

231470

BEFORE THE  
SURFACE TRANSPORTATION BOARD

ENTERED  
Office of Proceedings

DEC 12 2011

Part of  
Public Record

Ex Parte No. 706  
REPORTING REQUIREMENTS FOR POSITIVE  
TRAIN CONTROL EXPENSES AND INVESTMENTS

COMMENTS OF THE  
AMERICAN CHEMISTRY COUNCIL AND  
THE CHLORINE INSTITUTE

The American Chemistry Council and the Chlorine Institute respectfully submit these comments in opposition to the proposed rule regarding the recording of costs relating to positive train control ("PTC"). The rationale for the proposed rule is that it will provide for a consistent method of recording expenses, but the proposed rule does not in fact do so. The Board has not provided any clear guidance to ensure that expenses will be recorded in a uniform, fair and consistent manner. In addition, the rule is deficient because it fails to address ways of recording benefits of PTC, including productivity benefits from operating trains with reduced headways and at increased speeds. The rule thus fails in its purpose of providing a consistent and fair way of recording the actual costs of PTC, and instead is likely to serve mainly as a pretext for railroad efforts to recover (or over-recover) their PTC costs from shippers.

I. Statement of Interest – American Chemistry Council

The American Chemistry Council ("ACC") represents the leading companies engaged in the business of chemistry. Council members apply the science of chemistry to make innovative products and services that make people's lives better, healthier and safer. The Council is committed to improved environmental, health and safety performance through Responsible Care®, common sense advocacy designed to address major public policy issues, and health and

environmental research and product testing. The business of chemistry is a \$674 billion a year enterprise and a key element of the nation's economy. It is the nation's largest exporter, accounting for 10 cents out of every dollar of U.S. exports. Chemistry companies invest more in research and development than any other business sector.

TIH products are a major segment of the products produced by ACC members. They are used for a variety of purposes that are critical to the American economy, including water purifications, emission control at electric generating facilities, crop fertilization, and the production of a wide range of consumer products.

## II. Statement of Interest – Chlorine Institute

The Chlorine Institute ("CI") is a 200-member, not-for-profit trade association of chlor-alkali producers worldwide, as well as packagers, distributors, users and suppliers. CI's North American Producer members account for more than 93 percent of the total chlorine production capacity of the U.S. and offer for transportation essentially all the chlorine moved by rail in North America. CI members ship approximately 40 percent of the TIH materials moved by rail. CI's mission is focused on the safe and secure production, transport and use of our mission chemicals which include TIH materials, chlorine and anhydrous hydrogen chloride. CI members ship and receive TIH materials via all the Class I railroads.

## III. Background – PTC Legislation and Railroad Arguments that PTC Costs Should be Borne by TIH and Passenger Traffic

ACC and CI have long supported the adoption of measures to optimize the safety of the U.S. rail system. ACC has supported legislation mandating the installation of PTC. Such legislation was enacted, but was amended prior to its passage to require installation of PTC, at least initially, only on lines carrying passenger traffic and/or TIH traffic. Ironically, the amendment that allowed railroads to save money by not installing PTC on many lines gave the

railroads a talking point to the effect that, since PTC is required only for passenger and TIH traffic, all of the costs of PTC should be borne by TIH and passenger traffic. Moreover, the railroads have claimed that, apart from a small safety benefit accruing to the public, PTC produces no benefits, either for the railroads or shippers. The reality is that PTC has substantial benefits, including benefits to the railroads, as has been made clear in cost-benefit studies conducted by L.E. Peabody & Associates, Inc. These studies, originally submitted to the Federal Railroad Administration as part of its regulatory deliberations concerning the installation of PTC, are attached hereto as appendices.<sup>1</sup> Nonetheless, despite benefits accruing to a wide range of traffic and to the railroads themselves, railroads have made clear their intention to seek to recover all of their costs of installing and maintaining PTC equipment from passenger and TIH traffic. For example, the Union Pacific stated in a submission in the U.S. Magnesium case that:

A large portion of UP's costs to install PTC is caused by UP's transportation of TIH. As a matter of economic efficiency and regulatory precedent, it is reasonable and appropriate for UP's rate to TIH shippers to reflect the PTC costs caused by TIH.<sup>2</sup>

Railroads in this proceeding have not denied that PTC may produce efficiency and productivity gains, but claim it would be difficult to measure such efficiencies, and that these efficiencies will only occur in the future. As shown below, neither of these arguments can withstand scrutiny.

---

<sup>1</sup> Critique and Evaluation of FRA's Proposed Changes to the Requirements for the Implementation of Positive Train Control. L.E. Peabody & Associates, Inc. report to Chlorine Institute, Inc. October 18, 2011. Attachment 2 hereto. Positive Train Control: Statement of Updated Total Benefits and Costs, Restatement of FRA Cost-Benefit Analysis Based on Updated FRA Benefits and Costs, and Statement of Economic Harm to TIH Shippers. L.E. Peabody & Associates, Inc. report to Chlorine Institute, Inc. May 24, 2010. Attachment 3 hereto

<sup>2</sup> Docket No. 42114, US Magnesium, LLC v. Union Pacific Railroad Co., UP Opening Evidence at 42.

The railroad strategy is clear and is likely to lead to duplicative recovery of PTC costs: (1) through direct recovery of costs via higher rates, surcharges or terms of shipment,<sup>3</sup> (2) through an increased investment base that will result in higher variable costs (and jurisdictional rate floors) in rate reasonable cases, and (3) through railroads' pocketing of the efficiency gains resulting from the installation of PTC. It is not too much to suggest that the railroads may seek to make PTC a new "profit center," just as increasing fuel costs provided an excuse for the railroads to over-recover their incremental fuel costs by imposing fuel surcharges not calibrated to reflect actual fuel cost increases. The pattern is thus familiar; the practice should not be permitted.

#### IV. Argument

##### A. The Board's Proposed Rule Provides No Meaningful Guidance on What May Be Recorded as a PTC Cost, or How Costs Should be Recorded.

As is detailed in the attached verified statement of Thomas D. Crowley and Robert D. Mulholland of L.E. Peabody & Associates, Inc. (at 7-8), the Board has not provided sufficient guidance about which PTC-related costs may be recorded, and how they should be recorded. Tellingly, different railroads have recorded the same type of investment in different sections of their PTCIP reports, and in different ways. (*Id.* at 8.) Similarly, there is no guidance about how to record expenses that may be partially attributable to PTC requirements and partly not. Messrs. Crowley and Mulholland (at 8) point to the example of PTC-equipped locomotives. It would seem absurd to categorize an entire locomotive as a PTC expense just because it has certain enhanced control features. And yet there is nothing in the Board's proposed rule that would expressly rule this out, or indeed that would provide any guidance whatsoever on the subject.

---

<sup>3</sup> ACC does not concede that any of these devices would be lawful, and will contest any unwarranted charges, just as it is currently involved in contesting railroad practices such as special handling requirements for TIH, indemnification demands, and so forth.

The Union Pacific in its petition initiating this docket justified its request to the Board as seeking consistency in the process of recording PTC expenses. UP stated that "there is no substitute for the consistency the Board could bring to the process through regulation."<sup>4</sup> But neither the UP nor the Board has offered any specific guidelines about what expenses should be recorded, or how. There seems to be an assumption on the part of the Board that it should just be obvious what are and are not PTC related expenses. But as even the limited examples cited above make clear, this sort of "I'll know it when I see it" approach does nothing more than give each railroad carte blanche to record whatever expenses it wishes, in the manner each one thinks best. It may be that regulation could provide clarity and consistency, but the proposed regulation – completely devoid of any standards – does not do so.

This sort of defective regulation would not be without cost to ACC's members, other shippers, and rail passengers. In effect, by being enshrined as "official" costs in the official R-1 report, the PTC costs recorded by railroads would have at least the presumption of legitimacy, and would effectively shift the burden of proof to shippers to show that these costs should not be allocated to them, or that costs calculated by the railroads should be adjusted. But as the Board is well aware, once costs are entered in the tangled web of the R-1, it can become very difficult to separate them back out. Although the Board states in its NPR decision (at 4) that nothing in its decision is intended to change the way costs are allocated in regulatory proceedings, it acknowledges that breaking out costs in this way may encourage carriers to seek to recover costs in individual cases. In fact, given that railroads are well aware of their costs, and more than able to present any cost data they wish in regulatory proceedings, it should be obvious that the ONLY reason railroads are seeking the proposed change to the reporting requirement is so that they can

---

<sup>4</sup> Union Pacific October 13, 2010 Petition at p. 3.

accomplish precisely such a shift in the burden of proof, enhance their ability to recover (or double recover) these costs, and use this "official" cost data to pursue their legislative and public relations agenda.

**B. The Board Should Require Railroads to Report Benefits of PTC, or At a Minimum Should Provide Additional Time for Comments on How Benefits Should be Reported**

The rail parties argue that the benefits of PTC are complicated to compute, and in any case will not accrue until after PTC is installed. Neither of these arguments is tenable. Although the precise **amount** of benefits that will accrue to railroads as a result of PTC may not be known until after PTC is installed, the types of benefits that will accrue are anything but mysterious. Several clear benefits of PTC included increasing practical line capacity by reducing headways between trains, decreasing time-dependent costs (including at least some labor costs) by operating trains at higher average speeds, with less delay time at intermediate yards, making more efficient use of equipment and labor through more precise scheduling, and very likely reducing costs or reserves for losses as a result of conducting overall safer operations.

If the point of amending the reporting requirement is to establish categories into which costs (or benefits) may be put, it would be absurd to argue that the categories cannot be created because the precise figures that will later be placed in the categories are not presently known. There is therefore no justification for the lopsided treatment of PTC costs and benefits proposed by the Board – giving the railroads carte blanche to record whatever PTC expenses they like in their official reports to the Board, while allowing railroads to pretend that they are unable to foresee the type of benefits they will realize, and should not be required to report them. This approach simply cannot withstand scrutiny.

C. The Board Should Not be a Party to Changes to Cost Reporting Rules that Will Allow Railroads to Game the System.

Even the most cursory examination of the purported benefits of the proposed rule demonstrates that something does not add up. As the Board acknowledges (NPR fn. 8), failing to adopt the proposed changes will not deprive the railroads of the ability to seek to recover legitimate PTC-related costs. Hence railroads would not actually be injured if the proposed rule were not adopted. Likewise, the benefit which UP claims to be seeking in this proceeding, *i.e.*, "consistency" through regulation, is in no way advanced by the proposed rule, because the proposed rule provides no standards that could or would ensure consistent reporting of PTC costs. For its part, the Board has cited only speculative and slight benefits such as having information on hand in case Congress at some point in the future is interested. Needless to say, Congress has the ability to subpoena information when it wants to. It is also evident that railroads can provide, and already do provide, Congress with full information about the anticipated costs of PTC implementation.

Why then are the railroads so eager to see this rule adopted? As suggested above, the railroads' only credible motive for seeking the proposed change in reporting rules is to enhance their efforts to recover costs from shippers (and to a lesser extent, from passenger carriers). A secondary motive may be to facilitate coordinated treatment of PTC costs so that they can conduct parallel efforts to recover (or double or triple recover) these costs from shippers. Lest this scenario seem paranoid or far-fetched, we need only recall how beginning a few years ago the railroads found a silver lining in the dark cloud of increasing fuel prices – it was widely perceived that they were treating fuel surcharges as a new "profit center," and calculations proved that they were often substantially over-recovering their fuel costs. In response, the Board, in its January 25, 2007 decision in Ex Parte No. 661, Rail Fuel Surcharges, made it an

unreasonable practice for railroads to engage in behavior including “double dipping,” i.e., applying to the same traffic both a fuel surcharge and a rate increase that is based on a cost index that includes a fuel cost component. In announcing the decision, Chairman Nottingham said that “This new rule will preclude [railroads] from selectively imposing surcharges in a manner that bears little relationship to actual fuel use. It will also remove the possibility that railroads will view fuel surcharges as a profit center.”<sup>5</sup>

Nothing in the Board's proposed rule would help to ensure that the railroads do not engage in the same type of behavior regarding PTC costs. The proposed rule has no meaningful standards about what costs can be recorded, how they should be recorded, or what uses railroads may make of the information recorded under the proposed rule. Nor does the proposed rule make any effort to require the reporting of benefits, even though the types of benefits that will accrue from PTC may be anticipated with reasonable certainty. Given the non-existent, or at most slight and speculative benefits of adopting the rule, the danger of a repetition of the fuel surcharge experience – in which railroads double or triple recover their costs -- is manifest.

#### V. Conclusion

Before approving a reporting change that is at best vague, and at worst poorly considered, the Board should think through the possible consequences. Preferably, the Board will decide that the slight or non-existent benefits of the rule do not justify any change, and will simply withdraw the rule. If it does not withdraw the rule, the Board should at a minimum establish standards to prevent the new rule from being misused, and should in addition ask parties to supplement the

---

<sup>5</sup> STB news release 07-06 (January 26, 2007) concerning decision in Ex Parte No. 661, Rail Fuel Surcharges. Available on STB web site: <http://www.stb.dot.gov/newsrels.nsf/13c1d2f25165911f8525687a00678fa7/606420c7f58066458525726f0059a591?OpenDocument>

record on the issue of the reporting of benefits, so that net costs (after offsetting the benefits) can be calculated.

