Data Acquisition System (SCADA). As a whole, the safe and efficient operation of a SCADA—a centralized system that covers large areas, monitors and control systems, and passes status information from, and operational commands to, RTUs—is largely dependent on the ability of each of its RTUs to accurately receive and distribute the required information. As such, a PTC system cannot properly operate without properly functioning WIUs to provide and receive status information and react appropriately to control information.

It is commonly understood that a WIU device is capable of communicating directly to the office, train, or other wayside unit. FRA recognizes that there may not the same amount of WIUs and devices that they monitor. Depending on the architecture and technology used, a single WIU may communicate the necessarily information as it relates to multiple devices. FRA is comfortable with this type of consolidation provided that, in the event of a failure of any one of the devices being monitored, the most restrictive condition will be transmitted to the train or office, except where the system may uniquely identify the failed device in a manner that will provide safe movement of the train when it reaches the subject location.

Because of the critical role that WIU's play in the proper and safe operation of PTC systems, paragraph (a)(7) proposes that the railroad identify the number of WIU's required to be installed on any given track segment and the schedule for installing the WIU's associated with that segment. This information is necessary to fully and meaningfully fulfill the RSIA08 requirements that by December 31, 2012, Congress shall receive a report on the progress of the railroad carriers in implementing PTC systems. See 49 U.S.C. § 20157(d). To comply with this statutory requirement, each railroad must determine the number of WIUs it will need to procure and the location—as defined by the applicable subdivision—that each WIU will be installed. FRA believes that if a railroad does not perform these traditional engineering tasks, it will risk exceeding the statutory implementation deadline of December 31, 2015. FRA considers this information an integral part of the PTCIP that must be submitted to FRA for approval.

FRA recognizes the potential for technological improvements that may modify the number and types of WIU's required. FRA also recognizes that during test and installation, it may be discovered that additional WIU installation may be necessary. In either case, the railroad will be required to submit an RFA in accordance with § 236.1021 indicating how the railroad intends to appropriately revise its schedule to reflect the resulting necessary changes. Nevertheless, regardless of whether FRA approves or disapproves of the RFA, if a railroad is required to submit its PTCIP by April 16, 2010, implementation must still be completed by the statutory deadline December 31, 2015.

Under paragraph (a)(8), each railroad must also identify in its PTCIP which of its track segments are either main line or not main line. This list must be made based solely on the statutory and regulatory definitions regardless of whether FRA may later deem a track segment as other than main line. If a railroad has a main line that it believes should be considered not main line, it may file with the PTCIP a main line track exception addendum (MTEA) in accordance with § 236.1019, as further discussed below. Each track segment included in the MTEA should be indicated as much on the list required under paragraph (a)(8) so that the PTCIP accounts for each track segment with an appropriate cross-reference to the subject MTEA.

Under Paragraph (a)(9), as previously mentioned, § 236.1005(a) requires each applicable PTC system be designed to prevent train-to-train collisions. Under that section, FRA has proposed that certain requirements apply to at-grade rail-to-rail crossings, also known as diamond crossings. While the proposed rule text includes certain specific technical requirements, it also provides the opportunity for each subject railroad to submit an alternative arrangement providing an equivalent level of safety as specified in an FRA approved PTCSP. Accordingly, under paragraph (a)(10), if the railroad intends to utilize alternative arrangements providing an equivalent level of safety to that of the table provided under § 236.1005(a)(1)(i), the PTCSP must identify those alternative arrangements and methods, with any associated risk reduction measures, in its PTCSP.

Paragraph (b) addresses further deployment of PTC. As noted elsewhere in this preamble, the specific characteristics of the PTC route structure, with the focus on TIH traffic as an indicator of risk, was a late addition to the bill that would become RSIA08, not having appeared in either the House or Senate bills until the final package was assembled using consultations between the committee staffs in lieu of a formal committee of conference. Although the statutory construct (Class I rail line with 5 million gross tons and some TIH) adequately defines most of the core of the national freight rail system, it is a construct that will introduce distortions at both ends of the spectrum of risk.

On the one hand, a line with a maximum speed limit of 25 miles per hour ending at a grain elevator that receives a few cars of anhydrous ammonia is a “main line” if it has at least 5 million gross tons of traffic (a very low threshold for a Class I railroad). This is not a line without risk, particularly if it lacks wayside signals, but FRA analysis shows that the potential for a catastrophic release from a pressure tank car is very low at an operating speed of 25 miles per hour, and the low tonnage is likely associated with relatively infrequent train movements—limiting the chance of a collision. As FRA understands the congressional mandate, the law gives FRA little choice but to require PTC under these circumstances.

On the other end of the spectrum, lines with greater risk may go unaddressed. For instance, a line carrying significant volumes of other hazardous materials, without any TIH or passenger traffic, would not be equipped. This example is not likely to be present to any significant extent under current conditions. However, should the Class I railroads raise freight rates sufficiently to eliminate PIH traffic by making rail transportation prohibitively expensive, the issue would be presented as a substantial one. Most of the transportation risk―including hazards to train crews and roadway workers and exposure to other hazardous materials if released―would remain, but not the few carloads of TIH. FRA believes that the intent of the Congress with respect to deployment of PTC would be defeated, even though the literal language of the legislation would be satisfied.

Other lines carrying very heavy volumes of bulk commodities such as coal and intermodal traffic may or may not include TIH traffic. Putting aside the risk associated with TIH materials, significant risk exists to train crews and persons in the immediate vicinity of the right-of-way if a collision or other PTC-preventable accident occurs. Any place on the national rail system is a potential roadway work zone, but special challenges are presented in providing for on-track safety where train movements are very frequent.

Risk on the larger Class II and III railroads' lines is also a matter of concern, and the presence of significant numbers of Class I railroad trains on some of those properties presents the opportunity for further risk reduction, since over the coming years virtually all Class I road locomotives will be equipped with PTC. Examples include trackage and haulage rights retained over Class II and III railroads following asset sales in which the Class Is divested the subject lines. Other prominent examples involve switching and terminal railroads, the largest of which are owned and controlled by two or more Class I railroads and function, in effect, as extensions of their systems. Conrail Shared Assets, a large regional switching railroad that is owned by Norfolk Southern and CSX and is comprised of major segments of the former Conrail, then a Class I railroad, is perhaps the classic example.

FRA notes that there has also been a trend, only recently and temporarily abated by the downturn in the economy, toward higher train counts on some non-signaled lines of the Class I railroads. On a train-mile basis, these operations present about twice the risk as similar operations on signalized lines. These safety gaps need to be filled; and, while most will be filled due to the presence of TIH traffic, FRA cannot verify that this is the case in every instance.

FRA concludes that the mandated deployment of PTC will leave some substantial gaps in the Class I route structure, including gaps in some major urban areas. FRA believes that these gaps will, over time, be "filled in" by voluntary actions of the Class I railroads as they establish the reliability of their PTC systems, verify effective interoperability, and begin to enjoy the safety and other business benefits from use of these systems. FRA fully understands both the desire of the labor stakeholders in the PTC Working Group to see a broader build-out of PTC systems than that "minimally" required by RSIA08 and the concerns of the Class I railroads' representatives who noted the extreme challenge associated with equipping tends of thousands of wayside units, some 20,000 locomotives, and their dispatching centers' back offices (back offices are the combined dispatch system and central office system associated with PTC) within the statutory implementation period.

The Congress recognized that all of these issues are legitimate concerns and so mandated the establishment of Risk Reduction Programs under the same legislation. Section 103 of RSIA08 codifies language that includes, within the Risk Reduction Program, a Technology Implementation Plan that is specifically required to address technology alternatives, including PTC. Accordingly, the PTC and Risk Reduction provisions in RSIA08 are clearly aligned in purpose; and there are also references in the technology plan elements of the Risk Reduction language that address installation of PTC by other railroads. Further, FRA has been charged with a separate rulemaking under section 406 of RSIA08 regarding risk in non-signaled (dark) territory that significantly overlaps the issue set in this rulemaking and the Risk Reduction section. Use of technologies that are integral to PTC constitute the best response to hazards associated with non-signaled lines. Switch position monitoring systems, track integrity circuits, digital data links and other technology used to address dark territory issues should be and, as presently conceived, are forward-compatible with PTC. FRA proposes in paragraph (b) to dovetail these requirements by requiring that each Class I railroad include in its PTCIP deployment strategies indicating how it will approach the further build-out of full PTC or partial PTC implementation. These railroads would then be required to include in the technology elements of their initial Risk Reduction plans a specification of which lines will be equipped and with what PTC system elements. Proposed paragraph (b) makes clear that there would be no expectation regarding additional lines being equipped until those mandated by subpart I have been addressed. FRA shares the view of the Class I railroads and the passenger railroads that the December 31, 2015, deadline already presents a substantial challenge for railroads, suppliers and the employees affected.

Paragraph (c) codifies in regulation the statutory mandate that FRA review the PTCIP and determine, within 90 days upon receipt of the plan, whether to provide its approval or disapproval. FRA believes it is also important to provide procedural rules to communicate approval or disapproval. Thus, under proposed paragraph (b), FRA proposes that any approval or disapproval of a PTCIP requires FRA to provide written notice. In the event that FRA disapproves of the PTCIP, the notice will also include a narrative explaining the reasons for disapproval. Once the railroad receives notification that its PTCIP has been disapproved by FRA, it will have 30 days to resubmit its PTCIP for review and approval. A railroad may be subject to civil penalties if it fails to timely file its PTCIP under this section.

As noted previously, subpart I applies to each railroad that Congress and FRA has mandated to install a PTC system. A railroad that is not required to install a PTC system may still do so under its own volition. In such a case, it may either seek approval of its system under either subpart H or I. Paragraph (d) intends to make this choice clear.

The costs and benefits of this section are included in the general analysis below. The MTEA provisions may grant important flexibility to small entities.

Section 236.1013 PTCDP content requirements and Type Approval

As noted in the discussion above regarding § 236.1009, each PTCSP must be submitted with a Type Approval number identifying a PTC system that FRA believes could fulfill the requirements of subpart I. Under § 236.1009, a railroad may submit an existing Type Approval number in lieu of a PTC Development Plan (PTCDP) if the PTC system it intends to implement and operate is identical to the one described in that Type Approval's associated PTCDP. In the event, however, that a railroad intends to install a system for which a Type Approval number has not yet been assigned, or to use a system with an assigned Type Approval number that may have certain variances to its safety-critical functions, then the railroad must submit a PTCDP to obtain a new Type Approval number.

The PTCDP is the core document that provides the Associate Administrator sufficient information to determine whether the PTC system proposed for installation by the railroad could meet the statutory requirements for PTC systems specified by RSIA08 and the regulatory requirements under subpart I. Issuance of a product Type Approval number is contingent upon the approval of the PTCDP by the Associate Administrator. While filing of a PTCDP is optional in the sense that the railroad may proceed directly to submission of the PTCSP by the April 16, 2010 deadline (see § 236.1009), FRA encourages railroads engaged in joint operations to do so. Approval of the PTCDP, and issuance of a Type Approval, presents the opportunity for other railroads to reduce the effort required to obtain a PTC System Certification. If a Type Approval for a PTC system exists, another railroad may also use that Type Approval provided there are no variances in the system as described in the Type Approval's PTCDP. In such cases, the other railroad may avoid submitting its own PTCDP by simply incorporating by reference the supporting information in the Type Approval's PTCDP and certifying that no variances in the PTC system have been made.

This section describes the contents of the PTCDP required to obtain FRA approval in the form of issuance of a Type Approval number. The provisions of this section require each PTCDP to include all the elements and practices listed in this section to provide reasonable assurance that the subject PTC system will meet the statutory requirements and are developed consistent with generally-accepted principles and risk-oriented proof of safety methods surrounding this technology. FRA believes it is necessary to include the provisions contained in this section in order to provide reasonable assurance that the product, when developed and deployed, will have no adverse impact on the safety of railroad employees, the public, and the movement of trains.

FRA recognizes that much of the information required by § 236.1013 normally resides with the PTC system's developer or supplier maintains and not the client railroad. While FRA expects that each railroad and its PTC system supplier may jointly draft a PTCDP, the railroad has the primary responsibility for the safety of its operations and for providing the information required under § 236.1013. Accordingly, each railroad required to submit a PTCDP under subpart I should make the necessary arrangements to ensure that the requisite information is readily available from the supplier for submission to the agency.

FRA believes that suppliers and railroads will develop a PTCDP for most products that adequately address the requirements of the new subpart without substantial additional expense. As part of the design and evaluation process, it is essential to ensure that an adequate analysis of the features and capabilities is made to minimize the possibility of conflicts resulting from any use or feature, including a software fault. Since this analysis is a normal cost of software engineering development, we do not believe it imposes any additional significant costs beyond what should already be done when developing safety critical software.

In proposed §§ 236.1013 and 236.1015, various adjectives may precede the requirement. For instance, certain paragraphs require "a complete description," "a detailed description," or simply a "description." These phrases are inherited from subpart H. Their inclusion in subpart I are similarly not to imply that any description should be more or less detailed or complete than any other description required. By contrast, they are included merely for the purposes of emphasis.

Paragraph (a)(1) proposes to require that the PTCDP include system specifications that describe the overall product and identify each component and its physical relationship in the system. FRA will not dictate specific product architectures, but will examine each PTC system to fully understand how its various parts interrelate. Safety-critical functions in particular will be reviewed to determine whether they are designed to be fail-safe. FRA believes this provision is an important element that can be applied to determine whether safety is maximized and maintainability can be achieved.

Paragraph (a)(2) proposes to require a description of the operation where the product will be used. Upon receipt of this information within a PTCDP, FRA will have better contextual knowledge of the product as it applies to the type of operation on which it is designed to be used. Where operational behaviors are not applicable to a particular railroad, or the product design is not intended to address a particular operational behavior, FRA would expect a short statement indicating which operational characteristics do not apply and why they are not applicable.

Paragraph (a)(3) requires that the PTCDP include a concept of operations, a list of the product's functional characteristics, and a description explaining how various components within the system are controlled. FRA expects that the information provided under paragraphs (a)(2) and (a)(3) will together provide a thorough understanding of the PTC system.

FRA will review this information—primarily by comparing the subject PTC system's functionalities with those underlying principles contained in standards for existing signal and train control systems—to determine whether the PTC system is designed to account for all relevant safety issues. While FRA proposes to not prescribe PTC system design standards, FRA will require that the applicant compare the concepts contained in existing standards to the operational concepts, functionalities, and controls contemplated for the PTC system in order to determine whether a sufficient level of safety will be achieved. For example, FRA requirements prescribe that where a track relay is de-energized, a switch or derail is improperly lined, a rail is removed, or a control circuit is opened, each signal governing movements into the subject block occupied by a train, locomotive, or car must display its most restrictive aspect for the safety of train operations. FRA intends to apply the same and similar concept when reviewing each PTCDP to assure that such minimum safety requirements exist.

Paragraph (a)(4) requires that each PTCDP include a document that identifies and describes each safety critical function of the subject PTC system. The product architecture includes both hardware and software aspects which identify the protection developed against random hardware faults and systematic errors. Further, the document should identify the extent to which the architecture is fault tolerant. FRA intends to use this information to determine whether appropriate safety concepts have been incorporated into the proposed PTC system. For example, existing regulations require that when a route has been cleared for a train movement, it cannot be changed until the governing signal has been caused to display its most restrictive indication and a predetermined time interval has expired where time locking is used or where a train is in approach to the location where approach locking is used. FRA will apply this concept, among others, to determine whether all the safety-critical functions are included. Where such functionalities are not clearly determined to exist as a result of technology development, FRA will expect the reasoning to be stated and a justification provided describing how that technology provides the required level of safety. Where FRA identifies a void in safety-critical functions, FRA may not approve the PTCDP until remedial action is taken to rectify the concern.

FRA recognizes that the information required under paragraph (a)(4) may already be provided when complying with paragraph (a)(1). In such a case, the railroad shall cross reference where in the PTCDP that both paragraphs (a)(1) and (a)(4) are jointly satisfied.

Proposed paragraph (a)(5) requires that each PTCDP address the minimum requirements under § 236.1005 for development of safety-critical PTC systems. FRA expects the information provided under paragraph (a)(5) to cover: identification of all safety requirements that govern the operation of a system; evaluation of the total system to identify known or potential safety hazards that may arise over the life cycle of the system; identification of all safety issues during the design phase of the process; elimination or reduction of the risk posed by the hazards identified; resolution of safety issues presented; development of a process to track progress; and development of a program of testing and analysis to demonstrate that safety requirements are met. Paragraph (a)(5) also requires that each railroad identify the PTC system's safety assurance concepts.

Proposed paragraph (a)(6) requires a preliminary human factors analysis which must address each applicable human-machine interface (HMI) and all proposed product functions to be performed by humans to enhance or preserve safety. FRA expects this analysis to place special emphasis on proposed human factors responses—and the result of any failure to perform such a response—to safety-critical hazards including the consequences of human failure to perform. For each HMI, the PTCDP should address the proposed basis of assumptions used for selecting each such interface, its potential affect upon safety, and all potential hazards associated with each interface. Where more than one employee is expected to perform duties dependent upon HMI input or output, the analysis must address the consequences of failure by one or multiple employees. FRA intends to use this information to determine the proposed HMI's effect upon the safety of railroad operations. The preliminary human factors analysis must propose how the railroad or its PTC system supplier plans to address the HMI criteria listed in Appendix E or any alternatives proposed by the railroad and deemed acceptable by the Associate Administrator.

Proposed paragraph (a)(6) also requires that the PTCDP explain how the proposed HMI will affect interoperability. RSIA08 requires that each subject railroad explain how it intends to obtain system interoperability. The ability of a train crew member to operate another railroad's PTC system significantly depends upon a commonly understood HMI. The HMI provides the end user with a method of interacting with the underlying system and accessing the PTC functionality. FRA expects that each railroad will adopt an HMI standard that will ensure ease of use of the PTC system both within, and between, railroads.

Proposed paragraph (a)(7) requires an analysis regarding how subparts A through G of part 236 apply, or no longer apply, to the subject PTC system. FRA recognizes that while a PTC system may be designed in accordance with the underlying safety concepts of subparts A through G, the specific existing requirements contained in those subparts are not applicable. In any event, the PTCDP must identify each pertinent requirement considered to be inapplicable, fully describe the alternative method used to fulfill that underlying safety concept, and explain how the proposed PTC system supports the underlying safety principle. FRA notes that certain sections in subparts A though G may always be applicable to PTC systems certified under subpart I.

FRA is concerned about all dimensions of system security. Proposed paragraph (a)(8) requires the PTCDP to include a description of the security measures necessary to meet the specifications for each product. Security is an important element in the design and development of products and covers issues such as developing measures to prevent hackers from gaining access to software and developing measures to preclude sudden system shutdown, mechanisms to provide message integrity, and means to authenticate the communicating parties.

Safety and security are two closely related topics. Both are conditions that, when met, the subject is protected and without risk of harm. In the industrial marketplace, the goals of safety and security are to create an environment protecting assets from hazards or harm. While activities to ensure safety usually relate to the possibility of accidental harm, activities to ensure security usually relate to protecting a subject from intentional malicious act such as espionage, theft, or attack. Since system performance may be affected by either inadvertent or deliberate hazards or harms, the safety and security involved in the implementation and operation of a PTC system must both be considered.

Integrated security recognizes that optimum protection comes from three mutually supporting elements: physical security measures, operational procedures and procedural security measures. Today the convergence of information and physical security is being driven by several powerful forces. These include interdependency, efficiency and organizational simplification, security awareness, regulations, directives, standards and the evolving global communications infrastructure. Physical security describes both measures that prevent or deter attackers from accessing a facility, resource, or information stored on physical media and guidance on how to design structures to resist various hostile acts. Communications security describes measures and controls taken to deny unauthorized persons information derived from telecommunications and ensure the authenticity of such telecommunications. Because of the integrated nature of security, FRA expects that the railroads discussion will also address security as a holistic concept, and not restrict discussions of security to one specific aspect of security.

Paragraph (a)(9) proposes to require documentation of assumptions concerning reliability and availability targets of mechanical, electric, and electronic components. When building a PTC system, designers may make numerous assumptions that will directly impact specific implementation decisions. These fundamental assumptions usually come in the form of data (e.g., facts collected as the result of experience, observation or experiment, or processes, or premises) that can be randomly sampled. FRA does not expect to audit all of the fundamental assumptions on which a PTC system has been developed. Instead, FRA envisions sampling and reviewing fundamental assumptions prior to product implementation and after operation for some time. FRA expects that the data sampled may vary, depending upon the PTC system. It is not possible to provide a single set of quantitative numbers applicable to all systems, especially when systems have yet to be designed and for which the fundamental assumptions are yet to be determined. Quantification is part of the risk management process for each project. FRA believes that the actual performance of the system observed during the pre-operational testing and post-implementation phases will provide indications of the validity of the fundamental assumptions. FRA proposes that this review process will occur for the life of the PTC system (i.e., as long as the product is kept in operation). The depth of details required will depend upon what FRA observes. The range of difference between a PTC system's predicted and actual performance may indicate to FRA the validity of the underlying fundamental assumptions. Generally, if the actual performance matches the predicted performance, FRA believes that it will not have to extensively review the fundamental assumptions. If the actual performance does not match predicted performance, FRA may need to more extensively review the fundamental assumptions.

FRA expects each subject railroad to confirm the validity of initial assumptions by comparing them to actual in-service data. FRA is aware that mechanical and electronic component failure rates and times to repair are easily quantified data, and usually are kept as part of the logistical tracking and maintenance management of a railroad. FRA believes that this proposed criterion will enhance the quality of risk assessments conducted pursuant to this subpart by forcing PTC system designers and users to consider the long-term effects of operation over the course of the PTC system's projected life-cycle. If a PTC system can be used beyond its design lifecycle, FRA expects that any continued use would be only under a waiver provided in accordance with part 211 or under a PTCDP amended in accordance with § 236.1021. In its request for waiver or request for amendment, the railroad should address any new risks associated with the life cycle extension.

Proposed paragraph (a)(9) also requires specification of the target safety levels. This includes the identity of each potential hazard and how the events leading to a hazard will be identified for each safety-critical subsystems; the proposed safety integrity level of each safety-critical subsystem and the proposed way that accomplishment of these targets will be evaluated. This paragraph also requires identification of the proposed backup methods of operation and safety critical assumptions regarding availability of the product. FRA believes this information is essential for making determinations about the safety of a product and both the immediate and long-term effect of its failure. FRA contends that availability is directly related to safety to the extent the backup means of controlling operations involves greater risk (either inherently or because it is infrequently practiced).

Proposed paragraph (a)(10) requires a complete description of how the PTC system will enforce all pertinent authorities and block signal, cab signal, or other signal related indications. FRA appreciates that not all PTC architectures will seek to enforce the speed restrictions associated with intermediate signals directly, but nevertheless a clear description of these functions is necessary for clarity and evaluation.

Proposed paragraph (b) specifies the approval standard that will be employed by the Associate Administrator. The PTCDP is not expected to provide absolute assurance to the Associate Administrator for Safety. It only needs to show it meets the appropriate statutory and regulatory requirements for a PTC system required under this subpart, and that there is a reasonable chance that once built, it will meet the required safety standards for its intended use.   FRA emphasizes that approval of a PTCDP and issuance of a type approval does not constitute final approval to operate the product in revenue service. Such approval only comes after the Associate Administrator for Safety approves the PTCSP, and issues a PTC System Certification.

Proposed paragraph (c) establishes a time limit on the validity of a Type Approval. The purpose of this limit is to encourage the railroad to build and install a product, not merely to plan such a system. Further, the time limit will allow FRA to avoid maintaining records on Type Approvals which are not in use, and not likely to be in use. Provided that at least one product is certified within the 5 year period after issuance of the type approval, the type approval remains valid until final retirement of the system.

Proposed paragraph (d) provides the conditions under which a type approval may be used by another railroad. These conditions consist of the railroad maintaining a continually updated PTCPVL pursuant to § 236.1023(c), and the railroad provides licensing information associated with the use of the type approval. When a railroad submits for its PTC system a previously issued Type Approval provided for another railroad’s system, FRA expects that all the proper licensing agreements provide for continued use and maintenance of the PTC system. To ensure FRA’s confidence in this area, FRA proposes to require each Type Approval submission to include this relevant licensing information. FRA recognizes that there may be various licensing arrangements available relating to the exclusivity and sublicensing of manufacturing or vending of a particular PTC system. There may be other intellectual property variables that may make arrangements even more complex. To adequately capture all applicable arrangements, FRA proposes to generally require the submission of “licensing information.” More specific language may preclude FRA’s ability to collect information necessary to fulfill its intent. If any of this information were to change, either through any type of sale, transfer, or sublicense of any right or ownership, then FRA would expect the railroad to submit a request for amendment of its PTCDP in accordance with § 236.1021. FRA recognizes that this may be difficult for a railroad to accomplish, given the railroad may not be privy to any intellectual property transactions that may occur outside of its control. In any event, FRA would expect that a railroad would ensure, either through contractual obligation or otherwise, that its vendor or supplier continually provide it with updated licensing information. FRA seeks comments on this proposal.

Proposed paragraph (e) would require that a railroad submitting a PTCDP demonstrate that its vendor has a suitable quality control system. This requirement provides protection to the railroad and FRA that there is a reasonable probability that the vendor can design and manufacture the product such that it will meet the design targets specified in paragraph (a). FRA expects compliance with paragraph (e) will eliminate the operation of a PTC system where its vendor has inadequate quality control procedures and processes to support the proper development of a safety critical product.

Proposed paragraph (f) provides formal notification that the Associate Administrator for Safety may impose whatever conditions that are necessary to insure the safety of the public, train crews, and train operations when approving the PTCDP and issuing a type certificate. While FRA expects that adherence to the remainder of this section's requirements should justify issuance of a Type Approval, FRA also recognizes that there may be situations where other unaccounted for variables may reduce the Associate Administrator's confidence in the PTC system, its manufacturer, supplier, vendor, or operator.

The costs and benefits associated with Type approval are included in the general analysis below. Type approval is a cost minimizing alternative for meeting the PTCDP requirement.

Section 236.1015 PTCSP content requirements and PTC System Certification

The PTCSP is the core document which provides the Associate Administrator for Safety the information necessary to certify the as-built PTC system fulfills the required statutory PTC functions and is in compliance with the requirements of this s Issuance of a System Certification is contingent upon the approval of the PTCSP by the Associate Administrator for Safety. Under the proposed rules, the filing and approval of the PTCSP and issuance of a PTC System Certification is a mandatory prerequisite for PTC system operation in revenue service. Each PTCSP is unique to each railroad and must addresses railroad-specific implementation issues associated with the PTC system identified by the submitted Type Approval. Paragraph (a) codifies these meanings and limits.

