# Preventing a Regulatory Train Wreck

## Mandated Regulation and the Cautionary Tale of Positive Train Control

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**Abstract**

When Congress passes legislation that mandates prescriptive regulations, legislators are under no obligation to understand the problem they are trying to solve, assess alternative solutions, or understand the benefits and costs of their choices. Passage of the positive train control mandate in response to several high-profile train accidents amply illustrates how haphazardly the legislative branch can authorize regulations. Congressional hearings and committee reports on the Rail Safety Improvement Act of 2008 contain no analysis of the causes and extent of the safety problem, alternative solutions, and the benefits and costs of alternatives to this $12.5 billion mandate. Given that major regulations are often required by statute, the time has come for Congress to subject regulatory legislation to the same kind of analysis that presidents have required regulatory agencies to conduct for more than three decades.

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**Preventing a Regulatory Train Wreck:**

**Mandated Regulation and the Cautionary Tale of Positive Train Control**

Jerry Ellig and Michael Horney

## 1. Introduction

When executive branch agencies issue significant regulations, Executive Order 12,866 requires them to conduct a regulatory impact analysis (RIA) that assesses the cause and extent of the systemic problem the regulation seeks to solve, identifies alternative solutions, and estimates the benefits and costs of the alternatives (Clinton 1993). In contrast, when Congress passes legislation that mandates prescriptive regulations, legislators are under no similar obligation to understand the problem they are trying to solve, assess alternative solutions, or understand the benefits and costs of their choices. The Congressional Budget Office (CBO) "scores" legislation, but it assesses only effects on federal spending and revenues, not broader social benefits or costs.

Positive train control (PTC) presents a paradigmatic example of a regulation issued pursuant to legislation that gave the regulatory agency little discretion. The Rail Safety Improvement Act of 2008 (Pub. L. No. 110-432, sec. 104) requires regulations mandating that railroads implement PTC systems. PTC systems are intended to diminish the number of accidents caused by human error by stopping trains automatically under certain conditions. They are supposed to prevent train-to-train collisions, derailments, movements of the train when tracks are not switched correctly, and movements onto tracks occupied by work crews. The mandate is expected to cost more than $12.5 billion.[1]

[1] GAO (2015, 12) reports that Class I freight railroads (the largest freight railroads) expect to spend $9 billion, and commuter railroads expect to spend more than $3.5 billion. No estimates are available for the smaller (Class II and Class III) freight railroads.

The legislation itself specifies where and when railroads must implement PTC, but it leaves the tasks of review, approval, reporting, and enforcement to the Department of Transportation's Federal Railroad Administration (FRA). The legislation requires PTC systems on all intercity lines, commuter lines, and freight-only lines when they are part of a Class I railroad system, carrying 5 million gross tons of freight per year or carrying poisonous-by-inhalation (PIH) materials. The legislation also gives the FRA authority to require PTC on other lines. The original deadline for implementing PTC was December 31, 2015. Ultimately, lawmakers had to extend the deadline because many railroads simply could not meet it (Divis 2015).

This paper assesses the quality of analysis that informed congressional and regulatory decisions by examining congressional testimony preceding passage of the Rail Safety Improvement Act of 2008, congressional committee reports on the legislation, the most recent FRA benefit-cost study of PTC undertaken before the legislation was written, and the FRA's RIAs for the two principal regulations written to implement the law. We focus on the four principal elements that are supposed to be present in a complete RIA: (1) analysis of the systemic problem the regulation seeks to solve, (2) alternative solutions, (3) benefits or other outcomes, and (4) costs. The bulk of the paper summarizes the information on each of these topics that can be found in the source documents. We then apply the Mercatus Center's Regulatory Report Card scoring system (Ellig and McLaughlin 2012) to compare the quality of analysis in the FRA study, the FRA RIAs, and the congressional committee reports.

Our results demonstrate why it is important for agencies to conduct careful analysis of legislative mandates, even when Congress has required a regulation and given the agency little discretion. More importantly, they show why the legislative process for authorizing regulations needs reform. Considering the limited discretion given to the FRA, one would hope that the

congressional committees that wrote the legislation carefully considered the causes and extent of the safety problem, alternative solutions, and the benefits and costs of these alternatives. In reality, very little information of this type appears in congressional hearings and committee reports on the Rail Safety Improvement Act of 2008. The FRA's analyses of PTC contain much more careful assessments than any congressional documents, and they consistently show that the costs of PTC far exceed its safety benefits. Indeed, the FRA's first and most extensive study, conducted four years before passage of the legislation, is virtually ignored in the congressional hearings and reports. The FRA's RIA accompanying the 2010 regulation revealed that costs exceed the safety benefits by a factor of 20-to-1 (Roskind 2009, 2). Clearly, the FRA's research revealed significant information about the consequences of PTC that did not emerge during the congressional inquiries.

There is no guarantee that the legislative process will produce or use an analysis of the basic questions a good RIA answers. Between 2008 and 2013, 49 percent of economically significant, prescriptive regulations were required by law (Ellig forthcoming); the agency could not refuse to adopt a new regulation even if its analysis found no need for a new regulation. Given that half those decisions to regulate were "baked into the cake" by statute, the time has come for Congress to subject regulatory legislation to the same kind of analysis that presidents have required regulatory agencies to conduct for more than three decades.

## 2. Origins of the Positive Train Control Mandate

After a head-on collision of two commuter trains in 1969 that killed 4 people and injured 45, the National Transportation Safety Board (NTSB) called upon the FRA to study the possibility of automatic train control systems that would prevent collisions. Subsequent accidents caused by

human error led to continued NTSB recommendations for automatic train control. After a collision of a commuter train with a freight train in 1986, the NTSB called for the FRA to implement standards for a system for "positive train separation." The NTSB included positive train separation on its list of "most wanted" safety improvements when it initiated that list in 1990; the recommendation remained on the list until the Rail Safety Improvement Act of 2008 was passed (Roskind 2009, 6). In 2001, the NTSB changed terminology, calling for "positive train control" (NTSB 2001, 13).