Respectfully submitted:

A handwritten signature in black ink, appearing to read "S. N. Stone", written over a horizontal line.

Paul M. Donovan  
LaRoe, Winn, Moerman & Donovan  
1250 Connecticut Avenue, NW, Suite 200  
Washington, DC 20036

Counsel for the Chlorine Institute

Scott N. Stone  
Patton Boggs, LLP  
2550 M Street, NW  
Washington, DC 22037

Counsel for the American  
Chemistry Council

filed: December 12, 2011

**CERTIFICATE OF SERVICE**

I hereby certify that I have, this 12th day of December, 2011, served copies of the foregoing comments, and the attachments thereto, by email (with consent) upon counsel for PPG Industries and The Fertilizer Institute, and by first class mail upon the following counsel:

Michael L. Rosenthal  
Covington & Burling  
1201 Pennsylvania Avenue, NW  
Washington, DC 20004

Counsel for Union Pacific Railroad Company

Daniel G. Kruger  
Law Department  
Norfolk Southern Corporation  
Three Commercial Place  
Norfolk, VA 23510-9241

Counsel for Norfolk Southern Railway Company

Terence M. Hynes  
Sidley Austin LLP  
1501 K Street, NW  
Washington, DC 20005

Counsel for Canadian Pacific Railway Company

A handwritten signature in black ink, appearing to read "S. N. Stone", written over a horizontal line.

Scott N. Stone

**BEFORE THE  
SURFACE TRANSPORTATION BOARD**

---

	)	
	)	
	)	
	)	
<b>REPORTING REQUIREMENTS</b>	)	
<b>FOR POSITIVE TRAIN CONTROL</b>	)	<b>DOCKET NO. EP 706</b>
<b>EXPENSES AND INVESTMENTS</b>	)	
	)	
	)	
	)	
	)	

---

**Verified Statement**

**Of  
Thomas D. Crowley  
President**

**And  
Robert D. Mulholland  
Vice President**

**L.E. Peabody & Associates, Inc.**

**On Behalf Of  
American Chemistry Council**

**Filed: December 12, 2011**

TABLE OF CONTENTS

PAGE

<b>I. INTRODUCTION.....</b>	<b>1</b>
<b>II. SUMMARY AND FINDINGS .....</b>	<b>4</b>
<b>III. THE CLASS I RAILROADS INTEND TO ALLOCATE PTC IMPLEMENTATION COSTS TO THE MOVEMENTS OF TIH/PIH COMMODITIES.....</b>	<b>6</b>
<b>A. THROUGH EP 706, THE CLASS I RAILROADS SEEK TO DEVELOP     A STANDARD PROCESS TO IDENTIFY AND REPORT PTC     IMPLEMENTATION COSTS TO THE STB .....</b>	<b>6</b>
<b>B. A STANDARD SYSTEM OF PTC RELATED BOOK KEEPING     SHOULD BE DEVELOPED BEFORE PTC RELATED     ACCOUNTING CAN BE REQUIRED .....</b>	<b>7</b>
<b>C. PTC SPECIFIC R-1 EXPENDITURE REPORTING WILL     FACILITATE THE RAILROADS' EFFORT TO ALLOCATE PTC     IMPLEMENTATION COSTS TO SHIPPERS     OF TIH/PIH COMMODITIES .....</b>	<b>9</b>
<b>IV. TIH/PIH SHIPPERS WILL PAY DOUBLE FOR PTC IMPLEMENTATION .....</b>	<b>11</b>
<b>A. COST ALLOCATION CAN BE ARBITRARY, SO SHIPPERS     MAY PAY COSTS THAT ARE NOT ATTRIBUTABLE     TO THEIR SHIPMENTS .....</b>	<b>11</b>
<b>B. PTC IMPLEMENTATION COSTS WILL BE ROLLED INTO THE     CLASS I RAILROADS' INVESTMENT BASES THAT ARE USED     TO SET MAXIMUM REASONABLE RATES.....</b>	<b>12</b>
<b>V. THE CLASS I RAILROADS WILL BENEFIT FROM PTC IMPLEMENTATION .....</b>	<b>14</b>
<b>A. THE CLASS I RAILROADS OPPOSE THE DEVELOPMENT OF A     STANDARD PROCESS TO IDENTIFY, REPORT AND ALLOCATE     PTC IMPLEMENTATION BENEFITS TO SHIPPERS OF TIH/PIH     COMMODITIES .....</b>	<b>14</b>
<b>B. PTC RELATED EFFICIENCY BENEFITS COULD BE IDENTIFIED     AND QUANTIFIED ON AN ON-GOING BASIS.....</b>	<b>15</b>

**LIST OF EXHIBITS**

<b><u>EXHIBIT NO.</u></b> (1)	<b><u>TITLE</u></b> (2)
1	Thomas D. Crowley's Statement of Qualifications
2	Robert D. Mulholland's Statement of Qualifications

## I. INTRODUCTION

We are Thomas D. Crowley and Robert D. Mulholland, economists and President and a Vice President, respectively, of L. E. Peabody & Associates, Inc., an economic consulting firm that specializes in solving economic, transportation, marketing, financial, accounting and fuel supply problems. Copies of our credentials are included as Exhibit No. 1 and Exhibit No. 2 to this Verified Statement .

On October 13, 2011, the Surface Transportation Board (“STB” or “Board”) issued a Notice of Proposed Rulemaking (“NPRM”) in Docket No. EP 706. The NPRM proposes to amend reporting rules to require Class I rail carriers to identify information on capital and operating expenditures for Positive Train Control (“PTC”) and to identify those expenses in the railroads’ Annual Report Form R-1’s so that they can be viewed both as component parts of and separately from other capital investments and expenses. Specifically, the STB is proposing to adopt supplemental schedules to the Annual Report Form R-1 and require financial disclosure with respect to PTC specific costs. We have been requested by the American Chemistry Council (“ACC”) to address certain portions of the proposed rule in this proceeding.

PTC is an automated system designed to prevent train-to-train collisions and other accidents. Rail carriers with traffic routes that carry passengers and/or hazardous toxic-by-inhalation (TIH) or poisonous-by-inhalation (PIH) materials, as so designated under federal regulation, must implement PTC pursuant to The Rail Safety Improvement Act of 2008 (“RSIA”). Under RSIA, the Class I railroads must complete implementation of PTC

systems by December 31, 2015.<sup>1</sup> To meet this deadline, the railroads have already begun implementing the required systems.

Following current reporting requirements, PTC expenditures are incorporated into the Annual Report Form R-1's but are not indentified separately from other capital or operating expenditures. The STB's proposed rule, which is supported by the railroads, would require Class I carriers to separately identify PTC expenditures in their Annual Report Form R-1's.<sup>2</sup> However, the Board's proposed rule does not include a comparable, offsetting reporting mechanism for tracking PTC-related benefits, citing a lack of ability to identify the productivity gains attributable to PTC deployment.

The Federal Railroad Administration ("FRA") estimates that the total system cost for PTC implementation and maintenance over a 20-year time horizon is expected to be approximately \$8.9 billion.<sup>3</sup> The Class I railroads estimate that total costs to railroads to install and maintain PTC could be as much as \$13.2 billion over 20 years. By either measure, the costs are significant. Having a process in place to identify and quantify PTC costs will facilitate the railroads' effort to allocate PTC implementation costs to TIH/PIH shippers either through rate increases or a surcharge mechanism.

Several independent parties, including the FRA, project that significant operational and other business benefits are likely to accrue to the railroads as a result of

---

<sup>1</sup> The RSIA requires each Class I railroad and each entity providing regularly scheduled intercity or commuter rail passenger transportation to implement PTC on: 1) main line tracks over which intercity rail passenger transportation or commuter rail passenger transportation, as defined in section 24102, is regularly provided; 2) main line track over which PIH or TIH hazardous materials as defined in 49 CFR parts 171.8, 173.115, and 173.132 are transported; and 3) such other tracks as the Secretary may prescribe by regulation or order. *See*: 49 U.S.C. 20157

<sup>2</sup> The proposed rule does not include any modification to the Uniform System of Accounts to explicitly define PTC expenses and assets.

<sup>3</sup> Federal Register, Vol. 75, No. 10, Friday, January 15, 2010, Proposed Rules and Federal Register, Vol. 76, No. 164, Wednesday, August 24, 2011, Proposed Rules.

PTC system implementation.<sup>4</sup> The railroads oppose developing a system to track, record, and monitor the benefits accruing as a result of PTC implementation, and cite uncertainties with respect to how the benefits might be measured and/or when they will be realized as reasons for their position on the issue.<sup>5</sup> There are several mechanisms by which these benefits could be identified and quantified on an ongoing basis either by modifying existing performance reporting activities or developing new performance measures and initiating new data recording and reporting activities. Our testimony expands on the above under the following topical headings:

- II. Summary And Findings
- III. The Class I Railroads Intend To Allocate PTC Implementation Costs To The Movements Of TIH/PIH Commodities
- IV. TIH/PIH Shippers Will Pay Double For PTC Implementation
- V. The Class I Railroads Will Benefit From PTC Implementation

---

<sup>4</sup> Id.

<sup>5</sup> Union Pacific Railroad Company's Reply to PPG Industries Request to Expand the Scope of Proposed Rulemaking Proceeding to Adopt Reporting Requirements for Positive Train Control ("UP's Reply"), Docket No. EP 706, January 21, 2011.

## **II. SUMMARY AND FINDINGS**

The railroads are incurring significant costs to implement PTC systems required by Congress under the RSIA. The railroads view TIH materials as the reason for the PTC requirements, and have expressed an intent to target TIH shippers in an effort to recover their PTC-related costs. In this proceeding, the railroads seek to develop a uniform, regulated process by which they can isolate a specific category of expenditure reporting and use that report as the basis for levying targeted rate increases or surcharges on TIH traffic.

In addition, the railroads' PTC related expenses will increase the railroads' investment base reflected in the railroads' Uniform Railroad Costing System ("URCS") variable costs, which are used to establish maximum lawful rates for regulated traffic under the Board's maximum reasonable rate standards.

From an economic perspective, TIH shippers will be harmed several ways. First, the railroads will attempt to recover their PTC investment by directly targeting TIH shippers for the costs of PTC installation even though all shippers will benefit, to some extent, from PTC. Second, the railroads will recover their PTC investment, in part, through higher regulated rates, including regulated rates for TIH shippers. This means that even those shippers that seek rate relief from the STB due to excessively high rail rates imposed by railroads for recovering PTC costs, will still end-up paying the costs of PTC investment. The railroads will essentially be "double-recovering" their PTC investments.

The railroads and the Board must acknowledge that efficiency and productivity benefits will result from PTC implementation. Although these benefits will accrue over time and may not be as easily discernable as the costs of implementing PTC systems, these benefits are measurable using simple standard metrics. The Board must guard against developing a reporting system that allows

the railroads to pass all of their costs through to captive shippers while retaining all of the related efficiency and productivity gains.

Finally, many costs incurred by the railroads for equipment that is not principally PTC-related could be construed to be PTC expenditures if specific, uniform standards for allocating costs to PTC-related accounts are not developed and vetted.

**III. THE CLASS I RAILROADS INTEND TO  
ALLOCATE PTC IMPLEMENTATION COSTS  
TO THE MOVEMENTS OF TIH/PIH COMMODITIES**

TIH/PIH materials are used across the country for a wide variety of industrial and commercial purposes. As the railroads themselves acknowledged in their Congressional testimony, “[t]he majority of TIH materials are consumed in non-discretionary circumstances such as water purification, crop fertilization, and the operation of coal-fired power plants.”<sup>6</sup>

**A. THROUGH EP 706, THE CLASS I RAILROADS  
SEEK TO DEVELOP A STANDARD PROCESS  
TO IDENTIFY AND REPORT PTC  
IMPLEMENTATION COSTS TO THE STB**

The Class I railroads have spent and will spend significant capital to deploy PTC systems on much of their rail networks in the short term. The railroads will upgrade or replace signal systems, locomotive equipment, and computer hardware and software. The railroads were required to file PTC Implementation Plans (“PTCIP”) with FRA by April 16, 2010. Each PTCIP includes the sequence and schedule in which track segments required to be equipped with PTC will be so equipped, and the basis for those decisions.<sup>7</sup> Railroads have the option to file a request for amendment (“RFA”) of their PTCIP’s before December 31, 2015.