When filing a PTCSP, as an initial matter, paragraph (b) requires each railroad to: include the applicable and approved PTCIP, PTCDP, and Type Approval; describe any changes subsequently made to the PTC system, as reflected in the PTCSP, that would require amendment of the PTCIP or PTCDP; and assure FRA whether the PTC system built is the same PTC system described in the PTCDP and PTCSP.

Paragraph (b)(1) effectively merges the approved PTCIP and PTCDP into the PTCSP so that there will be a single "package" available for PTC operations and FRA review before and after issuance of a PTC System Certification. If a PTCSP is approved, and the railroad receives a PTC System Certification, all three plans continue to “live” and can only be amended in accordance with § 236.1021.

FRA recognizes the possibility that between PTCIP or PTCDP approval, and prior to PTCSP submission, there may be changes to the former two documents. While such changes may only be made in accordance with § 236.1021, documentation of those changes may not be readily apparent to the reader of the PTCSP. Accordingly, under proposed paragraph (b)(2), FRA expects that each PTCSP shall include a clear and complete description of any such changes by specifically and rigorously documenting each variance. Paragraph (b)(2) also proposes to require that the PTCSP include an explanation of each variance’s significance. To ensure that there are no other existing variances not documented in the PTCSP, FRA also proposes under this paragraph to require the railroad to attest that there are no further variances. For the same reason, FRA proposes in paragraph (b)(3) that, if there have been no changes to the plans or to the PTC system as intended, the railroad be required to attest that there are no such variances.

Paragraph (c) delineates the contents of the PTCSP. The first elements of the PTCSP are the same elements as the PTCDP (and are described more fully in the section by section for 236.1013). The additional, railroad specific elements are as follows:

Paragraph (c)(1) requires that a hazard log be included in the PTCSP. This log consists of a comprehensive description of all hazards to be addressed during the life-cycle of the product, including maximum threshold limits for each hazard. For unidentified hazards, the threshold shall be exceeded at one occurrence. In other words, if the hazard has not been predicted, then any single occurrence of that hazard is unacceptable. The hazard log addresses safety-relevant hazards, or incidents/ failures which affect the safety and risk assumptions of the product. Safety relevant hazards include events such as false proceed signal indications and false restrictive signal indications. If false restrictive signal indications happen with any type of frequency, they could cause train crew members or other users (roadway workers, dispatchers, etc.) to develop a lackadaisical attitude towards complying with signal indications or instructions from the product, creating human factors problems.

Incidents in which stop indications are inappropriately displayed may also necessitate sudden brake applications that may involve risk of derailment due to in-train forces. Other unsafe or wrong-side failures that affect the safety of the product will be recorded on the hazard log. The intent of this paragraph is to identify all possible safety-relevant hazards which would have a negative effect on the safety of the product. Right-side failures, or product failures which have no adverse effect on the safety of the product (i.e., do not result in a hazard) would not be required to be recorded on the hazard log.

Paragraph (c)(2) requires that a risk assessment be included in the PTCSP. FRA will use this information as a basis to confirm compliance with the appropriate performance standard. A performance standard specifies the outcome required, but leaves the specific measures to achieve that outcome up to the discretion of the regulated entity. In contrast to a design standard or a technology-based standard that specifies exactly how to achieve compliance, a performance standard sets a goal and lets each regulated entity decide how to meet it. An appropriate performance standard includes provisions to provide reasonable assurance of safe and effective performance. It includes (1) provisions respecting the construction, components, ingredients, and properties of the device and its compatibility with other systems and connections to such systems; (2) provisions for the testing (on a sample basis or, if necessary, on an individual basis); (3) provisions for the measurement of the performance characteristics; and (4) provisions requiring that the results of each or of certain of the tests required show that the device is in conformity with the portions of the standard for which the test or tests were required. The Administrator may recognize all or part of an appropriate standard established by a nationally or internationally recognized standard development organization.

Paragraph (c)(3) requires that a hazard mitigation analysis be included in the PTCSP. The hazard mitigation analysis must identify the techniques used to investigate the consequences of various hazards and list all hazards addressed in the system hardware and software including failure mode, possible cause, effect of failure, and remedial actions. A safety-critical system must satisfy certain specific safety requirements.

“To determine if these requirements are satisfied, the safety assessor must review and assess the results of the following tasks:

1. Hazards associated with the system have been comprehensively identified.
2. Hazards have been appropriately categorized according to risk (likelihood and severity).
3. Appropriate techniques for mitigating the hazards have been identified.
4. Hazard mitigation techniques have been effectively applied.”[1]

FRA does not expect that the safety assessment will prove that a product is absolutely safe. However, the safety assessment should provide evidence that risks associated with the product have been carefully considered and that steps have been taken to eliminate or mitigate them. Hazards associated with product use need to be identified, with particular focus on those hazards found to have significant safety effects. Any hazards that cannot be mitigated by system designs e.g. human over-reliance of the automated systems, need to be included in the risk assessment described in paragraph (c)(2) no matter how low the probabilities may be. Then the designer must take steps to remove them or mitigate their effects. Hazard analysis methods are employed to identify, eliminate and mitigate hazards. Under certain circumstances, these methods will be required to be reviewed by an independent third party for FRA approval.

Proposed paragraph (c)(4) also requires that the PTCSP address safety verification and validation procedures. FRA believes verification and validation for safety are vital parts of the development of products. Verification and validation requires forward planning and consequently, the PTCSP should identify the test planning at each stage of development and the levels of rigor applied

[1] Leveson, Nancy G., “Safeware: System Safety and Computers,” Addison-Wesley Publishing Company, 1995.

during the testing process. FRA will use this information to assure that the adequacy and coverage of the tests are appropriate.

Proposed paragraph (c)(5) requires the railroad to include in its PTCSP the training, qualification, and designation program for workers, whether or not railroad employees, who will perform inspection, testing, and maintenance tasks involving the product. FRA believes many benefits accrue from the investment in comprehensive training programs which, among other things, are fundamental to creating a safe workforce. Effective training programs can result in fewer instances of human casualties and defective equipment, leading to increased operating efficiencies, less troubleshooting, and decreased costs. FRA expects any training program to include employees, supervisors and contractors engaged in railroad operations, installation, repair, modification, testing, or maintenance of equipment and structures associated with the product.

Paragraph (c)(6) requires the PTCSP to identify specific procedures and test equipment necessary to ensure the safe operation, installation, repair, modification and testing of the product. Requirements for operation of the system must be succinct in every respect. The procedures must be specific about the methodology to be employed for each test to be performed that is required for installation, repair, or modification including documenting the results thereof. FRA will review and compare the repair and test procedures for adequacy against existing similar requirements prescribed for signal and train control systems. FRA will use this information to ascertain whether the product will be properly installed, maintained, and tested.

Proposed paragraph (c)(7) requires that each railroad develop a manual covering the requirements for the installation, periodic maintenance and testing, modification, and repair for its PTC system. The issue of warnings to ensure safety is addressed in the Operations and Maintenance Manual, which must describe warning labels placed on the equipment of each product as necessary. Such warnings include, but are not limited to, means to prevent unauthorized access to the system; warnings of electrical shock hazards; cautionary notices about improper usage, testing or operation; and configuration management of memory and databases. The PTCSP should provide an explanation justifying each such warning and an explanation of why there are no alternatives that would mitigate or eliminate the hazard for which the warning is placed.

Proposed paragraph (c)(8) requires that the PTCSP identify the various configurable applications of the product, since this rule mandates use of the product only in the manner described in its PTCDP. Given the importance of proper configuration management in safety critical systems, FRA believes it is essential that railroads learn of and take appropriate configuration control of hardware and software. FRA believes that a requirement for configuration management control will enhance the safety of these systems and ultimately provide other benefits to the railroad as well. Under this section, railroads are responsible for all changes to configuration of their products in use, including both changes resulting from maintenance and engineering control changes, which result from manufacturer modifications to the product. Since not all railroads may experience the same software faults or hardware failures, the configuration management, and fault reporting tracking system play a crucial role in the ability of the railroad and the FRA to be able to determine and fully understand the risks and their implications. Without an effective configuration management tracking system in place, it is difficult, if not impossible, to fairly evaluate risks associated with a product over the life of the product.

Proposed paragraph (c)(9) requires the railroad to develop comprehensive plans and procedures for product implementation. Implementation (field validation or cutover) procedures must be prepared in detail and identify the processes necessary to verify the product is properly installed and documented, including measures to provide for the safety of train operations during installation. FRA will use this information to ascertain the product will be properly installed, maintained, and tested. FRA also believes configuration management should reduce disarrangement issues. Further, configuration management will reduce the cost of troubleshooting by reducing the number of variables and will be more effective in promoting safety.

Proposed paragraph (c)(10) requires the railroad to provide a complete description of the particulars concerning measures required to assure products, once implemented, continue to provide the expected safety level without degradation or variation over their life cycles. The measures must be specific regarding prescribed intervals and criteria for testing; scheduled preventive maintenance requirements; procedures for configuration management; and procedures for modifications, repair, replacement and adjustment of equipment. FRA intends to use this information, among other data, to monitor the product to assure it continues to function as intended.

Proposed paragraph (c)(11) provides a PTCSP requirement to include a description of each record concerning safe operation. Recordkeeping requirements for each product are discussed in § 236.1037.

Proposed paragraph (c)(12) requires a safety analysis of unintended incursions into a work zone. Measuring incursion risks is a key safety risk assumption. Failing to identify incursion risk can have the effect of making a system seem safer on paper than it actually is. The requirements set forth in this paragraph attempt to mandate design consideration of incursion protection at an early stage in the product development process. The totality of the arrangements made to prevent unintended incursions or operation at higher than authorized speed within the work zone must be analyzed. That is, the required actions for dispatchers, train crews and roadway workers in charge must be evaluated, in addition to the functions of the PTC system. Whether or not previously approved or recognized, FRA will not accept a system that allows a single point human failure to defeat the essential protection intended by the Congress. *See* NTSB Recommendations R-08-05, R-08-06. FRA feels that exposure should be identified because increases in risk due to increased exposure could be easily distinguished from increases in risk due solely to implementation and use of the proposed product.

In the past, little attention was given to formalizing incursion protection procedures. Also training for crews has not been uniform among organizations, and has frequently received inadequate attention. As a result, a variety of procedures and techniques evolved based on what has been observed or what just seemed right at the time. This lack of structure, standardization, and formal training is inconsistent with the goal of increasing the safety and efficiency.

Proposed paragraph (c)(13) calls for a more detailed description of any alternative arrangements provided under § 236.1011(a)(10), pertaining to at grade rail-rail crossings.

Proposed paragraph (c)(14) asks for a complete description of how the PTC system will enforce mandatory directives and signal indications, unless already addressed in the PTCDP. FRA recognizes that all systems will enforce all signal indications; however, where the architecture of the system performs this function it must be described.

Proposed paragraph (c)(15) refers to the requirement of § 236.1019(e) that the PTCSP is aligned with the PTCIP, including any amendments.

Under proposed § 236.1029(b), FRA proposes to require certain limitations on PTC trains operating over 90 miles per hour. Under § 236.1029(c), FRA provides railroads with an opportunity to deviate from those limitations if the railroad describes and justifies the deviation in its PTCDP, PTCSP, or application for an Order of Particular Applicability, as applicable. Section 236.1015(c)(16) reminds railroads that this is one of the optional elements that may be included in a PTCSP.

Railroads are required under § 236.1005(c) to submit a complete description of its compliance regarding hazard detector integration and under §§ 236.1005(g)-(k) to submit a temporary rerouting plan in the event of emergencies and planned maintenance. Sections 235.1015(c)(17) and (c)(18) reminds railroads that such requirements must be fulfilled with the submission of the PTCSP. Under paragraph (c)(18), FRA expects each temporary rerouting plan to explain the host railroad's procedure relating to detouring the applicable traffic. In other words, FRA expects that each temporary rerouting plan address how the host railroad will choose the track that traffic will be rerouted onto. For instance, the plan should explain the factors that will be considered in determining whether and how the railroad should take advantage of temporary rerouting. FRA remains concerned about the unnecessary commingling of PTC and non-PTC traffic on the same track and expects each temporary rerouting plan to address this possibility. More specifically, each plan should describe how the railroad expects to make decisions to reroute non-PTC train traffic onto a PTC line, especially where another non-PTC line may be available. While FRA recognizes each railroad may seek to use the most cost effective route, FRA expects the railroad to also consider the level of risk associated with that route.

In proposed paragraph (d), FRA proposes to state the criteria that FRA will refer to in evaluating the PTCSP, depending up on the underlying technical approach. Whereas in subpart H the safety case is evaluated to determine whether is demonstrates with a high degree of confidence that relevant risk will be no greater under the new product than previously, the statutory mandate for PTC calls for a different approach. In crafting the proposed approach, FRA has attempted to limit requirements for quantitative risk assessment to those situations where the technique is truly needed. Regardless of the type of PTC system, the safety case for the system must demonstrate that it will reliably execute the all of the functions required by this subpart (particularly sections 236.1005 and 236.1007). With this foundation, the additional criteria that must be met depend upon the type of PTC technology to be employed.

It is FRA's understanding that PTC systems may be categorized as one of the following four system types: non-vital overlay; vital overlay; standalone; and mixed.

In general, PTC systems will have some features that are not fully fail-safe in nature, even if on-board processing and certain wayside functions are fully failsafe. Common causes include surveying errors of the track database, errors in consist weight or makeup from the railroad information technology systems, and the crew input errors of critical operational data. To the extent computer-aided dispatching systems are the only check on potential dispatcher error in the creation or inappropriate cancellation of mandatory directives, some room for undetected wrong-side failure will continue to exist in this function as well.

Paragraph (d)(1) specifies the required behavior for non-vital overlay systems. Based on previous experience with non-vital systems, FRA believes it is well within the technical capability of the railroads to reduce the level of risk on any particular track segment to a level of risk 80% lower than the level of risk prior to installation of PTC on that segment. For subsequent PTC installations on the same line segment FRA recognizes that requiring an addition 80% improvement may not be technically or economically practical. Therefore FRA is only requiring that an entity installing or a modifying an existing PTC system need only demonstrate that the level of safety that is equal to, and preferable greater than, the level of safety of the prior PTC system. The risk that must be reduced is the risk against which the PTC functionalities are directed, assuming a high level of availability. Note that the required functionalities themselves do not call for elimination of all risk of mishaps. It is scope of risk reduction that the functionalities describe that becomes the 100% universe which is the basis of comparison. Although it is understood that the system will endeavor to eliminate 100% of this risk,[2] the analysts will need to account for cases where wrong side failure of the technology is coincident with a human failure (potentially induced by reliance on the technology). Since, within an appropriate conservative engineering analysis, non-vital processing has the theoretical potential to result in more failures (in pro forma analysis) than will typically be experienced, a 20% margin is provided. In preparing the PTCSP, the railroad will want to affirmatively address how training and oversight (including programs of operational testing under 49 CFR § 217.9) will reduce the potential for inappropriate reliance by those charged with functioning in accordance with the underlying method of operation.

The 80% reduction for PTC preventable accidents must be demonstrated by an appropriate risk analysis acceptable to the Associate Administrator for Safety and address all intended track segments that the system will be installed on. Again, FRA does not expect, or require, that these types of systems will prevent all wrong side failures. However FRA expects that the systems will be designed to be robust, all pertinent risk factors (including human factors) will be fully addressed, and that no corners will be cut to "take advantage" of the nominal allowance provided for non-vital approaches. FRA also encourages those using non-vital approaches to preserve as much as possible the potential for a transition to vital processing.

[2] Meaning that if the system worked as intended every time and was always available, 100 of the target risk would be eliminated.

Paragraph (d)(2) addresses vital overlays. Unlike a non-vital system, the vital system must be designed to address, at a minimum, the factors delineated in Appendix C. The railroad and their vendors are encouraged to carry out a more through design analysis addressing any other potential product specific hazards. FRA cannot over emphasize that vital overlay system designs must be fully designed to address the Appendix C. The associated risk analysis supporting this design analysis demonstrating compliance may be accomplished using any of the risk analysis approaches in subpart H, including abbreviated risk analysis.

Paragraph (d)(3) addresses standalone PTC systems that are used to replace existing methods of operations. The PTCSP design and risk analysis submitted to the Associate Administrator for Safety must show the not only does the system not introduce any new hazards that have not been acceptably mitigated, based upon all proposed changes in railroad operation. The required analysis is much more comprehensive than that required for vital overlay systems, since it must provide sufficient information to the Associate Administrator for Safety to make a decision with a high degree of confidence. FRA will consider each request for standalone operations uniquely, and will render decisions in the context of the proposed operation and the associated risks. FRA recognizes that application of this standard to a new rail system for which there is no clear North American antecedent could present a conceptual challenge. FRA invites comments regarding how best to frame the risk assessment showing for a standalone system applied to a new rail operation.

Paragraph (d)(4) addresses mixed systems. Because of the inherent complexity of these systems, FRA will determine an appropriate approach to demonstrating compliance after consultation with the railroad. Any approach will of course, require that the system perform the PTC requirements as described in §§ 236.1005 and 236.1007.

Paragraph (e) discusses factors that the Associate Administrator for Safety will consider in reviewing the PTCSP. In general, PTC systems will have some features that are not failsafe in nature. Examples include surveys of the track database, errors in consist data from the railroad such as weight and makeup, and crew input errors. FRA participation in the design and testing of the PTC system product helps FRA to better understand the strengths and weaknesses of the product for which approval is requested, and facilitates the approval process.

The railroad must establish through safety analysis that its assertions are true. This standard places the burden on the railroad to demonstrate that the safety analysis is accurate and sufficiently supports certification of the PTC system. The FRA Associate Administrator for Safety will determine if the railroads case has been made. As provided in subpart H, FRA believes that final agency determinations under this Subpart should be made at the technical level, rather than the policy level, due to the complex and sometimes esoteric subject matters associated with risk analysis and evaluation.

When considering the PTC system's compliance with recognized standards in product development, FRA will weight appropriate factors, including the use of recognized standards in system design and safety analyses, the acceptable methods in risk estimates, the proven safety records for proposed components, and the overall complexity and novelty of the product design.

FRA may reconsider approval of a petition for cause such for potential reasons as credible allegation of error or fraud, assumptions determined to be invalid as a result of in-service experience, or one or more unsafe events calling into question the safety analysis underlying the approval.

In those cases where the submission lacks information the Associate Administrator deems necessary to make an informed safety decision, FRA will solicit the data from the railroad. If the railroad does not provide the requested information, FRA may consider that a safety hazard exists. Depending upon the amount and scope of the missing data, PTCSP approval, and the subsequent system certification, may be denied.

While paragraph (e) summarizes how FRA intends to evaluate the risk analysis, paragraph (f) applies specifically to cases where a PTC system has already been installed and the railroad subsequent wants to put in a new PTC system. Paragraph (f) re-emphasizes that FRA policy regarding the safety of PTC systems is not, and cannot expect to be, static. Rather, FRA policy may evolve as railroad operations evolve, operating rules are refined, related hazards are addressed (e.g., broken rails), and other readily available options for risk reduction emerge and become more affordable. FRA embraces the concept of progressive improvement and expects that when new systems are installed to replace existing systems that actual safety outcomes equal or exceed those for the existing systems.

The costs and benefits associated with this section are included in the general analysis below.

Section 236.1017 Independent Third Party Review of Verification and Validation

As previously noted in § 236.1009(e), FRA may require a railroad to engage in an independent assessment of its PTC system. In the event an independent assessment is required, § 236.1017 proposes the applicable rules and procedures.

Paragraph (a) establishes factors considered by FRA when requiring a third-party assessment. FRA will attempt to make a determination of what level of third party assessment is necessary as early in the approval process as possible. However based on issues that may arise during the development and testing processes, or during the detailed technical reviews of the PTCDP and PTCSP, FRA may deem it necessary to require a third party assessment after the initial determination was made.

Paragraph (b) is intended to make it clear that it is FRA who will make the determination of the acceptability of the independence of the third party. If a third party assessment is required, railroads are encouraged to identify in writing who they propose to utilize as their third party. This is intended to avoid any potential issues downstream regarding the acceptability of the independence of the assessor. Compliance with paragraph (b) is not mandatory. However, the railroad must understand that if FRA determines that the railroads choice of a third party does not meet the independence requires of paragraph (c), then the railroad will be obligated to have the assessment repeated, at their expense, until it has been completed by a suitable third party.

Paragraph (c) defines the term ``independent third party" as used in this section. It limits independent third parties to ones ``compensated by' the railroad or an association on behalf of one or more railroads that is independent of the supplier of the product. FRA believes that requiring the railroad to compensate a third party will heighten the railroad's interest in obtaining a quality analysis and will avoid ambiguous supplier/third-party relationships that could indicate possible conflicts of interest.

Paragraph (d) explains that the minimum requirements of a third party audit are outlined in Appendix F and that FRA has discretion to the limit the extent of the third party assessment. FRA intends to limits the scope of the assessment to areas of the safety validation and verification as much as possible, with in the bounds of FRA's regulatory obligations. This will allow reviewers to focus on areas of greatest safety concern and eliminate any unnecessary expense to the railroad. In order to limit the number of third-party assessments, FRA first strives to inform the railroad as to what portions of a submittal could be amended to avoid the necessity and expense of a third-party assessment altogether. However FRA wishes to make it clear that Appendix F represents minimum requirements, and that if circumstances warrant, FRA may expand upon the Appendix F requirements as necessary to enable FRA to render a decision that is in the public interest (i.e., if FRA is unable to certify the system without the additional information).

The costs and benefits of this section are included in the general analysis below.

Section 236.1019 Main Line Track Exceptions

The RSIA08 provides some discretion to FRA regarding what constitutes mainline track for passenger and freight rail requiring the installation of PTC. FRA is exercising its regulatory discretion and will consider requests for designation of track over which rail operations are conducted as "other than main track" for passenger and commuter railroads, or freight railroads operating jointly with passenger or commuter railroads. Such relief may be granted only after petition to FRA under a very specific set of circumstances and only after justification acceptable to the Associate Administrator for Safety by the requesting railroad or railroads. FRA recognizes that their may be circumstances certain statutory PTC system implementation and operation requirements are not practical and provide no significant safety benefit.

Paragraph (a) specifies who, when, and how a passenger or commuter railroad may request exemption from yard or terminal track being considered mainline. FRA will consider requests for relief for individual passenger or commuter railroads on track over which they have conduct solitary operations or jointly where they have commingled operations. FRA will also consider joint requests for exemption of yard and terminal tracks where freight or passenger railroads conduct joint operations. FRA expects that in the case of joint operations that one such request will be submitted by the railroads that are conducting joint operations, and the request will be concurred in by all railroads affected. These requests are to be submitted with each railroad's PTCIP, and FRA is requiring that the track for which the exemption is requested be clearly defined in an appendix (the Main Track Exclusion Addendum or MTEA) to the PTCIP. The

MTEA must clearly define the physical boundaries of trackage for which exclusion is requested, as well as its use and characterization.   This clearly segregates track for which exclusion is requested, makes it easier to easier to identify tracks over which joint operations are requested, and in the event the railroad requests additional track to be considered for exclusion, reduces the amount of paper work required to be submitted to FRA.

In accordance with carefully considered recommendations from the RSAC, FRA proposes to make provision for railroads to request that certain track segments be exempted from definition as a mainline. Such requests are filled with FRA in the MTEA. FRA reviews a submitted MTEA and may concur in whole or part with the requested exemptions.

Paragraph (b) more specifically addresses the conditions for relief for passenger and commuter railroads with respect to passenger-only terminal areas. In addition to identifying the physical boundaries to FRA, the railroad when describing the tracks use and characterization must include copies of the track and signal charts. If FRA grants relief, the conditions of (b)(1), b(2) and (b)(3) must be strictly adhered to. These 3 conditions represent the minimum conditions FRA believes is necessary for safe operations. FRA reserves the right to add more restrictive conditions if necessary to provide for the safety of the public and train crews.

Paragraph (c) addresses the conditions under which joint limited passenger and freight operations may occur on defined track segments without the requirement for installation of PTC. This paragraph describes three alternative paths to the mainline exception. First, an exception is available where both the freight and passenger trains are limited to restricted speed. Such operations are feasible only for short distances, and FRA would examine the circumstances involved. Second, FRA will consider an exception where temporal separation of the freight and passenger operations can be ensured. (A more complete definition of temporal separation is provided in paragraph (d)). Third, FRA will consider commingled freight and passenger operations provided that a jointly agreed risk analysis is provided by the passenger and freight railroads, and the level of safety is the same as that which would be provided under one of the two prior options selected as the base case.

The major passenger railroads requested an exception for tracks in passenger terminal areas because of the impracticability of installing PTC. These are locations were signal systems govern movements over very complex special track work divided into short signal blocks. Operating speeds are low (not to exceed 20 miles per hour), and locomotive engineers moving in this environment expect conflicting traffic and restrictive signals. Although low-speed collisions do occasionally occur in these environments, the consequences are low; and the rate of occurrence is very low in relation to the exposure. It is the nature of current-generation PTC systems that they work with averages in terms of stopping distance and use conservative braking algorithms.

Applying this approach in congested terminals would add to congestion and frustrate efficient passenger service, in the judgment of those who operate these railroads. The density of wayside infrastructure required to effect PTC functions in these terminal areas would also be exceptionally costly in relation to the benefits obtained. FRA agrees that technical solutions to address these concerns are not presently available. FRA does believe that the appropriate role for PTC in this context is to enforce the maximum allowable speed (which is presently accomplished in cab signal territory through use of automatic speed control, a practice which could continue where already in place).

Temporal separation of passenger and freight services has been used to reduce risk because of the lower mass of passenger/commuter trains relative to freight trains, and the consequent likelihood of greater collision damage to the passenger train relative to the freight train should one collide with the other. This approach is used under the joint FRA-Federal Transit Administration Joint Policy on Shared Use, which permits co-existence of light rail passenger services (during the day) and local freight service (during the evening). Conventional rail technology and secure procedures are used to ensure that these services do not commingle. Amtrak representatives in the Working Group were confident that more refined temporal separation strategies could be employed on smaller railroads that carry light freight volumes and few Amtrak trains (e.g., one train per day or one train per day in each direction). The Passenger Task Force agreed.

FRA recognizes that there may be situations where temporal separation may not be possible. In this situation FRA may allow commingled operations provided the risk top the passenger is no greater than if the passenger and freight trains where operating under temporal separation or with all trains limited to restricted speed. FRA requires a jointly agreed risk analysis between the freight and passenger services. This ensures that the risks and consequences to both parties have been fully analyzed, understood, and mitigated to the extent practical.

Paragraph (d) provides the definition of temporal separation with respect to paragraph (c)(2).