The NTSB has no regulatory authority and no responsibility for comparing the full benefits and costs of any policy changes it recommends. It investigates accidents and offers recommendations based on its assessment of what would have prevented those accidents. The NTSB's recommendation was prompted by its investigations of individual accidents that it believes PTC could have prevented. A search of the NTSB website for the terms "positive train control" and "positive train separation" turns up numerous reports on individual accidents the NTSB believes could have been prevented by PTC (NTSB 1994 cited in NTSB 2005a; NTSB 2001; NTSB 2003, 45–50; NTSB 2005a, 7; NTSB 2005b, 57–59; NTSB 2007, 52–54). Occasionally, NTSB officials have mentioned the number of PTC-preventable accidents that occurred in some previous time span. For example, in a 1987 letter urging the FRA to issue regulations requiring railroads to install "positive train separation" systems, the NTSB asserted that most of the 50 major train collisions it had investigated since 1967 could have been prevented by a positive train separation system (NTSB 1987). In its annual report to Congress for 1998, the NTSB claimed that positive train separation could have prevented more than 1,000 train accidents (NTSB 1998, 15). In 2005 Bob Chipkevich, director of the NTSB's Office of Railroads, Pipelines and Hazardous Materials Investigations, told a symposium audience that the

NTSB investigated 38 accidents in the previous six years that PTC could have prevented (Price and Soundworth 2006, 78).

The NTSB clearly articulated important outcomes PTC is expected to achieve—a reduction in deaths, injuries, and property damage from train accidents. Although the NTSB occasionally added up the number of accidents it believes PTC could have prevented over some time period, it did not produce a comprehensive analysis showing the total number of deaths, injuries, or monetary damage PTC could have prevented or could be expected to prevent in the future. The NTSB vigorously advocated for PTC and complained about slow progress in implementation, but it did not appear to have conducted any type of study to identify the systemic reasons for the slow progress.

**3. The FRA's 2004 Analysis**

The task of evaluating the overall benefits of PTC and comparing them with the costs fell to the FRA. An FRA report in 1994 and a report by the FRA's Railroad Safety Advisory Committee in 1999 concluded that the cost of implementing PTC would far outweigh the value of any safety benefits. Both reports also discussed the possibility that PTC could create cost reductions or other business benefits for railroads and shippers. They did not estimate those benefits and noted that the existence and size of such benefits was controversial (FRA 2004, 1–2).

In 2003, the House-Senate conference report on the consolidated appropriations resolution instructed the FRA to prepare an updated analysis that accounts for changes in PTC technology and potential cost savings to carriers and shippers (House of Representatives 2003, 1286–87). The FRA interpreted these instructions to mean that it should evaluate the benefits and costs of a PTC system providing the core safety functions, plus some add-on capabilities that

might provide cost savings or other business benefits (FRA 2004, 3). The conference committee's instructions originated with the Senate Committee on Appropriations' report, which agreed with the NTSB that progress in implementing PTC had been too slow (Senate Committee on Appropriations 2002, 96–97).

The FRA issued its report in August 2004. Thus, it was the most recent comprehensive study preceding congressional hearings that addressed PTC in 2005, 2006, and 2007.

### *Systemic Problem*

The FRA study did not explicitly analyze the nature and significance of underlying systemic problems a PTC mandate could be expected to solve. Safety was the sole concern motivating the NTSB to call for adoption of PTC. How big was the safety problem? The FRA study was based on an estimate of the number of PTC-preventable accidents, but the number was not reported in the study. Either the number of accidents or the consequences appear to be small relative to costs, given the relatively small size of the safety benefits calculated in the analysis. No theoretical discussion or empirical assessment was done of whether railroads internalize the costs of those accidents; such an analysis would have helped assess whether a market failure exists that impairs safety.

Many of the claimed benefits were "business benefits" to railroads, which the railroads themselves disputed. Examples of these postulated benefits include (1) real-time transmission of locomotive diagnostic information, (2) fuel savings from pacing of trains to avoid cycles of rapid movement followed by long waits, (3) more efficient car use due to frequently updated and optimized dispatching, and (4) avoided investments in track capacity because of more efficient use of existing capacity (FRA 2004, 11–16). No extensive theory or empirical analysis explains why

railroads ignore these business benefits if they are real. The study notes that competition often forces railroads to pass on to shippers about 80 percent of productivity improvements, so it assumes that only 20 percent of the business benefits would be captured by railroads (FRA 2004, 16).

***Benefits***

The report addresses four types of benefits: direct safety benefits, business benefits to railroads, benefits to shippers due to more reliable service, and social benefits due to diversion of traffic from highways to railroads. All benefits were monetized. Depending on whether option A or B was chosen, annual benefits projected in 2010 for each category ranged from $35 million to $96 million (improved railroad safety), from $299 million to $1.3 billion (business benefits to railroads), from $371 million to $2.5 billion (benefits to shippers), and from $363 million to $699 million (social benefits) (FRA 2004, tables 1, 2, and 7). Rail safety benefits would be reduced by $20 million to $40 million annually if the predicted diversion of traffic to rail occurred (FRA 2004, 20). With or without this adjustment, direct railroad safety benefits clearly accounted for a very small percentage of the total benefits.

The size of the safety benefits depended on the number of accidents PTC could be expected to prevent. The study explains how PTC could be expected to reduce accidents, but it does not include evidence showing how effectively PTC could reduce accidents. No large-scale PTC system interoperable across multiple freight railroads had yet been deployed, so the FRA could not rely on actual experience to provide empirical proof of the likelihood or size of the safety benefits.

Instead, the FRA instructed a contractor to estimate the cost of two alternative PTC systems that would be 85 percent effective and 98 percent effective in preventing accidents.