In its October 13, 2010 petition to the STB in this proceeding, the Union Pacific Railroad Company (“UP”) proposed additional PTC-related reporting requirements. UP stated that:

“[u]nless the Board establishes these requirements early in the PTC implementation process, it may be unable to account accurately for PTC costs in pursuing its general industry oversight responsibilities and specific regulatory initiatives,

---

<sup>6</sup> Public Hearing Notice of Proposed Rulemaking for Positive Train Control Systems, Docket No.FRA-2008-0132, August 13, 2009, transcript Page 42 line 7.

<sup>7</sup> See 49 CFR 236.1011.

such as improving the Uniform Rail Costing System ("URCS") to better reflect the costs associated with transporting Toxic Inhalation Hazards ("TIH").<sup>8</sup>

Specifically, UP proposed creating "PTC versions" of several existing schedules in the Annual Report Form R-1 that are currently submitted to the Board that would be "used to report information relating to PTC-specific investment, expenses, and operating statistics."<sup>9</sup> UP proposed that the PTC versions of these schedules would "contain the same accounts as the current version, but the dollar amounts reported would reflect the amounts attributable to PTC."<sup>10</sup> Canadian Pacific Railway Company ("CP")<sup>11</sup> and Norfolk Southern Railway Company ("NS")<sup>12</sup> filed reply comments in support of UP's proposal to initiate a rulemaking to create new "PTC specific" reporting requirements but did not offer any specific suggestions on the structure or contents of the new reporting requirements or process.

**B. A STANDARD SYSTEM OF PTC RELATED BOOK KEEPING SHOULD BE DEVELOPED BEFORE PTC RELATED ACCOUNTING CAN BE REQUIRED**

The STB's EP 706 NRPM states that "UP has proposed a viable approach...to supplement the R-1 reports and capture [PTC costs]."<sup>13</sup> The Board then largely adopts UP's suggestions and proposes a "PTC Supplement" that consists of PTC versions of Schedules 330 (road property and equipment improvements), 332 (depreciation base and rates – road property and equipment), 335 (accumulated depreciation), 352B (investment in railway property), 410 (railway operating expenses), 700 and 720 (aggregate mileage on which PTC is installed) and 710 (number of

---

<sup>8</sup> Petition of Union Pacific Railroad Company to Institute a Rulemaking Proceeding to Adopt Reporting Requirements for Positive Train Control ("UP Petition"), Docket No. EP706, p. 1.

<sup>9</sup> Id. p. 11.

<sup>10</sup> Id.

<sup>11</sup> Reply of Canadian Pacific Railway Company in Support of Petition to Institute Rulemaking Proceeding ("CP Reply"), Docket No. EP 706, November 2, 2010.

<sup>12</sup> Reply Comments of Norfolk Southern Railway ("NS Reply"), Docket No. EP706, November 24, 2010.

<sup>13</sup> Surface Transportation Board, Notice of Proposed Rulemaking, Docket No. EP 706, October 13, 2011, p. 7.

locomotives equipped with PTC). Though the Board states that the responding entity should separate “capital expenses and operating expenses incurred by the railroad for PTC”<sup>14</sup> it does not offer any specific guidance on how that separation should be made. This lack of specificity is likely to lead to inconsistent data reporting. For example, a railroad that purchases a PTC-equipped locomotive may consider the entire purchase price for the locomotive to be a PTC-related expense, whereas another railroad may back out a PTC-related premium for the PTC equipment on the locomotive and consider the majority of the purchase price to be non-PTC-related. UP recognized the importance of uniform reporting<sup>15</sup> in its October 13, 2010 Petition when it noted that there “is no substitute for the consistency the Board could bring to the process through regulation.”<sup>16</sup>

The railroads have been inconsistent in their reporting format and level of detail in their filed PTCIP’s.<sup>17</sup> Consider, for example, the section on “Wayside Devices”. In a sample of PTCIP’s, we found the following: In BNSF Railway Company’s (“BNSF”) PTCIP, wayside devices are included in Section 10. That section does not contain a schedule but does list the number of devices per subdivision. In UP’s PTCIP, “Wayside Devices” are included in Section 9. That section contains a detailed list of devices and the schedule for installation. In NS’s PTCIP, wayside devices are in Section 10. NS indicates the total number of devices only and refers to the general schedule section. In CSX Transportation’s (“CSXT”) PTCIP, wayside devices are in Section 9, which is mostly redacted. The railroads clearly have different approaches and philosophies to PTC-related reporting.

---

<sup>14</sup> Surface Transportation Board, Notice of Proposed Rulemaking, Docket No. EP 706, October 13, 2011, p. 8.

<sup>15</sup> However, the UP did not propose and the STB did not specify any changes to the railroads’ system of accounts to insure that reporting was consistently accounted for by all Class I railroads

<sup>16</sup> UP Petition, p. 3.

<sup>17</sup> The railroads also have been inconsistent in their determinations about which information in the PTCIP’s is confidential.

**C. PTC-SPECIFIC R-1 EXPENDITURE REPORTING  
WILL FACILITATE THE RAILROADS' EFFORT  
TO ALLOCATE PTC IMPLEMENTATION COSTS  
TO SHIPPERS OF TIH/PIH COMMODITIES**

The Class I railroads view PTC installation as an unfunded mandate, and have called on Congress to consider various funding mechanisms to offset PTC investment, including a 25 percent infrastructure tax incentive and a fully funded Rail Safety Technology Grant Program.<sup>18</sup> The railroads now seek to change the reporting requirements to separately identify PTC expenditures in the railroads' Annual Report Form R-1 filed with the STB.

The railroads will attempt to recover mandated PTC investments as quickly and as efficiently as possible given the limitations placed on them by the market and industry regulators. Left unchecked, there is little doubt that the railroads will attempt to exploit their most vulnerable customers to recover their PTC investment. From a general sense, this would include all captive railroad shippers, because those shippers have little recourse against a railroad's monopoly power on a captive movement.<sup>19</sup> From a more focused position however, the railroads have stated that they will attempt to recover their investment directly from the shippers the railroads view as being responsible for the requirement to install PTC, namely TIH/PIH shippers.<sup>20</sup>

---

<sup>18</sup> "The ABCs of PTC: A Primer on Positive Train Control & Implications for the Rails," Citi Investment Research & Analysis, February 22, 2010.

<sup>19</sup> The STB defines captive locations as those rail served locations without effective intramodal or intermodal competition. In other words, those locations that are not served by two or more railroads (intramodal competition) or can be economically served by another mode of transportation such as truck, barge or pipeline (intermodal competition).

<sup>20</sup> For example, consider the comments of Mark Schulze, BNSF Railway's Vice President of Safety, Training, and Operation Support, at the August 13, 2009, Public Hearing on the PTC NPRM in Docket Number: FRA-2008-0132. "In several recent hearings, the Surface Transportation Board has recognized that there are substantial and unique costs associated with the transportation of toxic inhalant materials ranging from the additional cost elements such as equipment and facility investment associated with PTC to huge potential and largely uninsurable liability risk associated with such movements. Those TIH/PIH costs will likely continue to increase in the future, especially if the RSIA mandates are not carefully represented in regulation. Those costs require significant up-front investment which will initially be borne by railroads. In order to remain economically viable, the railroads must look to their rail shippers to contribute to these mandatory expenditures." (Page 38-39 at line 12.)

In its evidence filed in *US Magnesium*,<sup>21</sup> UP stated that because the majority of PTC implementation is due to the transportation of TIH materials, TIH shippers should bear the cost of the installation. As indicated by the UP:

“A large portion of UP’s costs to install PTC is caused by UP’s transportation of TIH. As a matter of economic efficiency and regulatory precedent, it is reasonable and appropriate for UP’s rates to TIH shippers to reflect the PTC costs caused by TIH...”

\*\*\*\*

“In short, if UP did not transport TIH, its costs to install PTC would be substantially lower than the approximately \$1.4 billion that will actually be required to install PTC.”

\*\*\*\*

“That is, UP is incurring substantial PTC costs to provide service to TIH traffic, and it would not be incurring those costs if it were not providing that service. Thus, he [Dr. Marius Schwartz] concludes that it is reasonable and appropriate to allow railroads an opportunity to charge higher rates to TIH shippers than to shippers of other freight in order to recover PTC costs.”<sup>22</sup>

UP’s position is clear in that it places the burden of having to install the majority of its PTC infrastructure on TIH shippers. CP echoed this position in its reply in support of UP’s petition in this proceeding when it stated “[t]he Board should grant the Petition to ensure that it (and parties to future proceedings) have sufficient data to account for the full costs of TIH traffic in the Uniform Rail Costing System (“URCS”).”<sup>23</sup> It is equally as clear that UP, CP, and presumably all the Class I railroads, will attempt to recoup a large portion, of PTC costs through higher rates to TIH shippers.

---

<sup>21</sup> Docket No. 42114, *US Magnesium, L.L.C. v. Union Pacific Railroad Company*, served August 24, 2009 (“*US Magnesium*”)

<sup>22</sup> Source: UP Opening Evidence in *US Magnesium*, pages 42 and 43 (internal quotations omitted).

<sup>23</sup> CP Reply, p. 4.

#### **IV. TIH/PIH SHIPPERS WILL PAY DOUBLE FOR PTC IMPLEMENTATION**

FRA included approximately \$4.1 billion on a net present value basis in capital investment costs to install PTC in its 2010 Final Rule Regulatory Impact Analysis (“RIA”). This figure, when accounting for the impact of discounting, is virtually the same as the figures presented by the railroads in their most recent SEC filings about the costs to install PTC systems. To directly tie to the costs, the railroad companies are indicating to the investment community and, by extension, their shipping communities, that the railroads have relied upon these figures to estimate the costs expected to be the responsibility of TIH shippers.

##### **A. COST ALLOCATION CAN BE ARBITRARY, SO SHIPPERS MAY PAY COSTS THAT ARE NOT ATTRIBUTABLE TO THEIR SHIPMENTS**

Because the Congressional mandate requires PTC along main line railroad segments that carry TIH commodities and/or passenger traffic, it is necessary to allocate the costs between those rail lines that will exclusively carry TIH commodities, those carrying passenger traffic but not TIH traffic and rail lines carrying both TIH and passengers. In its testimony in *US Magnesium*, the UP allocated 100 percent of its PTC investment to TIH shippers on the line segments where only TIH shipments occurred, e.g., no passenger traffic. On those segments where TIH traffic and Amtrak traffic would share the UP right of way, UP assumed 75 percent of the costs would be allocated to TIH traffic and 25 percent to Amtrak.<sup>24</sup>

UP indicated in its *US Magnesium* filings that its approach provides an extremely conservative estimate of costs sharing between TIH shippers and passenger rail traffic. This is

---

<sup>24</sup> There are also rail lines covered by the PTC mandate that transport TIH traffic and passenger traffic other than that carried by Amtrak, including primarily commuter rail lines. This amount of track miles is extremely small when compared against the TIH only traffic and TIH and Amtrak combined traffic segments.

because based on Amtrak's 2010 Grant and Legislative Request, Amtrak is only requesting funds to pay the costs to install PTC on Amtrak-owned track and on its own locomotives, and to not contribute to PTC costs where it is the tenant railroad.<sup>25</sup>

As indicated by the UP in its filings in *US Magnesium*, the railroads look at TIH traffic as the cause of the PTC investment requirements, and will attempt to recover these costs from the TIH shippers. The railroads attempt to recover this cost, notwithstanding the PTC benefits to the railroads and other shippers, will directly impact and harm TIH shippers as they will absorb much of the costs and only a small portion of the benefits.

**B. PTC IMPLEMENTATION COSTS WILL BE ROLLED INTO THE CLASS I RAILROADS' INVESTMENT BASES THAT ARE USED TO SET MAXIMUM REASONABLE RATES**

Besides directly recovering their investment costs from TIH shippers by charging them higher rates, current or future TIH shippers with rates set under the STB's regulatory procedures will be impacted by the railroads' PTC investment.

One way to regulate rates based on the concept of return on investment equaling the cost of capital is to ensure the rates charged by the company do not produce a rate of return that is greater than the companies' cost of capital. Under this rate of return type of regulation, as a company's invested capital declines, its regulated rates or prices should decline holding all else constant. This is because as the amount invested declines, the amount of return needed to generate a sufficient return on the assets also declines. On the other hand, if a company's investment increases, its prices or rates should increase as the rate of required return will increase as the company now has a larger investment to recoup. Because the railroads' PTC investment will roll into their investment

---

<sup>25</sup> National Railroad Passenger Corporation FY 2010 Grant and Legislative Request.

bases, they will be allowed to obtain a return on this investment in regulatory proceedings, which will force increases in regulated rates.

The most direct way the PTC impact will occur is in the calculation of the STB's URCS variable costs. URCS is the STB's general purpose costing system and is used in a number of STB regulated proceedings, including the testing and setting of reasonable rail rates. Under the STB's methodologies, rate reasonableness is established as a ratio of movement's revenue to URCS variable costs ("R/VC ratio").<sup>26</sup> This means regulated rates will change over time as the underlying URCS variable costs change. With PTC investment increasing the size of the railroads' investment base and thereby increasing their allowed return, the URCS variable costs, which includes return on and of investment as well as operating expense components, will also increase. In this way, rates on regulated TIH traffic (and other regulated traffic) will increase with the installation of PTC.