Paragraph (e) ensures that the railroad has made no unapproved changes in what is considered and implemented as excepted track without FRA approval. FRA understands that as a railroad implements its PTC system in accordance with their PTCIP, changes to what is considered excepted track may occur. Such changes will require FRA review. In the case that such relief is required, and the PTCSP has not been approved, the railroad may include their request for relief as part of their submission of the PTCSP. The change, however, must be fully justified to the Associate Administrator for Safety. FRA wishes to make it clear that such requests may not be approved, even if the PTCSP is other wise acceptable Changes made subsequent to FRA approval that involve removal or reduction in functionality of the PTC system are treated as material modifications. In keeping with traditional signaling principles, such requests must be formally submitted for review and approval by FRA. Prior to approval of the PTCSP, FRA is also requiring the railroad to certify that it has made no changes, or request relief as previously described.

The costs and benefits of this section are included in the general analysis below. The flexibility granted here is a key part of complying with the Regulatory Flexibility Act, and is discussed in the regulatory flexibility analysis below.

Section 236.1021 Discontinuances, material modifications, and amendments

This section describes the required information associated with amendments to the PTCIP, PTCDP, and PTCSP before and after FRA approval of the PTCSP, as well as material modifications to, or discontinuances of PTC systems once they have installed in accordance with this subpart.

FRA considers an amendment to be a formal or official change made to the PTCIP, PTCDP, and PTCSP. Amendments can add, remove, or update parts of these documents. They are often used when it is better to change the document than to write a new one. Prior to any system receiving FRA anticipates that there may need to be changes to the document associated with the PTCIP, PTCDP, and PTCSP. These changes can be done one of two ways. The first, and least preferable, is to make a formal request by submission of the new document without prior FRA involvement. This leaves FRA in the position in trying to evaluate the impact of the changes on the safety of the public without a complete understanding of the system, how it works, and the proposed changes. Because of this lack of understanding it may take FRA an significantly longer time to render a decision, and may also lead FRA to requesting a third party audit.

This approach also starts a formal process that FRA is required to follow. Such a process is often much slower since any exchange of information between the railroad and the FRA when considering the change requests is done sequentially, and in writing.

FRA believes it is more advantageous for FRA and entities requesting changes discuss the changes informally before formal submission of the change request. This allows FRA and the railroad to discuss the details of the change, and facilitates FRA's understanding of the change before the change request is formally submitted.

FRA wants to emphasize only amendments to the PTCIP, PTCDP, and PTCSP that affect safety critical issues need to be submitted to FRA for approval

Paragraph (a) discusses the amendment process prior to approval of the various documents. In general, changes may be made to any of these documents at any time before they have been approved by FRA. Once approved, and a PTCIP has been accepted, or a Type Approval has been assigned , or PTC System Certification has been issued by FRA, no safety critical changes may be made to the installed system, or supporting documentation, may be made without FRA approval.

FRA recognizes that there are legitimate reasons for making changes in the system design, and the locations where the system is installed. Paragraph (b) and paragraph (c) provides a mechanism for requesting such change. Paragraph (b) requires that railroads instituting changes to the PTCIP, PTCDP, and PTCSP with no changes to the existing signal and train control system file a request for amendment (RFA).

In paragraph (c) FRA also recognizes that the railroad may wish to remove existing train control systems based on the installation of an appropriate PTC system. To facilitate this process, and reduce the number of filings, requests for materials modifications and discontinuances normally processed under part 235 may be integrated with the PTCIP, PTCDP or PTCSP. This allows change requests to the existing signal system to be made concurrent with the submission of the PTCIP, PTCDP, or PTCSP or as an amendment to these documents.

Change to any PTCIP, PTCDP, or PTCSP or removal or discontinuance of any signal system under the provisions of this section may not take effect until after FRA has approved the corresponding PTCIP, PTCDP, or PTCSP. FRA may approve the removal with or without conditions, or may disapprove of that part of a PTCIP, PTCDP, or PTCSP associated with changes to existing signal and train control systems while still approving possibly approving the remainder of the PTCIP, PTCDP, or PTCSP. Until FRA has granted appropriate relief or approval, the railroad may not make the change, and once a requested change has been made, the railroad must comply with requested change.

Paragraph (d) provides the minimum information required to be submitted to FRA when submitting a request for amendment. In the case where a discontinuance or material modification for an existing signal system is being requested concurrently with or part of the PTCIP, PTCDP, or PTCSP, the PTCIP, PTCDP, or PTCSP must contain the information required in 235.10 and any additional information that might be requested by FRA. This information may include data as specified in 235.12.

When any change for a PTCIP, PTCDP, or PTCSP is requested, regardless if a concurrent filing for a discontinuance or material modification is proposed, the proposed change must identify the proposed modification, reason for modification, the changes, and the modifications effect on system safety.

FRA classifies changes to the PTCIP, PTCDP, or PTCSP in one of two categories- planned and unplanned. Planned changes are changes that the system developer and the railroad have included in the safety analysis associated with the product, but have not yet been implemented. These changes provide enhanced functionality to the system, and FRA strongly encourages railroads to include product improvements that further increase safety. Planned changes only require FRA approved regression testing to demonstrate that their implementation has not had an adverse affect on the system they are augmenting. Planned changes must be clearly identified as part of the PTCSP, and the PTCSP safety analysis must show the affect that their implementation will have on safety, as well as the level of safety associated with the change not having been installed.

Unplanned changes are changes not foreseen by the railroad or developer that are necessary to ensure the safety of the system, or are functional enhancements from the original core system. Depending upon what phase of the development cycle these changes are introduced will determine the scope of the additional work necessary to ensure safety. If the PTCDP has not yet been submitted to FRA, no FRA involvement is required. However if the PTCDP has been submitted to FRA, or if the change impacts the safety functionality of the system once a Type Approval has been issued , and a PTCSP not yet submitted , the change must be documented in the PTCDP, and the new PTCDP submitted for FRA approval. The subsequent PTCSP must account for the change in its analysis.

If the change is made after approval of the PTCSP and the system has been certified by the FRA, a new PTCDP as well as a new PTCSP with the change must be submitted to FRA for approval. Because this requires significant effort on the part of the railroad, as well as FRA, FRA expects that every effort will be made to eliminate the need for unplanned changes. If the railroad and the vendor submit a large number of unplanned safety related changes (the term large is relative to the complexity of the product involved), FRA may revoke any approvals previously granted and disallow the use of the product until such time the railroad demonstrates the product is sufficiently mature.

Paragraph (e) clarifies that even if a request for material modification or discontinuance is submitted with a PTCIP, PTCDP, and PTCSP that the material modification will be posted in the Federal Register and public comment solicited before FRA action is taken.

Paragraph (f) simply makes it clear that FRA will consider all impacts on the public safety prior to approval or disapproval of any request for discontinuance, modification, or amendment of a PTC system and any associated changes in the existing signal system that may have been concurrently submitted. While the economic impact to the affected parties may be considered by the FRA, the primary and final deciding factor on any FRA decision is safety. FRA will consider not only how safety is affected by installation of the system, but how safety is impacted by the failure modes of the system.

The purpose of paragraph (g) is to emphasize the right of FRA to unilaterally issue a new type approval, with what ever conditions are necessary to ensure safety, based on the impact of the proposed changes.

In paragraph (h) FRA wants to make it perfectly clear that FRA considers any installed PTC system to be a safety device, and once installed, the removal modification, or change of the system is not authorized without prior FRA approval.

That said FRA recognizes there are a limited number of situations where changes of the PTC system may not have an adverse impact upon public safety. These specific situations where prior FRA approval is not required are spelled out in paragraph (h)((1) through (h)(3). FRA notes that only temporary removal of the PTC system without prior FRA approval is allowed to support highway rail separation construction or damage to the PTC system by catastrophic events. In both cases, the PTC system must be restored to operation no later than 6 months after completion of the event.

This provision does not add any new costs or benefits, as it reflects current burdens for discontinuance or modification of existing signal systems.

Section 236.1023 Errors and Malfunctions

Because PTC systems are approved, in part, based on certain assumptions regarding expected failure modes and frequencies, reporting and recording of errors and malfunctions takes on critical importance. If the number of errors and malfunctions exceeds those originally anticipated in the design, or errors and malfunctions that were not predicted are observed to occur, the validity of the risk analysis is suspect.

Since not all railroads may experience the same software faults or hardware failures, the developer's development, configuration management, and fault reporting tracking system play a crucial role in the ability of the railroad and the FRA to be able to determine and fully understand the risks and their implications. Without an effective configuration management tracking system in place it is difficult, if not impossible, to fairly evaluate risks associated with a product over the life of the product.

Inherent in this paragraph is the obligation that in the event of the failure of a component essential to the safety of a system to perform as intended, the cause be identified and corrective action taken without undue delay. Until repair is completed, the railroad and vendors are required to take appropriate measures to assure the safety of train movements, roadway workers, and on-track equipment. This requirement mirrors current requirement 49 C.F.R. § 236.11, which applies to all signal system components.

FRA recognizes that there be situations where reducing the severity of such hazards will suffice for an equivalent reduction in risk. For example, reducing operating speed may not reduce the frequency of certain hazards involving safety-critical products, but it would in most cases reduce the severity of such hazards

Paragraph (a) places a direct obligation on suppliers to report safety-relevant failures, which would include ``wrong-side'' failures and failures significantly impacting on availability where the PTCSP indicates availability to be a material issue in the safety performance of the larger railroad system. The supplier is expected to identify the problem, the corrective actions, recommended risk mitigations, and the estimated time to correct the action. FRA is to be informed to ensure public safety in any case where a commercial dispute (e.g., over liability) might disrupt communication between a railroad and supplier.

Paragraph (b) places a similar responsibility on the part of the railroad to report safety relevant failures to the supplier and the FRA, and to keep the vendor and FRA apprised of any subsequent failures.

To aid not only the FRA in understanding the scope of a problem on a railroad , and to aid the railroad in communicating any PTC system failures to the appropriate vendor, paragraph (c) requires each railroad to keep a currently updated list identifying each supplier of PTC equipment on their railroad.

Paragraph (d) adds the requirement that each railroad identify the procedures for action upon notification of a safety critical upgrade, patch, or revision. FRA expects that when issues with are discovered that may adversely affect the safe operation of the system, regardless if the railroad has experienced the problem, the railroad will take correct action without undue delay. FRA believes this is necessary to ensure that any component changes that, if left uncorrected would increase risk or interfere with the safety of train operations, are promptly addressed and that a common safety baseline is maintained. If the action were to take a significant time, FRA proposes to require the railroad to provide periodic progress reports to FRA

Paragraph (e) provides time limits for reporting failures and malfunction and the minimum reporting requirements. FRA has no specific format for the reports, and will accept any format provided it contains at least the information of this part. FRA will accept delivery of these reports by courier, fax, and email.

Paragraph (f) levies a requirement, in the event that a product is found to be unsafe, upon the vendor to provide, if requested by FRA, a detailed explanation of the problem, the corrective action, and the mitigation. While the railroad may be able to report symptoms of a problem, it is the vendor who is in the best position to determine the underlying root cause FRA may require this information to determine the full impact of the problem, and to determine if any additional restrictions or limitations on the use of the product may be necessary to ensure the safety of the general public and the railroad personnel.

Paragraph (g) is intended to limit unnecessary reporting. If the failure was the result of improper operation of the product outside the design parameters or non compliance with the operating instructions, FRA believes that remedial training by the railroad in the proper operation of the product is required. Similarly, once a problem has been identified to all stakeholders, formal re-reporting of the problem is not necessary. In either situation, however, FRA expects that they will be proactively notified in a timely manner of the misuse of the equipment, and the railroads corrective actions taken, or the recurrence of the failure. Such reports, however, do not have to be made within 7 days of occurrence, but in a reasonable time appropriate to the nature, ands extent of the problem.

Paragraph (h) is intended to make it clear that the reporting requirements of part 233 are not a substitute for the reporting requirements of this subpart. Both requirements apply. In the case of a false proceed signal indication, FRA would not expect the railroad to wait for the frequency of such occurrences to exceed the threshold reporting level assigned in the hazard log of the PTCSP. Rather, current section 233.7 requires all such instances to be reported.

This provision is a key part of any performance standard, and parallels current requirements under subpart H. The costs and benefits of this section are included in the general analysis below.

Section 236.1027 Exclusions.

FRA recognizes that there may be bona-fide exemptions from compliance with the requirements of subpart I. Railroads employ numerous safety-critical products in their existing signal and train control systems. These existing systems have proven to provide a very high level of safety, reliability, and functionality. FRA believes it would be a tremendous burden on the rail industry to apply this subpart to all existing systems, which have to date proven safe. Provided the equipment is compliant with the requirements of 49 CFR 236.1031, then they may be exempt from full compliance with the requirements of this Subpart. Such exemptions, however, do not relieve the railroad from requesting system certification.

Paragraph (a) addresses the issue of exclusion of office systems technology. Currently, some railroads employ these dispatch systems as part of their existing signal and train control systems. These existing systems have been implemented voluntarily to enhance productivity and have proven to provide a reasonably high level of safety, reliability, and functionality. It would be a tremendous burden on the rail industry to apply subpart I entirely to this technology and, in the case of smaller railroads, might discourage its use. Therefore FRA is limiting the application of subpart I to those subsystems or components of an office system that perform safety-critical functions or affect the safety performance of a PTC system. The level, and extent, of safety analysis and review of the office systems will, however, vary depending upon the type of PTC system with which the office system interfaces. FRA expects, for example, that railroads relying on the office system conflict resolution functionality to ensure overlapping authorities are not issued will provide credible evidence that demonstrates that checkers have been developed as safety critical (although not necessarily vital) hardware and software, and tie risks associated with their operations have been identified and properly mitigated in the PTCDP and PTCSP included in the risk analysis. Particularly where mandatory directives and work authorities are evaluated for use in a PTC system without separate oral transmission from the dispatcher to the train crew or employee in charge, with the opportunity receiving personnel to evaluate and confirm the integrity of the directive or authority received and the potential for others overhearing the transmission to note conflicting actions by the dispatching center, FRA will insist on explanations sufficient to provide reasonable confidence that additional errors will not be introduced.

Paragraph (b) establishes requirements for modifications of excluded products. At some point changes to excluded products are significant enough to require the safety assurance processes of subpart I to be followed. This point exists when a change results in degradation of safety or in a material increase in safety-critical functionality. FRA believes that all modifications caused by implementation details will not necessarily cause the product to become subject to subpart I. These types of implementation modifications will be minor in nature and be the result of site specific physical constraints. FRA expects that implementation modifications that will result in a degradation of safety or a material increase in safety-critical functionality, like a change in executive software, will cause the product to be subject to subpart I and its requirements. FRA is concerned, however, that a series of incremental changes, while each individually not meeting the threshold for compliance with this subpart, may when aggregated result in a product which differs sufficiently as to be considered a new product. FRA therefore reserves the right to require products that have been incrementally changed in this manner to comply with the requirements of this subpart. Prior to FRA making such a determination, the affected railroad will be allowed to present detailed technical evidence why such a determination should not be made.

Paragraph (c) addresses the integration of train control systems with other locomotive electronic control systems. The earliest train control systems were electro-mechanical systems that were independent of the discrete pneumatic and mechanical control systems used by the locomotive engineer for normal throttle and braking functions. Examples of these train control systems included cab signals and ACS/ATC appliances. These systems included a separate antenna for interfacing with the track circuit or inductive devices on the wayside. Their power supply and control logic were separate from other locomotive functions, and the cab signals were displayed from a separate special-purpose unit. Penalty brake applications by the train control system bypassed the locomotive pneumatic and mechanical control systems to directly operate a valve that accomplished a service reduction of brake pipe pressure and application of the brakes as well as reduction in locomotive tractive power. In keeping with this physical and functional separation, train control equipment onboard a locomotive came under part 236, rather than the locomotive inspection requirements of part 229.

Advances in technology have presented the capability for allowing original equipment manufacturers (OEMs) of the various components making up the locomotive and the train control systems began individually repackaging the individual components using the enhanced microprocessor capabilities and eliminating parts and system function control points access. Access to control functions became increasingly restricted to the processor interfaces using proprietary software. While this resulted in significant simplification of the previously complex discrete pneumatic and mechanical control train and locomotive control systems into fewer, more compact and reliable devices,

FRA encourages such enhancements, and believes, if properly done, can result in significant safety, as well as operational, improvements. Locomotive manufacturers can certainly provide secure locomotive and train controls, and it is important that they do so if locomotives are to function safely in their normal service environment. FRA highly encourages the long-term goal of common platform integration. However when such an integration occurs, it must not be done at the expense of decreasing the safe, and reliable operation of the train control system.

Accordingly FRA expects that the complete integrated system will be shown to have been designed to fail safe principles, and then demonstrated that the system operates in a fail safe mode. Any commingled system must have a manual failsafe fall back up that allows the engineer to be brought to be a safe stop in the event of an electronic system failure. This analysis must be provided to FRA for approval in the PTCDP and PTCSP as appropriate.

Finally paragraph (d) clarifies the application of subparts A through H to products excluded from compliance with subpart I. These products are excluded from the requirements of subpart I, but FRA expects that the developing activity demonstrates compliance of products with subparts A through H. FRA believes that railroads not mandated to implement PTC, or are implementing other non PTC related processor based products ought to be given the option to have products which are made subject to subpart H by submitting a PSP and otherwise complying with subpart H or voluntarily complying with subpart I.

This section adds considerable flexibility, and does not add to costs, nor does it reduce any benefits. The costs outlined below are calculated assuming the existence of this section.

Section 236.1029 PTC system use.

This section establishes minimum requirements, in addition to those found in the PTCDP PTCSP, for PTC system use after approval. Railroads are allowed, and encouraged, to adopt more restrictive rules that increase safety.

Paragraph (a) requires that, in the event of the failure of a component essential to the safety of a PTC system to perform as intended, the cause be identified and corrective action taken without undue delay. The paragraph also requires that until repair is completed, the railroad is required at a minimum, to take the measures specified in the PRCSP as well as any other appropriate measures to assure the safety of train movements, roadway workers, and on-track equipment. This requirement mirrors current requirement § 236.11, which applies to all signal system components.

Paragraph (b) requires that the railroad operate the PTC within the design parameters specified in the PTCDP and PTCSP. Railroads will not exceed maximum volumes, speeds, or any other parameter limit provided for in the PTCDP or PTCSP. On the other hand, a PTCDP or PTCSP could be based upon speed/volume parameters that are broader than the intended initial application. So long as the full range of sensitivity analyses are included in the supporting risk assessment. FRA feels this requirement will help ensure that comprehensive product risk assessments are performed before products are implemented.

Paragraph (c) sets forth the requirement that any testing of the PTC system must not interfere with its normal functioning. An exception to this may be obtained under 49 CFR 236.9035, where special conditions have been established to protect for the safety of the public and the train crew. Otherwise, Paragraph (c) requires that each railroad ensure the integrity of the PTC system not be compromised, by prohibiting the normal functioning of such system to be interfered with by testing or otherwise without first taking measures to provide for the safety of train movements, roadway workers, and on-track equipment that depend on the normal functioning of the system. This provision parallels current § 236.4, which applies to all devices. By requiring this paragraph, FRA merely intends to clarify that the standard in current § 236.4 applies to subpart I products.

Paragraph (d) establishes requirement that the operating crew has appropriate access to the information and functions necessary to perform their jobs safely when products are implemented and used in revenue service. Where two-person crews are employed, availability of a screen and any needed function keys will enable the second crew person to carry out PTC onboard computer-related activities with out distracting the engineering from maintaining situational awareness of activities outside the locomotive cab. FRA's existing regulations for train control requires that the cab signal display be clearly visible to each member of the crew. FRA believes the decision to operate with one PTC screen, only accessible to the engineer, can only be made after careful analysis of the human factor implications, the associated risks, and the sensitivity of the safety analysis that is used to potentially justify the decision to operate with single screens that are not accessible to the entire crew in the cab. FRA notes that the principles of crew resource management and current crew briefing practices in the railroad industry require that all members of a functioning team (e.g., engineer, conductor, dispatcher, roadway worker in charge) have all relevant information available to facilitate constructive interactions and permit incipient errors to be caught and corrected. Retaining and reinforcing this level of cooperation will be particularly crucial during the early implementation of PTC as errors in train consist information, errors generated in on-board processing, delays in delivery of safety warnings due to radio frequency congestion, and occasional errors in dispatching challenge the integrity of PTC systems even as the normal reliability of day-to-day functioning supports reductions in vigilance. Loss of crew cooperation could easily spill over to other functions, including switching operations and management of emergency situations.

This is a subject that was the subject of significant disagreement within the Working Group, and FRA appreciates the views of those who suggest that the cost of additional displays is not warranted and the argument that, where there is an additional crew member assigned, so value might be added by isolating the second crew member from potentially corrupted information displayed on the PTC display. However, FRA believes that there is a strong likelihood that railroads will seek to deliver all mandatory directives on board electronically, obviating the need for oral transmission, within a relatively short time. Given current technology and experience, FRA believes that when this occurs having a second crew member involved in receipt and confirmation of the authority will be useful to verify situational appropriateness and avoid overload of the locomotive engineer.

The costs of a second screen where required are included in the costs calculated below. FRA does not believe that it can meet the intent of Congress without providing the means to comply with core functions to every required crewmember. The costs and benefits of this section are included in the general analysis below.

Section 236.1031 Previously approved PTC systems.

FRA recognizes that substantial effort has been voluntarily undertaken by the railroads to develop, test, and deploy Positive Train Control Systems prior to the passage of the RSIA of 2008, and that some of the PTC systems have accumulated a significant history of safe and reliable operations. In order to facilitate the ability of the railroads to leverage the results of PTC design, development, and implementation efforts that have been previously been approved or recognized by FRA prior to the adoption of this subpart, FRA is providing the expedited approval process of this section.

Positive Train Control Systems previously approved by FRA under Subpart H, as well as PTC systems installed under either a FRA waiver (such the Incremental Train Control System) or FRA order (such as the Advanced Civil Speed Enforcement System) are eligible to request type approval as well as system certification under this section.   Products that have not received approval under the subpart H, or have that have not been previously recognized by FRA, are ineligible.

FRA encourages railroads, to the maximum extent possible, to use proven service history data to support their requests for Type Approval and PTC System Certification. While proven service history cannot be considered as a complete replacement for an engineering analysis of the risks and mitigations associated with a PTC product, it provides great credibility for the accuracy of the engineering analysis. Testing and operation can only show the absence or mitigation of a particular failure mode, and FRA believes that there will always be some failure modes that may only be determined through analysis. Because of this inherent limitation associated with testing and operation, FRA also strongly encourages the railroads to also submit any available analytical analysis or information.

Nothing in this abbreviated process should be construed as implying the automatic granting of a type approval or system certification by FRA. Requests for type approval and system certification still must be submitted by the railroad under this abbreviated process must still demonstrate the system reliably enforces positive train separation, over-speed protection, roadway worker protection, and movement through a misaligned switch.

The PTC product for which type approval and certification is sought may differ in terms of functionality or implementation from the PTC product previously approved or recognized by FRA. In such cases the service history and analysis may not align directly with the new variant of the product. In a similar vein, the available service history and analysis associated with a PTC product may be inconclusive about the reliability of a particular function. It is because of these possible situations that FRA can not unequivocally say that all requests for type approval and system certification submitted by a railroad under this part will be automatically granted be approval.

FRA, will however, apply the available service history and analytical data as credible evidence to the maximum extent possible. FRA believes that this still greatly simplifies the railroads task in making their safety case, since the additional testing and analysis required need only address those areas for which credible evidence is insufficient.

FRA also encourages the sharing of a system's service history and the results of any analytical analysis between different railroads for the same reason. This sharing of information, even in the case where the information being shared does not fully support a particular railroad's safety analysis, should reduce overall the level of effort, both in terms of time and money, to obtain sufficient credible evidence to support the claims being made for the safety performance of the product.

FRA was unable to fashion an outright grandfathering of equipment previously used in transit and Foreign Service. FRA does not have the same degree of direct access to the service history of these systems. Transit systems—except those that are connected to the general railroad system—are not directly regulated by FRA. FRA's experience with eliciting safety documentation from foreign authorities has not been good, particularly given the influence of national industrial policies.

However, FRA does believe that the potential exists for simplification of the subpart I process (rather than an exclusion from the process) under which the railroad and supplier could establish safety performance at the highest level of analysis for the particular product, relying in part on experience in the other service environments and showing why similar performance should be expected in the U.S. environment. International signal suppliers should be in a good position to marshal service histories for these products and present them as part of the PTCSP. The applicant(s) should address additional issues such as the following:

1. Detailed description of the change, the associated affected components, functional data flow changes, and any changes associated with safety capabilities of the product.
2. The analysis used to verify that the change did not introduce any new safety risks, or if potential risks were added, the risks and their mitigation.
3. The tests plan and associated results used to verify and validate the correct functionality of all modes of the safety-related capabilities of the product with the component refreshed.
4. Identification of any changes in training, test equipment, or maintenance required for the continued safe operation of the product.

The costs and benefits associated with the requirements of this section are included in the general analysis below.

Section 236.1033 Communications and security requirements.

Subpart I establishes specific communications security requirements for PTC system messages. In data communications, “cleartext” is a message or data in a form that is immediately comprehensible to a human being without additional processing. In particular, it implies that this message is transferred or stored without cryptographic protection. It is related to, but not entirely equivalent to, the term “plaintext.” Formally, plaintext is information that is fed as an input to a cryptographic process, while “ciphertext” is what comes out of that process. Plaintext might be compressed, encrypted, or otherwise manipulated before the cryptographic process is applied, so it is quite common to find plaintext that is not cleartext. Cleartext material is sometimes in plain text form, meaning a sequence of characters without formatting, but this is not strictly required as the sense is “no protection from snooping.”

The subject proposal originated from a Security Task Force within the PTC Working Group. The objectives of the proposal are to ensure data integrity and authentication.

The security requirements set forth are consistent with Department of Homeland Security (DHS) guidance for SCADA systems[1] and National Institute of Standards and Technology guidance. FRA has coordinated this proposal with DHS.

FRA does not believe that a system which does not have secure communications meets the intent of Congress in RSIA08. The costs and benefits of this section are included in the general analysis below.

§ 236.1035 Field testing requirements.

Initial field or subsequent regression testing of a PTC product on the general rail system is often required before the product has been certified in order to obtain data to support the safety case presented in the PTCSP. To ensure the safety of the public and train crews, prior FRA approval is required to conduct test operations on the general rail system. This paragraph provides an alternative to the waiver process when only part 236 regulations are involved. When regulations concerning track safety grade crossing safety or when operational rules are involved, however, this process would not be available. Such testing may also implicate other safety issues, including adequacy of warning at highway-rail crossings (including part 234 compliance), qualification of passenger equipment (part 238), sufficiency of the track structure to support higher speeds or unbalance, and a variety of other safety issues, not all of which can be anticipated in any special approval procedure. Approval under this part for testing does not grant relief from other parts of these and the railroads must still apply for relief the non-236 regulations under the discrete special approval sections of those regulations, under provisions of part 211 related to waivers, or both.