These were christened “PTC A” and “PTC B.” PTC A would be overlaid on railroads’ existing operating systems to provide an additional margin of safety. PTC B would become the system for operating the railroad. The FRA directed its consultants to design PTC A to be 85 percent effective and PTC B to be 98 percent effective (FRA 2004, appendix A). For the purpose of estimating benefits, the two systems were assumed to be 85 percent and 98 percent effective. These percentages were combined with Volpe Center data on the cost of PTC-preventable accidents to estimate how each PTC system could be expected to improve safety (FRA 2004, 19). Because the study measured safety benefits by estimating how PTC would affect the trend in PTC-preventable accident costs, it did not quantify the number of lives saved or injuries avoided.

The business benefits to railroads and shippers were based on assumptions that PTC could reduce costs, save fuel, use equipment more intensively, reduce travel time, and improve reliability of service. Social benefits—reduced maintenance cost of highways, improved highway safety, and reduced air pollution—would occur if reduced travel time and improved reliability lead to a diversion of traffic from highways to rail. The FRA study provides a theoretical explanation for why PTC might be expected to produce these benefits, but it does not directly test these theories (FRA 2004, 9–18). In fact, it notes repeatedly that railroads disputed whether PTC would create most of these business benefits. The FRA study reports its consultant’s estimates of the business benefits with the caveat that “FRA does not endorse these results nor, with the caveats stated, does it have objection to these results” (FRA 2004, 9). The FRA notes that many of the business benefits would be speculative until a freight railroad uses PTC on a large scale (FRA 2004, 6).

***Costs***

The FRA estimates that the initial acquisition cost of PTC A would be between $1.2 billion and $2.2 billion. The initial acquisition cost of PTC B would be between $2.0 billion and $3.7 billion. Annual maintenance cost is estimated at $182 million to $335 million for PTC A and $307 million to $551 million for PTC B (FRA 2004, 23). The analysis acknowledges that it excluded costs of the communications backbone necessary to transport the data (FRA 2004, 5). The figures do not appear to be discounted to reflect the time value of money. The study lists five possible discount rates that could be used: 3 percent and 7 percent (the rates specified in Office of Management and Budget *Circular A-4* [OMB 2003]), 4 percent (the federal government's borrowing cost), 13.3 percent (the railroads' cost of capital), and 20 percent (the railroads' internal hurdle rate for investments) (FRA 2004, 24). It notes that the use of any discount rate makes the benefit-cost balance even less attractive, given that most of the costs are borne up front.

Because the study estimates that PTC would lead to a diversion of traffic from highways to rail, it calculates a cost that stems from this shift: a $20 million to $40 million annual increase in rail accident costs due to the increase in rail traffic. However, the study does not estimate any increase in railroad investment required to accommodate an increase in rail traffic diverted from highways. The report suggests these costs might total several hundred million dollars (FRA 2004, 5).

The study explicitly calculates the amount of business benefits (or losses) the railroads would pass through to shippers. It does not, however, assess whether or how the initial acquisition cost or cost of financing would affect rail rates.

### *Alternatives*

The only alternatives analyzed are the two hypothetical PTC systems. The FRA did not consider other ways of improving railroad safety or achieving the business benefits claimed for PTC. Nor did it consider the effects of implementing PTC on a larger or smaller percentage of rail lines or on a faster or slower time line—two issues that would later become highly contentious.

The analysis estimates ranges of benefits, costs, and "net benefits" for each alternative. "Net benefits" in 2010 were $762 million to $1.9 billion for PTC A and $2.1 billion to $3.5 billion for PTC B (FRA 2004, tables 1 and 2). Because the study did not annualize or amortize these costs, it also does not show whether PTC is a profitable investment for railroads.

To each PTC system, the FRA directed its contractor to add other functionalities intended to create the business benefits and social benefits from traffic diversion. The analysis does not break out the incremental benefits or costs of those add-ons.

## 4. Hearings on Railroad Safety and PTC Systems

Congress held several hearings on rail safety subsequent to the 2004 FRA report. The hearings were likely sparked not by the report, but by a tragic accident that occurred at Graniteville, South Carolina, on January 6, 2005. Due to an incorrectly set switch, a northbound freight train collided with another train on a siding, rupturing a tank car containing chlorine. Nine people died from chlorine gas inhalation, 554 experienced respiratory problems, 75 were admitted to hospitals, and 5,400 people near the accident site were evacuated (NTSB 2005c, 1).

Benefits or costs of PTC were mentioned in six subsequent congressional hearings. The House Subcommittee on Railroads, Pipelines, and Hazardous Materials held one hearing in 2005 and four in 2006. The Senate Committee on Commerce, Science, and Transportation held a

hearing on July 26, 2007. In every hearing involving railroad safety and PTC systems, witnesses stated that human error causes collisions and derailments. Other than claims that PTC would reduce human error, little additional analysis was done about the impact of PTC implementation or alternative policies that might reduce accidents that stem from human error.

### *Systemic Problem*

The primary rationale for PTC is that human error causes accidents that can result in injuries and fatalities. Bob Chipkevich, director of the NTSB's Office of Railroads, Pipelines, and Hazardous Materials Investigations, testified that the biggest causes of human error were fatigue, medical conditions, alcohol and drug use, cell phones, loss of situational awareness, and improperly positioned switches (House Subcommittee on Railroads 2006a, 73–81). Although regulations have been established to stop the use of alcohol and drugs while operating trains (House Subcommittee on Railroads 2006a, 68), controlling for fatigue, medical conditions, attention spans, and the position of switches is much harder.

FRA administrator Joseph Boardman testified that human factors cause 38 percent of all train accidents (House Subcommittee on Railroads 2006a, 4). Chipkevich said that FRA data from 2003 and 2004 showed that human factors caused 91 percent of head-on, rear-end, and side collisions (House Subcommittee on Railroads 2005, 11). Ninety-one percent of a subset of accidents is obviously a larger percentage than 38 percent of all accidents. The 91 percent figure may have led committee members to believe that PTC would prevent more accidents than was realistic to expect.