From an economic perspective, TIH shippers will be getting harmed from several directions. First, the railroads will attempt to recover their PTC investment by directly targeting TIH shippers for the costs of PTC installation. Second, the railroads will recover their PTC investment, in part, through higher regulated tariff rates, including regulated tariff rates for TIH shippers. This means that even those shippers that seek rate relief from the STB due to excessively high rail rates imposed by railroads for recovering PTC costs, will still end-up paying the costs of PTC investment. The railroads will essentially be "double-recovering" their PTC investments.

---

<sup>26</sup> Depending upon the size of the case and the amount of relief being sought, one of three different approaches may be used to develop the regulated rates. In all cases, the rate is eventually determined by an R/VC ratio. See STB Ex Parte No. 657 (Sub-No. 1), *Major Issues in Rail Rate Cases*, served October 30, 2006 and STB Ex Parte No. 646 (Sub-No. 1), *Simplified Standards For Rail Rate Cases*, served September 4, 2007.

## **V. THE CLASS I RAILROADS WILL BENEFIT FROM PTC IMPLEMENTATION**

As shown in numerous reports there is no doubt that the Class I railroads will receive substantial benefits from the installation of PTC beyond the primary benefits of risk mitigation. For example, in 2010<sup>27</sup> and 2011,<sup>28</sup> the FRA issued rules regarding PTC and in doing so, calculated of the costs *and benefits* of nationwide implementation of PTC systems.<sup>29</sup>

### **A. THE CLASS I RAILROADS OPPOSE THE DEVELOPMENT OF A STANDARD PROCESS TO IDENTIFY, REPORT AND ALLOCATE PTC IMPLEMENTATION BENEFITS TO SHIPPERS OF TIH/PIH COMMODITIES**

On January 18, 2011, PPG Industries, Inc. (“PPG”) filed comments in opposition to UP’s petition to initiate this rulemaking. PPG argued that a requirement for separate expenditure reporting should be accompanied by a reporting requirement that tracks any benefits of PTC, including economic benefits from increased efficiencies on the lines that have PTC installed. PPG also requested that the STB should initiate a process to gather data on any efficiency gains caused by PTC on lines that do not have PTC installed.

On January 21, 2011, UP responded to PPG’s filing stating that it opposes broadening this proceeding to address benefits reporting<sup>30</sup> on the basis that it would add complications and delay. UP argued that while its PTC installation costs are measurable and occurring in the present, benefits from installing PTC will occur in the future, and will be speculative and complex by

---

<sup>27</sup> See Federal Register, Vol. 75, No. 10, Friday, January 15, 2011, Proposed Rules, pp. 2598-2606.

<sup>28</sup> See Federal Register, Vol. 76, No. 164, Wednesday, August 24, 2011, Proposed Rules, pp. 52918-52929.

<sup>29</sup> As we stated in our November 11, 2011 report to the Chlorine Institute, we believe FRA’s approach to quantifying the costs and benefits is theoretically and mechanically inadequate. Nonetheless, we agree that costs and benefits can be calculated.

<sup>30</sup> UP stated that it would not object to a separate rulemaking to address the benefits of PTC.

nature. UP also pointed out that PPG does not dispute that railroads are incurring substantial costs to implement PTC.

**B. PTC RELATED EFFICIENCY BENEFITS  
COULD BE IDENTIFIED AND QUANTIFIED ON  
AN ON-GOING BASIS**

One methodology for estimating PTC-related benefits would be to initiate a process to split currently reported universal performance measures into two subsets: segments with PTC installed and segments without PTC installed. The relative changes in performance measures between the two groups could then be used to tease out productivity gains attributable to PTC. For example, all seven Class I railroads report cars on line (by owner and type), average train speed (by train type), and terminal dwell times (for the entire system and major yards) on a weekly basis on the Railroad Performance Measures website.<sup>31</sup>

Alternatively, new measures could be developed for segments with PTC installed and segments without PTC installed. The new measures would be designed to assess the extent to which widespread implementation of PTC and related sophisticated train management software allows more efficient use of equipment and personnel. Useful performance measures could include car-miles per locomotive unit mile, carloads per train start, or carloads per crew start.

Using these metrics to develop relative efficiency and productivity changes on segments with PTC systems installed versus segments without PTC systems installed would create an indicator of the extent to which PTC deployment improved a railroad's efficiency, reduced the railroad's operating costs, and increased the railroad's profits.

---

<sup>31</sup> <http://www.railroadpm.org/> accessed December 5, 2011.





**STATEMENT OF QUALIFICATIONS**

My name is Thomas D. Crowley. I am an economist and President of the economic consulting firm of L. E. Peabody & Associates, Inc. The firm's offices are located at 1501 Duke Street, Suite 200, Alexandria, Virginia 22314, 760 E. Pusch View Lane, Suite 150, Tucson, Arizona 85737, and 21 Founders Way, Queensbury, New York 12804.

I am a graduate of the University of Maine from which I obtained a Bachelor of Science degree in Economics. I have also taken graduate courses in transportation at George Washington University in Washington, D.C. I spent three years in the United States Army and since February 1971 have been employed by L. E. Peabody & Associates, Inc.

I am a member of the American Economic Association, the Transportation Research Forum, and the American Railway Engineering and Maintenance-of-Way Association.

The firm of L. E. Peabody & Associates, Inc. specializes in analyzing matters related to the rail transportation of all commodities. As a result of my extensive economic consulting practice since 1971 and my participation in maximum-rate, rail merger, service disputes and rule-making proceedings before various government and private governing bodies, I have become thoroughly familiar with the rail carriers that move coal over the major coal routes in the United States. This familiarity extends to subjects of railroad service, costs and profitability, cost of capital, railroad capacity, railroad traffic prioritization and the structure and operation of the various contracts and tariffs that historically have governed the movement of traffic by rail.

### **STATEMENT OF QUALIFICATIONS**

As an economic consultant, I have organized and directed economic studies and prepared reports for railroads, freight forwarders and other carriers, for shippers, for associations and for state governments and other public bodies dealing with transportation and related economic problems. Examples of studies I have participated in include organizing and directing traffic, operational and cost analyses in connection with multiple car movements, unit train operations for coal and other commodities, freight forwarder facilities, TOFC/COFC rail facilities, divisions of through rail rates, operating commuter passenger service, and other studies dealing with markets and the transportation by different modes of various commodities from both eastern and western origins to various destinations in the United States. The nature of these studies enabled me to become familiar with the operating practices and accounting procedures utilized by railroads in the normal course of business.

Additionally, I have inspected and studied both railroad terminal and line-haul facilities used in handling various commodities, including unit train coal movements from coal mine origins in the Powder River Basin and in Colorado to various utility destinations in the eastern, mid-western and western portions of the United States and from the Eastern coal fields to various destinations in the Mid-Atlantic, northeastern, southeastern and mid-western portions of the United States. These operational reviews and studies were used as a basis for the determination of the traffic and operating characteristics for specific movements of numerous commodities handled by rail.

### **STATEMENT OF QUALIFICATIONS**

I have frequently been called upon to develop and coordinate economic and operational studies relative to the rail transportation of various commodities. My responsibilities in these undertakings included the analyses of rail routes, rail operations and an assessment of the relative efficiency and costs of railroad operations over those routes. I have also analyzed and made recommendations regarding the acquisition of railcars according to the specific needs of various shippers. The results of these analyses have been employed in order to assist shippers in the development and negotiation of rail transportation contracts which optimize operational efficiency and cost effectiveness.

I have developed property and business valuations of privately held freight and passenger railroads for use in regulatory, litigation and commercial settings. These valuation assignments required me to develop company and/or industry specific costs of debt, preferred equity and common equity, as well as target and actual capital structures. I am also well acquainted with and have used the commonly accepted models for determining a company's cost of common equity, including the Discounted Cash Flow Model ("DCF"), Capital Asset Pricing Model ("CAPM"), and the Farma-French Three Factor Model.

Moreover, I have developed numerous variable cost calculations utilizing the various formulas employed by the Interstate Commerce Commission ("ICC") and the Surface Transportation Board ("STB") for the development of variable costs for common carriers,

### **STATEMENT OF QUALIFICATIONS**

with particular emphasis on the basis and use of the Uniform Railroad Costing System (“URCS”) and its predecessor, Rail Form A. I have utilized URCS/Rail form A costing principles since the beginning of my career with L. E. Peabody & Associates Inc. in 1971.

I have frequently presented both oral and written testimony before the ICC, STB, Federal Energy Regulatory Commission, Railroad Accounting Principles Board, Postal Rate Commission and numerous state regulatory commissions, federal courts and state courts. This testimony was generally related to the development of variable cost of service calculations, rail traffic and operating patterns, fuel supply economics, contract interpretations, economic principles concerning the maximum level of rates, implementation of maximum rate principles, and calculation of reparations or damages, including interest. I presented testimony before the Congress of the United States, Committee on Transportation and Infrastructure on the status of rail competition in the western United States. I have also presented expert testimony in a number of court and arbitration proceedings concerning the level of rates, rate adjustment procedures, service, capacity, costing, rail operating procedures and other economic components of specific contracts.

Since the implementation of the Staggers Rail Act of 1980, which clarified that rail carriers could enter into transportation contracts with shippers, I have been actively

**STATEMENT OF QUALIFICATIONS**

involved in negotiating transportation contracts on behalf of shippers. Specifically, I have advised shippers concerning transportation rates based on market conditions and carrier competition, movement specific service commitments, specific cost-based rate adjustment provisions, contract reopeners that recognize changes in productivity and cost-based ancillary charges.

I have been actively engaged in negotiating coal supply contracts for various users throughout the United States. In addition, I have analyzed the economic impact of buying out, brokering, and modifying existing coal supply agreements. My coal supply assignments have encompassed analyzing alternative coals to determine the impact on the delivered price of operating and maintenance costs, unloading costs, shrinkage factor and by-product savings.

I have developed different economic analyses regarding rail transportation matters for over sixty (60) electric utility companies located in all parts of the United States, and for major associations, including American Paper Institute, American Petroleum Institute, Chemical Manufacturers Association, Coal Exporters Association, Edison Electric Institute, Mail Order Association of America, National Coal Association, National Industrial Transportation League, North America Freight Car Association, the Fertilizer Institute and Western Coal Traffic League. In addition, I have assisted numerous government agencies, major industries and major railroad companies in solving various transportation-related problems.

### **STATEMENT OF QUALIFICATIONS**

In the two Western rail mergers that resulted in the creation of the present BNSF Railway Company and Union Pacific Railroad Company and in the acquisition of Conrail by Norfolk Southern Railway Company and CSX Transportation, Inc., I reviewed the railroads' applications including their supporting traffic, cost and operating data and provided detailed evidence supporting requests for conditions designed to maintain the competitive rail environment that existed before the proposed mergers and acquisition. In these proceedings, I represented shipper interests, including plastic, chemical, coal, paper and steel shippers.

I have participated in various proceedings involved with the division of through rail rates. For example, I participated in ICC Docket No. 35585, *Akron, Canton & Youngstown Railroad Company, et al. v. Aberdeen and Rockfish Railroad Company, et al.* which was a complaint filed by the northern and mid-western rail lines to change the primary north-south divisions. I was personally involved in all traffic, operating and cost aspects of this proceeding on behalf of the northern and mid-western rail lines. I was the lead witness on behalf of the Long Island Rail Road in ICC Docket No. 36874, *Notice of Intent to File Division Complaint by the Long Island Rail Road Company.*

**STATEMENT OF QUALIFICATIONS**

My name is Robert D. Mulholland. I am an economist and a Vice President of the economic consulting firm of L. E. Peabody & Associates, Inc. The firm's offices are located at 1501 Duke Street, Suite 200, Alexandria, Virginia 22314, 760 E. Pusch View Lane, Suite 150, Tucson, Arizona 85737, and 21 Founders Way, Queensbury, New York 12804.

I am a graduate of George Mason University's School of Public Policy from which I obtained a Master's degree in Transportation Policy, Operations & Logistics and Bowdoin College from which I obtained a Bachelor of Arts degree in Government and Legal Studies. I have been employed by L. E. Peabody & Associates, Inc since 2008 and from 1995-2004. From 2004-2006, I was the staff economist for the Office of Freight Management and Operations of the Federal Highway Administration ("FHWA") of the United States Department of Transportation ("USDOT"). From 2006-2008, I worked for ICF International as a consultant in the transportation group.

The firm of L. E. Peabody & Associates, Inc. specializes in analyzing matters related to the rail transportation of all commodities. As a result of my extensive economic consulting experience since 1995 and my participation in and support of maximum-rate, rail merger, service dispute, and rule-making proceedings before various government bodies, I have become thoroughly familiar with the major rail carriers in the United States. This familiarity extends to subjects of railroad service, costs and revenues, capacity, traffic prioritization, operations, and contracts and tariff terms that historically have governed the movement of commodities by rail.