The information required for this filing is described in paragraphs 236.1035(a)(1)–(a)(7). This information is necessary in order for FRA to make informed decisions regarding the safety of testing operations. FRA would prefer that the informational filings to test under this part be accompanied by any requests for relief from non 236 regulations so that they may be considered as a whole.

Paragraph (b) provides notification that FRA may, based on the results of the review of the information provided in (a), impose special conditions on the execution of the testing, up to, and including the appointment of an FRA test monitor to provide additional oversight to ensure the safety of rail operations. When a test monitor is appointed, they have the authority to stop testing if the testing is unsafe, require additional tests as necessary to demonstrate the safe operation of the system, or have tests rerun when the results are in question.

Paragraph (c) reemphasizes the earlier discussion that either temporary or permanent requests for relief for other than requirements of part 236 must be submitted in accordance with the processes specified by part 211.

[1] Supervisory Control and Data Acquisition systems govern industrial processes, such as management of a power grid, control of a water treatment plant, etc. PTC systems are a subset of SCADA systems.

The costs and benefits associated with this section are included in the general analysis below.

Section 236.1037 Records retention

Retention of PTC related records provides documentary proof that the system is performing as intended, and that the appropriate training has occurred. Accordingly under (a) FRA is requiring each railroad, and each vendor if appropriate, a repository of records documenting actions taken by the railroads The location of this repository is at the discretion at the railroad, and my be either distributed or centralized as long as FRA or FRA designated state inspectors have access during normal business hours. All documents and records must be available for FRA inspection and copying.

FRA appreciates the expense associated with the creation, transmission, and storage of documents, and therefore is willing to accept either paper copies, or electronic copies maintained in accordance with a plan approved under § 236.110, which authorizes electronic recordkeeping under part 236 generally. FRA would expect to make conforming amendments to § 236.110 paralleling paragraph (c) of that section, which currently govern recordkeeping under subpart H. Comment is requested on the extent to which these provisions have proved successful or require revision. The minimum sets of documents that must be maintained are:

A. Any type approval, its associated PTDP if appropriate, variances from the PTCDP if approved, and the PTCSP that the railroad holds.
B. Adequate documentation that to demonstrate the PTCDP and PTCSP meets the safety requirements of this subpart including the risk assessment. The risk assessment must contain all initial assumptions for the system that are listed in paragraph (i) of Appendix B—Risk Assessment Criteria.
C. The current (master) operations and maintenance manual as described in 236.1039
D. The training and testing records which designate persons who are qualified
E. All implementation, maintenance, inspection, and testing and regression testing records as described in Paragraph (2) is intended to make it clear that the requirements not only apply to the railroads, but also to the railroads vendors.

The retention period for these records begins when the railroad places the PTC system in service. After the product is placed in service, paragraph (b) requires the railroad to maintain a database of safety-relevant hazards which occur or are discovered on the product. This database information shall be available for inspection and replication by FRA and FRA certified state inspectors, during normal business hours. Paragraph (b) also provides the procedure which must be followed if the frequency of occurrence for a safety relevant hazard exceeds the threshold value provided in its PTCDP /PTCPP. This procedure involves taking immediate steps to reduce the frequency of the hazard and report the hazard occurrence to FRA. FRA realizes the scope and impact could vary dramatically. In some cases, an adequate response could be completed within days. In other cases the total response could take years, even with prompt, deliberate action. If either case, prompt notification to FRA of the problem is required (b)(1). The reports may be made to FRA by mail, facsimile, e-mail, or hand delivery.

These reporting requirements are not intended to replace, or excuse from compliance, FRA reporting requirements under part 233. In the case of a false proceed signal indication; FRA would not expect the railroad to wait for the frequency of such occurrences to exceed the threshold reporting level assigned in the hazard log. Rather, current § 233.7 requires all such instances to be reported.

FRA believes the 15 day reporting period especially in light of electronic means of delivery, is adequate. FRA currently allows faxing, emailing, or hand delivery. Documents that are hand delivered to FRA must not be enclosed in an envelope, as all envelopes are required to be routed through the DOT mail room.

FRA believes that the records required in this section are a key to complying with a performance standard. Were FRA to impose a specification standard it could dispense with some of the recordkeeping requirements, but the burden of such a specification standard would far exceed the burden of recordkeeping. The costs and benefits of this section are included in the general analysis below.

Section 236.1039 Operations and Maintenance manual

This section, which is modeled on the analogous section of subpart H, requires that each railroad develop a manual covering the requirements for the installation, periodic maintenance and testing, modification, and repair for its PTC systems. FRA encourages the use of an electronic format as an appropriate medium for such a manual. Electronic copies of the manual should be maintained in the same manner as other electronic records, and the manual should be included in the railroad's configuration management plan (with the master copy and dated amendments carefully maintained so that the status of instructions to the field as of any given date can be readily determined).

All specified documentation contained in the PTCDP and PTCSP that are necessary for the installation, repair, modification and testing of a product must be placed in an Operations and Maintenance Manual for that product and be made available to both persons required to perform such tasks and to FRA.

Paragraph (b) requires that plans necessary for proper maintenance and testing of products be correct, legible, and available where such systems are deployed or maintained. The paragraph also requires that plans identify the current version of software installed, revisions, and revision dates.

Paragraph (c) requires that the hardware, firmware, and software versions be recorded in the Operations and Maintenance manual in accordance with the configuration management requirements specified in the PTCDP and PTCSP.

Paragraph (d) requires that safety critical components contained in PTC systems, including spare equipment, be identified, replaced, handled, and repaired in accordance with the configuration management requirements specified in the PTCSP.

Finally, paragraph (e) requires that a railroad officer be appointed to be responsible for coordination of the restoration plan required under 236.1033(f) for communications outages.

FRA believes that the manuals required in this section are a key to complying with a performance standard. Were FRA to impose a specification standard it could dispense with some of the manual requirements, but the burden of the operations and maintenance required by such a specification standard would likely exceed the burden of those under the manuals. The costs and benefits of this section are included in the general analysis below.

Section 236.1041 Training and Qualification Program (General)

The training provisions of this proposal closely track the analogous sections of subpart H. This general section sets forth the general requirements of an employer's training and qualification programs related to PTC systems. This section requires the PTCP to provide a description of the specific training necessary to ensure the safe installation, implementation, operation, maintenance, repair, inspection, testing, and modification of the product. This section does not restrict the employer from adopting additional or more stringent training requirements. The training program takes on particular importance with respect to PTC systems, because the railroad industry's workforce generally does not have thorough knowledge of the operation of such equipment and appropriate practices for its operation and maintenance. FRA believes employee training and qualification on how to properly and safely perform assigned duties are crucial to maintaining safe railroad equipment and a safe workplace.

FRA believes that many benefits will be gained from the railroads' investment in a comprehensive training program. The quality of inspections will improve, which will result in fewer instances of defective equipment in revenue service and increased operational safety. Under an effective training program equipment conditions that require maintenance attention are more likely to be discovered and repairs can be completed safely and efficiently before catastrophic failure, trouble-shooting will more likely take less time; and maintenance will more likely be completed correctly the first time, resulting in increased safety and decreased costs.

The program will provide training for persons whose duties include inspecting, testing, maintaining or repairing elements of the PTC system including central office, wayside, or onboard subsystems. In addition, it will include training required for personnel dispatching and operating trains in territory where PTC is in use and for roadway workers whose duties require knowledge and understanding of operating rules. Finally, it will include supervisors of the foregoing persons.

Paragraph (a) establishes the general requirement for when a training program is necessary and who must be trained. Training programs must meet the minimum requirements listed in §§

236.1043 through 236.1049 as appropriate, and any more stringent requirements in the PTCSP for the product. FRA wants to clarify the intent of this section. Railroads are responsible for training their own employees. Contractors, including suppliers whose employees are performing the duties described in this section, are also responsible for training their own employees. FRA is not requiring that railroads provide training for contractor employees. FRA wishes to make it very clear employers are responsible for having their employees who perform work covered by this section trained and qualified. If FRA finds untrained contractors performing work that requires training, both the contractor and railroad may potentially be subject to civil penalty enforcement activity. Railroads should be seeking assurance that contractors have training programs that comply with this section and that the contractors are utilizing trained and qualified personnel to perform work on the PTC system.

If the railroad has placed a clear contractual responsibility on the provider of services to train personnel and maintain appropriate records, FRA would normally proceed first against the contractor. In any event, FRA would expect to see prompt corrective action.

Paragraph (b) establishes the general requirement that the persons cited in paragraph (a) must be trained to the appropriate degree to ensure that they have the necessary knowledge and skills to effectively complete their duties related to operation and maintenance of the PTC system.

No railroad could adopt PTC without sufficient training. The costs and benefits of this section are included in the general analysis below.

Section 236.1043 Task Analysis and Basic Requirements

This section sets forth specific parameters for training railroad employees and contractor employees to assure they have the necessary knowledge and skills to effectively complete their duties as related to the safe operation and maintenance of PTC systems. Employers, whether railroads or contractors, are responsible for complying with this section. This section explains that the functions performed by an individual will dictate what type of training that person should receive related to the PTC system. For example, a person that operates a train would not require training on how to inspect, test, and maintain the system equipment unless the person were also assigned to perform those tasks.

The intent of this section is to ensure that employees, who work with products covered by this rule, including contractors, know how to keep them operating safely. The rule grants the employer flexibility to focus and provide training that is needed in order to complete a specific task. However, the rule is designed to prevent the employer from using under-trained and unqualified people to perform safety critical maintenance on a PTC system.

This section describes that the training and qualification programs specified in §236.1041 must include a minimum group of identified requirements. These minimum requirements will be described in the PTCSP. This required training is for railroad employees and contractor employees to assure they have the necessary knowledge and skills to effectively complete their duties related to the PTC system,

Paragraphs (a)(2) and (a)(3) provide that the employer will identify inspection, testing, maintenance, repairing, dispatching, and operating tasks for the PTC system and develop written procedures for performance of those tasks. Paragraph (a)(4) requires that the employer identify additional knowledge and skills above those required for basic job performance necessary to perform each task. The point here is that work situations often present unexpected challenges, and employees who understand the context within which the job is to be done will be better able to respond with actions that preserve safety. Further, the specific requirements of the job will be better understood; and requirements that are better understood are more likely to be adhered to. An example is the so-called ''gap training'' for employees who are expected to work on the electronics of the PTC system. Employees need to understand in at least a general way how their duties fit into the larger program for maintaining safety on a railroad. If they lack a basic understanding of the functioning of the systems they are working on, they are more likely to make a mistake in a situation where instructions are ambiguous and where the unusual nature of the problem prompts discovery of a void in the instruction set. Well informed employees will be less likely to free-lance trouble shooting; and, incidentally, they should also be of greater value in assisting with trouble shooting (an economic benefit which should, by itself, offset the some of the cost of this requirement).

Paragraph (a)(5) requires that the employer develop a training curriculum which includes either classroom, hands-on, or other formally-structured training designed to impart the knowledge and skills necessary to perform each task. The training curriculum may be designed by the railroad in consultation with the manufacturer of the product, utilizing training materials and manuals prepared by the vendor.

Paragraph (a)(6) establishes the requirement that all persons subject to training requirements and their direct supervisors must successfully complete the training curriculum and pass an examination for the tasks for which they are responsible. For example, a person who operates a train would not require training on how to inspect, test, or maintain the equipment unless the person were assigned to also perform those tasks. Generally, appropriate training must be given to each of these employees prior to task assignment; however, an employee may be allowed to perform a task for which that person has not received the appropriate training only if the employees do so under the direct, on-site supervision of a qualified person. The "direct supervisor" is intended to mean the immediate, first level supervisor to whom the employee reports.

The training of direct supervisors would depend upon an analysis of the supervisor's job, including his or her specific tasks, and not merely position on the organizational chart. The identification of training goals and the task analysis required in paragraphs (a)(1) and (2) includes management goals and tasks. Managers and supervisors must be trained to carry out the functions their duties require. If a direct supervisor is in a position where he or she may have to fulfill the responsibilities or duties of a subordinate, he or she must have the requisite knowledge and training to do so. If, however, a manager or supervisor will likely never need to fulfill the duties of a subordinate, and that person is not expected to provide technical oversight for certain functions, he or she may not need to be trained on those functions. This requirement is designed to ensure that supervisors have the requisite knowledge, training, and familiarity with the duties of their subordinates such that they can competently supervise the workforce.

Paragraph (a)(7) requires that periodic refresher training be conducted at intervals specified in the PTCSP. This periodic training must include either classroom, hands-on, computer-based training, or other formally-structured training in order that railroad employees and contractor employees maintain the knowledge and skills necessary to safely perform their assigned tasks.

Paragraph (a)(8) establishes a requirement to compare actual and desired success rates for the examination. The objective of this requirement is twofold. The first is to determine if the training program materials and curriculum are imparting the specific skills, knowledge, and abilities to accomplish the stated goals of the training program. The second is to determine if the stated goals of the training program reflect the correct, and current, products and operations.

Over time, changes in railroad products and operations may result in differences between the original defined goals and tasks from the original PTCDP and PTCSP. Similarly, over time the effectiveness of the training process may change as a result of instructional methods and student skill levels. Changes in training may be necessary as a result. Ongoing, regular verification of the results of the training process is required to ensure that the training program materials and curriculum are relevant, the learning objectives are being met, and the necessary skills, knowledge and ability are actually being imparted. Without regular feedback, verification and validation (and if necessary, adjustments, to ensure the necessary relevancy and effectiveness) cannot occur.

Paragraph (b) provides that the employers must maintain records which designate persons who are qualified under this section. These records must be kept until new designations are recorded or for at least one year after such person(s) leave applicable service, and must be available for FRA inspection and copying. A railroad's contractor must maintain records on contractor employees who perform work covered by this section. FRA expects to have access to the training records of contractor employees whose work functions are covered by the training requirements of this section. If FRA cannot get access to such records, the railroad and contractor or supplier may be subject to civil penalty enforcement activity.

No training program is likely to achieve its goals without analyzing the tasks for which training is needed, and then training on those tasks. Most proposed PTC systems are vulnerable to overreliance by crewmembers compromising the additional safety provided, so this is a key part of any performance standard.

The costs and benefits of this section are included in the general analysis below.

Section 236.1045 Training Specific to Control Office Personnel

This section explains the training that must be provided to employees responsible for issuing or communicating mandatory directives. This training must include instructions concerning the interface between computer-aided dispatching systems and the PTC system as applicable to the safe movement of trains and other on-track equipment. In addition, the training must include operating rules that pertain to the train control system, including the provision for moving unequipped trains and trains on which the train control system has failed or been cut out en route.
This section sets forth the requirements for instructions on control of trains and other on-track equipment when a train control system fails. It also includes periodic practical exercises or simulations and operational testing under part 217 to assure that personnel are capable of providing for safe operations under alternative operation methods.

The costs and benefits of this section are included in the general analysis below.

Section 236.1047 Training Specific to Locomotive Engineers and Other Operating Personnel

This section specifies minimum training requirements for locomotive engineers, conductors, and other operating personnel who interact with PTC systems. "Other operating personnel" is intended to refer to onboard train and engine crew members other than the engineer or conductor. Paragraph (a) requires that the training contain familiarization with the PTC equipment and the functioning of that equipment along with its relationship to other onboard systems under that person's control. The training program must cover all notifications by the system (i.e. onboard displays) and actions or responses to such notifications required by onboard personnel, as well as how each action or response ensures proper operation of the system and safe operation of the train.

Paragraph (b) states that with respect to certified locomotive engineers, the training requirements of this section must be integrated into the training requirements of 49 CFR part 240.

Paragraph (c) addresses requirements for use of PTC system to effect full automatic operation. FRA acknowledges that this rule is not designed to address all of the various safety issues which accompany full automatic operation (although it by no means discourages their development and implementation); however, insofar as skills maintenance of the operator is concerned, the rule offers the standards in this paragraph.

Paragraph (c)(1) establishes the requirement that the PTCDP and PTCSP must identify all safety hazards to be mitigated by the locomotive engineer. Paragraph (c)(2) concerns required areas of skills maintenance training. Paragraph (d) requires similar training for conductors as provided for engineers.

FRA believes that there is no one curriculum across the board that will generally satisfy the locomotive engineer and conductor training requirements. As with the general training requirements, the requisite task analysis will be specific to the functions of the system or systems of each railroad. Accordingly, the resulting training curriculum will correspond with the tasks or functions necessary for that particular system.

The costs and benefits of this section are included in the general analysis below.

Section 236.1049 Training Specific to Roadway Workers

This section requires the railroad to incorporate appropriate training in the program of instruction required under part 214, subpart C, Roadway Worker Protection. This training is designed to provide instruction for workers who obtain protection for roadway work groups or themselves and will specifically include instruction to ensure an understanding of the role of a processor-based train control system in establishing protection for workers and their equipment, whether at a work zone or while moving on track between work locations. Also, this section requires that training include recognition of PTC control equipment on the wayside and how to avoid interference with its proper functioning.

The required task analysis will tailor each program to the needs of the particular system to which it applies. FRA assumes that a good task analysis would include procedures and training on procedures for system failures. Roadway workers are uniquely situated out on the right-of-way are at risk of being struck by trains and on-track equipment. Given the potential for exposure to extreme peril, FRA believes specifying training and periodic drills on that training is worthwhile.

The costs and benefits of this section are included in the general analysis below.

Appendix B to Part 236 – Risk Assessment Criteria

FRA is modifying Appendix B to part 236 to enhance the language for risk assessment criteria in a light of experience gained during the initial stage of PTC system implementation under subpart H and to accommodate the requirements of subpart I regulating the use of mandatory PTC systems required by RSIA08. As modified, the Appendix B will incorporate new language in paragraphs from (a) through (h), as well as modifying some of the associated headings.

Paragraph (a) reflects the change in the required length of time over which the [system] risk must be computed. FRA replaces the requirement to assess risk for the system “over the life-cycle of 25 years or greater” with the requirement to assess risk “over the designed life-cycle of the product.” FRA believes that the new wording of this requirement puts it in correspondence with the final rule language that does not specify the length of a system life-cycle, and with the subpart H preamble language that leaves room for the new processor-based systems to have a shorter than 25 years life-cycle.

Paragraph (b) is reworded to clarify the intent of this requirement.

Paragraph (c) is modified and the heading of this paragraph is changed to better identify the main purpose of this requirement and to put it in correspondence with the associated requirements of sections 236.909 (c) and (d). The previous text of this paragraph and its title does not fully support or clarify the main intent of subpart H to require that the total cost of hazardous events should be the risk measure for a full risk assessment and the MTTHE calculations for all hazardous events the risk measure for the abbreviated risk assessment.

The existing subpart H text asks for both the base case and the proposed case to be expressed in the same metrics. Paragraph (c) of this appendix, as currently written, does not fully reflect FRA's intent that the same risk metric is to be used in the risk assessment for both the previous and current conditions (see 236.913 (g) (2) (vii). FRA believes that the revised title of this paragraph poses the right question and that the new formulation of this paragraph provides better guidance on how to perform risk assessment for previous and current conditions.

The text and the title of paragraph (d) have been modified to create a comprehensive and detailed list of system characteristics that must be included in the risk assessment for the proposed PTC systems subject to requirements of [both] subpart H and subpart I. FRA believes that the extended description of system characteristics better suits the requirements of Subpart H and especially subpart I related to risk assessment. For example, the new text makes it clear that the risk assessment must account not only for the total volume of traffic, but also for the type of transported fright materials (TIH, PIH), as well as for speeds for freight and passenger trains if part 236 places additional requirements for certain types of train control systems to be used at such speeds.

Paragraph (e) is also modified to clarify its intent and reflect industry's experience in risk assessment techniques gained during initial stage of PTC system implementation under subpart H. In the revised text of this paragraph FRA gives more specific guidance on how to derive the main risk characteristics, MTTHE, and what role reliability and availability parameters, such as MTTF or MTBF for different system components can play while assessing risk for vital and non-vital hardware/software components of the system. FRA emphasizes it is critical, that railroads and their vendor(s) include the software failure rates into risk assessments for the system. FRA also finds it necessary to advise railroads and their vendors to include reliability and availability characteristics, such as MTTF or MTBF into risk assessment in order to account for potential system exposure to hazards during system failures or malfunctioning, when the system operates in its fall back mode. FRA believes that the new version of this paragraph more accurately addresses the industry's need for clarity in interpretation and execution of final rule requirements related to risk assessment.

Paragraph (f)(2) is modified to reflect FRA's "understanding"- that software failure analysis may not necessarily be based on MTTHE "validation and verification" processes and that MTTHE characteristic's cannot be easily obtained for the system software components. Therefore item (2) of this paragraph is revised to outline the significance of detailed software fault/ failure analysis and software testing to demonstrate repeatable predictive results that all software defects are identified and corrected.

Paragraph (g) is revised minimally to clarify that (1) that MTTHE calculations should account for the restoration time after system or component failure, and clarify in (2) that the system design must be assessed for adequacy through verification and validation process.

Paragraph (h) is modified to emphasize the need to document all assumptions made during the risk assessment process. FRA believes that the assumptions should be documented while deriving the total cost of potential accident consequences for full risk assessment or MTTHE values for abbreviated risk assessment, rather than only documenting assumptions for her intermediate parameters, such as MTTF and MTTR, as asked in the previous text of this paragraph. These later two parameters may or may not be relevant for the risk assessment.

FRA believes that the changes to Appendix B do not change industry practice, but make both subparts H and I easier to comply with, and therefore the changes do not add any costs or benefits.

Appendix C to Part 236 – Safety Assurance Criteria and Processes

FRA is modifying Appendix C to part 236 to enhance the language of this appendix, to re-organize the existing list of safe system design principles in accordance with the well established models of system safety engineering, and to augment the list of safe system design principles with the principles related to safe system software design. As modified, the Appendix C will incorporate new language and the language from current Appendix C in the same number of paragraphs from (a) through (c) with paragraph (b) being significantly restructured. A safe state is a system configuration that the system defaults to in the event of a fault or failure or when unacceptable or dangerous conditions are detected. The safe state is a state of the process operation where the hazardous event cannot occur.

Paragraph (a) is revised to reflect the main purpose of this appendix in clear, accurate, and consistent language that will be repeatedly used throughout the appendix. It also outlines that the requirements of this appendix will be applicable to railroads' PTCIP as well as PTCSP required by subpart I.

Paragraph (b) is modified and restructured to present in a consistent language a complete list of safety assurance principles properly classified or "categorized" in accordance with well established system safety engineering principles that need to be followed by the designer of the system to assure that all system components performs safely under normal operating conditions and under failures, accounting for human factor impacts, external influencing, and procedures and policies related to maintenance, repair, and modification of the system. The title of this paragraph is changed to outline the mentioned above purpose of this paragraph. FRA also added that these principles must be applicable to PTC systems designed and implemented under requirements of subpart I.

The title of Subparagraph (1) of Paragraph (b) is changed to better suit the chosen base of classification for all safety principles under paragraph (b).

Subparagraph (2), (3) and (4) of Paragraph (b) are combined under the changed title of Subparagraph (2) gathering all safety principles to be followed to assure safe state of the systems under different types of failures. The texts of previous subparagraphs (2), (3), (4) remained unchanged with the exception of PTCSP reference in (ii) applicable to subpart I.

Closed Loop Principle under new Subparagraph (3) is revised to reflect the industry accepted definition of Closed Loop Principle given in AREMA Manual. The previous definition of Closed Loop Principle was too general and did not reflect the essence of the most significant principles of safe signaling system design.

Under the new Subparagraph (4) FRA added a list of Safety Assurance Concepts that the designer may consider for implementation to assure sail-safe system design and operation. These principles are predominantly applicable for the safe system software design and quoted from the IEEE-1483 standard.

The previous Subparagraphs (5) through (8) are renumbered to follow the chosen scheme for the proper classification and sequence of safety principles discussed above.

New Subparagraph (5) presents the unchanged language of previous subparagraph (9) outlining Human Factor Engineering safety principle.

New Subparagraph (6) presents the unchanged language of previous subparagraph (5) outlining safety principles for system operation under external influences.

New Subparagraph (7) combines the text of previous subparagraph (6) and the new text added to accentuate the requirements for proper regression testing after system modifications.

The previous Subparagraph (9) is eliminated due to redundancy. The requirements of this subparagraph are included in Subparagraph (1).

Paragraph (c) is revised to reflect changes in recommended standards. The standard EN50126: 1999, Railway Applications: Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) is superseded by the standard IEC62278: 2002 under the same title. The standard EN50128 (May 2001), Railway Applications: Software for Railway Control and Protection Systems is superseded by the Standard IEC62279: 2002 under the same title.

Under Subparagraph (i) of Paragraph (c) FRA references additional IEEE standards that became available and will support the designs of PTC systems that are widely using communication as their main component. In addition to existing reference under (A) for IEEE-1483 Standard, the following standards are added to Subparagraph (i): (B) IEEE 1474.2-2003, Standard for user interface requirements in communications based train control (CBTC) systems; and (C) IEEE 1474.1-2004, Standard for Communications-Based Train Control (CBTC) Performance and Functional Requirements.

After analysis of current applicability of ATCS Specification 130 and 140, FRA removes these standards from the list of referenced standards due to their being not used, but adds the ATCS 200, Data Communication standard that remains relevant for communication segment of PTC system designs.

FRA also considers necessary referencing several additional sections of current AAR-AREMA 2009 Communications and Signal Manual of Recommended Practices. In addition to Section 17 of this manual referenced in a previous version of Appendix C, FRA adds to the list of references (A) Section 16 Vital Circuit and Software Design; (C) Section 21 Data Transmission; (D) Section 23 Communication-Based Signaling.

FRA believes that the changes to Appendix C reflect current industry practice and do not add to societal benefits or costs.