No discussion occurred at the hearing about why railroads lack adequate incentives to reduce human error on their own. According to the committee overview of the hearing, mandated

employee training reduced the annual number of accidents caused by human error by 91 percent between 1978 and 2005 (House Subcommittee on Railroads 2006b, 40). Increased training thus seems to have made a huge difference in improving employee accountability and reducing accidents. The hearings do not provide any solid evidence on whether this improvement trend could be expected to continue.

### *Benefits*

Throughout the hearing testimony on rail safety and PTC, many witnesses agreed that the implementation of PTC would prevent human error and subsequently reduce accidents, fatalities, and injuries. Despite this agreement and references to NTSB accident investigations, witnesses provided no estimates of the number of accidents, fatalities, or injuries that PTC could be expected to prevent. Thus, although the desired outcomes were clear, the hearings provided little information that could be used to estimate the size of the benefits from a PTC mandate.

### *Costs*

Witnesses listed several types of costs associated with PTC. The Association of American Railroads' president, Edward Hamberger, stated that PTC could require capital investments in wireless networks, sophisticated location determination systems, highly reliable software, and digital processors on board locomotives in dispatching offices and along tracks (House Subcommittee on Railroads 2006c, 115). Hamberger mentioned these same costs again in a subsequent hearing, recommending that PTC should be required only on high-density main lines and at a pace that can be "justified by available funds." He recommended a flexible timetable due to the tremendous costs associated with implementing PTC (Senate Committee on

Commerce, Science, and Transportation 2007, 5). He also implied that PTC may be more costly than expected due to wireless spectrum congestion and suggested that the Federal Communications Commission allocate more spectrum to railroads for PTC (Senate Committee on Commerce, Science, and Transportation 2007, 6).

In the same hearing, John P. Tolman, vice president and national legislative representative from the Brotherhood of Locomotive Engineers and Trainmen, endorsed PTC implementation but warned that it could bring about "unanticipated safety challenges," due to baby boomer railroad transportation workers retiring and less experienced workers performing the tasks of implementation (Senate Committee on Commerce, Science, and Transportation 2007, 1).

David Solow, CEO of the Southern California Regional Rail Authority, also warned about the substantial cost of implementation and noted that federal assistance may be necessary to ensure interoperability of PTC systems used by freight and commuter equipment that share some of the same tracks (Senate Committee on Commerce, Science, and Transportation 2007, 32–35). Matthew Rose, CEO of Burlington Northern Santa Fe Railway, estimated that the full implementation of PTC systems in the entire Class I railroad industry could cost somewhere between $5 billion and $8 billion (House Subcommittee on Railroads 2006d, 45). This is the only cost estimate presented in the hearings.

Each hearing had a witness from the FRA. Only one FRA witness, Acting Administrator Jo Strang, mentioned the FRA's August 2004 study that found a PTC mandate would have costs that far exceeded the benefits (House Subcommittee on Railroads 2005, 73). The scant attention to the FRA study is noteworthy, given that all these hearings occurred after the study's release.

### *Alternatives*

The hearings included no discussion of any alternatives to mandating the implementation of PTC as a means of lessening human error. Hamberger's suggestion of a flexible timetable was the closest thing to an alternative proposal.

## 5. Congressional Committee Reports

Congressional committee reports outline the legislation, explain its rationale, and sometimes contain minority views if there is significant disagreement about the legislation. If the legislation has significant costs or benefits, one might expect them to be documented in the committee report. This information could have been gathered from prior hearings, briefings, or the committee staff's own research.

House and Senate committees each issued a substantive report on railroad safety legislation. The House Committee on Transportation and Infrastructure released a report on September 19, 2007 (H.R. Rep. 110-336). The Senate Committee on Commerce, Science, and Transportation released a report on March 3, 2008 (S. Rep. 110-270).[2]

Another high-profile accident spurred prompt congressional action on legislation to mandate PTC. On September 12, 2008, a commuter train collided with a freight train in Chatsworth, California, leading to 25 deaths and more than 100 injuries (GAO 2015, 1). Congress passed the Rail Safety Improvement Act on October 16, 2008.

[2] The House Committee on Rules released a report on October 10, 2007; however, this report does not provide any substantive analysis of PTC (H.R. Rep. 110-371).

### *Systemic Problem*

The committee reports identified a problem, but they did not assess whether the problem existed due to some failure of private market incentives or government institutions that could be solved by regulation. Although the reports do not use these terms, both reports clearly find that operational failures occur due to human error. The House report states that 40 percent of all train accidents result from human factors and that fatigue plays a role in in 25 percent of accidents (House Committee on Transportation and Infrastructure 2007, 30). Although the reports identify human error as a problem, they provide no theory or empirical evidence showing why railroads fail to internalize the safety benefits of PTC or lack incentives to implement PTC systems or other solutions voluntarily (House Committee on Transportation and Infrastructure 2007; Senate Committee on Commerce 2008). Indeed, railroads on their own were able to reduce the annual number of accidents caused by human error by 91 percent between 1978 and 2005 (House Subcommittee on Railroads 2006b, 40). Without a clear understanding of why railroads are unlikely to mitigate human error further, one cannot know whether a law mandating PTC is necessary or whether other solutions might be appropriate.

### *Benefits*

The Senate report does identify the ultimate desired outcomes—reduced accidents, fatalities, and injuries by reducing human error. Despite mentioning that the goal of PTC systems is to override human performance failures, the reports do not describe the physical attributes of the technology that accomplish this. The Senate report claims that the NTSB has estimated that PTC could prevent approximately 40 to 60 accidents that could result in 7 fatalities and 55 injuries each year. However, the report does not provide a citation to an NTSB source for these figures, and

they were not mentioned in testimony, so the NTSB source is not clear (Senate Committee on Commerce 2008, 5). "Operational and productivity benefits" are also mentioned, but without clarification as to what they may be (Senate Committee on Commerce 2008, 6).

The committee reports do not offer a coherent or testable theory of how the legislation will produce the desired outcomes. The analysis claims that implementation of PTC will reduce fatalities and injuries but does not show any empirical evidence for this theory or cite any specific reports, other than asserting that the NTSB claimed this was the case (Senate Committee on Commerce 2008, 5).