## **STATEMENT OF QUALIFICATIONS**

As an economic consultant, I have directed and conducted economic studies and prepared reports for freight carriers, shippers, federal agencies, the U.S. Congress, associations, and other public bodies dealing with transportation and related economic issues. Examples of studies I have participated in include organizing and directing traffic operations and cost analyses in connection with single and multiple car movements and unit train operations for various commodities, rail facilities analyses, rate and revenue division analyses, and other studies dealing with freight transportation markets for many commodities over various surface modes throughout the United States. Through conduct of these studies I have become familiar with the operating practices and accounting procedures utilized by railroads in the normal course of business.

I have inspected and studied railroad terminal facilities used in handling various commodities to inform studies that were used as a basis for the determination of the traffic and operating characteristics for specific movements of numerous commodities handled by rail.

I have developed economic and operational studies relative to the rail transportation of coal on behalf of electric utility companies, including analyses of the relative efficiency and costs of railroad operations over multiple routes. The results of these analyses have been used to assist shippers in the development and negotiation of rail transportation contracts that optimize operational efficiency and cost effectiveness.

I have developed numerous variable cost calculations utilizing the various formulas employed by the Surface Transportation Board ("STB") for the development of variable

**STATEMENT OF QUALIFICATIONS**

costs for common carriers, with particular emphasis on the basis and use of the Uniform Railroad Costing System ("URCS"). I have utilized URCS costing principles since the beginning of my career with L. E. Peabody & Associates Inc. in 1995.

I have presented written testimony before the STB. This testimony was generally related to the development of rail traffic and operating patterns and forecasts, and economic principles concerning the maximum level of rates.

I have supported the negotiation of transportation contracts between shippers and railroads. Specifically, I have conducted studies concerning transportation rates based on market conditions and carrier competition, movement specific service commitments, and specific cost-based rate adjustment provisions.

I have conducted different economic analyses regarding rail transportation matters for dozens of electric utility companies located in all parts of the United States, and for major associations, including Chemical Manufacturers Association, National Industrial Transportation League, and Western Coal Traffic League. In addition, I have assisted numerous government agencies in analyzing and solving various transportation-related problems.

In the Western rail merger that resulted in the creation of the present Union Pacific Railroad Company, I reviewed the railroads' applications including their supporting traffic, cost and operating data and developed detailed evidence supporting requests for conditions designed to maintain the competitive rail environment that existed before the proposed merger.

**STATEMENT OF QUALIFICATIONS**

While employed at FHWA, I was a member of the USDOT inter-agency working group that drafted the current National Freight Policy. In addition, I served on the USDOT Freight Gateway Team, a group headed by the Undersecretary for Policy and composed of one representative from each of the surface modal agencies.

While employed at ICF International, I directed and conducted numerous analyses of the rail and trucking industries for federal transportation agencies including the Federal Railroad Administration ("FRA"), the Federal Motor Carrier Safety Administration ("FMCSA"), and the FHWA, including analyses of the current rail and trucking industries and forecasts of future trends in both industries.

# Report

to



---

**Critique and Evaluation  
Of FRA's Proposed Changes To The Requirements  
For The Implementation Of Positive Train Control**

---

by

**L. E. PEABODY & ASSOCIATES, INC.**  
ECONOMIC CONSULTANTS

1501 Duke Street, Suite 200  
Alexandria, Virginia 22314

Date: October 18, 2011

**TABLE OF CONTENTS**

**PAGE**

<b>I.</b>	<b>INTRODUCTION AND SUMMARY .....</b>	<b>1</b>
<b>II.</b>	<b>FRA PTC RULEMAKING HISTORY .....</b>	<b>4</b>
	<b>A. GENESIS OF LEGISLATION REQUIRING PTC IMPLEMENTATION .....</b>	<b>4</b>
	<b>B. FRA’S FIRST PTC NPRM .....</b>	<b>4</b>
	<b>C. FRA’S AUGUST 2011 NPRM .....</b>	<b>7</b>
<b>III.</b>	<b>AUGUST 2011 NPRM APPROACH THEORETICAL PROBLEMS .....</b>	<b>9</b>
	<b>A. RELINQUISHED OVERSIGHT RESPONSIBILITIES.....</b>	<b>9</b>
	<b>B. FAILURE TO ADDRESS SHIPPER CONCERNS .....</b>	<b>9</b>
<b>IV.</b>	<b>2011 NPRM APPROACH MECHANICAL PROBLEMS AND CBA RESTATEMENT.....</b>	<b>14</b>
	<b>A. REVISED (TRUNCATAED) CBA SCOPE.....</b>	<b>14</b>
	<b>B. UNSUPPORTED COST ASSUMPTIONS.....</b>	<b>17</b>
	<b>C. REVERSED CBA STRUCTURE (e.g. BENEFITS ARE CLASSIFIED AS COSTS IN AUGUST 2011 NPRM).....</b>	<b>18</b>
	<b>D. CORRECTED CBA STRUCTURE.....</b>	<b>20</b>
	1. Term (2028 vs. 2031).....	20
	2. Costs vs. Benefits.....	21
	3. Wayside Equipment Cost Calculations.....	22
	4. Locomotive Cost Calculations.....	26
	5. Maintenance Costs .....	27
	6. Cost Summary.....	27
	7. Safety Benefits.....	28
	8. Annualized Costs and Benefits .....	29
	9. Final Cost-to-Benefit Calculation.....	30
	<b>E. SENSITIVITY ANALYSES .....</b>	<b>31</b>
<b>V.</b>	<b>CONCLUSIONS.....</b>	<b>34</b>
<b>VI.</b>	<b>BIBLIOGRAPHY OF IMPORTANT PTC RELATED DOCUMENTS.....</b>	<b>37</b>

## LIST OF ATTACHMENTS

<u>Attachment No.</u> (1)	<u>Title</u> (2)
1.	Timeline for Relevant Legislative and Regulatory Activity
2.	Restated Avoided Costs for PTC Implementation Under August 2011 Proposed Rules Changes
3.	Restated Forgone Benefits for PTC Implementation Under August 2011 Proposed Rules Changes

## **LIST OF ACRONYMS**

<b>AAR</b>	<b>Association of American Railroads</b>
<b>BNSF</b>	<b>BNSF Railway Company</b>
<b>C/B</b>	<b>Cost-to-Benefit</b>
<b>CBA</b>	<b>Cost-Benefit Analysis</b>
<b>CFR</b>	<b>Code of Federal Regulations</b>
<b>CN</b>	<b>Canadian National Railways</b>
<b>CP</b>	<b>Canadian Pacific Railway</b>
<b>CSXT</b>	<b>CSX Transportation, Inc.</b>
<b>FRA</b>	<b>Federal Railroad Administration</b>
<b>ITIC</b>	<b>Intermodal Transportation and Inventory Cost Model</b>
<b>KCS</b>	<b>The Kansas City Southern Railway Company</b>
<b>NPRM</b>	<b>Notice of Proposed Rulemaking</b>
<b>NS</b>	<b>Norfolk Southern Railway Company</b>
<b>NTSB</b>	<b>The National Transportation and Safety Board</b>
<b>OMB</b>	<b>Office of Management and Budget</b>
<b>PHMSA</b>	<b>Pipeline and Hazardous Materials Safety Administration</b>
<b>PIH</b>	<b>Poisonous Inhalation Hazard</b>
<b>PTC</b>	<b>Positive Train Control</b>
<b>PTCIP</b>	<b>Positive Train Control Implementation Plan</b>
<b>RFA</b>	<b>Request For Amendment</b>
<b>RIA</b>	<b>Regulatory Impact Analysis</b>

**LIST OF ACRONYMS**

(continued)

<b>RSIA</b>	<b>Rail Safety Improvement Act of 2008</b>
<b>STB</b>	<b>Surface Transportation Board</b>
<b>TIH</b>	<b>Toxic Inhalation Hazard</b>
<b>UP</b>	<b>Union Pacific Railroad Company</b>

## I. INTRODUCTION AND SUMMARY

This Report evaluates and critiques the proposed changes to the requirements for implementing Positive Train Control (“PTC”) systems<sup>1</sup> by freight railroads, as well as the Regulatory Impact Analysis (“August 2011 RIA”) performed by the Federal Railroad Administration (“FRA”) in support of its August 24, 2011 Notice of Proposed Rulemaking (“August 2011 NPRM”) announcing those changes. This Report also includes a corrected statement of the total costs and benefits anticipated to result from PTC implementation based on FRA’s prior cost-benefit analysis (“CBA”) methodology and the changes to the PTC implementation rule reflected in the August 2011 NPRM.<sup>2</sup> This Report also discusses the potential for economic harm to shippers of Toxic or Poisonous by Inhalation Hazard (“TIH/PIH”) materials and the ability of the railroads to force TIH/PIH shipments off the rail system or parts of the rail system. The key findings are summarized below.

In the August 2011 NPRM, FRA proposes to change the PTC implementation requirements established in 2010 by removing two qualifying tests that were incorporated in the 2010 Final Rule. The qualifying tests were intended to ensure that sufficient consideration was given to the effect on safety of railroad proposals to exclude segments from the railroads’ PTC implementation plans before the right to exclude those segments was granted. Conceptually, the tests were meant to provide flexibility to the railroads while preserving FRA’s oversight authority. The August 2011 NPRM increases the railroads’ flexibility while removing FRA oversight. FRA’s justification for the proposed rule change is flawed on many levels. These include:

---

<sup>1</sup> PTC is a generic term for technology systems that monitor train movements and that can automatically stop trains to avoid imminent collisions or other incidents.

<sup>2</sup> The primary basis of this statement was the FRA’s 2009 and 2010 economic analyses supporting the January 2010 PTC Final Rule, September 2010 Amended Final Rule and the August 2011 NPRM.

1. FRA does not consider the costs or benefits to shippers or the public in its analysis;
2. FRA continues to exclude business and other societal benefits FRA had itself identified, quantified, and championed for much of the previous decade. FRA includes only railroad safety benefits in its economic analyses;
3. FRA incorrectly categorizes costs as benefits and benefits as costs, which directly contradicts FRA's treatment of those items in its prior Regulatory Impact Analyses ("RIA");
4. FRA relies on several unsupported assumptions and estimates to derive its cost and benefit calculations;
5. In many cases the FRA accepts, without question, the Association of American Railroads ("AAR") estimates and assumptions;
6. FRA improperly focuses on the net costs and benefits associated with PTC implementation based on the AAR's estimated 10,000 track miles that would be equipped with PTC but for the proposed rules changes. In doing so, FRA fails to account for 3,500 track miles it had originally determined would not be equipped with PTC;
7. In 2010, FRA estimated that 64,525 miles would require full PTC implementation (\$3.226 billion at \$50,000 per mile) and another 3,204 miles would require mitigation systems only (\$32 million at \$10,000 per mile) or a total estimated cost of \$3.258 billion;
8. In the August 2011 RIA, FRA's new assumptions should have resulted in an estimate of 58,033 miles that would require full PTC implementation (\$2.9017 billion at \$50,000 per mile) and another 550 miles that would require mitigation systems only (\$5.5 million at \$10,000 per mile). This is an estimated total cost of \$2.907 billion. Between FRA's 2010 and 2011 analyses, full PTC wayside equipment implementation costs have been reduced by \$351 million (\$3.258 billion - \$2.907 billion);
9. FRA estimates that 110 locomotives will no longer need to be equipped for PTC based on the same faulty arithmetic. Calculated correctly, 77 fewer locomotives will need to be equipped for PTC under the proposed rule change than without it, even accepting FRA's unsupported assumptions;
10. FRA continues to assume a high annual maintenance cost equal to 15% of the costs of the installed system. We use a more reasonable 12.5%; and
11. FRA improperly shifts the analysis period from 2009-2028 to 2012-2031.

Because of the flawed logic and mechanics, FRA's cost and benefit estimates are inaccurate. When the CBA is performed using Office of Management and Budget ("OMB") guidelines, the results are vastly different. Specifically:

1. In the August 2011 RIA, FRA's cost-benefit analysis focused only on the incremental costs and benefits between the 2010 Final Rule and the rule as altered in the August 2011 NPRM. FRA neglected to develop a cost-benefit analysis comparing the new proposed rule to the "no action" scenario; and
2. When the full costs and benefits are evaluated using a comprehensive CBA model, and when adjustments are made to correct for errors and omissions, the cost-benefit ratio associated with implementing PTC on rail lines as required by the rule as amended by the August 2011 NPRM equals 0.77 to 1.