GENERAL COSTS OF PTC

The costs anticipated to accrue from adopting this proposed rule would include: (1) costs associated with developing implementation plans and administrative functions related to the implementation and operation of PTC systems, including the information technology and communication systems that make up the central office; (2) hardware costs for onboard locomotive system components, including installation; (3) hardware costs for wayside system components, including installation; and (4) maintenance costs for all system components. The two largest components of initial PTC system acquisition costs are the costs associated with installation of PTC units onboard locomotives, including multiple unit (MU) locomotives and cab cars used in passenger service3, and along the wayside. All commuter operations connected to the general railroad system of transportation, which include all current commuter rail

---

3. Most commuter railroads generally operate one or both of two types of passenger train service: MU locomotive and push-pull. An MU locomotive is a self-propelled rail vehicle that is designed to transport and be occupied by passengers. MU locomotives typically operate semi-permanently coupled together as a pair or triplet with a control cab at each end. 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. In contrast, push-pull service is passenger train service typically operated with a conventional locomotive in the rear of the train “pushing” the consist with a cab car in the lead position of the train, and with the conventional locomotive in the lead position of the train “pulling” the consist with the cab car in the rear of the train.

operations, would be subject to the proposed rule. Note that PATH is not physically connected to the general freight system yet is considered a commuter railroad for all purposes. PATH formerly was part of the general freight system and remains under FRA safety jurisdiction. Rapid transit systems, such as the Washington Metro Area Transit Authority (WMATA) and New York City Transit Authority (NYCTA), would not be impacted.

As with other major system installations, the cost of PTC system installation on locomotives will depend on whether it is a retrofit installation or one that is done during manufacture. Most locomotives built in the past 15 years have electronic systems incorporated that would facilitate installation of PTC. Older locomotives might be slightly more expensive to retrofit, and as a consequence they might be retired earlier than planned. Discussions with railroads and manufacturers of PTC systems yielded a wide range of opinions with respect to locomotive cost implications, however, most members of the RSAC PTC Working Group seemed to think that it would not cost much more to retrofit older equipment. Nevertheless, a fixed investment of some amount, for example the $55,000 per unit of V-TMS used in estimates here, is a larger portion of the total value of a used locomotive than a new one. If a locomotive has a market value of $75,000 it is much harder to retain that locomotive if it needs a $55,000 PTC system than it is to add the $55,000 to a new locomotive costing $2,000,000. To the extent that installation of PTC components on locomotives results in replacement of some locomotives with new ones, there will be some efficiency gains. Newer locomotives are more fuel efficient, produce fewer emissions, are more easily maintained, and may have other cost savings features that are likely offset the cost of replacement. This effect might even benefit some small railroads that would not be required to install PTC, as it would reduce their acquisition cost.

Class I railroad locomotive counts were derived from "The Official 2009 Edition, Locomotive Rosters and News," by totaling the locomotive counts for each of the seven Class I railroads.

In the Initial Regulatory Flexibility Analysis section below, FRA analyzes the impact on small railroads, and estimates that 240 Class III railroad locomotives would need to be equipped, because they operate on other railroad lines that will be equipped with PTC. Some Class II railroad locomotives may also need to be equipped. However, the number of locomotives that Class II and III railroads would have to equip is roughly the same as the small number of locomotives that Class I railroads may not have to equip. Therefore, the total number of Class I locomotives is a good surrogate for the total number of all freight locomotives that would have to be equipped.

Table 1 presents the locomotive related costs. A detailed breakdown of commuter railroad equipment was needed to determine the most likely type of PTC systems that will be implemented on each type of equipment based on the need for interoperability with existing or planned systems. American Public Transportation Association (APTA) member railroad locomotive counts are grouped together by anticipated type of PTC system to the extent practical.

Two railroads, Alaska Railroad (ARR) and PATH, are expected to use unique systems, with little interoperability, so their costs are not presented in Table 1. Costs for Amtrak are listed separately in Table 3 and costs for PATH will be incurred voluntarily, so they are not included. Future passenger operations are not included, although the unit costs would be similar to those on existing systems. FRA would have to speculate on the likelihood of plans coming to fruition, as well as the likelihood that startup operations would have had PTC systems in the absence of a mandatory requirement. It is fairly likely that PTC systems would be voluntarily included in future high-speed operations. High speed operations around the world rely on advanced train control systems and an order of particular applicability requires ACSES on portions of the Northeast Corridor. FRA requests comments regarding the likelihood of voluntary application on new high speed operations as well as the types of systems that might be used.

As noted above, the costs presented below do not include implementation costs for PATH because it is already adopting a system similar to the Communications Based Train Control (CBTC) system used by the New York City Transit Authority on the Canarsie line in order to increase capacity, or the ARR, whose costs are presented separately in Table 3 because the ARR is installing its own version of PTC and its systems does not need to be interoperable with any other system since the ARR does not connect with other railroads except through barge service. The costs included in this analysis for the ARR are for more extensive switch monitoring and track integrity circuits. ARR has and would continue to incur other PTC implementation costs in absence of this rule and RSIA08.

In developing cost estimates, FRA assumed that railroads connecting with the Northeast Corridor would use ACSES compatible technology. ACSES technology can have higher unit costs, in part because the onboard units must pick up transponder signals from beneath the train, as well as data transmitted by radio. Both require additional equipment. Further, ACSES equipment may be more expensive because it has to respond to data on a shorter cycle. It is this shorter cycle, with shorter response time, which makes ACSES relatively a better choice for the higher density operations of the Northeast Corridor. FRA is in no way mandating that any railroad adopt any particular technology, but is estimating costs based on what FRA thinks are the most logical ways to meet the mandate. Of course, if a railroad were to disagree with this analysis, it could install another system with corresponding different costs and benefits. FRA notes that, in order to be fully functional, ACSES must be combined with cab signals and automatic train control. As the NRPM was prepared, FRA lacked detailed information regarding whether or to what extent railroads in the northeast might find it necessary to install cab signal equipment on additional rail lines in order to take advantage of ACSES. FRA is aware that New Jersey Transit has already made these investments and that both of the Metropolitan Transit Authority commuter railroads have non-signaled lines for which “main line” exceptions will apparently be requested. Comment is requested regarding these additional potential costs.

Table 1
Onboard Equipment Costs

Number of commuter RR units, excluding PATH	All units	Unit cost	Total cost	2-cab
APTA locomotives	492			
APTA, single cab, cab car/MU, 1 level	2,186			
APTA, single cab, cab car/MU, 2 level	637			
APTA, double cab, MU, 1 level	98			98
APTA, double cab, MU, 2 level	0			0
APTA, double cab, MU,1 level, articulated	4			4
Massachusetts Bay Transportation Authority	83			
Massachusetts Bay Transportation Authority cab cars	84			
New Mexico Railrunner locomotives	5			
New Mexico Railrunner cab cars	5			
New Jersey Transit locomotives	155			
New Jersey Transit EMUs	230			
New Jersey Transit assumed cab cars, single cab	155			
Total commuter units	4,134			102
Commuter units excluded				
Alaska RR cab cars	4			4
Alaska RR locomotives	58			
Total Alaska RR	62			4
Total commuter units, excluding ARR and PATH	4,072			98
Additional costs for equipping second cabs		**$15,000**	**$1,470,000**	
Units to be equipped with ACSES only				
Amtrak locomotives	0			
Connecticut DOT cab cars	14			
Connecticut DOT locomotives	8			
Long Island Railroad (LIRR)cab cars	1,025			
LIRR locomotives	69			
Metro North cab cars	896			
Metro North locomotives	46			
Southeastern Pennsylvania Transportation Authority	382			71
Southeastern Pennsylvania Transportation Authority	8			
Total equipped with ACSES only	**2,448**	**$80,000**	**$195,840,000**	**71**
Units to be equipped with ACSES and V-TMS				
Amtrak locomotives	20			
Massachusetts Bay Transportation Authority	83			
Massachusetts Bay Transportation Authority cab cars	84			
MARC Train cab cars	27			
MARC Train locomotives	36			
Freight locomotives	100			
Total equipped with ACSES and V-TMS	**247**	**$125,000**	**$30,875,000**	

Units to be equipped V-TMS only			
Commuter units	1497		
Amtrak locomotives	366		
Freight locomotives	27,598		
Total equipped with V-TMS only	**29,461**	**$55,000**	**$1,620,355,000**
Total Onboard costs			**$1,848,540,000**

Wayside installation costs are estimated based on assumptions made above regarding application of either VTMS or ACSES and cost estimates from the 1999 Report, updated to current dollars. These are presented in Table 2. Again, costs for Alaska Railroad and PATH are not included. The two railroads are expected to adopt PTC systems that are different from those adopted by the rest of the industry. The Alaska Railroad system costs are presented in Table 3 and are treated as a single purchase including all system components, while the already planned PATH system is assumed to be funded as a voluntary transit improvement, as it is intended to boost capacity.

Table 2.

Wayside Equipment Costs			
ACSES	miles	Unit cost	
1998 cost & mileage (1999 Report)	198		$20,250,000
Implied unit cost, 1998		$102,273	
Inflation factor			1.1803
Estimated current unit cost		$120,713	
Miles to be equipped with ACSES			
LIRR	308		
Metro North	271.6		
New Jersey Transit	313.6		
Southeastern Penn Transp Authority	94.2		
Total	**987.4**	**$120,713**	**$119,191,523**
New Cab Signals Required			
LIRR ABS	136	$20,000	$2,720,000
Metro North Dark Territory	58.7	$60,000	$3,522,000
Metro North TCS	51.06	$20,000	$1,021,200
Total	**245.76**		**$7,263,200**
Miles to be equipped with V-TMS	**68700**	**$50,000**	**$3,435,000,000**
Total Wayside costs			**$3,561,454,723**

Railroads will also incur costs associated with developing implementation plans and administrative functions related to the implementation and operation of PTC systems, including the information technology and communication systems that make up the central office. It is tempting to look at costs of consumer electronics, which have been dropping since 1998, and ask if PTC systems would be less expensive now, as well. Unfortunately, much of the cost associated with PTC systems is for system development, which must be performed under rigorous conditions in order to avoid costly unintended consequences. Central office costs, if anything, have increased since 1998, with inflation, although some software development tools may have reduced the time needed to perform some functions.

Table 3 presents total PTC system costs. PTC cost estimates used in this analysis are based on discussions with RSAC participants and others over the course of more than a decade of experience in estimating PTC costs. FRA is aware of lower estimates, which typically did not include installation costs, and much higher estimates, which often involved what FRA believes are unreasonable expectations of difficulties in retrofitting older equipment. The estimates from individuals who have actually installed, or been involved in the bid process for installations, are more consistent with the estimates used in this analysis. FRA believes that its onboard equipment cost estimates are likely in the upper bound, however actual equipment costs may vary for one or more systems. It would not be unreasonable for actual locomotive equipment costs to total as low as 60% of this estimate or as high as 125% of the estimate. FRA believes that its wayside costs may be in the lower bound. Wayside costs are not likely to be less than 80% of that, however, costs could be twice as high if more wayside units are required than we expect. FRA believes that its central office and development costs are likely in the upper bound. Cooperation and collaboration among industry participants could significantly reduce development costs. FRA believes that central office and development costs could be as low as 40% of its estimates, but no more than 50% higher than its estimates. FRA has taken the high and low estimates for each cost category, and derived total system cost range of from 71% to 176% of FRA's best estimates for total system acquisition costs.

Table 3

	Units	Unit cost	Total Cost	low cost	High cost
Onboard Equipment	see Table 1		$1,848,540,000	$1,109,124,000	$2,310,675,000
Wayside Equipment	see Table 2		$3,561,454,723	$2,849,163,778	$7,122,909,445
Central Office Equipment	20	$15,000,000	$300,000,000	$120,000,000	$450,000,000
Alaska Railroad			$30,000,000	$30,000,000	$30,000,000
Total system acquisition costs			$5,739,994,723	$4,108,287,778	$9,913,584,445

Railroads have until December 31, 2015 to implement PTC systems. Not all components will be phased in at the same rate. FRA has made some assumptions about the phase-in by component type. FRA assumes that development and central office acquisition will occur first, in roughly equal increments of 20% of total installed costs over five years, starting in 2009. FRA assumes that wayside systems acquisition will start in 2011 and with a smaller portion in the first year, building up to a much larger portion in the final year of acquisition, 2015; specifically, 5% in the first year, 10% in the second year, 15% in the third year, 30% in the fourth year, and 40% in the fifth and final year. FRA assumes that onboard system acquisition will occur in roughly equal increments of 20% of total installed costs over five years, starting in 2011.

Further, a life cycle cost is calculated, over a service life of 20 years. Annual maintenance costs are assumed to be 15% of installed system costs at the end of the previous year. Electronic systems may even have a greater annual maintenance cost if the components must be replaced frequently, because the components are no longer manufactured as technology brings chips and other electronic equipment with greater capabilities to the general market. It is unlikely that a chip maker will maintain production of an obsolete chip just to serve the railroad market, which is very small relative to the total market for processors. Discounted life-cycle costs are calculated using both 3% and 7% annual discount factors. The maintenance costs exceed the initial procurement costs over the thirty year period, as shown in Tables 4a through 4f.

Expected PTC costs are detailed in Tables 4a and 4b, which present annual breakdowns, Tables 4c and 4d present high cost scenarios. Tables 4e and 4f present low cost scenarios. Tables 4a, 4c, and 4e present costs in current dollars using a 7% discount rate, while Tables 4b, 4d, and 4f present current costs based on a 3% discount rate. Tables 4a through 4f also present expected railroad accident reduction benefits, which are discussed in the following section of this analysis.

Because the circumstances of the ARR cost accruals are distinct from other railroads included in this analysis, they are presented separately in Tables 4g and 4h.

This analysis discusses the total cost of each PTC system component. However, each component has a paperwork requirement, whether for configuration management, training, maintenance, hazard log or something else. All such costs are included in aggregate form, and there is no separate paperwork estimate in this regulatory impact statement. Some paperwork requirements may already reflect current industry practices, and would not as a result be a new burden of the proposed rule, even if they qualify as a paperwork burdens for the analysis required under the Paperwork Reduction Act.

IMPACTS OF EXTENDING THE IMPLEMENTATION SCHEDULE

RSIA08 requires the railroads to have all mandatory PTC systems operational on or before December 31, 2015. Members of the PTC Working Group, especially railroad and supplier representatives, said that the timeframe was very tight, and that the scheduled implementation dates would be difficult to meet. In general, the faster a government agency requires a regulated entity to adopt new equipment of procedures, the more expensive compliance becomes. In part, this is due to supply elasticity being less over shorter time periods.

FRA is unable to estimate the potential savings if Congress provided a longer implementation schedule or provided incentives, rather than mandates, for PTC system installation. In order to estimate the likely reduction in costs in such situations, FRA would need to develop some other schedule for implementation. The element least sensitive to an implementations schedule appears to be onboard costs. Each PTC system's onboard equipment seems similar and is not very different from existing onboard systems. Further, the 2015 deadline is not so restrictive that it would cause railroads to pull locomotives out of service just to install on board PTC equipment. Locomotives must be inspected thoroughly every 90 and more extensively every 360 days. The inspections can last from one to several days. Railroads usually bring locomotives into their shops to perform these inspections, during which time a skilled and experienced team could install the on board equipment for PTC.   System development is much less certain, and more time would enable vendors to develop, test, and implement the software at a more reasonable cost. Wayside costs are also sensitive to the installation timetable, as the wayside must be mapped and measured, and then the railroads must install wayside interface units (WIUs). Wayside mapping and measurement takes a highly skilled workforce. A larger workforce is necessary to timely implement the required PTC systems in a shorter amount of time. WIU installation is likely similar to existing signal or communication systems installation, and is likely to involve use of existing railroad skilled workers. The shorter the installation time period, the more work will be done at overtime rates, which are, of course, higher.

FRA believes that lower costs could result from a longer installation period, but FRA also believes that the differences in costs would be within the range of the low costs provided in the main analysis of the proposed rule. The 2004 report included some lower cost estimates, but in light of current discussions with railroads, the cost estimates in the 1998 report seem more accurate. The lower estimates FRA received in preparing the 2004 report were both overly optimistic, and excluded installation costs, as well as higher costs which stem from meeting the performance standards.

Table 4a

Phase In analysis

Discount Rate 7%

Expected Case

Year	Discount Factor	Development & Central Office	Wayside Costs	Onboard Costs	Total Installed Costs	Maintenance Cost	Annual Cost	Discounted Annual Cost	Annual Benefit	Discounted Annual Benefit
2009	1.00	$ 60,000,000	$ 0	$ 0	$ 60,000,000	$ 0	$ 60,000,000	$ 60,000,000	$ 0	$ 0
2010	0.93	$ 60,000,000	$ 0	$ 0	$ 120,000,000	$ 9,000,000	$ 69,000,000	$ 64,485,981	$ 0	$ 0
2011	0.87	$ 60,000,000	$ 178,072,736	$ 369,708,000	$ 727,780,736	$ 18,000,000	$ 625,780,736	$ 546,581,130	$ 2,700,000	$ 2,358,285
2012	0.82	$ 60,000,000	$ 356,145,472	$ 369,708,000	$ 1,513,634,208	$ 109,167,110	$ 895,020,583	$ 730,603,401	$ 9,000,000	$ 7,346,681
2013	0.76	$ 60,000,000	$ 534,218,208	$ 369,708,000	$ 2,477,560,417	$ 227,045,131	$ 1,190,971,340	$ 908,586,333	$ 18,000,000	$ 13,732,114
2014	0.71	$ 0	$ 1,068,436,417	$ 369,708,000	$ 3,915,704,834	$ 371,634,063	$ 1,809,778,479	$ 1,290,347,044	$ 45,000,000	$ 32,084,378
2015	0.67	$ 0	$ 1,424,581,889	$ 369,708,000	$ 5,709,994,723	$ 587,355,725	$ 2,381,645,614	$ 1,586,991,035	$ 76,500,000	$ 50,975,180
2016	0.62	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 533,384,661	$ 90,000,000	$ 56,047,477
2017	0.58	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 498,490,337	$ 90,000,000	$ 52,380,819
2018	0.54	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 465,878,820	$ 90,000,000	$ 48,954,037
2019	0.51	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 435,400,766	$ 90,000,000	$ 45,751,436
2020	0.48	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 406,916,604	$ 90,000,000	$ 42,758,352
2021	0.44	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 380,295,892	$ 90,000,000	$ 39,961,076
2022	0.41	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 355,416,721	$ 90,000,000	$ 37,346,800
2023	0.39	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 332,165,160	$ 90,000,000	$ 34,903,552
2024	0.36	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 310,434,729	$ 90,000,000	$ 32,620,142
2025	0.34	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 290,125,915	$ 90,000,000	$ 30,486,114
2026	0.32	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 271,145,715	$ 90,000,000	$ 28,491,695
2027	0.30	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 253,407,210	$ 90,000,000	$ 26,627,752
2028	0.28	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 236,829,168	$ 90,000,000	$ 24,885,750
Total	11.33559524							$ 9,957,486,622		$ 607,711,640

Annualized Cost	$ 939,916,295	(excludes ARR)
Annualized Benefit	$ 57,363,680	

Table 4b

Phase In analysis

Discount Rate Expected Case Table 3b

3.00%

Year	Discount Factor	Development & Central Office	Wayside Costs	Onboard Costs	Total Installed Costs	Maintenance Cost	Annual Cost	Discounted Annual Cost	Annual Benefit	Discounted Annual Benefit
2009	1.00	$ 60,000,000	$ 0	$ 0	$ 60,000,000	$ 0	$ 60,000,000	$ 60,000,000	$ 0	$ 0
2010	0.97	$ 60,000,000	$ 0	$ 0	$ 120,000,000	$ 9,000,000	$ 69,000,000	$ 66,990,291	$ 0	$ 0
2011	0.94	$ 60,000,000	$ 178,072,736	$ 369,708,000	$ 727,780,736	$ 18,000,000	$ 625,780,736	$ 589,858,362	$ 2,700,000	$ 2,545,009
2012	0.92	$ 60,000,000	$ 356,145,472	$ 369,708,000	$ 1,513,634,208	$ 109,167,110	$ 895,020,583	$ 819,070,621	$ 9,000,000	$ 8,236,275
2013	0.89	$ 60,000,000	$ 534,218,208	$ 369,708,000	$ 2,477,560,417	$ 227,045,131	$ 1,190,971,340	$ 1,058,162,610	$ 18,000,000	$ 15,992,767
2014	0.86	$ 0	$ 1,068,436,417	$ 369,708,000	$ 3,915,704,834	$ 371,634,063	$ 1,809,778,479	$ 1,561,130,814	$ 45,000,000	$ 38,817,395
2015	0.84	$ 0	$ 1,424,581,889	$ 369,708,000	$ 5,709,994,723	$ 587,355,725	$ 2,381,645,614	$ 1,994,590,707	$ 76,500,000	$ 64,067,546
2016	0.81	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 696,412,236	$ 90,000,000	$ 73,178,236
2017	0.79	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 676,128,384	$ 90,000,000	$ 71,046,831
2018	0.77	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 656,435,325	$ 90,000,000	$ 68,977,506
2019	0.74	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 637,315,849	$ 90,000,000	$ 66,968,452
2020	0.72	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 618,753,252	$ 90,000,000	$ 65,017,915
2021	0.70	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 600,731,312	$ 90,000,000	$ 63,124,189
2022	0.68	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 583,234,284	$ 90,000,000	$ 61,285,621
2023	0.66	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 566,246,877	$ 90,000,000	$ 59,500,603
2024	0.64	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 549,754,250	$ 90,000,000	$ 57,767,575
2025	0.62	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 533,741,990	$ 90,000,000	$ 56,085,025
2026	0.61	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 518,196,107	$ 90,000,000	$ 54,451,480
2027	0.59	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 503,103,016	$ 90,000,000	$ 52,865,515
2028	0.57	$ 0	$ 0	$ 0	$ 5,709,994,723	$ 856,499,208	$ 856,499,208	$ 488,449,531	$ 90,000,000	$ 51,325,742
								$ 13,778,305,817		$ 931,253,681

Annualized Cost	$ 926,118,575	(Excludes ARR)
Annualized Benefit	$ 62,594,875	

Table 4c

Phase In analysis

Discount Rate		High Cost Case		Table 3c						
7%					Total			Discounted		Discounted
Year	Discount Factor	Development & Central Office	Wayside Costs	Onboard Costs	Installed Costs	Maintenance Cost	Annual Cost	Annual Cost	Annual Benefit	Annual Benefit
2009	1.00	$ 90,000,000	$ 0	$ 0	$ 90,000,000	$ 0	$ 90,000,000	$ 90,000,000	$ 0	$ 0
2010	0.93	$ 90,000,000	$ 0	$ 0	$ 180,000,000	$ 13,500,000	$ 103,500,000	$ 96,728,972	$ 0	$ 0
2011	0.87	$ 90,000,000	$ 356,145,472	$ 462,135,000	$ 1,088,280,472	$ 27,000,000	$ 935,280,472	$ 816,910,186	$ 2,700,000	$ 2,358,285
2012	0.82	$ 90,000,000	$ 712,290,945	$ 462,135,000	$ 2,352,706,417	$ 163,242,071	$ 1,427,668,015	$ 1,165,402,370	$ 9,000,000	$ 7,346,681
2013	0.76	$ 90,000,000	$ 1,068,436,417	$ 462,135,000	$ 3,973,277,834	$ 352,905,963	$ 1,973,477,379	$ 1,505,556,444	$ 18,000,000	$ 13,732,114
2014	0.71	$ 0	$ 2,136,872,834	$ 462,135,000	$ 6,572,285,667	$ 595,991,675	$ 3,194,999,509	$ 2,277,990,493	$ 45,000,000	$ 32,084,378
2015	0.67	$ 0	$ 2,849,163,778	$ 462,135,000	$ 9,883,584,445	$ 985,842,850	$ 4,297,141,628	$ 2,863,366,908	$ 76,500,000	$ 50,975,180
2016	0.62	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 923,249,949	$ 90,000,000	$ 56,047,477
2017	0.58	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 862,850,420	$ 90,000,000	$ 52,380,819
2018	0.54	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 806,402,262	$ 90,000,000	$ 48,954,037
2019	0.51	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 753,646,973	$ 90,000,000	$ 45,751,436
2020	0.48	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 704,342,966	$ 90,000,000	$ 42,758,352
2021	0.44	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 658,264,454	$ 90,000,000	$ 39,961,076
2022	0.41	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 615,200,424	$ 90,000,000	$ 37,346,800
2023	0.39	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 574,953,668	$ 90,000,000	$ 34,903,552
2024	0.36	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 537,339,876	$ 90,000,000	$ 32,620,142
2025	0.34	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 502,186,800	$ 90,000,000	$ 30,486,114
2026	0.32	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 469,333,458	$ 90,000,000	$ 28,491,695
2027	0.30	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 438,629,400	$ 90,000,000	$ 26,627,752
2028	0.28	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 409,934,019	$ 90,000,000	$ 24,885,750
Total								$ 17,072,290,043		$ 607,711,640

Table 4d

Phase In analysis

Discount Rate		High Cost Case		Table 3d						
3%					Total			Discounted		Discounted
Year	Discount Factor	Development & Central Office	Wayside Costs	Onboard Costs	Installed Costs	Maintenance Cost	Annual Cost	Annual Cost	Annual Benefit	Annual Benefit
2009	1.00	$ 90,000,000	$ 0	$ 0	$ 90,000,000	$ 0	$ 90,000,000	$ 90,000,000	$ 0	$ 0
2010	0.97	$ 90,000,000	$ 0	$ 0	$ 180,000,000	$ 13,500,000	$ 103,500,000	$ 100,485,437	$ 0	$ 0
2011	0.94	$ 90,000,000	$ 356,145,472	$ 462,135,000	$ 1,088,280,472	$ 27,000,000	$ 935,280,472	$ 881,591,547	$ 2,700,000	$ 2,545,009
2012	0.92	$ 90,000,000	$ 712,290,945	$ 462,135,000	$ 2,352,706,417	$ 163,242,071	$ 1,427,668,015	$ 1,306,518,477	$ 9,000,000	$ 8,236,275
2013	0.89	$ 90,000,000	$ 1,068,436,417	$ 462,135,000	$ 3,973,277,834	$ 352,905,963	$ 1,973,477,379	$ 1,753,409,091	$ 18,000,000	$ 15,992,767
2014	0.86	$ 0	$ 2,136,872,834	$ 462,135,000	$ 6,572,285,667	$ 595,991,675	$ 3,194,999,509	$ 2,756,034,642	$ 45,000,000	$ 38,817,395
2015	0.84	$ 0	$ 2,849,163,778	$ 462,135,000	$ 9,883,584,445	$ 985,842,850	$ 4,297,141,628	$ 3,598,788,462	$ 76,500,000	$ 64,067,546
2016	0.81	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 1,205,438,792	$ 90,000,000	$ 73,178,236
2017	0.79	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 1,170,328,924	$ 90,000,000	$ 71,046,831
2018	0.77	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 1,136,241,674	$ 90,000,000	$ 68,977,506
2019	0.74	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 1,103,147,256	$ 90,000,000	$ 66,968,452
2020	0.72	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 1,071,016,754	$ 90,000,000	$ 65,017,915
2021	0.70	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 1,039,822,091	$ 90,000,000	$ 63,124,189
2022	0.68	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 1,009,536,011	$ 90,000,000	$ 61,285,621
2023	0.66	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 980,132,049	$ 90,000,000	$ 59,500,603
2024	0.64	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 951,584,514	$ 90,000,000	$ 57,767,575
2025	0.62	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 923,868,460	$ 90,000,000	$ 56,085,025
202	0.61	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 896,959,670	$ 90,000,000	$ 54,451,480