***Costs***

The reports also fail to analyze the cost of the legislation. They do not mention how much the PTC systems mandated in the legislation would cost on average for the individual railroad, nor do they assess total costs of the legislation. The Senate report states that many railroads believe that the benefits of implementing PTC systems do not outweigh the estimated $6 billion to $8 billion for deployment throughout the entire US railroad network, especially because the number of collisions has decreased by 82 percent since 1980 (Senate Committee on Commerce 2008, 6). Because the legislation requires PTC only on some types of routes, it is not clear whether the law would cost $6 billion to $8 billion or just a fraction of that amount. The committee reports offer no help in this regard. They do not even mention the conclusions of the FRA's 2004 benefit-cost study.

The House report does mention CBO estimates of federal budgetary costs in its report on the Federal Railroad Safety Improvement Act of 2007, but it does not offer any specific estimates with regard to PTC systems (House Committee on Transportation and Infrastructure 2007, 54). A single line in the CBO report claims that, based on information from the FRA and

the Association of American Railroads, CBO estimates that positive train control would cost "at least a few billion dollars for the industry" (House Committee on Transportation and Infrastructure 2007, 60).

### *Alternatives*

The committee reports completely failed to analyze the effectiveness of alternative approaches, other than mentioning the problems under the status quo. They contain no discussion of alternative ways to reduce human error other than mandatory implementation of PTC on particular types of routes specified in the legislation. The reports also do not consider the effects of requiring PTC on a larger or smaller number of routes.

Clearly, the authors of the Rail Safety Improvement Act of 2008 were aware of alternative ways to improve rail safety. In addition to PTC, the legislation includes more than a dozen other measures, such as training standards, grants to improve grade crossing safety, programs to prevent trespassing on railroad property, and increased FRA civil penalties (RSIA 2008). But no analysis compares these alternatives to find the ones that are most effective or provide the greatest net benefits. Instead, the legislation simply includes them all.

## 6. The FRA's 2010 Rule and RIA

The FRA proposed its first regulation to implement the PTC mandate in July 2009 (FRA 2009). The rules specify required functionalities of the technology and the means by which it would be certified. The notice of proposed rulemaking also describes the contents of the PTC implementation plans required by the statute and contains the proposed process for submission of those plans for review and approval by the FRA.

The final rule, issued in January 2010 and revised slightly in September 2010,[3] used a past year (2008) as a baseline for determining where a railroad carried passengers and PIH materials instead of projecting where this traffic would travel in one or more future years. Railroads were permitted to request exclusion or removal of routes from the PTC baseline, but the rule required them to satisfy a two-part test showing safe and secure alternative routes existed for passenger and PIH traffic and that the residual risk associated with PTC-preventable accidents did not exceed the average comparable risks of tracks that were PTC-equipped. Although this provision provided some potential for regulatory relief, it did nothing to ensure that the RIA used the most likely baseline to assess the effectiveness of the rule.

***Systemic Problem***

The RIA offers no theory of market failure that would explain why the risk and cost of accidents was insufficient to motivate freight railroads to adopt PTC. Before the Rail Safety Improvement Act of 2008, the FRA sought to encourage voluntary adoption of PTC through financial support for a test program and a 2005 regulation specifying performance standards for processor-based train control systems. Amtrak developed and deployed PTC technologies to support high-speed passenger service in the Northeast Corridor and Michigan. Freight railroads also developed, tested, and in limited cases deployed PTC-related technologies (Roskind 2009, 6–11). Nevertheless, the pace of PTC adoption was slow, apparently because the significant costs exceeded any private benefits to the railroads.

[3] The main difference between these two final rules is the deletion of a few sections based on comments received from the Association of American Railroads (Absent Special Circumstances, Alternative Route Analysis, Residual Risk Analysis). The September 2010 rule did not contain a separate RIA. The FRA claimed the revisions would reduce compliance costs, but the reduced costs could not easily be measured, and it referred readers to the RIA for the rule issued on January 15 (FRA 2010, 59, 116).

The RIA states that, in the wake of several high-profile accidents, Congress opted to proceed with a mandate regardless of cost:

> 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 (Roskind 2009, 12).

The RIA notes that prior studies found significant business benefits to railroads under highly controversial assumptions (Roskind 2009, 8). In its discussion of business benefits to railroads, the RIA suggests that at least some railroads appear to find that the benefits of PTC to them justify the costs:

> 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 (Roskind 2009, 225).

If railroads are adopting PTC because they find the business benefits make it worthwhile, that action undercuts the rationale for a PTC mandate. The RIA, however, does not make this obvious point.

### *Benefits*

The RIA lists the primary benefits of the regulation as a reduction in casualties, property damage, and other costs associated with accidents, such as environmental damage, track closure, road closures, evacuations, and government expenditures to deal with hazardous materials spills (Roskind 2009, 213). To estimate the monetary value of PTC-preventable accidents, the Volpe

Center updated its 2005 study to reflect current prices and the Department of Transportation's current value to pay to avoid a fatality (Roskind 2009, 213). To these figures, the FRA added costs associated with several high-profile accidents that were not included in the database of PTC-preventable accidents. After accounting for countermeasures already instituted to prevent accidents and assuming that PTC would prevent 80 percent of the remaining accidents, the RIA estimates that the regulation would reduce accident costs by about $65 million annually. About 70 percent of this figure reflects reduced fatalities and injuries, with reduced property damage accounting for most of the remainder (Roskind 2009, 221–2). Over a 20-year period, these benefits total between $440 million (7 percent discount rate) and $674 million (3 percent discount rate) (Roskind 2009, 202–3).

A sensitivity analysis examines the possible business benefits to railroads, along with an assessment of social and environmental benefits that could result from fuel savings and diversion of traffic to rail. It estimates that over 20 years, these benefits could total between $6.3 billion (7 percent discount rate) and $14.1 billion (3 percent discount rate) (Roskind 2009, A-6).