## **II. FRA PTC RULEMAKING HISTORY**

### **A. GENESIS OF LEGISLATION REQUIRING PTC IMPLEMENTATION**

PTC systems have been discussed, studied, and designed for over two decades. However, PTC was not required until 2008<sup>3</sup> when Congress, prompted in part by a series of high profile rail accidents involving multiple fatalities, passed the Rail Safety Improvement Act (“RSIA”), mandating implementation of PTC systems by December 31, 2015. Pursuant to the RSIA, each Class I railroad and each entity providing regularly scheduled intercity or commuter rail passenger transportation must implement PTC on: 1) main line tracks over which intercity rail passenger transportation or commuter rail passenger transportation, as defined in Section 24102, is regularly provided; 2) main line track over which PIH or TIH hazardous materials as defined in 49 CFR parts 171.8, 173.115, and 173.132 are transported; and 3) such other tracks as the Secretary may prescribe by regulation or order.<sup>4</sup>

### **B. FRA’S FIRST PTC NPRM**

Consistent with the statutory mandate discussed above, FRA published a Final Rule with a request for further comments on January 15, 2010 (“2010 Final Rule”). The rule established new regulations codified primarily in 49 CFR, Part 236, Subpart I. In support of the 2010 Final Rule, FRA issued a RIA on December 8, 2009 (“2009 RIA”). FRA received a number of comments and petitions for reconsideration in response to the 2010 Final Rule. However, in a letter dated July 8, 2010, FRA denied all of the petitions

---

<sup>3</sup> Also in 2008, the U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration (“PHMSA”), Rail Hazmat Routing Rule became final. The rule requires railroads that transport certain hazmat commodities (including TIH/PIH materials) to perform comprehensive safety and security risk analyses in order to determine and select routes which pose the least overall risk.

<sup>4</sup> See 49 U.S.C. 20157.

for reconsideration. On September 27, 2010, FRA issued an Amended Final Rule (“2010 Amended Rule”) with clarifying amendments to the 2010 Final Rule (collectively the “Original Rule”).

The Original Rule required each railroad to file a PTC Implementation Plan (“PTCIP”) by April 16, 2010. Each PTCIP includes the sequence and schedule in which track segments required to be equipped with PTC will be so equipped, and the basis for those decisions.<sup>5</sup> This list of track segments is required to include all track segments that fit the RSIA statutory criteria based on calendar year 2008 traffic types and levels.<sup>6</sup> The Original Rule also reflected the December 31, 2015 statutory deadline for installation of PTC.

The Original Rule directed the railroads to determine which track will be equipped with PTC by analyzing data from calendar year 2008. However, in response to the AAR’s expressed concern that 2008 is an unacceptable base year, the Original Rule included provisions that allowed railroads the option to file a request for amendment (“RFA”) of its PTCIP before December 31, 2015. A particular track segment could be nominated for removal from a filed PTCIP in a RFA if the segment originally included in a PTCIP would no longer carry TIH/PIH traffic by the statutory implementation deadline, and PTC system hardware and infrastructure is scheduled, but not yet installed, on the segment.

Pursuant to the Original Rule, FRA must review a railroad’s RFA and agree that two qualifying tests are passed before the FRA exempts a track segment from PTC implementation. The first test, which has become known as the “alternative route analysis test,” required the railroad to establish that current or prospective rerouting of TIH/PIH materials traffic to one or more alternative track segments is justified. The railroads would

---

<sup>5</sup> See 49 CFR 236.1011.

<sup>6</sup> See 49 CFR 236.1005(b)(1) and (b)(2).

be required to show not only that the TIH/PIH shipments had been removed from the line segment, but also that the new route segment would have substantially the same risk as the initial segment, assuming both segments were equipped with PTC systems. Thus, even if the railroad proposes to reroute TIH/PIH material off a particular segment, PTC may still be required on the initial track segment if the segment poses a higher overall safety and security risk than the alternate route segment.

The second test is the so-called “residual risk test.” Under this test, the railroad must show that, without a PTC system, the remaining risk on the track segment is less than the national average equivalent risk per route mile on track segments required to be equipped with PTC systems due to statutory reasons other than passenger traffic presence. When FRA issued the 2010 Amended Rule, it indicated that it was delaying the effective date of this second test pending the completion of a separate rulemaking to establish how residual risk would be determined.<sup>7</sup>

Pursuant to the Original Rule, if FRA determined a track segment passed both tests, FRA would approve the RFA and relieve the railroad of its requirement to implement PTC on that track segment. If a track segment failed either of the two tests, FRA would deny the request, thus requiring PTC system implementation on the track segment as originally required based on the 2008 baseline determination. Stated differently, if the initial track segment, despite the elimination of all TIH/PIH materials traffic, is determined to pose higher overall safety and security risks under this analysis, then a PTC system must still be installed on that initial track segment. PTC system implementation may also be required on the line segment if it meets the 5 million gross

---

<sup>7</sup> This test has not been established.

tons of annual traffic threshold and does not qualify under the *de minimis* exception of the rule.

After FRA issued its 2010 Final Rule and denied reconsideration on July 8, 2010, the railroads' Washington, D.C. based lobby group, the AAR, filed a petition for review of the rule with the U.S. Court of Appeals for the District of Columbia. The AAR filed another petition for review on October 5, 2010 after FRA issued its 2010 Amended Rule. The court consolidated those two petitions on October 22, 2010. The AAR challenged FRA's determination to use 2008 as the baseline year, arguing that FRA's determination rests on a fundamental legal error and was arbitrary and capricious.

To settle these court cases, FRA and AAR entered into a Settlement Agreement on March 2, 2011 ("Settlement Agreement"). The terms and conditions of the Settlement Agreement included the joint filing of a motion to hold the Petition for Review in abeyance pending the completion of this rulemaking. That motion was filed on March 2, 2011, and was granted by the Court on March 3, 2011.

Attachment No. 1 to this Report contains a timeline of relevant legislative and regulatory activity concerning the implementation of PTC.

### **C. FRA'S AUGUST 2011 NPRM**

In the Settlement Agreement, FRA agreed to issue two (2) NPRM's. The first NPRM would address whether FRA should amend the PTC rule by eliminating the tests (the alternate route test and the residual risk test) that may determine where PTC is installed. The NPRM issued on August 24, 2011, that we are commenting on herein, is that first NRPM. The Settlement Agreement also requires FRA to issue a second NPRM that addresses the issues of how to handle en-route failures of PTC-equipped trains, circumstances under which a signal system may be removed after PTC installation, and

whether yard movements and certain other train movements should qualify for a *de minimis* risk exception to the PTC rule.<sup>8</sup> This Report does not address those issues.

---

<sup>8</sup> The second NPRM has not yet been issued.

### **III. AUGUST 2011 NPRM APPROACH THEORETICAL PROBLEMS**

#### **A. RELINQUISHED OVERSIGHT RESPONSIBILITIES**

In the August 2011 NPRM, FRA proposes to eliminate the two “qualifying tests” that were meant to ensure that no safety degradation would occur as a result of granting railroads’ requests to avoid PTC implementation on certain low-density lines based on changes in traffic patterns since FRA’s analysis of the 2008 base year. FRA is essentially allowing railroads to determine, without any regulatory oversight, where PTC will not be required to be implemented. In the absence of regulatory oversight on the determination of which track requires PTC, the railroads will be allowed to make unilateral decisions about which routes will be equipped with PTC and which shippers will have access to PTC equipped line segments.

According to FRA’s web page, “In addition to promulgation and enforcement of railroad safety regulations, FRA provides financial support, research and development, as well as policy analysis and recommendations on broad subjects relating to the rail industry and the nation’s general railroad system.”<sup>9</sup> The primary reason to require PTC is to increase the safety of the country’s rail system. By removing the qualifying tests, it appears that the FRA may be abdicating its regulatory responsibility.

#### **B. FAILURE TO ADDRESS SHIPPER CONCERNS**

The National Transportation Safety Board (“NTSB”), an independent Federal agency charged with determining the probable cause of transportation accidents and promoting transportation safety, commented on the Original Rule that the inclusion of the

---

<sup>9</sup> <http://www.fra.dot.gov/Pages/4.shtml> accessed October 5, 2011.

two tests correctly balanced the safety concerns of the RSIA and the potential PTC implementation costs. In the 2010 Amended Rule, FRA reaffirmed its decision to include the tests. However, less than a year later, in the August 2011 NRPM, FRA now proposes to remove both tests, thus allowing the railroads to determine which track segments will be equipped with PTC without regulatory oversight regarding the determination of the level of safety and security on the subject segment. In support of this proposal, FRA states that:

While FRA believes that the alternative route analysis and residual risk tests are legally sustainable, it recognizes that these tests could potentially require the installation of PTC systems *at a great cost to the railroads*. FRA also recognizes that the railroads have much work to do to have interoperable PTC systems installed in accordance with the congressional mandate. FRA is, therefore, proposing to eliminate the tests that would potentially require the installation of PTC systems on lines not specifically mandated by Congress.<sup>10</sup> (emphasis added)

FRA further justifies the changes proposed by certifying that “this proposed rule will result in ‘no significant economic impact on a substantial number of small entities.’” In making the statement, FRA clarifies that the “universe of entities” that may be affected is “Class III freight railroads that operate rail lines that are currently required to have PTC systems installed” and that “such lines are owned by railroads not considered small.”<sup>11</sup> Curiously, FRA states the justifications only in terms of the impact on railroads. It does not discuss, and evidently has not considered, any impacts (economic or otherwise) on shippers or the public. In fact, the word “shipper” does not appear in either the thirty-three page August 2011 RIA or the entire August 2011 NPRM.

---

<sup>10</sup> **Federal Register** / Vol. 76, No. 164 / Wednesday, August 24, 2011 / Proposed Rules, page 52922.

<sup>11</sup> *Id.*, page 52924.

TIH/PIH materials are used across the country for a wide variety of industrial and commercial purposes. The railroads themselves acknowledged this fact in their Congressional testimony, “[T]he majority of TIH materials are consumed in non-discretionary circumstances such as water purification, crop fertilization, and the operation of coal-fired power plants.”<sup>12</sup> In addition, some TIH traffic “is anhydrous ammonia for fertilizer going to these little co-ops out in the middle of, you know, very rural areas.”<sup>13</sup> Yet, in the time period since FRA first proposed the PTC rule, the railroads have made several statements that seem to marginalize the TIH/PIH shippers’ transportation needs and imply that railroads may seek to eliminate some TIH/PIH routes. For example, Jeff Young, from the Union Pacific Railroad Company (“UP”) stated:

“ there [are] a number of lines that are on the bubble where we've got a number of lines where we have 800 miles of trackage that we have to equip for three [cars] of TIH, those kinds of things that are on the bubble. Those are the ones that we would like to see pushed out so every year we can file with you our revised implementation plan starting out front, and we could list these to you in our implementation plan as to when we expect, if we're going to equip this line, where it would be, but those that have small amounts of TIH would be out in the very end anyway, due to managing the greater risk by lesser risk anyway. ... We want to have that flexibility to not define that as a PTC-mandated line until later out in the -- toward the 2015.”<sup>14</sup>

More recently, the AAR stated in its March 17, 2011 Congressional testimony:

“Using 2008 [as a base year] makes no sense because TIH traffic patterns in 2015 will be vastly different than they were in 2008. In fact, TIH traffic patterns are already changing because of changes in the marketplace (e.g., rail customers moving TIH production or use to other locations, going out of business, replacing TIH materials with safer substitutes, etc.) and because of recent U.S. DOT regulations requiring

---

<sup>12</sup> Public Hearing Notice of Proposed Rulemaking for Positive Train Control Systems, Docket No.FRA-2008-0132, August 13, 2009, transcript page 42, line 7.

<sup>13</sup> Id., transcript page 57, line10.

<sup>14</sup> Id., transcript pages 56-77.

railroads to make sure that TIH materials are being transported on the safest, most secure routes.”<sup>15</sup>

FRA has not addressed the impact on shippers that are raised by this statement, except to state in the August 2011 NPRM that, “[t]he AAR and its members appear to have been more effective in the future reduction of PIH materials traffic than FRA had initially estimated...” FRA is proposing to replace two objective tests it created to ensure a minimum standard of safety on the entire U.S. rail system with the railroads’ judgment. It is unclear why FRA recommends removing the tests when FRA included the tests in the Original Rule in response to the AAR’s concern that 2008 was an inappropriate base year and AAR’s statements that using 2008 traffic data would require the railroads to unnecessarily install PTC on track segments that no longer carry TIH/PIH in 2015. The tests were designed to account for any changes in TIH/PIH traffic patterns and to provide flexibility for the railroads. However, the AAR claims that despite its members’ ability to submit RFA’s demonstrating those traffic pattern changes for FRA review, PTC likely would have been required on track segments that *no longer carry TIH/PIH but cannot pass the alternate route test and the residual risk test.*

If there are track segments that no longer carry TIH/PIH materials but that fail one of the tests, then either the tests are flawed or it is appropriate for PTC to be installed on that track segment. There have been no comments suggesting that either test is flawed.

The impact of FRA’s failure to address shipper concerns is particularly problematic because of the potential for cascading impacts on future rules promulgated by FRA and other government agencies. For example, the Surface Transportation Board (“STB”), the

---

<sup>15</sup> Joint Statement of Edward R. Hamberger and Mark Manion before the U.S. House of Representatives, Committee on Transportation and Infrastructure. Hearing on the Rail Safety Improvement Act of 2008, March 17, 2011, page 9.