6										
2027	0.59	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 870,834,631	$ 90,000,000	$ 52,865,515
2028	0.57	$ 0	$ 0	$ 0	$ 9,883,584,445	$ 1,482,537,667	$ 1,482,537,667	$ 845,470,516	$ 90,000,000	$ 51,325,742
								$ 23,691,208,998		$ 931,253,681

Table 4e

Phase In analysis

Discount Rate Low Cost Case Table 3e

7%

Year	Discount Factor	Development & Central Office	Wayside Costs	Onboard Costs	Total Installed Costs	Maintenance Cost	Annual Cost	Discounted Annual Cost	Annual Benefit	Discounted Annual Benefit
2009	1.00	$ 24,000,000	$ 0	$ 0	$ 24,000,000	$ 0	$ 24,000,000	$ 24,000,000	$ 0	$ 0
2010	0.93	$ 24,000,000	$ 0	$ 0	$ 48,000,000	$ 3,600,000	$ 27,600,000	$ 25,794,393	$ 0	$ 0
2011	0.87	$ 24,000,000	$ 142,458,189	$ 221,824,800	$ 436,282,989	$ 7,200,000	$ 395,482,989	$ 345,430,159	$ 2,700,000	$ 2,358,285
2012	0.82	$ 24,000,000	$ 284,916,378	$ 221,824,800	$ 967,024,167	$ 65,442,448	$ 596,183,626	$ 486,663,428	$ 9,000,000	$ 7,346,681
2013	0.76	$ 24,000,000	$ 427,374,567	$ 221,824,800	$ 1,640,223,533	$ 145,053,625	$ 818,252,992	$ 624,241,290	$ 18,000,000	$ 13,732,114
2014	0.71	$ 0	$ 854,749,133	$ 221,824,800	$ 2,716,797,467	$ 246,033,530	$ 1,322,607,463	$ 943,000,842	$ 45,000,000	$ 32,084,378
2015	0.67	$ 0	$ 1,139,665,511	$ 221,824,800	$ 4,078,287,778	$ 407,519,620	$ 1,769,009,931	$ 1,178,766,012	$ 76,500,000	$ 50,975,180
2016	0.62	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 380,962,899	$ 90,000,000	$ 56,047,477
2017	0.58	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 356,040,093	$ 90,000,000	$ 52,380,819
2018	0.54	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 332,747,750	$ 90,000,000	$ 48,954,037
2019	0.51	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 310,979,206	$ 90,000,000	$ 45,751,436
2020	0.48	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 290,634,772	$ 90,000,000	$ 42,758,352
2021	0.44	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 271,621,282	$ 90,000,000	$ 39,961,076
2022	0.41	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 253,851,665	$ 90,000,000	$ 37,346,800
2023	0.39	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 237,244,547	$ 90,000,000	$ 34,903,552
2024	0.36	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 221,723,876	$ 90,000,000	$ 32,620,142
2025	0.34	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 207,218,576	$ 90,000,000	$ 30,486,114
2026	0.32	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 193,662,220	$ 90,000,000	$ 28,491,695

2027	0.30	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 180,992,729	$ 90,000,000	$ 26,627,752
2028	0.28	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 169,152,083	$ 90,000,000	$ 24,885,750
								$ 7,034,727,821		$ 607,711,640

Table 4f

Phase In analysis

Discount Rate		Low Cost Case		Table 3e						
7%					Total			Discounted		Discounted
Year	Discount Factor	Development & Central Office	Wayside Costs	Onboard Costs	Installed Costs	Maintenance Cost	Annual Cost	Annual Cost	Annual Benefit	Annual Benefit
2009	1.00	$ 24,000,000	$ 0	$ 0	$ 24,000,000	$ 0	$ 24,000,000	$ 24,000,000	$ 0	$ 0
2010	0.93	$ 24,000,000	$ 0	$ 0	$ 48,000,000	$ 3,600,000	$ 27,600,000	$ 25,794,393	$ 0	$ 0
2011	0.87	$ 24,000,000	$ 142,458,189	$ 221,824,800	$ 436,282,989	$ 7,200,000	$ 395,482,989	$ 345,430,159	$ 2,700,000	$ 2,358,285
2012	0.82	$ 24,000,000	$ 284,916,378	$ 221,824,800	$ 967,024,167	$ 65,442,448	$ 596,183,626	$ 486,663,428	$ 9,000,000	$ 7,346,681
2013	0.76	$ 24,000,000	$ 427,374,567	$ 221,824,800	$ 1,640,223,533	$ 145,053,625	$ 818,252,992	$ 624,241,290	$ 18,000,000	$ 13,732,114
2014	0.71	$ 0	$ 854,749,133	$ 221,824,800	$ 2,716,797,467	$ 246,033,530	$ 1,322,607,463	$ 943,000,842	$ 45,000,000	$ 32,084,378
2015	0.67	$ 0	$ 1,139,665,511	$ 221,824,800	$ 4,078,287,778	$ 407,519,620	$ 1,769,009,931	$ 1,178,766,012	$ 76,500,000	$ 50,975,180
2016	0.62	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 380,962,899	$ 90,000,000	$ 56,047,477
2017	0.58	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 356,040,093	$ 90,000,000	$ 52,380,819
2018	0.54	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 332,747,750	$ 90,000,000	$ 48,954,037
2019	0.51	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 310,979,206	$ 90,000,000	$ 45,751,436
2020	0.48	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 290,634,772	$ 90,000,000	$ 42,758,352
2021	0.44	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 271,621,282	$ 90,000,000	$ 39,961,076
2022	0.41	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 253,851,665	$ 90,000,000	$ 37,346,800
2023	0.39	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 237,244,547	$ 90,000,000	$ 34,903,552
2024	0.36	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 221,723,876	$ 90,000,000	$ 32,620,142
2025	0.34	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 207,218,576	$ 90,000,000	$ 30,486,114
2026	0.32	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 193,662,220	$ 90,000,000	$ 28,491,695

2027	0.30	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 180,992,729	$ 90,000,000	$ 26,627,752
2028	0.28	$ 0	$ 0	$ 0	$ 4,078,287,778	$ 611,743,167	$ 611,743,167	$ 169,152,083	$ 90,000,000	$ 24,885,750
								$ 7,034,727,821		$ 607,711,640

Table 4G

Phase In analysis

Discount Rate

7%			Alaska	Total			Discounted
Year	Discount		Railroad	Installed	Maintenance	Annual	Annual
	Factor		Costs	Costs	Cost	Cost	Cost
2009	1.00		$ 0	$ 0	$ 0	$ 0	$ 0
2010	0.93		$ 0	$ 0	$ 0	$ 0	$ 0
2011	0.87		$ 1,500,000	$ 1,500,000	$ 0	$ 1,500,000	$ 1,310,158
2012	0.82		$ 3,000,000	$ 4,500,000	$ 225,000	$ 3,225,000	$ 2,632,561
2013	0.76		$ 4,500,000	$ 9,000,000	$ 675,000	$ 5,175,000	$ 3,947,983
2014	0.71		$ 9,000,000	$ 18,000,000	$ 1,350,000	$ 10,350,000	$ 7,379,407
2015	0.67		$ 12,000,000	$ 30,000,000	$ 2,700,000	$ 14,700,000	$ 9,795,231
2016	0.62		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,802,374
2017	0.58		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,619,041
2018	0.54		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,447,702
2019	0.51		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,287,572
2020	0.48		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,137,918
2021	0.44		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 1,998,054
2022	0.41		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 1,867,340
2023	0.39		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 1,745,178
2024	0.36		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 1,631,007
2025	0.34		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 1,524,306
2026	0.32		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 1,424,585
2027	0.30		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 1,331,388
2028	0.28		$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 1,244,287
							$ 50,126,089
Annualized ARR Cost		$ 4,731,548					
All Railroads			**Expected**	High	Low		
Total annualized cost			**$ 944,647,844**	$ 1,611,503,406	$ 664,028,541		
Total discounted cost			**$ 10,007,612,712**	$ 17,122,416,132	$ 7,084,853,910		

Table 4h

Phase In analysis

Discount Rate

3%

Year	Discount Factor	Alaska Railroad Costs	Total Installed Costs	Maintenance Cost	Annual Cost	Discounted Annual Cost
2009	1.00	$ 0	$ 0	$ 0	$ 0	$ 0
2010	0.97	$ 0	$ 0	$ 0	$ 0	$ 0
2011	0.94	$ 1,500,000	$ 1,500,000	$ 0	$ 1,500,000	$ 1,413,894
2012	0.92	$ 3,000,000	$ 4,500,000	$ 225,000	$ 3,225,000	$ 2,951,332
2013	0.89	$ 4,500,000	$ 9,000,000	$ 675,000	$ 5,175,000	$ 4,597,920
2014	0.86	$ 9,000,000	$ 18,000,000	$ 1,350,000	$ 10,350,000	$ 8,928,001
2015	0.84	$ 12,000,000	$ 30,000,000	$ 2,700,000	$ 14,700,000	$ 12,311,019
2016	0.81	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 3,658,912
2017	0.79	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 3,552,342
2018	0.77	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 3,448,875
2019	0.74	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 3,348,423
2020	0.72	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 3,250,896
2021	0.70	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 3,156,209
2022	0.68	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 3,064,281
2023	0.66	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,975,030
2024	0.64	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,888,379
2025	0.62	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,804,251
202	0.61	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,722,574

6						
2027	0.59	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,643,276
2028	0.57	$ 0	$ 30,000,000	$ 4,500,000	$ 4,500,000	$ 2,566,287
						$ 70,281,900

Annualized Cost	$ 4,724,048		
All Railroads	Expected	High	Low
Total annualized cost	$ 930,842,623	$ 1,597,145,424	$ 661,229,515
Total discounted cost	$ 13,848,587,717	$ 23,761,490,898	$ 9,837,425,482

PTC BENEFITS

The primary benefit of PTC implementation is the safety benefits or savings expected to accrue from the reduction in the number and severity of casualties arising train accidents that would occur on lines equipped with PTC systems. In addition, benefits related to accident preventions would accrue from a decrease in damages to property such as locomotives, railroad cars, and track; environmental damage; track closures; road closures; and evacuations. Benefits more difficult to monetize--such as the avoidance of hazmat accident related costs incurred by Federal, state, and local governments and impacts to local businesses--will also result. FRA also expects that once PTC systems are refined there will be substantial additional business benefits resulting from more efficient transportation service; however such benefits are not included in the total benefits.

ACCIDENT REDUCTION BENEFITS

In 2005, as part of the ongoing effort to study the effectiveness of PTC at preventing accidents, the Volpe Center estimated its rail safety benefits for the period 1988 – 2001, a span of 14 years. The estimate was based on a pool of 728 PTC-preventable accidents (PPA) identified by a joint FRA and industry working group and accident cost factors from the 1999 report. This analysis showed that implementation of PTC systems with essentially the same characteristics as systems that would meet the proposed requirements would have resulted in accident cost savings totaling $827,743,610.96, an average annual cost of $59,124,543.64, and an average accident cost of $1,137,010.45. Accident costs included costs associated with casualties as well as various other factors discussed in detail below. Since these cost estimates were developed, the Department of Transportation has increased its estimate of the willingness to pay to avoid a fatality from $2.7 million to $6 million, by a factor of 2.222. On the other hand, changes in GDP (http://cost.jsc.nasa.gov/inflateGDP.html), indicate that prices rose by a factor of 1.5143 from 1988 (the first year of the study) to 2008, and 1.1158 from 2001 (the last year of the study) to 2008. Using the GDP deflator value for 1995 to 2008, which would be the midpoint GDP deflator value for the period of study, yields a price increase of 1.238 from the midpoint of the study period to 2008.

Using an inflator value slightly greater than 1.7 (the average of 2.222 and 1.238) to update costs from the Volpe study yields annual PPA costs of approximately $105,000,000 in current dollars.

PPA Cost Factors from the 1999 Report

The cost factors discussed below are the basis for the PPA estimates presented above. They were derived by consensus of the Economics Team of the PTC Working Group and were published in the 1999 report. All costs were measured in 1998 constant dollars.

Equipment Damage

The Economics Team could not discern a difference between the costs of damage to passenger equipment reported to FRA and the societal cost of the damage. The Team agreed that the best estimator of passenger equipment damage is the reported damage. Passenger equipment is often insured for replacement value, so sometimes equipment damage is reported as the cost of replacement equipment, which is likely an overestimate. Other times the equipment is reported as the depreciated value of the equipment. There does not seem to be a pattern that would produce a scaling factor.

Track and Right-of-Way Damage

It appears that actual damage reported for track and right-of-way damage is fairly accurate, and reflects societal costs. It may be underestimated in some cases as the full extent of the repair costs may not be captured, but in other cases it may be overestimated as older track and right-of-way may be repaired to better than pre-accident condition. This appeared to the Economics Team to balance out over time, and not to be correlated with any reported characteristics. For purposes of the study the Economics Team agreed to use the reported damage to track and wayside.

Damage Off the Right-of-Way

Some damage may occur to property not on the right-of-way, for example when an overspeed train derails, damaging a building owned by someone other than the railroad. The Economics Team estimated average damage at $2,000 per PTC-preventable accident[2]. Such damage is rare, and cannot easily be attributed to an accident based on any characteristics reported

Hazardous Materials Cleanup

If an accident involves a release of hazardous materials, there may be a cost to clean up the hazardous material and remediate (restore) the environment. Based on data from actual settlements and judgments in such cases, the Economics Team estimated the cost of cleanup and remediation at $250,000 per hazardous material car releasing. The Team considered using a single cost per incident in which hazardous material was released, but thought that it would be at least as good to base the estimated cost on cars releasing to provide some measure of the severity of the accident. This measure is still far from perfect, as some accidents involving single car releases may have resulted in far more costly clean-ups than some multi-car releases, yet it is the best measure the Team could agree upon.

Evacuations

[2] Yard and highway-rail grade crossing accidents are excluded from any definition of PTC preventable accident considered here.

Accidents may lead to evacuations, either because of real or perceived threats to safety from hazardous materials. The Team estimated the societal cost of an evacuation from data on 77 evacuations for which it had data on the duration of the evacuation. These accidents were not necessarily PTC preventable (most were not) and occurred between 1993 and 1997. The Team estimated the value of time at $11.70 per hour per person, plus 30%, or $15.21 per hour. It added 30% to reflect the involuntary and unplanned nature of the costs imposed. Unfortunately, one accident, at Weyauwega, Wisconsin, on March 4, 1996, dominated the costs. The Weyauwega evacuation lasted 426 hours, while the next longest evacuation lasted 43 hours. The average cost per evacuation was $986 with the Weyauwega evacuation, and $267 without. The Weyauwega evacuation was clearly an outlier, but nevertheless relevant, so the Economics Team compromised on an estimate of $500 per evacuation.

Loss of Lading

If there is an accident involving a loaded freight car, there may be a loss to society as a result of loss or damage to lading. In this case railroad payments to shippers are probably very close to the societal cost of lading loss and damage, which based on data from the American Association of Railroads is roughly $6,500 per loaded freight car derailed, a figure the Team agreed upon.

Wreck Clearing

Locomotives or cars that are derailed or destroyed need to be removed from the right of way. Railroads costs for this include the cost of mobilizing a crane or rerailing equipment to the accident site and the cost of employing that equipment. The Team estimated that the cost of mobilizing equipment to an accident site is $2,500 per incident where cars or locomotives are derailed. Once the equipment is there, the Team estimated that it would cost $750 to rerail, wreck or transport a freight locomotive that had derailed, and $300 to rerail, wreck or transport a derailed freight car.

Rerailing passenger equipment can be far more costly. The equipment is more expensive, and may be less robust than freight equipment. It needs to be handled with more care. The sites of passenger accidents are more likely to be in urban areas where the right of way is constrained, as in tunnels and sunken routes under streets. Further, the National Transportation Safety Board is far more likely to investigate a passenger train accident, so there may be significant costs while the rerailing/wrecking equipment sits near the accident site, awaiting NTSB's permission to clear the accident. Four commuter railroads' data suggests that the cost per incident of clearing equipment is roughly $75,000 per accident in which passenger cars or locomotives are derailed. The Team agreed with this estimate.

Train Delays

If a train is derailed it will block the track it is on, and may block adjacent tracks too. The Team estimated that the average blockage would last two hours. If affected trains arrive randomly, the average train delay would be one hour, for freight trains and fifteen minutes for passenger trains, which are likely to be switched around a delay. The Team estimated the average cost per hour of freight train delay at $250 per hour. Thus the estimated cost of a delay would be freight trains per day divided by twelve (the expected number of trains in two hours), times one (the average expected delay) times the cost per hour of a delay ($250).

The Team estimated the cost of passenger train delays, based on 285 passengers per train (a national average), an average duration of blockage of 2 hours (which implies passenger trains per day/12 are affected), an average per train delay of 15 minutes, and an average value of passenger time of $25 per hour. This relatively high per hour value of time is related to the income of train passengers. Many commuter lines have average passenger household incomes in excess of $75,000 per year.

Multiplying 285 passengers per train, $25 per passenger hour, and 1/4 hour yields a cost of $1781.25 per train. The Team estimated the number of passenger trains affected as trains per day divided by 12, to reflect 24 hours per day divided by two hours duration of blockage. To get the average cost of passenger train delay, $1781.25 is divided by twelve to get $148.44, which must then be multiplied by the number of passenger trains per day.

HEADLINE ACCIDENTS

Notable accidents are always investigated, and as a consequence the cause code is commonly recorded as “under investigation.” Therefore, they were generally not captured by data queries used to establish the PPA database. This database may also under-represent such accidents because they are so infrequent they did not occur in the time period. For example, an accident that occurred on February 16, 1996, in Silver Spring, Maryland, resulted in 11 fatalities, but is not in the PPA database. An article in the online version of the International Herald Tribune, dated September 14, 2008, lists fourteen train accidents, starting with one in 1910. Four of these accidents were PTC preventable accidents that occurred between 1972 and 2005. Included in this group were the Graniteville, South Carolina accident and the three listed below. The recent accident at Chatsworth, California that had just occurred was not listed. Including the Chatsworth accident, five headline PPAs occurred between 1969 and 2008, killing 106 people. These accidents are very rare, unique in circumstance, and very hard to predict or avoid. Nevertheless after each accident, FRA took steps to avoid such accidents and to mitigate the outcome of those that might occur. Some of the safety initiatives included the issuance of regulations addressing training, operating rules for calling of signals, drug testing, crashworthiness of cars and locomotives, hazardous materials routing (FRA assisted PHMSA in this developing this rule) , and passenger train emergency preparedness. While this analysis extensively discusses the accidents that occurred at Graniteville, South Carolina and Chatsworth, California, this analysis also includes fatalities resulting from the following three accidents included in the 2008 Herald Tribune article:

- Feb. 16, 1996: Amtrak's locomotive-led Capitol Limited sideswiped a cab car-led Maryland commuter train at a crossover switch in Silver Spring, Maryland. All three crew members and eight passengers on the commuter train died.

- Jan. 4, 1987: An engineer drove three linked Conrail engines through a closed track switch and into the path of Amtrak train near Chase, Md., killing 16 and injuring 175.
- Oct. 30, 1972: Two Illinois Central commuter trains collided during morning rush hour in Chicago, killing 45 and injuring more than 200.

FRA has studied quite extensively of the consequences of the January 6, 2005 accident in Graniteville, South Carolina and estimates the total cost of the accident as $189,154,845 based on the following information.

The Graniteville accident resulted in 9 fatalities and more than 550 injuries. It was the deadliest train accident involving a hazardous material in nearly three decades. At 2:39 a.m. on January 6, 2005, a train crashed into a locomotive and two cars on a siding in Graniteville, South Carolina. A tank car containing chlorine was punctured in the shell by the coupler of another car and released chlorine. The release affected commercial and residential areas of the city. Approximately 5,400 residents were evacuated from a 1-mile radius around the accident site. About 554 people complaining of respiratory difficulties were taken to local hospitals. Of those, 75 were admitted for treatment. Nine people died from exposure to chlorine gas. Fifteen people were placed on ventilators in intensive care units. Twenty-five people were hospitalized for more than 3 days. Twenty-six people were hospitalized for 1 to 2 days. There were 68 repeat visits to the emergency department, 58 people with significant symptoms and 98 with moderate symptoms. Forty-one people who visited the emergency department were released and 13 people were treated at a physician's office.

The monetary impact of the injuries sustained as a result of the Graniteville accident is estimated using the Abbreviated Injury Scale (AIS). One criterion for a reportable injury is that the injury requires medical treatment. Because one criterion of an AIS 2 injury is that it almost always requires treatment, it can be assumed that all injuries reported are at least AIS 2. Of the 554 people taken to the hospital, it was reported that 75 were admitted for treatment. It was further reported that 9 died, 15 people were placed on ventilators, 25 people were hospitalized for more than 3 days, and 26 people were hospitalized for 1 or 3 days. In the interest of being conservative, and without more specific information, an AIS 2 - moderate will be assessed for 479 persons and the remaining 75 persons admitted will be assessed as AIS 3 - severe.

Authorities evacuated homes and businesses within a mile of the crash, affecting about 5,400 people. Some were away from their homes for more than a week. On January 14, 2005, approximately 1,500 Graniteville residents were allowed to return to their homes. By January 17, 2005, an estimated 4,500 people had returned home, including the 1,500 individuals who had previously returned home on January 14. On January 19, 2005, residents remained displaced from an estimated 75 homes in the immediate area of the derailment.

The Graniteville incident caused some local businesses to have a dramatic drop in business immediately after the accident. Part of the reason for this drop was because parts U.S. Highway 1 were closed due to the deadly chlorine cloud. After four days the highway was opened but it had signs that noted that it was open only to local traffic.

Table 5

Graniteville Accident Cost

Rail Hazardous Material Incident Summary

Negative Impact	People Involved		Pecuniary Value
Fatalities	9		$54,000,000
Injuries - AIS 1	0		$0
Injuries - AIS 2	479		$44,547,000
Injuries - AIS 3	75		$25,875,000
Injuries - AIS 4	0		$0
Injuries - AIS 5	0		$0
Evacuation ($200 / day / person)	5,400	;2,350 days	$10,470,000
Property Damage			$6,900,000
Environmental Cleanup (Diesel Fuel Only)	1		$162,845
Environmental Cleanup - Other			
Track Out of Service	$2 Mill/day	23 days	$46,000,000
Road Closure	$300,000/day	4 days	$1,200,000
Total Value:			**$189,154,845**

Evacuation	$200 Per Day Per Person	52,350 total

FRA has also developed a preliminary estimate of the Chatsworth, California accident cost. The accident resulted in 25 fatalities and a total of $382,856,856 in monetized accident costs.

Table 6
Chatsworth Accident Cost

Casualties

	Number	Cost Per	Total (Million $)
Fatalities (AIS 6)	25	$ 6,000,000	$ 150,000,000
AIS 1 (minor)*	23.75	$ 12,000	$ 285,000
AIS 2 (moderate)*	23.75	$ 93,000	$ 2,208,750
AIS 3 (serious)*	23.75	$ 345,000	$ 8,193,750
AIS 4 (severe)*	23.75	$ 1,125,000	$ 26,718,750
AIS 5 (critical)	40	$ 4,575,000	$ 183,000,000
Total			**$ 370,406,250**

According to FRA 39i -- 84

Train Delay

Passengers - Day 1 immediate	Number Pass	Number	Cost / Hour	Hours
Pass - Day 1 later	225	4	$ 43.51	3
Passengers - Subsequent days	225	30	$ 43.51	1.5
	225	40	$ 43.51	1

UP	Number		Hours
Freight - local	1	$ 420	21
Freight - other	4	$ 420	279
Total	$126,000		

Rolling Stock Equipment

Metrolink	Number	Cost Per	Total	Notes
Locomotive	1	$ 3,000,000	$ 3,000,000	Completely
Coach	1	$ 2,000,000	$ 2,000,000	Completely
Coach damage	2	$ 500,000	$ 1,000,000	
UP				
Lead locomotive	1	$ 500,000	$ 500,000	
Trailing locomotive	1	$ 150,000	$ 150,000	
Cars	7	$ 100,000	$ 700,000	
Lading damage	7	$ 300,000	$ 2,100,000	
Total			**$ 9,450,000**	

Emergency Response

	Number	Cost Per Hour	Hours	Total
Fire *	270	$ 50	36	$ 486,000
LAPD / Sheriffs*	210	$ 50	36	$ 378,000
Others (Highway Patrol,	15	$ 50	36	$ 27,000
Total				**$ 891,000**

Equipment Clean Up

	Number	Hourly Rate	Hours	Total
Labor	28	$ 50	35	$ 49,000
Heavy Equipment Used	7	$ 3,000	35	$ 735,000
Biohazard remediation	5	$ 100	16	$ 8,000
Total				**$ 784,000**

Equipment Derailed: 1 Metrolink

Track Damage

		Cost Per	Total
1,000 feet	1000	$ 250	$ 250,000
Total			**$ 250,000**

Chatsworth Incident Cost

Casualties	$ 370,406,250
Train Delay	$ 1,075,606
Damaged Rolling Stock	$ 9,450,000
Emergency Response	$ 891,000
Equipment Clean Up	$ 784,000
Track Damage	$ 250,000
Total	**$ 382,856,856**

Between the Graniteville and Chatsworth accidents, there were a total of 34 fatalities and $572,011,701 total costs including fatality costs, or an average of $16,823,874 in total damages per fatality. If that ratio had been the same at all the other headline PPA's then the total cost of those accidents, involving 106 fatalities, would have been $1,783,330,597 over 40 years, with an expected annual cost of $44,583,265, or roughly $45,000,000.

The table below breaks down these benefits by fatalities and other accident costs, including non-fatal injuries.