***Costs***

The RIA estimates PTC costs for locomotives, rights-of-way, and central office functions. Total system acquisition costs range from $3.9 billion to $9.4 billion, with a most likely estimate of $5.5 billion. Maintenance costs were assumed to equal 15 percent of total acquisition costs, or $816 million annually. The cost over 20 years totaled $9.5 billion (7 percent discount rate) or $13.1 billion (3 percent discount rate). Most costs were based on discussions with the Railroad Safety Advisory Committee PTC Working Group or other industry sources with experience in bidding and installing PTC systems (Roskind 2009, 193–203). The RIA opines that lower costs

estimated in the 2004 report were overly optimistic and excluded installation costs, which the RIA includes (Roskind 2009, 201).

These costs ($9.5 billion to $13.1 billion) far exceed the direct safety benefits of the regulation ($440 million to $674 million). But the RIA's sensitivity analysis concludes that the combination of business benefits and social benefits could lead PTC to cover its costs in 20–25 years, depending on the discount rate (Roskind 2009, A-6).

### *Alternatives*

The RIA mentions two alternatives but provides no significant analysis of their effects. It raises the possibility that Congress could have adopted a longer implementation schedule or used incentives rather than mandates. The RIA offers some brief speculation that a longer implementation schedule could lower costs to some degree but concludes with an assertion that those costs would still be within the lower range calculated for the rule (Roskind 2009, 200–201).

## 7. The FRA's 2012 Rule and RIA

The FRA ended up revising the 2010 PTC rule because of a lawsuit. The Association of American Railroads challenged the two-part test and 2008 baseline in court. As a result of an agreement settling the lawsuit, the FRA issued a final rule in May 2012 that eliminated the two qualifying tests. Instead, an exclusion/removal request is approved if the railroad can show that the tracks will not have passenger or PIH traffic as of December 31, 2015 (FRA 2012a).

The 2012 RIA assessed the effects of the changes introduced by the 2012 rule, which eliminated the two tests railroads had to meet to exempt lines from the PTC requirement. The RIA calculated the benefits of the 2012 rule as the cost reductions railroads experience because

PTC would be required on fewer lines. The costs of the rule in the RIA are costs attributable to the forgone reductions in safety risks on the lines that will now no longer have to have PTC.

***Systemic Problem***

The RIA does not directly address a systemic problem motivating either the 2012 regulation or the 2010 regulation that it amends. It states that the legislation mandating PTC was enacted in response to accidents, with no further explanation or analysis (FRA 2012b, 5). It also states that the FRA issued the revised regulation in response to the agreement settling the lawsuit (FRA 2012b, 7–8). The benefit-cost analysis implies that the 2010 regulation mandated very costly PTC measures on lines that posed very little risk of the types of major accidents that motivated the legislation; thus, the 2012 regulation corrected a significant defect in the 2010 regulation. The reader has to infer this, however; it is not explicitly stated as a reason for the new regulation.

***Benefits***

The primary benefit is a reduction in the cost of the 2010 rule. Under the new rule, railroads could avoid new costs on approximately 10,000 miles of track that would not carry PIH materials by 2015. About half that mileage was track that would have required PTC under the old rule, and half was track that could have avoided PTC if railroads took some less expensive mitigation measures, such as reductions in train speeds, reduction in traffic volume, intensified track maintenance, and installation of hazard detectors (FRA 2012b, 31). Thus, the new rule saved the costs of PTC for 5,000 miles of track and the costs of mitigation for 5,000 miles of track. Fewer locomotives would have required PTC equipment, and annual maintenance expenditures would be lower as well.

Total costs avoided are estimated at $620 million (7 percent discount rate) or $818 million (3 percent discount rate), applying the discount rates required in the Office of Management and Budget's *Circular A-4* (OMB 2003). The 7 percent rate is supposed to reflect the private costs of capital, although railroads likely have a higher actual cost of capital than that. The RIA also offers a range of low and high estimates that assumed costs would be avoided on 3,500 or 7,000 miles of track (FRA 2012b, 37–42). It provides a separate calculation of cost savings to smaller railroads.

***Costs***

As calculated in the RIA, the costs of this regulation are equivalent to the reduction in projected benefits of the 2010 regulation that would occur because PTC would be installed on fewer miles of track. Prevention of high-profile "headline" accidents accounted for 41 percent of the benefits in the 2010 RIA, and the FRA argued that these benefits would still occur because such accidents were unlikely to occur on the lines affected by the 2012 rule. The risk of nonheadline PTC-preventable accidents on these lines is also lower; the FRA assumes that the risk on these lines is 60 percent of the risk on the remaining lines where PTC would be required, because traffic on these lines is less dense than traffic on the lines where PTC would still be required. Based on these figures, the RIA estimated that the 2012 regulation would reduce the benefits of the 2010 regulation by 3.54 percent to 7.07 percent, with a likely value of 5.05 percent. This cost of the 2012 regulation amounts to $18.7 million to $26.7 million over 20 years (7 percent discount rate) or $27.5 million to $39 million over 20 years (3 percent discount rate) (FRA 2012b, 44–48). Total net benefits of the regulation ranged from $581 million to $1 billion, depending on the cost estimate and discount rate used (FRA 2012b, 51).

### *Alternatives*

The RIA considers no alternatives to the new regulation. It shows how benefits and costs could change compared to the 2010 regulation, but this is because it treats the 2010 regulation as the baseline, not as an alternative.

## 8. Report Card Scoring of FRA and Congressional Analyses

The Mercatus Center's Regulatory Report Card provides a framework to systematically compare the quality of analysis in the FRA and congressional reports (Ellig and McLaughlin 2012). The Regulatory Report Card is a qualitative evaluation of both the quality and the use of regulatory analysis in federal agencies. Four of the Report Card criteria assess the quality of the agency's analysis of the systemic problem the regulation seeks to solve, alternative solutions, outcomes or other benefits, and costs.