Federal agency responsible for the economic regulation of the railroad industry, recently issued an NPRM on reporting requirements for PTC expenses and investment.<sup>16</sup> Although the STB states that it is not, at this time, proposing changes to the way costs are currently assigned in maximum reasonable rate cases and other proceedings, the STB's NPRM does appear to open the door for the railroads to implement imbalanced cost recovery procedures that target captive TIH/PIH shippers, as well as all captive shippers.

The STB will require PTC expense reporting but will not require the railroads to report on benefits accruing from PTC implementation. Although this may appear to be a STB endorsement of FRA's model that considers only costs and disregards benefits accruing from PTC installation, an important distinction must be made. According to the STB, "identifying costs associated with implementing PTC appears to be relatively straight forward...it is not clear how, at this point, we would identify those productivity gains that may arise as a result of PTC investment".<sup>17</sup> However, the costs included in the railroads' Annual Report Form R-1's filed with the STB stem from a different basis than FRA's cost-benefit analyses. The Annual Report Form R-1 reports are accounting products, which by definition are ex post analyses that rely upon actual historic data. FRA's cost/benefit calculations are an ex ante analyses that rely upon estimated future costs and benefits. In other words, the two presentations are a classic example of the difference between accounting figures and economic figures.

---

<sup>16</sup> See STB Decision in Ex Parte No. 706. "Reporting Requirements for Positive Train Control Expenses and Investments," October 13, 2011.

<sup>17</sup> Id., page 5.

#### **IV. 2011 NPRM APPROACH MECHANICAL PROBLEMS AND CBA RESTATEMENT**

In its 2010 Final Rule, FRA incorrectly stated that the cost-to-benefit ratio associated with nationwide implementation of PTC systems was in the 20 to 1 range. We previously demonstrated that this estimate was generated using a flawed CBA methodology and that a properly structured CBA framework consistent with OMB guidelines produced a cost-to-benefit ratio close to 1 to 1. This, and several other mechanical problems with the FRA's approach are discussed below.

##### **A. REVISED (TRUNCATED) CBA SCOPE**

A 2004 report commissioned by FRA and performed by ZETA-TECH identified numerous business benefits associated with the implementation of PTC. FRA supplemented the ZETA-TECH report through the results of a peer review workshop, which included representatives of freight and passenger railroads, shippers, labor organizations and suppliers, and through the inclusion of additional societal benefits developed using a FRA-developed model. The total PTC benefits calculated by FRA in its supplemented report ranged from \$2.4 to \$3.9 billion annually.<sup>18</sup>

In 2009, in its NPRM on PTC implementation ("2009 NPRM"), FRA excluded the very societal and other business benefits it had itself identified, quantified, and championed for much of the previous decade, and included only railroad safety benefits in its RIA.<sup>19</sup> FRA's tone with regard to the implementation of PTC systems had taken a 180 degree turn. FRA transformed from an outspoken advocate for PTC implementation to a

---

<sup>18</sup> See L. E. Peabody and Associates Inc., May 2010 Report to the Chlorine Institute, pages 67-74, for a more complete summary of selected key documents describing FRA's (and others) participation in the earlier studies and advocacy.

<sup>19</sup> Importantly, FRA continued to include those business and societal benefit calculations in a more expansive economic analysis that it conducted simultaneously with its development of the RIA. However, the RIA included only direct railroad safety benefits.

reluctant enabler. With the exclusion of its own significant benefit calculations from its RIA, FRA's 2009 NPRM estimated the cost-to-benefit ratio of PTC implementation to equal 16.47 to 1. Our analysis of FRA data shows that the proper inclusion of all FRA calculated benefits would have dropped the cost-to-benefit ratio to 1.19 to 1.<sup>20</sup> In 2010, FRA published its Original Rule on PTC implementation. As it did in its 2009 analysis, FRA only included railroad safety benefits in its RIA and excluded all other benefits it originally estimated from its analysis. When considering only direct railroad safety benefits, the cost-to-benefit ratio in the 2010 Final Rule increased to 21.71 to 1 due to some changes in assumptions underlying FRA's cost and safety benefit estimates. However, if FRA included all of the societal and business benefits it had developed in 2009, the cost-to-benefit ratio would have equaled 1.15 to 1.

We conducted detailed reviews of FRA's 2004, 2009, and 2010 cost and benefit calculations and identified several errors and omissions that collectively overstated the total costs of PTC implementation and dramatically understated the total benefits in the 2010 RIA. These errors included failures to index different cost and benefit figures to the same year price levels, improper commingling of costs and benefits to develop net benefits (which is a fundamental violation of CBA principles), incorrect calculations of direct benefits and modal diversion factors, and misapplication of FRA's Intermodal Transportation and Inventory Cost ("ITIC") Model.

In March 2010, at the request of the Chlorine Institute Inc., we corrected the scope of FRA's estimate of benefits anticipated to result from PTC implementation.<sup>21</sup> Our Report focused primarily on the framework, methodology and calculations underlying the FRA's 2010 RIA. When we used the proper framework, methodologies, and calculations,

---

<sup>20</sup> See L. E. Peabody and Associates Inc., May 2010 Report to the Chlorine Institute.

<sup>21</sup> See L. E. Peabody and Associates Inc., March 2010 Report to the Chlorine Institute

*and used FRA's own assumptions regarding the quantity and value specific business and societal benefits arising from PTC implementation*, we demonstrated that the cost-to-benefit analysis presented in the 2010 RIA was erroneous and incomplete, and the results were misleading. We demonstrated that FRA's cost-to-benefit ratio of 21.71 to 1 should properly be restated to 0.86 to 1 by accepting FRA's estimate of the total PTC implementation costs and including the corrected safety, societal, and other business benefits, and correctly categorizing costs and benefits.

The AAR took exception to our 2010 Report and hired Oliver Wyman, Inc. ("Oliver Wyman") to "provide an independent evaluation of the potential commercial benefits of PTC"<sup>22</sup> which AAR claimed "clearly dispels assertions that there will be substantial business benefits to railroads that implement PTC technology under federal regulations."<sup>23</sup> In its Report, Oliver Wyman addressed certain of the specific items incorporated in FRA's business benefits estimates (and updated in our May 2010 Report). For each of the items discussed in its Report, Oliver Wyman broke down the underlying assumptions and cost components, opined as to the validity of the assumptions and unit costs, and restated the benefits based on its own assessment. The Oliver Wyman Report concluded that the cost-to-benefit ratio is in the neighborhood of 11 to 1 when considering railroad safety and business benefits.

Even using Oliver Wyman's sponsored results it is clear that FRA improperly excluded significant benefits accruing to both railroads and non-railroad parties, including

---

<sup>22</sup> "Assessment of the Commercial Benefits of Positive Train Control." Oliver Wyman, Inc. April 23, 2010, page 1.

<sup>23</sup> AAR press release dated April 27, 2010, accessed on the web at <http://www.aar.org/NewsAndEvents/PressReleases/2010/04/042710-PTCclaimsOverblown.aspx> on April 28, 2010.

shippers, from its analysis. Oliver Wyman's inclusion of these benefits changed the CBA ratio by an order of magnitude (from 22 to 1 to 11 to 1.)<sup>24</sup>

In the August 2011 NPRM, FRA continues to ignore many major classes of benefits in its analysis. FRA compounds this problem by improperly treating benefits as costs and vice-versa, and by introducing other inconsistencies between its 2010 and 2011 analyses, as discussed in more detail in the following section.

## **B. UNSUPPORTED COST ASSUMPTIONS**

FRA relies on several unsupported assumptions to support its cost calculations.

For example, the following passage is taken from page 13 of FRA's 2011 RIA:

"For purposes of this analysis, FRA estimates that half of the mileage from which PIH is eliminated or rerouted would have passed both tests under the 2010 PTC rule, and would have qualified for exclusion, but would have required some mitigation to do so. *FRA chose 50 percent as a best estimate, because the affected segments would need to pass two tests, one of which has never been fully developed.* The first test applies to rerouted PIH traffic, but not to eliminated PIH traffic. Under that test, the new route with PTC must be at least as safe as the existing route would have been if the existing route also been equipped with PTC. FRA believes that more than half of the rerouted traffic could pass this test, in part because railroads are trying to diminish risk with their rerouting. The second test, that would apply to both segments from which PIH is rerouted and segments from which PIH is eliminated, is that residual risk (with mitigations, if needed) is not higher than the average risk for Class I lines in the United States that are required to be equipped with PTC because of gross tonnage and the presence of PIH traffic. As noted below in the discussion of costs through increased accident risk, the segments in question, based on FRA's review of the initial AAR data, appear on average to have lower than average traffic volumes than an average of all segments subject to the PTC requirement. *FRA never fully developed that test, but FRA believes that some segments would have passed that test, although many might have needed some kind of mitigation.* For purposes of this analysis, FRA continues to estimate the cost of

---

<sup>24</sup> We have not been asked to critically review the assumptions and analyses that underlie Oliver Wyman's Report, and take no position as to the Report's validity or conclusions beyond noting that the Oliver Wyman Report included estimated non-safety benefits in its CBA.

mitigation at \$10,000 per mile in initial costs on the average and *applies this to half of the segments subjected to the two tests. In other words, this analysis assumes that half of the mileage that may be excludable under the proposed rule would have been excludable under the 2010 PTC rule with some form of mitigation implemented, at an average cost of \$10,000 per mile.*" (emphasis added)

The highlighted passages show that FRA appears to have no qualms about relying on unsupported (and perhaps unsupportable) assumptions in its estimation of costs. This directly contradicts FRA's stated reason for excluding several classes of benefits from its analysis. Specifically, FRA stated in the January 2010 Final Rule that:

FRA also expects that once PTC systems are refined, there likely would be substantial business benefits resulting from more efficient transportation service; however, such benefits are not included because of significant uncertainties regarding whether and when individual elements will be achieved.<sup>25</sup>

Uncertainty is always a part of cost-benefit analyses as explained below:

Changes to the transportation system can have both direct and indirect impacts on the social and economic activities.... The challenge in evaluation is to understand these complex relationships and to identify a set of benefits and costs that accounts for the diverse impacts associated with any particular action."<sup>26</sup>

FRA's cost-benefit analysis remains as deficient as it was in 2010.

**C. REVERSED CBA STRUCTURE (e.g. BENEFITS ARE CLASSIFIED AS COSTS IN THE AUGUST 2011 NPRM)**

In the August 2011 RIA, FRA incorrectly categorizes costs as benefits and benefits as costs, which directly contradicts FRA's prior RIA treatment of those items and skews the final analysis used to support FRA's conclusion. A cost item must remain a cost item and a benefit must remain a benefit in incremental CBA's. What FRA has done is turn its

---

<sup>25</sup> Federal Register, Vol. 75, No. 10, Friday, January 15, 2010, Proposed Rules, p. 2684.

<sup>26</sup> Meyer, Michael D. and Eric J. Miller. "Urban Transportation Planning: A Decision Oriented Approach", Second Edition, McGraw Hill, Boston, 2001, ("Meyer and Miller"), page 488.

flawed cost to benefit ratio of roughly 20 to 1 on its head, claiming a cost to benefit ratio of 1 to 20 associated with the new rule.

FRA's logic rests on the false premise that the proposed rule results in cost and benefit changes relative to the status quo, when in reality the cost and benefit changes presented by FRA are relative to an alternate future state. Stated differently, FRA previously claimed that the cost to benefit ratio associated with implementing the rule was 20 to 1, and FRA is now saying the cost to benefit ratio associated with not implementing part of the rule is 1 to 20.

What FRA should have done is calculate the cost to benefit ratio associated with implementing the rule as altered by the August 2011 NPRM relative to the current state (i.e., "no-action scenario"). Under the cost benefit method, one must "separate[e] costs from benefits, discount the cash flows to their equivalent... present values and compare the equivalent benefits to the equivalent cost for each alternative. A benefit to cost ratio is determined for each alternative."<sup>27</sup> Using FRA's numbers, the correct framework is depicted in Table 1 below.

---

<sup>27</sup> Meyer and Miller, page 512.

**Table 1**  
**Statement of Costs and Benefits of Original Rule and August 2011 NPRM**  
 (20-year Costs and Benefits Discounted at 7%)

<u>Scenario</u> (1)	<u>Costs</u> (2)	<u>Benefits</u> (3)	<u>Cost to Benefit Ratio</u> 1/ (4)
1. Original Rule	\$9,547,522,721	\$439,705,397	21.71 to 1
2. August 2011 NPRM Change in Costs and Benefits	\$619,969,287	\$26,702,267	xxx
3. August 2011 NPRM Total Costs and Benefits 2/	\$8,927,553,434	\$413,003,129	21.62 to 1

Source: FRA January 2010 Final Rule and August 2011 NPRM  
 1/ Column (2) – Column (3)  
 2/ Line 1 – Line 2

Under the Original Rule, FRA calculated a 21.71 to 1 cost to benefit ratio based on its methodology. Under the August 2011 NPRM, FRA should have calculated a 21.62 to 1 cost to benefit ratio based on its methodology.