Headline Accidents (40 years)

	# fatalities	$ fatalities	$ Injuries and Other damages
Chatsworth	25	$ 150,000,000	$ 232,856,856
Graniteville	9	$ 54,000,000	$ 135,154,845
Total	34	$ 204,000,000	$ 368,011,701
Average per fatality	**1**	**$ 6,000,000**	**$ 10,823,874**
Chatsworth	25	$ 150,000,000	$ 270,596,839
Graniteville	9	$ 54,000,000	$ 97,414,862
Silver Spring	11	$ 66,000,000	$ 119,062,609
Chase, MD 1987	16	$ 96,000,000	$ 173,181,977
Chicago 1972	45	$ 270,000,000	$ 487,074,310
Total	106	$ 636,000,000	$ 1,147,330,597
Average per incident	**21.2**	**$ 127,200,000**	**$ 229,466,119**
Yearly (divide by 40)	**2.65**	**$ 15,900,000**	**$ 28,683,265**

TOTAL RAILROAD SAFETY BENEFITS FROM PTC PREVENTABLE ACCIDENTS

Total railroad safety benefits are the sum of “baseline” PPA costs of about $105 million per year and “headline” PPA costs of about $45 million per year, which total $150 million per year. FRA estimates that approximately one third of these benefits would be attributable to fatality avoidance. Virtually all PPA’s occurred on the very broad PTC system required by RSIA08, and defined in the proposed rule. The remaining portion of the system tends to have lower speeds and densities, reducing both the likelihood of PPAs and the potential severity of those accidents. Such accidents would have a negligible impact on this analysis, thus there is no need to reduce the estimated benefit to account for PPAs unaffected by the proposed systems.

As mentioned above, FRA has instituted many countermeasures that might have helped mitigate or avoid these accidents. For purposes of this analysis, FRA assumes that 25% of the annual PPA costs would be reduced through countermeasures already instituted. FRA does not believe that PTC will be 100 percent effective in reducing the remaining PPAs, although FRA believes it will be very effective. For purposes of this analysis, FRA assumes that PTC will be 80% effective. Applying an 80% effectiveness rate to the 75% of PPA costs not already addressed by countermeasures yields a potential 60% cost reduction. Thus, FRA is estimating that 60% of all PPA costs will be eliminated once PTC is fully implemented. The expected annual savings would then be $90 million (60% of $150 million) once PTC is fully implemented.

FRA believes these benefits will be phased in as PTC systems are installed and are thus applied in greater proportion as the system is completed. Even the early installations will result in some portion of the total potential benefit. For instance, a locomotive equipped with PTC will not let its crew exceed limits of authority nor will it let it over-speed. Further, at least in signaled territory the onboard PTC system will warn of an unequipped train exceeding the limits of its authority, helping the crew of an equipped train avoid an accident that would have been caused by an error aboard the unequipped train. FRA's estimate of this phase-in schedule of benefits is shown in Table 7. Note that these factors were used in Tables 4a-4f to calculate 20-year life cycle benefits.

Table 7
Benefit Phase In

Year	Percent
2011	3.00%
2012	10.00%
2013	20.00%
2014	50.00%
2015	85.00%
2016	100.00%

BUSINESS BENEFITS

FRA conducted a sensitivity analysis that takes into account potential business benefits from realizing service efficiencies and related additional societal benefits from environmental attainment and an overall reduction in transportation risk from modal diversion. Note that business benefits are not included for the ARR.

FRA analyzed business benefits associated with PTC system implementation and presented its findings in a letter report to Congress in 2004. Due to the aggressive implementation schedule for PTC, FRA has not formally updated this study. Economic and technical feasibility of the necessary system refinements and modifications to yield the potential business benefits has not yet been demonstrated. Nevertheless, FRA believes that there is opportunity for significant business benefits to accrue several years after implementation, once the systems have been refined to the degree necessary. The 2004 report included business benefits from improved or enhanced locomotive diagnostics, fuel savings attributable to train pacing, precision dispatch, and capacity enhancement. The improvements in dispatch and capacity have further implications. With those improvements railroads could increase the reliability of shipment arrival time, and thus dramatically increase the value of rail transportation to shippers, who in turn would divert certain shipments from highway to rail.

At the time, railroads argued that FRA's estimates of business benefits to the railroads were exaggerated. However, shortly after the report was published several railroads announced to investors and other industry insiders that the railroads were proceeding with PTC systems, and that those systems would bring significant profit to the railroads.

The two biggest components of business benefits identified in the 2004 analysis came from increased capacity, and precision dispatching, which offered the greatest opportunity for benefits.

At present, the PTC systems contemplated by the railroads, with the possible exception of PATH, would not increase capacity, at least not for some time. If the braking algorithms need to be made more conservative in order to ensure that trains do not exceed the limits of their authority, PTC may actually decrease capacity in the early years. As noted earlier, PATH is apparently considering the system used by the New York City Transit Authority on the Canarsie line. This system, which is known as Communication-Based Train Control, is not similar in concept to any of the other PTC systems (including the CSX CBTC, with which its name might easily be confused), and would not be suitable, as FRA understands the system, except on a railroad with operating characteristics similar to a heavy rail mass transit system, which PATH has. FRA believes that even in absence of this rule and RSIA08 PATH would adopt PTC for business reasons, and just as in the case where FRA requires a railroad to adopt a current business practice, FRA is neither claiming benefits nor costs associated with implementation of PTC on PATH in this analysis.

The main business benefit of PTC would be derived from precision dispatch, which decreases the variance of arrival times of delivered freight. Over time, if shippers realize that they could count on a more accurate arrival time of freight, then they could reduce the stock that they keep in inventory as a precaution against running out of stock. It costs shippers approximately 25% of the value of inventory, regardless of the material being stored, to store that inventory for a year. This estimate accounts for shrinkage, borrowing costs, and storage costs. Freight with more value per unit of mass or volume tends to have greater storage costs per unit. At present, no such precision dispatch system exists. Accurate train data is a necessary, but not a sufficient condition, for precision dispatch. At least two of the Class I railroads have attempted to develop precision dispatch systems but have not been successful. The mandatory installation of PTC is likely to divert any resources that might have been devoted to precision dispatch, so these benefits are unlikely during the first ten years of this rule.

In the years since the 2004 report, developing technology and rising fuel costs have caused the rail supply industry and the railroads to focus on additional means of conserving diesel fuel while minimizing in-train forces that can lead to derailments and delays from train separations (usually broken coupler knuckles). Software programs exist that can translate information concerning throttle position and brake use, together with consist information and route characteristics, to produce advice for prospective manipulation of the locomotive controls to limit in-train forces. Programs are also being conceived that project arrival at meet points and other locations on the railroad. These types of tools can be consolidated into programs that either coach the locomotive engineer regarding how to handle the train or even take over the controls of the locomotive under the engineer's supervision. The ultimate purpose of integrating this technology is to conserve fuel use while handling the train properly and arriving at a designated location "just in time" (e.g., to meet or pass a train or enter a terminal area in sequence ahead of or behind other traffic). Further integrating this technology with PTC communications platforms and traffic planning capability could permit transmittal of "train pacing" information to the locomotive cab in order to conserve fuel. Like the communications backbone, survey data concerning route characteristics can be shared by both systems.

The diesel fuel use for road operations to the Class I railroads is approximately 3.5 billion gallons annually, which is $8.75 billion at $2.50 per gallon. If PTC helps to potentiate the growth and effective use of train pacing, fuel savings of 5% ($437,500,000 annually) or greater could very likely be achieved. Clearly, if the railroads are able to conserve use of fuel, they will also reduce emissions and contribute to environmental attainment, even before modal diversion occurs.

ADDITIONAL SOCIETAL BENEFITS

Clearly, if the railroads are able to conserve use of fuel, they will also reduce emissions and contribute to environmental attainment, even before the modal diversion discussed below. There are also potential additional societal benefits that could result downstream once the systems are refined and efficiencies allow rail to compete more effectively in certain markets and divert certain traffic from highways to rail.

To assess the potential for highway to rail diversion in its 2004 report, FRA employed the Department of Transportation's Intermodal Transportation and Inventory Cost (ITIC) model, which measures shipper logistics cost for both highway and rail. Business that rail can capture from highway results in shipper logistics cost savings. Many of the benefits estimated to accrue in 2010 were based on implementation by 2010. Note that given the current state of implementation, they are more likely to accrue several years after PTC is implemented.

Applying current factors to the analysis used in the 2004 report to Congress, indicates that diversion could result in annual highway safety benefits of $744 million by 2022, and $1,148 million by 2032. Of course, these benefits require that the productivity enhancing systems be added to PTC, and are heavily dependent on the underlying assumptions of the 2004 model.

Modal diversion would also yield environmental benefits. The 2004 report implied reduced air pollution costs would have been between $68 million and $132 million in 2010 (assuming PTC would be implemented by 2010), and between $103 million and $198 million in 2020. This benefit would have accrued to the general public. FRA has not broken out the pollution cost benefit of the current rule, but offers the estimates from the 2004 report as a guide to the order of magnitude of such benefits.

Modal diversion is highly sensitive to service quality. It may be true that problems with terminal congestion and lengthy dwell times might overwhelm the benefits of PTC; or it may be that the other initiatives which the railroads have been pursing (reconfiguration of yards, pre-blocking of trains, shared power arrangements, car scheduling, AEI, etc.) might actually work in synergy with PTC.

It should be noted that, in the years since the 2004 Report was developed, the Class I railroads have shown an increased ability to retain operating revenue as profit, rather than surrendering it in the form of reduced rates. This was particularly true during the period prior to the current recession, when strained highway capacity favored the growth of rail traffic. Accordingly, the precise partition of business and societal benefits cannot be estimated with any certainty.

The sensitivity analysis performed by FRA indicates that realization of business benefits could yield benefits sufficient to close the gap between PTC implementation costs and rail accident reduction benefits within the first 20 years of the rule applying a 3% discount rate and by year 25 of the rule, applying a discount rate of 7%. Appendix A of this document presents the findings of this analysis in detail.

RELATIONSHIP BETWEEN BENEFITS AND COSTS, AND TIMING OF IMPLEMENTATION

Once PTC is fully implemented, annual maintenance costs will be approximately $860 million, and the annual railroad accident prevention benefits will be approximately $90 million. Obviously a system which costs $5.75 billion initially, and then costs another $860 million per year to maintain does not make a lot of sense financially if the returns are limited to $90 million per year. Safety benefits include:

- Casualties (Value of a Statistical Life = $6 Million)
- Equipment Damage
- Track & Right-of-Way
- Damage Off Right-of-Way
- Hazardous Material Cleanup
- Evacuation (e.g., Hazmat)
- Loss of Lading
- Wreck Clearing
- Train Delays

For purposes of its primary analysis FRA has not assumed any business benefits, beyond those from railroad accident prevention. Several railroads affected by RSIA08 are already developing PTC and would very likely be proceeding absent this rulemaking or the statutory requirement. These railroads have in the past claimed that there were no additional business benefits to be gained by implementing PTC, beyond safety benefits. Their behavior, in adopting PTC, however, would appear to contradict their statements to FRA that they expect no additional business benefits. FRA's letter report to Congress on the Benefits and Costs of PTC projected that railroads would generate significant business benefits from PTC, but would retain a very small portion of total societal benefits. As noted above, there has been more recent evidence that railroads are able to retain revenues generated through efficiencies (much of which has been reinvested to renew infrastructure or expand capacity).

According to the 2004 study railroads could gain between $675,000,000 and $1,318,000,000 per year in business benefits through use of PTC. If railroads are voluntarily adopting PTC, then their revealed preferences strongly suggest that they believe the benefits are likely to be at least as great as those projected in the letter report to Congress. FRA believes that the opportunity for such business benefits will not occur for several years, but that when those opportunities do present themselves the railroads will take advantage of them.

FRA's analysis (see Tables 4a-4h) presents a 20-year analysis of the costs and benefits associated with FRA's proposed rule, using both 7 percent and 3 percent discount rates, including net present value (PV) and annualized value, which is the annuity required at the discount rate to yield the total over the analysis period. It also presents sensitivity analyses associated with varying cost assumptions used for estimating PTC implementation costs. The 20-year total cost estimates are $10,008 million (PV, 7%) and $13,849 million (PV, 3%). Annualized costs are $945 million (PV, 7%) and $931 million (PV, 3%). Using high-cost assumptions, the 20-year total cost estimates would be $17,122 million (PV, 7%) and $23,761 million (PV, 3%). Using low-cost assumptions, the 20-year cost estimates would be $7,085 million (PV, 7%) and $9,837 million (PV, 3%). Twenty-year railroad safety (railroad accident reduction) benefit estimates associated with implementation of the proposed rule are $608 million (PV, 7%) and $931 million (PV, 3%). Annualized benefits are $57 million (PV, 7%), and $63 million (PV, 3%).

Table 7, Summary of Costs and benefits

Twenty Year Discounted Values

Discount Rate	3.00%	7.00%
Costs		
Central Office and Development	$283,025,904	$263,232,675
Wayside Equipment	$3,109,098,494	$2,586,453,456
On-Board Equipment	$1,643,839,209	$1,416,706,349
Maintenance	$8,812,624,111	$5,741,220,231
Total	$13,848,587,717	$10,007,612,712
Railroad Safety Benefits	$931,253,681	$607,711,640

Sensitivity analysis performed by FRA indicates that realization of business benefits could yield benefits sufficient to close the gap between PTC implementation costs and rail accident reduction benefits within the first 20 years of the rule applying a 3% discount rate and by year 25 of the rule, applying a discount rate of 7%. The precise partition of business and societal benefits cannot be estimated with any certainty.

FRA recognizes that the likelihood of business benefits is uncertain and that the cost-to-benefit comparison of this rule, excluding any business benefits, is not favorable. However, FRA has taken measures to minimize the rule's adverse impacts and to provide as much flexibility as FRA is authorized to grant under RSIA08.

As far as timing of the investment and its returns, in the first years while the systems are being implemented, the safety benefits will probably be gained more than in proportion to the degree of implementation. If half the rolling stock is equipped, then at least those units will avoid the collisions that could have been caused by a crew error in those units, while on PTC territory, and probably those units will also avoid collisions with unequipped units when the onboard PTC system warns the PTC equipped crew of other trains outside the limits of the other train's authority. Assuming that right of way is equipped with higher risk segments assigned higher priority, and that the railroads make some effort to use equipped locomotives in the lead, it is likely that the greater risk on more heavily traveled corridors will make the use of equipped units on that territory relatively more beneficial.

FRA invites comments on all portions of this RIA.

APPENDIX A – BUSINESS BENEFITS

In analyzing the benefits and costs of the proposed rule, FRA alludes to potential business benefits, which raises an obvious question. Could the business benefits cited in the 2004 report offset the costs of PTC, or even create a net benefit? The 2004 report found that net benefits in excess of a billion dollars a year, measured in 2003 dollars, were possible. Of course, the 2004 report relied on assumptions that certain technologies could be developed, and that those technologies would be used to optimize business benefits. The 2004 report acknowledged significant technical and economic barriers to implementation of the necessary "Add-On" technologies. There may be institutional barriers to overcome as well. In this appendix, FRA explains how it integrated the 2004 report and the analysis of the proposed rule to examine potential business benefits in light of the RSIA08 mandate for PTC and the proposed rule.

First FRA updated 2003 dollar values used in the 2004 report. FRA used the GDP deflator calculator at http://cost.jsc.nasa.gov/inflateGDP.html, which shows that a 2003 dollar is equivalent to 1.1007 current 2009 dollars, to update the values of direct and indirect shipper benefits. FRA also updated the cost of highway accidents, doubling it from 0.13 per diverted mile to 0.26 per diverted mile, because DOT has doubled the Value of a Statistical Life (VSL) used for analytical purposes since the 2004 report.

Second, for this Add-On analysis FRA chose to focus on only one of the two types of PTC systems included in the 2004 report—the one most comparable to the PTC systems that will be installed in response to RSIA08. FRA believes that a productivity system can be added to the currently proposed V-TMS types of systems that will generate benefits comparable to those that would be generated by PTC B in the 2004 study. FRA further decided to use single-point estimates for costs and benefits for ease of analysis. To arrive at such estimates, FRA took arithmetic averages of the high and low cost and benefit estimates from the 2004 report.

The third adjustment FRA made was to address potential fuel savings. FRA believes that the business benefits of PTC may include significant fuel savings. Test runs at several railroads indicate that the difference in fuel consumption between the best and worst locomotive engineers is approximately 30%. Railroads have shown that training can narrow that gap. FRA believes that with PTC and a productivity enhancing system using the PTC data, that fuel savings of 5% are very likely attainable. Translating that into monetary terms is not a simple since, in recent years, fuel consumption and prices have varied from year to year. For the past several years, Class I railroads have been consuming slightly over four billion gallons each year by Class I railroads and per gallon costs have risen. Based on information available, FRA believes a price of $2.50 per gallon is reasonable for use in this analysis. Since not all railroad fuel consumption is for road use and the actual percentage for road use varies from railroad to railroad, FRA is conservatively estimating that 12.5%, or one eighth, of total fuel consumption is for yard use and 87.5%, or at least 3.5 billion gallons, is for road use. Applying a savings rate of 5% to the 3.5 billion gallons at a cost of $2.50 per gallon, yields annual savings of $437.5 million. This is an increase from the $130 million low and $391 million high, estimates of potential fuel savings from the original 2004 report.

The fourth and most complex modification was to the approach taken in the 2004 report to address modal diversion. The 2004 report estimated benefits derived from diversion from highway to rail. These benefits resulted from changes in shipper behavior in response to productivity increases experienced by shippers when using rail. The 2004 report estimated the productivity benefits to shippers under PTC B, which is most similar to the currently proposed PTC systems. The productivity benefit estimates were kept constant in the 2004 study and FRA has kept that assumption here, although it is reasonable, but less conservative, to assume that the productivity benefits will increase over time as shippers have time to modify their physical plants to take greater advantage of productivity enhancements on the railroads. The indirect business and safety benefits presented in the 2004 report increased over time, due to increased costs of congestion on the highway systems resulting increased modal diversion in terms of volume and value per ton mile over time.

The 2004 report estimated diversion for two different years, 2010, and 2020. The earlier year was to have been around the time the full PTC system could have been deployed, under the most optimistic assumptions. The report presented high and low benefits estimates. For the current analysis, FRA assumes that the indirect benefits to society (?) were a result of productivity benefits to shippers and that these indirect benefits would be in proportion to shipper productivity benefits. Similarly, the ratio of indirect benefits to shipper cost impacts would remain constant over time. According to the 2004 report, the 2010 ratio of indirect benefits to shipper productivity was 1.02 for the low benefit estimate, and 0.86 for the high benefit estimate. FRA averaged these two numbers to arrive at an estimate of 0.94. The 2020 ratio of indirect benefits to shipper productivity was 1.57 for the low benefit estimate, and 1.32 for the high benefit estimate. FRA averaged these two numbers to arrive at an estimate of 1.45. FRA then estimated the average annual growth rate that would be needed to grow from .94 in 2010 to 1.45 in 2020 (the tenth root of 1.45/0.94), and used that rate to estimate the diversion impact relative to shipper costs in every year of the analysis period. See Table A-1

Table A-1

Indirect Benefit Phase In

Year	Percent
2009	90.01%
2010	94.00%
2011	98.16%
2012	102.51%
2013	107.05%
2014	111.80%
2015	116.75%
2016	121.92%
2017	127.32%
2018	132.96%
2019	138.85%
2020	145.00%

2021	151.42%
2022	158.13%
2023	165.14%
2024	172.45%
2025	180.09%
2026	188.07%
2027	196.40%
2028	205.10%

The 2004 report did not consider how PTC would be funded. The benefits were analyzed as if the system had been donated to the railroads. Based on the current environment and the focus of this analysis on business benefits to Class I railroads, this analysis is based on the assumption that the railroads will purchase PTC systems. If the railroads pass on savings from their productivity savings to shippers, then that implies that there is a price elasticity that will enable the railroads to pass on costs as well. If FRA is going to say that an increase in benefit to shippers will induce them to ship more by rail, then a cost increase to shippers will induce them to ship less by rail. FRA estimates the diversion caused by the portion of total railroad costs passed on to shippers, as a cost, as well as the diversion caused by shipper benefits, as a benefit. FRA estimates that 80% of railroad benefits or costs are passed on to shippers. The annual costs of PTC are derived from Tables 4a and 4b in the primary analysis above. FRA did not estimate business benefits for the high and low cost cases, only the expected cost case. See Tables A-3 and A-4.

The last major adjustment FRA made to the values in the 2004 report was to eliminate any benefit attributable to locomotive diagnostics, as FRA now believes those benefits have already been captured by other technologies in the absence of PTC.

The PTC systems that railroads are planning for purposes of complying with RSIA08 and the proposed rule do not have features built in to enhance productivity, but such features could be added without facing the large economic hurdle that existed prior to RSIA08, when the railroads contemplating whether to install PTC and productivity enhancing systems would have had to develop business cases for spending the entire cost of PTC, estimated in the main analysis at $5.7 billion, plus the added productivity system cost. If PTC costs are sunk costs[4], then the railroads only need to consider the marginal costs above PTC of adding productivity systems. These systems include fuel management systems that have onboard and central office components and precision dispatching systems that take advantage of train location data generated by the PTC system. A large railroad procured an entire dispatch system for roughly $50 million less than ten years ago. It is reasonable to believe that all seven Class I railroads could procure productivity enhancing systems for around $150 million today, since the systems would be add-ons to existing dispatch and onboard systems. For purposes of this analysis, FRA assumes that productivity systems would cost $150 million. Over the twenty year analysis period, at the discount rate of 3%, the Net Present Value (NPV) of the maintenance costs would be $148 million, for a total NPV over the analysis period of $298 million, which is far less than the $13.8 billion NPV of business

4 Costs that have already been incurred and cannot be reversed.

benefits. Clearly, the investment would be justified. The gap between the costs and benefits is so large that even a large variance in costs would not affect the positive outcome of the analysis.

In Tables A-3 and A-4, Costs to Shippers (the portion of PTC implementation costs passed on by railroads) are derived by multiplying annual costs from Tables 4a and 4b by 80%. Annual indirect costs to society are derived by multiplying Costs to Shippers presented in Tables A-3 and A-4 by the percentages from Table A-1 (the multipliers used to translate increases/decreases in shipper productivity to increases/decreases in societal benefits from modal diversion). Productivity or Add-On system costs are based on a cost estimate of $150 million and an annual phase in of 20%, starting in 2016. The Installed Productivity System represents the part of the productivity system that has been installed through the end of the previous year. Productivity Maintenance Costs are the annual maintenance cost, which are 15% of the Installed Productivity System cost already incurred. The Productivity Benefit is the steady state annual productivity benefit, derived from the 2004 report, $1,265,805,000, multiplied by a business benefit phase-in factor assumed by FRA. See Table A-2, below. FRA derived the $1,265,805,000 productivity benefit by averaging PTC B shipper direct benefits from the 2004 report ($900 million and $1.4 billion for low and high estimates, respectively) to get $1.15 Billion, and then multiplying that number by the GDP deflator, 1.1007.

FRA followed a similar process to derive Other Direct Benefits, in Tables A3 – A4. FRA averaged inflated low and high Direct Benefits from the 2004 report, using the GDP deflator5, and is using the average, $2,746,022,666, as the estimate of total direct benefits. Total direct benefits included shipper direct benefits, so to calculate Other Direct Benefits, FRA subtracted the $1,265,805,000 of Shipper Direct Benefits from $2,746,022,666 and arrived at an Other Direct Benefits estimate of $1,481,022,666 per year. These benefits were also phased in using the values in Table A-2.

Table A-2

Business Benefit Phase In

Year	Percent
2017	10.00%
2018	20.00%
2019	40.00%
2020	60.00%
2021	85.00%
2022	100.00%

As discussed above, FRA believes that favorable diversion impacts will increase over time relative to shipper impacts because the value of alleviating highway congestion will increase per ton mile

5   Low and high benefits of $1,933,310,740 and $3,057,925,253 were inflated by a factor of 1.1007 to arrive at low and high benefits of $2,127,797,005 and $3,366,858,326 in current dollars. The average of these two values is $1,265,805,000.

as highways get more congested. FRA calculated the Indirect Benefit by multiplying the Productivity Benefit by the annual factors from Table A-1.

FRA next calculated the Annual Business Net impact, which is the difference between the sum of the Productivity Benefit, the Other Direct Benefit, and the Indirect Benefit, and the sum of the Indirect Costs, the Productivity System Costs, and the Productivity Maintenance Costs. Note that Costs to Shippers is a transfer payment to railroads, and is not included in business costs. This cost is used to derive other costs, which are included. Negative values represent net societal costs and positive values net societal benefits.

Tables A3 – A4 also present Discounted Annual Business Net impact as well as total 20-year Discounted Business Net impact. Net benefits total $ 6,129,794,313 discounted at 7%, and $13,820,044,963, discounted at 3%. Discounted at 3% the net business-related benefit is large enough, that coupled with the safety benefits from Table 4b, the benefits would exceed the costs of PTC implementation with productivity enhancing add-ons. Discounted at 7%, the net business-related benefits would not be large enough to offset the costs. However, extending the analysis to twenty five years allows the Discounted Net Business Impact to reach $10,687,250,077 (NPV 7%) and the Discounted Railroad Safety Benefit to reach $709,748,128, which together would exceed Discounted PTC System Total Costs, which would grow to $10,983,760,885. Thus, over a 25-year period using a 7% discount factor, net discounted benefits would exceed the net discounted costs.

The 2004 report notes that reductions in highway accident costs comprise 81.1188% of indirect benefits. FRA derived the Net Highway Accident Impact associated with the PTC productivity add-on implementation in this analysis by subtracting Indirect Costs from Indirect Benefits, and multiplying the result by 81.1188%. FRA also calculated Discounted Net Highway Accident Impact using both 3% and 7% discount rates. In this analysis, the early expenditures on PTC system implementation in response to RSIA08 and the proposed rule cause significant adverse cost impact in the early years. It is not until later years, when productivity-enhancing systems come on line, that the net impact becomes beneficial. If productivity-enhancing systems fail to materialize, then the net impact of PTC system implementation would be adverse as is portrayed in the primary analysis. An interesting implication of the model presented in this appendix is that finding a way to move costs from early years to later years, perhaps through financing, could provide a significant reduction in the adverse diversion impacts. Smoothing out the expenditures would result in fewer negative impacts to shippers and thus fewer costs passed on to society in the years before the positive impacts are realized.