Box 1 lists the questions evaluators consider under each of the four criteria. Evaluators assign each question a score ranging from 0 (no useful content) to 5 (comprehensive analysis with potential best practices).[4] The score for each of the four criteria is a rounded average of the scores for the lettered questions under each criterion.[5]

[4] For the first several years, the evaluators were senior Mercatus Center regulatory scholars and graduate students trained in RIA. After 2009, the Mercatus Center developed a nationwide team of economics professors who serve as evaluators in conjunction with senior Mercatus Center regulatory scholars. Biographical information on current evaluators is available at http://www.mercatus.org/reportcard.

[5] In 2008–12, the Report Card consisted of 12 criteria. The 4 analysis criteria were outcomes, systemic problem, alternatives, and cost-benefit. In 2013, the Report Card was streamlined and reorganized to cover 6 criteria, including the 4 analysis criteria listed in box 1. The reorganization of the analysis criteria only involved rearrangement of some of the subquestions into different categories. Therefore, the 2008–12 scores can easily be transformed to match the post-2012 scoring system. This paper uses those transformed scores for the PTC RIAs.

## Box 1. Regulatory Report Card Analysis Assessment Criteria

1. How well does the analysis identify and demonstrate the existence of a market failure or other systemic problem the regulation is supposed to solve?
   A. Does the analysis identify a market failure or other systemic problem?
   B. Does the analysis outline a coherent and testable theory that explains why the problem (associated with the outcome above) is systemic rather than anecdotal?
   C. Does the analysis present credible empirical support for the theory?
   D. Does the analysis adequately address the baseline—what the state of the world is likely to be in the absence of further federal action?
   E. Does the analysis adequately assess uncertainty about the existence and size of the problem?

2. How well does the analysis assess alternative approaches?
   A. Does the analysis enumerate other alternatives to address the problem?
   B. Is the range of alternatives considered narrow or broad?
   C. Does the analysis evaluate how alternative approaches would affect the amount of the outcome achieved?
   D. Does the analysis identify and quantify incremental costs of all alternatives considered?
   E. Does the analysis identify the approach that maximizes net benefits?
   F. Does the analysis identify the cost-effectiveness of each alternative considered?

3. How well does the analysis identify the benefits or other desired outcomes and demonstrate that the regulation will achieve them?
   A. How well does the analysis clearly identify ultimate outcomes that affect citizens' quality of life?
   B. How well does the analysis identify how these outcomes are to be measured?
   C. Does the analysis provide a coherent and testable theory showing how the regulation will produce the desired outcomes?
   D. Does the analysis present credible empirical support for the theory?
   E. Does the analysis adequately assess uncertainty about the outcomes?
   F. Does the analysis identify all parties who would receive benefits and assess the incidence of benefits?

4. How well does the analysis evaluate costs?
   A. Does the analysis identify all expenditures likely to arise as a result of the regulation?
   B. Does the analysis identify how the regulation would likely affect the prices of goods and services?
   C. Does the analysis examine costs that stem from changes in human behavior as consumers and producers respond to the regulation?
   D. Does the analysis adequately address uncertainty about costs?
   E. Does the analysis identify all parties who would bear costs and assess the incidence of costs?

The Report Card project evaluated all prescriptive, economically significant regulations proposed between 2008 and 2013.[6] Thus, the RIAs for the two FRA regulations were evaluated as part of the Report Card project.[7] For this paper, we prepare Report Card evaluations of the 2004 FRA benefit-cost analysis and the congressional committee reports on the Rail Safety Improvement Act of 2008. Because the congressional committee reports have such scant analysis, we treat them all as a single report and create one Report Card evaluation covering all of their content.

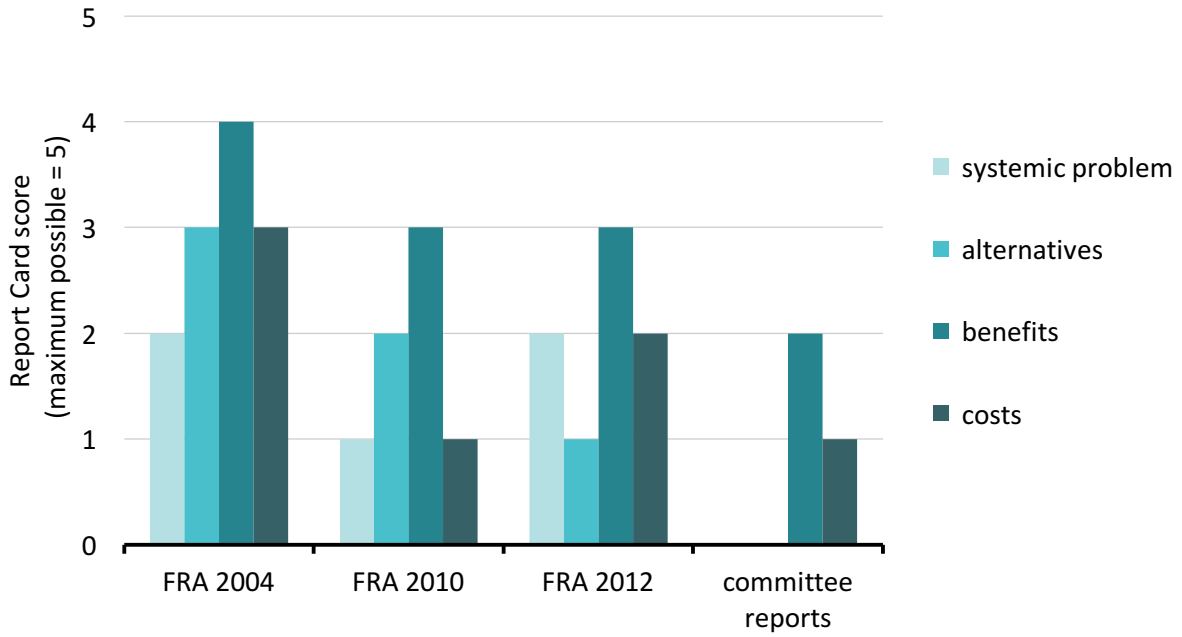
Figure 1 shows the results. Clearly, all of the FRA documents have much more analytical content than the congressional committee reports. The committee reports contain no analysis of the systemic problem or alternatives; the FRA documents contain a small amount. Benefits and costs are at least mentioned in the committee reports, but in no great level of detail. The FRA undertook a much more careful consideration of benefits and costs than Congress did.