Table A-3

Discount Rate 7%

Year	Costs to Shippers	Indirect Costs	Productivity System Costs	Installed Productivity System	Productivity Maintenance Costs	Productivity Benefit	Other Direct Benefit	Indirect Benefit	Annual Business Net	Discounted Annual Business Net	Net Highway Accident Impact
2009	$ 48,000,000	$ 43,206,101	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 43,206,101	-$ 43,206,101	-$35,048,27
2010	$ 55,200,000	$ 51,888,000	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 51,888,000	-$ 48,493,458	-$42,090,92
2011	$ 500,624,589	$ 491,432,693	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 491,432,693	-$ 429,236,347	-$398,644,30
2012	$ 716,016,466	$ 734,004,788	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 734,004,788	-$ 599,166,550	-$595,415,87
2013	$ 952,777,072	$ 1,019,978,919	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 1,019,978,919	-$ 778,137,033	-$827,394,65
2014	$ 1,447,822,783	$ 1,618,599,193	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 1,618,599,193	-$ 1,154,038,855	-$1,312,988,24
2015	$ 1,905,316,491	$ 2,224,411,104	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 2,224,411,104	-$ 1,482,219,042	-$1,804,415,59
2016	$ 685,199,367	$ 835,389,276	$ 30,000,000	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 865,389,276	-$ 538,920,948	-$677,657,75
2017	$ 685,199,367	$ 872,394,483	$ 30,000,000	$ 30,000,000	$ 4,500,000	$ 126,580,500	$ 148,102,267	$ 161,162,043	-$ 471,049,673	-$ 274,155,199	-$576,943,22
2018	$ 685,199,367	$ 911,038,909	$ 30,000,000	$ 60,000,000	$ 9,000,000	$ 253,161,000	$ 296,204,533	$ 336,602,064	-$ 64,071,312	-$ 34,850,548	-$465,976,27
2019	$ 685,199,367	$ 951,395,166	$ 30,000,000	$ 90,000,000	$ 13,500,000	$ 506,322,000	$ 592,409,066	$ 703,025,027	$ 806,860,927	$ 410,167,181	-$201,474,87
2020	$ 685,199,367	$ 993,539,082	$ 30,000,000	$ 120,000,000	$ 18,000,000	$ 759,483,000	$ 888,613,600	$ 1,101,250,350	$ 1,707,807,868	$ 811,367,216	$87,374,08
2021	$ 685,199,367	$ 1,037,549,845	$ 0	$ 150,000,000	$ 22,500,000	$ 1,075,934,250	$ 1,258,869,266	$ 1,629,212,560	$ 2,903,966,231	$ 1,289,395,736	$479,949,69
2022	$ 685,199,367	$ 1,083,510,152	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,001,625,563	$ 3,642,443,077	$ 1,511,484,380	$744,764,20
2023	$ 685,199,367	$ 1,131,506,361	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,090,291,496	$ 3,683,112,801	$ 1,428,374,645	$777,754,99
2024	$ 685,199,367	$ 1,181,628,656	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,182,885,060	$ 3,725,584,070	$ 1,350,323,117	$812,207,18
2025	$ 685,199,367	$ 1,233,971,216	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,279,580,238	$ 3,769,936,688	$ 1,277,007,988	$848,185,49
2026	$ 685,199,367	$ 1,288,632,393	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,380,558,719	$ 3,816,253,992	$ 1,208,128,281	$885,757,53
2027	$ 685,199,367	$ 1,345,714,894	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,486,010,240	$ 3,864,623,011	$ 1,143,402,499	$924,993,90
2028	$ 685,199,367	$ 1,405,325,977	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,596,132,942	$ 3,915,134,632	$ 1,082,567,350	$965,968,32
										$ 6,129,794,313	

Table A-4

Discount Rate
3.00%

Year	Costs to Shippers	Indirect Costs	Productivity System Costs	Installed Productivity System	Productivity Maintenance Costs	Productivity Benefit	Other Direct Benefit	Indirect Benefit	Annual Business Net	Discounted Annual Business Net	Net Highway Accident Impact
2009	$ 48,000,000	$ 43,206,101	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 43,206,101	-$ 43,206,101	-$35,048,271
2010	$ 55,200,000	$ 51,888,000	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 51,888,000	-$ 50,376,699	-$42,090,923
2011	$ 500,624,589	$ 491,432,693	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 491,432,693	-$ 463,222,446	-$398,644,304
2012	$ 716,016,466	$ 734,004,788	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 734,004,788	-$ 671,718,360	-$595,415,876
2013	$ 952,777,072	$ 1,019,978,919	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 1,019,978,919	-$ 906,238,058	-$827,394,659
2014	$ 1,447,822,783	$ 1,618,599,193	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 1,618,599,193	-$ 1,396,217,883	-$1,312,988,242
2015	$ 1,905,316,491	$ 2,224,411,104	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 2,224,411,104	-$ 1,862,909,280	-$1,804,415,595
2016	$ 685,199,367	$ 835,389,276	$ 30,000,000	$ 0	$ 0	$ 0	$ 0	$ 0	-$ 865,389,276	-$ 703,640,674	-$677,657,756
2017	$ 685,199,367	$ 872,394,483	$ 30,000,000	$ 30,000,000	$ 4,500,000	$ 126,580,500	$ 148,102,267	$ 161,162,043	-$ 471,049,673	-$ 371,850,962	-$576,943,221
2018	$ 685,199,367	$ 911,038,909	$ 30,000,000	$ 60,000,000	$ 9,000,000	$ 253,161,000	$ 296,204,533	$ 336,602,064	-$ 64,071,312	-$ 49,105,325	-$465,976,275
2019	$ 685,199,367	$ 951,395,166	$ 30,000,000	$ 90,000,000	$ 13,500,000	$ 506,322,000	$ 592,409,066	$ 703,025,027	$ 806,860,927	$ 600,380,306	-$201,474,876
2020	$ 685,199,367	$ 993,539,082	$ 30,000,000	$ 120,000,000	$ 18,000,000	$ 759,483,000	$ 888,613,600	$ 1,101,250,350	$ 1,707,807,868	$ 1,233,756,740	$87,374,088
2021	$ 685,199,367	$ 1,037,549,845	$ 0	$ 150,000,000	$ 22,500,000	$ 1,075,934,250	$ 1,258,869,266	$ 1,629,212,560	$ 2,903,966,231	$ 2,036,783,487	$479,949,695
2022	$ 685,199,367	$ 1,083,510,152	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,001,625,563	$ 3,642,443,077	$ 2,480,326,494	$744,764,204
2023	$ 685,199,367	$ 1,131,506,361	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,090,291,496	$ 3,683,112,801	$ 2,434,971,454	$777,754,996
2024	$ 685,199,367	$ 1,181,628,656	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,182,885,060	$ 3,725,584,070	$ 2,391,310,647	$812,207,180
2025	$ 685,199,367	$ 1,233,971,216	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,279,580,238	$ 3,769,936,688	$ 2,349,299,907	$848,185,491
2026	$ 685,199,367	$ 1,288,632,393	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,380,558,719	$ 3,816,253,992	$ 2,308,896,426	$885,757,532
2027	$ 685,199,367	$ 1,345,714,894	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,486,010,240	$ 3,864,623,011	$ 2,270,058,717	$924,993,901
2028	$ 685,199,367	$ 1,405,325,977	$ 0	$ 150,000,000	$ 22,500,000	$ 1,265,805,000	$ 1,481,022,666	$ 2,596,132,942	$ 3,915,134,632	$ 2,232,746,573	$965,968,321
										$ 13,820,044,963	

Much of the preceding analysis depends on analysis conducted earlier and presented in the 2004 report, so it is important to introduce the key concepts from that report.

As part of a Congressionally mandated study of all costs and benefits of PTC, including business benefits, FRA had a contractor, Zeta-Tech Associates (Zeta-Tech), examine the business benefits and costs of PTC implementation. FRA combined that analysis with FRA estimates of modal diversion and societal consequences, and with findings from a joint effort between FRA and the Volpe Center (Volpe) to analyze potential accident cost reductions and additional societal benefits from implementing PTC.

FRA then conducted a peer review workshop to which representatives of railroads (freight and passenger), labor organizations, suppliers, and shippers were invited. Draft reports were presented, and post-workshop written filings were received.

Although there was significant disagreement over the FRA contractor's report, if the Zeta-Tech's analysis is correct then major benefits might arise from (1) improved railroad productivity; (2) resulting reductions in shipper logistical costs caused by faster, more reliable rail shipments, and (3) diversion of freight traffic from highway to rail. Adaptations made in order to conduct the present analysis are discussed throughout this appendix.

Zeta-Tech studied the costs, and found they were similar to those estimated by the RSAC in 1998-1999. However, according to peer reviewers, on-board systems were expected to be about one-third less expensive than previously estimated. In its analysis of the proposed rule, FRA is using higher costs for on-board systems because FRA believes the railroads are facing a very constrained market with the tight deadlines of RSIA08.

The 2004 report analyzed two levels of PTC, then called PTC A and PTC B, for purposes of analysis. In general, both the costs and benefits of PTC A were similar to, but smaller than the costs and benefits of PTC B. PTC B is more like the systems that will be installed under RSI08. Significant timing issues, which were not considered fully in that analysis, have impacted the use of the results in this analysis. The most significant timing issue is that PTC will take several years to deploy and the benefits, especially the business-related benefits, will not flow until the systems are substantially complete. In the 2004 report, FRA analyzed the effects on railroads using estimates based on year 2000 traffic flows, but the truck-to-rail diversion estimates that formed the basis for additional societal benefits were estimated for 2010, and 2020. This did not allow for any growth in traffic leading to conservative diversion estimates. Another timing issue is that the intermodal diversion projections were based on PTC having been in service for several years, yet a realistic timeline for systemwide adoption of PTC might not have had PTC in place before year 2010. In fact, FRA is not projecting full PTC deployment until the end of 2015, and FRA is not projecting full productivity benefits until 2022. Thus the level of productivity benefits presented for 2010 in the 2004 report are more likely reflective of Year 2022 under current circumstances.

The 2004 report did not definitively resolve whether, in order to realize any modal diversion, railroads would have to make additional investments in yard and terminal capacity to handle the additional traffic volume. If that were necessary, several hundred million dollars in additional investment might be required to realize improvements in rail service that generate the largest portion of the possible benefits, which come from productivity enhancements. Some additional highway and railroad investment might also be required to provide access to new or expanded intermodal terminals from the interstate highway system.

Finally, the 2004 report did not examine an issue that is critical for the success of PTC–the question of communications capacity. More sophisticated forms of PTC will require rapid flows of digital data. Developments in communications technology promise a rich set of options for addressing this need. However, to the extent a PTC system requires partial reliance on a commercial service, additional costs might be incurred. That is, the data communication backbone might not be available "free" for auxiliary business functions. FRA believes that the data needed to operate PTC is sufficient to add productivity benefits, and has accounted for communication costs in the main analysis of the proposed rule.

Key Elements of the Business Benefits:

Work Order Reporting:

The purpose of the work order system is to plan and schedule the work of train crews. However, it is not possible to schedule all work in advance, since it is impossible to perfectly predict future occurrences. However, the addition of unplanned work may mean delays to cars or train crews, since without advance knowledge of work to be done, crews may run out of time before completing all scheduled work and any unplanned work. Outbound connections in yards may also be missed if large volumes of additional work delay completion of a switching shift.

Work order reporting systems send instructions over the digital data link communications network from the control center to train crews regarding the setting out and picking up of loaded and empty cars enroute. When crews acknowledge accomplishment of work orders, the system automatically updates the on-board train consist information and transmits information on car location and train consists back over the digital data link communications network to the railroad's operating data system and to customers. Work order reporting information can be displayed in locomotives on the same screens that would display PTC instructions and information.

Real-time or near real-time information will reduce additional, unplanned work, by reducing the volume of inaccurate or out-of-date information used in the generation of work orders. The earlier there is knowledge of unplanned work the better the plan is able to accommodate that work without disruption of other elements of the plan. Since yard and industry switchers and local freights perform most additional work, the benefits resulting from a reduction in additional work will be realized mostly in these services. For this reason, the analysis presented here is confined to switchers and local freights. There simply do not seem to be large benefits to be realized from real-time reporting of train consist data and completed work by unit trains and through freight trains, because those trains do not undergo much switching activity.

Zeta-Tech estimated the benefits from work order reporting to be $10 million per year, under either PTC A or PTC B[1] (the additional features of PTC B have nothing to do with collecting and disseminating information useful for work order reporting). The methodology used to derive these benefits focuses on the ability to process a rail car more rapidly through a terminal area, given better and more timely information about that car, and therefore to reduce the likelihood that the car will miss the next train leaving the yard for its destination. At present it does not appear, based on anecdotal information, that any Class I railroad has a work order reporting system that can provide these benefits without PTC, however, it also appears that such systems are under development.

The AAR, in its comments, said that these benefits were already being derived from other, non-PTC systems. (One of these, the UP work order reporting system, actually utilizes an ATCS communications platform.)

FRA recognizes that commercial wireless communications have become available that no longer make a train control communications platform a necessity. The widespread availability of commercial communications services offers an alternative means of realizing these benefits. Further, most major railroads now have car scheduling programs that address the same needs. The Automatic Equipment Identification (AEI) program provides data on cars passing fixed points throughout the national rail system. Accordingly, the extent to which work order reporting might be profitably employed in the future is not known, and FRA has not included any quantified benefit from this report. FRA does believe that a PTC communications platform could help hold down the cost of work order reporting.

Fuel Savings:

PTC can let train operations be paced, so that trains do not operate at top speed for a short duration, only to wait for an extended period to acquire authority for the next track segment. A great deal of fuel could be wasted in accelerating from a stop, or from operating at unnecessarily high speeds.

FRA has described its estimation process for this value added above.

Precision Dispatch:

Precision dispatching is dispatching based on very frequent updates of the positions, and in some cases, speeds, of trains. PTC systems can provide frequent updates on train position, and in most cases speed. Most PTC systems also require modifications of the railroad's operating system and rules. A railroad can opt to install precision dispatching concurrently with PTC at a lower cost than the marginal cost of a stand-alone precision dispatching system. That is not to say that a railroad cannot attempt to install a stand-alone precision dispatching system. At least three railroads now report efforts to upgrade their computer-aided dispatching systems to include

---

[1] *Quantification of the Business Benefits of Positive Train Control*, Zeta-Tech Associates, Cherry Hill, NJ, March 15, 2004, pp. 35 *et seq*.

planning elements.

Precision dispatching involves traffic planners. FRA has identified two types of traffic planners that might be of use in precision dispatching:

> Tactical traffic planners (TTPs) produce plans showing when trains should arrive at each point on a dispatcher's territory, where trains should meet and pass, and which trains should take sidings. As the plans are executed, a TTP takes the very detailed train movement information provided by the PTC system and compares it with desired train performance. If there are significant deviations from plan, the TTP will re-plan, adjusting meet and pass locations to recover undesired lateness. TTPs make use of sophisticated non-linear optimization techniques to devise an optimal dispatching plan. Once a TTP prepares a plan, the dispatcher need only accept it. Then the computer-assisted dispatching system of PTC produces all authorities needed to execute the plan and sends them over the digital data link communications network to trains and maintenance-of-way vehicles. Some prototype TTPs have been developed and tested.
>
> Strategic traffic planners (STPs) - TTPs cannot function without knowing the schedule for each train. STPs measure train movements against a set of externally defined schedules that include information on scheduled block swaps and connections, both internal and with other railroads. STPs integrate a flow of information about actual train performance from the TTP, the performance of connections, and detailed consist information for all trains from operating data systems. They make cost-minimizing decisions on whether, and how, train priorities and schedules might be adjusted on a real-time basis. STPs are the highest-level real-time control system in the PTC hierarchy. STPs will be able to display the performance of trains against schedule, the real-time location of every train by type (e.g., coal, intermodal, grain, intercity passenger), and the location of trains at future times based on current performance. The Federal Aviation Administration developed an STP (called "central flow control") to support the U.S. air traffic control system; the same philosophy could apply to railroad STPs.

The main benefit of precision dispatching is that a railroad can have a dispatch plan that is updated and optimized at frequent enough cycles to provide near optimal operations. At least one railroad has contended that precision dispatching has no benefit because rail operations are unpredictable, due to unanticipated events, such as broken rails and broken equipment. FRA disagrees, and believes that unpredictable events are better managed when a railroad can respond promptly with optimized alternatives.

Further, even in ordinary operations, precision dispatching has much to offer. According to Smith, Resor, and Patel, significant reductions in travel time are available when there is a greater availability of real-time or near real-time information for railroad dispatchers. In fact, their study showed that a travel time reduction of 2.3% could be available as a result of dispatchers receiving train position information every 3.5 minutes, as can be expected under PTC A, rather than every

17 minutes, as would be expected under a classic CTC system. For this reason, the benefits of precision dispatching are included in the discussion of PTC A benefits.

FRA notes that even without precision dispatching, more precise information on where trains are would allow dispatchers to "roll up" authorities behind a train more rapidly as it passes, freeing the track for use by the next train more rapidly, which might create additional capacity, or enhanced throughput. *Nonetheless, the AAR objected to any such increases in estimated throughput.*

With effective meet/pass planning achievable with accurate position information and possibly supplemented with sophisticated computer analysis, system velocity and reliability can increase. When system velocity increases, each car reaches its destination more rapidly, and is available sooner for its next move. Likewise, each locomotive is ready more rapidly to pull its next train. This means the railroad can use less equipment to accomplish any given level of traffic.

Railroads disagreed with this point, saying that they already have the cars they need to transact business, and that there is no reduction in procurement cost. Further, many cars sit idle because of seasonal or cyclical shifts in demand for cars. Nevertheless, railroads still need to replace existing stock, and to buy locomotives to service different types of business as shipper demand patterns change. Railroads could accommodate these shifts in demand with less equipment, yielding considerable savings.

Zeta-Tech estimated these benefits at $400 million to $1 billion per year, for both PTC A and PTC B, but in a letter to FRA agreed with a point raised by the AAR, that the savings in car utilization should only be applied to the portion of the time a car is in motion.

As noted above, in response to Zeta-Tech and AAR's comments on ownership cost savings, FRA had reduced Zeta-Tech's estimate of the potential savings to railroads from precision dispatch (i.e., better utilization of plant and equipment) by 75% of the original estimates

Capacity Benefits:

PTC B adds a central safety system, traffic planning functions, and the capability to both "pace" trains and apply more advanced energy management technology to reduce fuel consumption by improving train handling and the capability to implement "dynamic headways" (moving block train separation). Dynamic headways can increase line capacity by permitting shorter and lighter trains to operate on closer headways, rather than constraining all trains to the separation required by the longest and heaviest trains. Dynamic headways, in conjunction with a tactical planner, can reduce average running times.

Zeta-Tech measured the benefits of capacity improvements in terms of avoided infrastructure costs for track and signals, including maintenance. This estimate was derived by estimating the number of miles of track at or above capacity, and estimating the costs of investments that would need to be made in order to maintain an adequate level of service. Zeta-Tech estimated the benefit of improved capacity at $800 million to $1.2 billion per year.

Railroad commenters, including the AAR, stated that PTC safety systems may have the effect of reducing line capacity. They noted that the conservative braking algorithms used in current PTC projects may result in trains operating at slower speeds approaching targets. Further, even if it is possible to achieve dynamic blocks, the full benefit of the technology would be realized only in multi-track territory. A major signal supplier called attention to the technical risk associated with dynamic block architectures, noting that such projects have not been successful in conventional railroading internationally.

Demonstration of dynamic block capability is a major objective of the North American Joint PTC project, and several transit applications are presently being deployed using this approach. FRA agrees that dynamic block capability will be one of the last attributes of communication-based train control that will be deployed (due to the technical challenge, communications requirements, etc.). FRA believes that attainable PTC systems, used in combination with precision dispatching, can increase line capacity by releasing restrictions on movements to the rear of trains and more efficiently staging train operations, regardless of whether dynamic blocks are employed for freight operations.

FRA is aware of the challenges currently being experienced in developing and implementing braking algorithms within the current PTC projects. These difficulties must be overcome for PTC to be a viable safety system and contribute to the efficiency of the industry. FRA believes that these issues will be resolved through use of realistic train consist and track database information and a more refined understanding of how specific train types perform. During the period PTC is being implemented, railroads will also be converting to use of electronically-controlled pneumatic (ECP) brakes, which will lead to more extensive use of train braking; and that in turn will provide feedback on the actual performance of each individual train (as well as exception information on the braking systems on individual cars).

However, in response to comments, including those from the AAR in writing and at the Peer Review Workshop, FRA has modified the Zeta-Tech estimate, reducing it by 60%, to account for such issues as the fact that adding PTC is not as effective as double tracking in increasing capacity, and that a railroad could increase capacity substantially by installing a series of long sidings, at cost much less than that of double tracking. FRA believes this is a conservative assumption, and the societal benefits estimated remain significant even after reducing the estimate of this benefit substantially.

Shipper Benefits:

Zeta-Tech, in its analysis, said that PTC can enable railroads to deliver shipments more rapidly, and with greater certainty of the arrival time, *a statement with which the AAR strongly disagreed in its comments*.

The theory underlying these projected benefits is that a PTC communications system, coupled with precision dispatching, could reduce delays and help trains adhere to their schedules. Implicit in this analysis is the assumption that precision dispatching, informed by real-time information, can improve recovery from unexpected occurrences.

Reduced variability in arrival time is extremely important to shippers, as it enables them to lower logistics costs. Zeta Tech estimated this benefit using three methodologies:

1. Determine the savings shippers might realize in terms of the reduced inventory portion of logistics cost reduction if service reliability improves. This would be one measure of the total benefit available from improved service when PTC is installed. The Zeta-Tech report showed that a reduction in the cost of carrying safety stock may be a useful surrogate for a lower-bound measure of the total benefit available from improved reliability.

2. Determine what additional amount shippers might be willing to pay for improved service reliability.

3. Determine the cross-elasticity of demand and price relative to PTC-enabled improvements in transit time and its variability as reported in a study on total logistics cost that had been prepared for the Federal Highway Administration. This method for measuring the size of the total benefit provides a useful check on the first two methods used.

Zeta-Tech developed estimates of shipper benefits which ranged from $400 million per year to $2.6 billion per year. It appeared that the higher estimates might be unrealistic, so in developing a summary of benefits, Zeta Tech picked as representative figures estimates of shipper benefits between $400 million and $900 million per year for PTC A and between $900 million and $1.4 billion per year for PTC B.

These benefits would only occur if the improvements in service, as estimated by Zeta-Tech, were realized. AAR took strong exception to those estimated improvements in service, stating that many of the delays and uncertainties relate to handling of cars in yards and terminal areas and that even if PTC could perform as promised shippers would not see the projected service quality improvements.

FRA notes that the estimates provided above are based on achieving a 3.5-10% improvement in trip times and 3.8-11% improvement in reliability. Even though the absolute benefit numbers are large, these are modest improvements from a percentage viewpoint. FRA agrees it is not possible to say with certainty whether they might be achieved without testing and demonstrating the technology. For instance, precision dispatching requires development of very sophisticated software that proved to be a much greater challenge than originally anticipated by the first vendor to offer the product. It is also true that uncertainties with respect to yard dwell times may be more influential in affecting service quality than over-the-road planning. Nevertheless, this is an era in which all successful businesses are utilizing real-time data and analysis to address customer expectations. It is difficult to imagine that railroads, which are both capital and labor intensive, could contrive to make no gains in service quality with ready availability of current data regarding their train operations.

Modal Diversion

This model depends on the estimates of improved rail velocity and reliability derived in the Zeta-Tech study, which have been challenged by several commenters (see discussion above).

To assess the potential for highway to rail diversion, FRA employed the Department's Intermodal Transportation and Inventory Cost (ITIC) Model. The ITIC model measures shipper logistics cost for both highway and rail. If rail can improve its service offerings, lowering shipper logistics cost vis-à-vis highway service offerings, then rail should have the opportunity to better compete and potentially capture the business from motor carriers. Business that rail can capture from highway results in shipper logistics cost savings.

FRA used input values for improved transit time and service reliability developed by Zeta-Tech. **Of course, if the Zeta-Tech estimates are not correct, then neither are the estimates derived by FRA**. Zeta-Tech estimated that transit time would improve between 3.5% and 10% and that reliability would improve by between 3.8% and 11%. Details of the impact of modal diversion can be found in the 2004 report, Appendix B, and Appendix D, Tables 7 and 8.

One caution to readers of the diversion study: the study assumes constant railroad rates, which is not meant to be a realistic assumption. The assumption is meant to provide conservative estimates of total diversion. An artifact of using constant rates is that it appears in the study that railroad revenues will grow substantially. In reality most of that revenue would be passed on to shippers in the form of lower rates, and actual diversion would be greater. It does, however provide an indication that the shipper benefits in the Zeta Tech study might be conservative.

Heavy trucks operating over highways create a risk of accidents, and moving them to railroads removes that accident risk from the highways, although it does increase somewhat the rail safety risk. According to the diversion model, PTC will divert between 1.937 billion VMT and 3.723 billion VMT from highway to rail in 2010. The diversion increases to between 3.005 billion VMT and 5.714 billion VMT in 2020. The safety benefits of diversion accrue primarily to highway users.

As described here, the safety benefit from PTC would in part be offset by what FRA estimates to be volume related rail accident costs of $22 million to $44 million per year.

FRA estimates diversion of between 30.7 billion ton-miles and 59.5 billion ton-miles in 2010, and between 46.4 billion ton miles and 89.4 billion ton-miles in 2020. As previously noted, the 2010 figures may be overstated because the PTC systems might not be in place until 2010. This implies reduced air pollution costs between $68 million and $132 million in 2010, and between $102 million and $198 million in 2020. This benefit would accrue to the general public.

In its May 2000 Addendum to the 1997 Highway Cost Allocation Study, the Federal Highway Administration said that the cost responsibility[2] of an 80,000 pound combination was 8.65 cents

[2]Highway Cost Responsibility is an entire chapter in the *1997 Federal Highway Cost Allocation*

(10.08 cents in 2009 dollars) per mile, but that the actual contribution of such combinations only covered 80% of their cost share. That means that such trucks created a net societal cost of 1.73 cents per mile, in 2000 dollars, or 2.02 cents, in 2009 dollars.

Again, railroad commenters strongly disputed the estimated improvements in velocity and reliability, without which benefits to shippers and the public would not be realized.

As noted above, FRA remains convinced that an integrated communications, command and control system such as PTC and allied elements should be able to contribute to improvements in service quality. Modal diversion is highly sensitive to service quality. It may be true that problems with terminal congestion and lengthy dwell times might overwhelm the benefits of PTC; or it may be that the other initiatives that the railroads have been pursing (reconfiguration of yards, pre-blocking of trains, shared power arrangements, car scheduling, AEI, etc.) might actually work in synergy with PTC.

Summary

FRA has done its best to integrate the analysis from the 2004 report with the analysis of the proposed rule. FRA has removed benefit elements, such as locomotive diagnostics, which no longer apply, and added more significant fuel savings, and increased accident cost savings, as a consequence of DOT adopting higher VSLs. The 2004 report did not account for adverse impacts of PTC funding, while this analysis has attempted to estimate those impacts. It would take between twenty and twenty five years for business benefits to bring the rule to the break-even point, assuming what seem to be reasonable costs and effective productivity enhancing systems. Should the railroads incur higher costs for PTC, the system may never pay for itself. Should productivity enhancing systems prove unfeasible, or institutionally unacceptable, the costs of PTC will far exceed its benefits.

Study, , Federal Highway Administration, Washington, DC, 1997, pp. V-1 *et seq*.. The basic concept is that each user should pay the highway costs it creates or "occasions."