Figure 2 compares Report Card scores for the PTC analyses with the average scores for all 130 prescriptive regulations evaluated for the Report Card in 2008–2013. The FRA's 2004 benefit-cost study was close to the 2008–2013 average in its analysis of the systemic problem, alternatives, and costs, but it presented a somewhat more complete analysis of benefits than the typical RIA. The FRA's two RIAs score slightly below the 2008–2013 average for their analysis of the systemic problem, alternatives, and costs and score close to the average for their analysis of benefits. The FRA PTC analyses clearly outscore the congressional committee reports not because FRA produces exceptional PTC RIAs, but because the congressional reports contain so little analysis.

[6] "Prescriptive" regulations are what most people think of when they think of regulations: they mandate or prohibit certain activities. This type is distinct from budget regulations, which implement federal spending programs or revenue collection measures. The Report Card evaluated budget regulations in 2008 and 2009, then discontinued evaluating budget regulations in subsequent years because it was clear the budget regulations had much lower-quality analysis. See McLaughlin and Ellig (2011); Ellig, McLaughlin, and Morrall (2013).

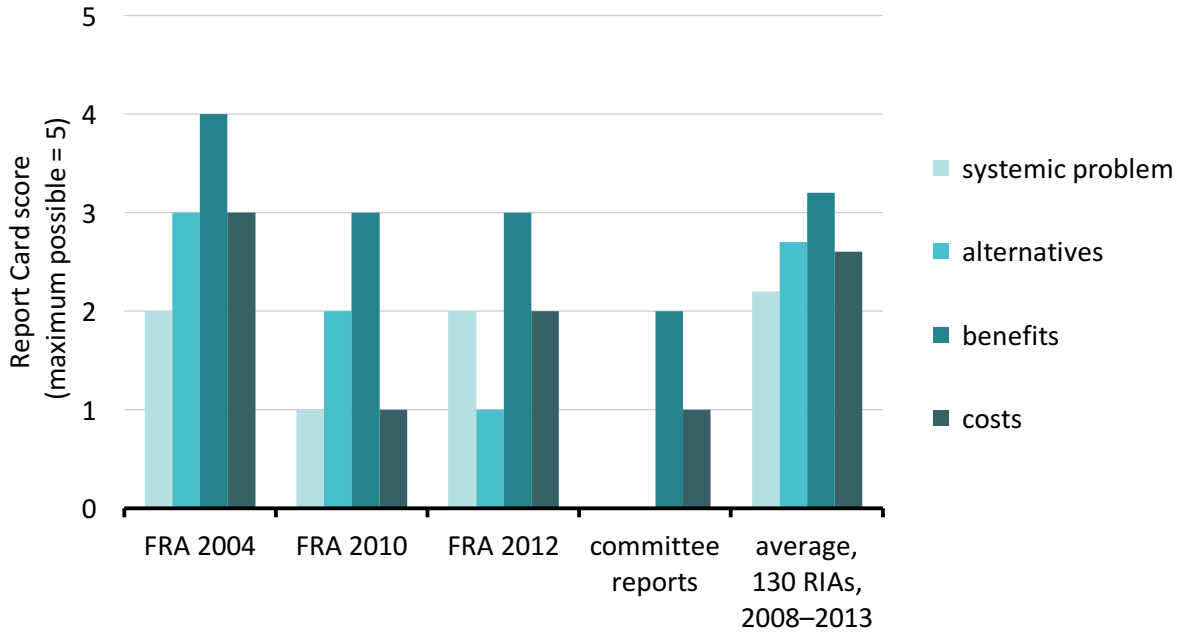
[7] The Report Card evaluated the RIAs that accompanied the Notice of Proposed Rulemaking. Our review of the RIAs accompanying the final rule reveals no significant changes that would have affected the Report Card scores.

**Figure 1. Federal Railroad Administration (FRA) Positive Train Control Studies Have Much More Analysis Than Congressional Committee Reports**




Source: Authors scored the Federal Railroad Administration's 2004 benefit-cost report and the congressional committee reports using the Mercatus Center's Regulatory Report Card evaluation framework. Report Card scores for the agency's regulatory impact analyses for 2010 and 2012 are available at http://www.mercatus.org/reportcards.

**Figure 2. Federal Railroad Administration (FRA) Positive Train Control Studies vs. Average Scores for Regulatory Impact Analyses (RIAs), 2008–2013**




Source: Authors scored the Federal Railroad Administration's 2004 benefit-cost report and the congressional committee reports using the Mercatus Center's Regulatory Report Card evaluation framework. Report Card scores for the 130 regulatory impact analyses from 2008–2013 are available at http://www.mercatus.org/reportcards.

## 9. Conclusion

Passage of the PTC mandate amply illustrates how haphazardly the legislative branch can authorize regulations. Congress imposed the mandate in response to several high-profile train accidents. The committees that wrote the legislation did not seriously consider the extent of the problem, evaluate alternative methods of improving rail safety, or compare benefits with costs. An appropriations conference committee report required the FRA to produce a study on the benefits and costs of PTC in 2004, but the study appeared to have been ignored in the hearings and congressional committee reports accompanying the Rail Safety Improvement Act of 2008.

When Congress passed legislation mandating positive train control, there was little evidence that lawmakers considered the types of factors that should be considered in a good RIA. The recent experience with the PTC mandate illustrates how unlikely it is that congressional hearings and reports will generate the fundamental information about the nature of the problem, alternative solutions, benefits, and costs that a good RIA provides. If Congress insists on writing regulatory mandates into statutes, it should have an organized process for obtaining this critical information before decisions are made.

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