**D. CORRECTED CBA STRUCTURE**

In this section of our Report, we critique and correct (to the extent possible) FRA's CBA. Our findings are summarized below under the following headings:

1. Term (2018 vs. 2031)
2. Costs vs. Benefits
3. Wayside Equipment Cost Calculations
4. Locomotive Cost Calculations
5. Maintenance Costs
6. Cost Summary
7. Safety Benefits
8. Annualized Costs and Benefits
9. Final Cost-to-Benefit Calculation

**1. Term (2028 vs. 2031)**

FRA's prior analyses supporting the Original Rule used a 20-year analysis period running from 2009 through 2028 inclusive as the basis for its statement of costs and benefits. In the prior analyses, PTC installation activities were assumed to occur during a

five year period in years 3 through 7 (2011 – 2015). In the August 2011 RIA, FRA correctly states that the changes it believes will result from the rules will occur “toward the end of the 5-year installation period [2014 and 2015].”<sup>28</sup>

However, FRA does not end its analysis period in 2028, as it must in order for the analysis to remain comparable to the 2010 Final Rule analysis. Rather, FRA shifts its analysis period from the original 2009-2028 time frame to a new 2012-2031 time frame. For example, costs that should be considered as occurring in model year 6 are improperly classified as model year 3 costs in FRA’s August 2011 RIA. We have corrected this incongruity in our analysis.

## **2. Costs vs. Benefits**

As indicated above, FRA’s analysis incorrectly categorizes costs as benefits and benefits as costs. The error in the FRA’s CBA is evident from the first page of the August 2011 RIA. On that page the FRA states “the largest part of the *cost savings benefit* comes from reducing the extent of wayside that must be equipped with PTC.” [emphasis added] The corresponding error can be found on page 3 of the August 2011 RIA, where it states, “[r]egulatory costs will come from reducing the potential for accident reduction.”

As discussed above, in the August 2011 NPRM, FRA is proposing to remove the two qualifying tests included in the Original Rule. In the Original Rule, if a railroad filed a RFA, relief was only possible if the two tests were met *and the PTC had not yet been installed*. If the PTC is not yet installed, there have been no costs or benefits realized. In performing the cost-to-benefit analysis, a reduction in costs is just that – a reduction in costs. It is not a “cost savings benefit”. Similarly, if PTC has not yet been installed, no

---

<sup>28</sup> Regulatory Impact Analysis, Docket No. FRA-2011-0028, August 3, 2011, page 15

benefits have yet been realized. Therefore, “reducing the potential for accident reduction” is a reduction in expected benefits. It is not a regulatory cost.

According to the Federal Government publication “Regulatory Impact Analysis Guidance Document”, “[a]ll costs calculated should be incremental, that is, they should represent changes in costs that would occur if the regulatory alternative is chosen compared to the costs in the base case (ordinarily no regulation or the existing regulation)”.<sup>29</sup> In this case the regulatory alternative is PTC and the base case is no PTC.

The August 2011 RIA is also flawed because it improperly focused on the costs and benefits associated with PTC implementation on the AAR’s estimated 10,000 track miles that may be excluded by the proposed rules changes. Again, FRA has flipped the analysis. The proper scope of the analysis should be the roughly 60,000 miles of track on which PTC will *still* be required to be implemented if the rule including the proposed changes is promulgated and PTC is implemented.

### **3. Wayside Equipment Cost Calculations**

The August 2011 NPRM states that the basis for FRA’s baseline estimate of 10,000 miles of track on which PTC systems will no longer be required under the proposed rule change is based on a joint AAR and Norfolk Southern Railway Company (“NS”) statement that, “If unchanged, the 2008 base-year provision means railroads would have to spend more than \$500 million in the next few years to deploy PTC on more than 10,000 miles of rail lines on which neither passenger nor TIH materials will be moving in 2015.”<sup>30</sup>

---

<sup>29</sup> Regulatory Program of the United States. “Regulatory Impact Analysis Guidance Document”, April 1, 1990-March 31, 1991. Appendix V, Page 663.

<sup>30</sup> **Federal Register** / Vol. 76, No. 164 /Wednesday, August 24, 2011 / Proposed Rules, page 52921.

The August 2011 NPRM further states that, "FRA assumes that 50 percent of the 10,000 miles would be able to pass both tests with the implementation of mitigation measures."<sup>31</sup> Therefore, whereas AAR assumed that full PTC implementation would be required on all of the 10,000 miles in question, FRA believes that half of the miles would have passed the two tests with some mitigation measures.

FRA evidently believes that 10,000 miles of track would have been subjected to the two tests under the Original Rule and 5,000 of those miles would have failed at least one of the two tests. Therefore, in determining the PTC implementation cost differential between the Original Rule and the rule as currently proposed to exclude the two qualifying tests, FRA calculates the avoided costs of full implementation (\$50,000 per track mile) on 5,000 miles and the avoided costs of mitigation measures (\$10,000 per track mile) on 4,450 of the other 5,000 miles. FRA believes mitigation measures would still be required on 550 miles. However, FRA had already accounted for some rail segments to be subjected to and pass the two qualifying tests in its Original Rule RIA. The August 2011 NPRM states that:

"[Under the PTC final rule RIA], FRA estimated that... PTC system implementation could be avoided on 3,204 miles of [] track because PIH materials traffic will have ceased by 2015 and the subject track segments would pass the residual risk analysis and alternative route analysis tests... [and] PTC system implementation could be avoided on 304 miles of track because gross tonnage will fall below 5 million gross tons per year, or passenger service would end so that neither of the two tests above would apply... Between the two categories, FRA estimated that railroads could exclude more than 3,500 miles."<sup>32</sup>

FRA assumed mitigation measures would be required on 3,204 of the 3,508 miles of track that it estimated would pass the two tests in its 2010 RIA. Therefore, the wayside

---

<sup>31</sup> Id.

<sup>32</sup> Id.

cost estimate for those track miles was already included at \$10,000 per mile (required for mitigation) rather than the \$50,000 per mile estimate for full PTC implementation. The NPRM goes on:

“Assuming that the 3,500 miles [excluded because they passed the two tests] represents about 50% of those tracks where PIH materials traffic will have ceased, FRA was implicitly estimating that there would be about 7,000 miles of track where PIH materials traffic will have ceased.”<sup>33</sup>

This passage raises several questions. First, the 50% assumption is a new concept. It was not discussed in 2010. That is, FRA did not start with 7,000 miles that would be subject to the two tests and back into the 3,500 miles that it determined would not require PTC implementation using an assumed 50% failure rate. FRA simply determined that roughly 3,200 track-miles would be subjected to and would pass the tests (with the caveat that some mitigation measures would be required), and that another roughly 300 miles would not be subjected to the two tests. FRA is now retroactively applying a new, arbitrary assumption to qualify its prior analysis in a manner that is not supported by the record.

In developing its 2010 RIA, FRA explained in detail the impact its two tests would have on PTC implementation requirements, and it determined that 3,508 miles would be affected. FRA now has changed positions and is endorsing AAR's unsupported and undefined estimate of 10,000 miles. If one doubles FRA's original estimate<sup>34</sup> or halves AAR's more recent estimate<sup>35</sup>, the two numbers appear to be somewhat comparable. They are not.

---

<sup>33</sup> Id.

<sup>34</sup>  $3,508 \times 2 = 7,016$

<sup>35</sup>  $10,000 \div 2 = 5,000$

As a result, there is a major disconnect between the 2010 RIA estimate of the impact of the two tests (3,508 miles) and the AAR's estimate (10,000 miles). The so-called "cost savings benefit" FRA now calculates is in no way related to its original cost estimates.

In its 2009 NPRM, FRA originally estimated that full PTC systems would be required on 69,933 miles of track. In its 2010 RIA, FRA adjusted that estimate to account for 3,204 miles that would require only mitigation measures, and 304 miles that would require no PTC system (along with 1,900 additional passenger miles that would require no systems)<sup>36</sup>. In the 2010 RIA, FRA also estimated that the remaining 64,525 miles would require full PTC implementation (\$3.226 billion at \$50,000 per mile) and another 3,204 miles would require mitigation systems only (\$32 million at \$10,000 per mile). This results in a total cost of \$3.258 billion.

Imposing FRA's newly adopted AAR estimates result in the following: 69,933 original miles of track, less 550 miles that would require only mitigation measures, 9,450 miles that would require no systems, and 1,900 additional passenger miles that would require no systems for a total of 58,033 miles of full PTC implementation.<sup>37</sup> In the August 2011 RIA (as adjusted to reflect AAR's estimates), FRA should have estimated that 58,033 miles would require full PTC implementation (\$2.9017 billion at \$50,000 per mile) and another 550 miles would require mitigation systems only (\$5.5 million at \$10,000 per mile). This results in a total cost of \$2.907 billion or a cost differential of \$351 million (\$3.258 billion - \$2.907 billion).

Rather than using the correct approach described above, FRA simply calculated the "avoided cost" associated with 5,000 miles of full wayside installation (\$250 million at

---

<sup>36</sup>  $69,933 - (3,204 + 304 + 1,900) = 64,525$

<sup>37</sup>  $69,933 - (550 + 9,450 + 1,900) = 58,033$

\$50,000 per track mile) and added another “avoided cost” associated with 4,450 miles of mitigation equipment installation (\$44.5 million at \$10,000 per mile) for a total cost of \$294.5 million.

#### **4. Locomotive Cost Calculations**

FRA assumes there will be no changes to the number of Class I railroads’ locomotives that are required to be equipped for PTC compatibility. FRA assumes that there will be changes to the number of Class II and Class III railroads’ locomotives based on the fact that there will be a reduction in Class I railroad PTC coverage, and by extension there will be a reduction in the number of Class II and Class III railroads connecting to PTC-equipped Class I railroad segments.

FRA estimated that 240 Class III railroad locomotives would have been required to be PTC compatible based on an analysis it performed to comply with the Regulatory Flexibility Act.<sup>38</sup> For the August 2011 RIA, FRA assumes there will be three times as many Class II railroad locomotives affected ( $240 \times 3 = 720$ ) as Class III railroad locomotives. In total, FRA assumes the baseline is equal to 960 locomotives ( $240 + 720$ ). FRA provided no support for its assumption that the number of Class II railroad impacted locomotives will be three times that of impacted Class III railroad locomotives.

In the August 2011 RIA, in what FRA labeled “the base case”, FRA starts with the original estimate of track miles required to be equipped with PTC rounded to the nearest thousand (70,000) and reduces that number by 10,000 miles. This amounts to a 14.29% ( $10,000 / 70,000$ ) reduction in track miles. FRA then multiplies this factor by 80% to arrive at a reduction of 11.43% ( $14.29\% \times 0.80$ ) in Class II and Class III railroad locomotives required to be equipped. Based on the above, FRA estimates that 110 (11.43%

---

<sup>38</sup> 5 U.S.C. 601 *et seq.*

x 960) locomotives will no longer need to be equipped for PTC under the 2011 proposed rules changes. FRA offers no support for its 80% factor. Although we believe the 80% factor is arbitrary and unsupported, we use it in our restatement in lieu of any available actual data.

FRA again erred in its use of 70,000 miles as the baseline in this economic analysis. As shown in the preceding section, the 2010 RIA reflected a system wherein 64,525 track miles would require full PTC systems. Under the corrected “base case”, FRA assumes 58,033 track miles will require PTC system installation. Therefore, the correct calculation would be a reduction of 8.05%  $[(6,492 / 64,525) \times 80\%]$  in the base case. This would mean a reduction of 77 locomotives<sup>39</sup>, not 110 locomotives as included in FRA’s 2011 analysis.

#### **5. Maintenance Costs**

FRA’s analysis assumes annual maintenance costs equal to 15% of the costs of the installed system as of the end of the previous year. As we discussed in our May 2010 Report, 15% is a high-range estimate for a base case maintenance expenses, and a maintenance rate of 12.5% is more reflective of the middle range based on similar studies (range equals a low of 10% to a high of 15%.) We restate the maintenance expenses based on 12.5%.

#### **6. Cost Summary**

A summary of the restated and corrected initial costs avoided based on the corrections discussed above is provided in Attachment No. 2 to this Report. As shown in Attachment No. 2, the avoided costs associated with the rules changes equal \$355 million, not \$301 million calculated by FRA.

---

<sup>39</sup> 8.05% x 960 locomotives

Attachment No. 2 to this Report also contains the restated and corrected base case 20-year discounted avoided costs calculation, using a 7% discount factor. As shown in Attachment No. 2, the 20-year discounted avoided costs associated with the rules changes equal \$507 million, not \$620 million calculated by FRA.

## **7. Safety Benefits**

In the August 2011 NPRM Executive Summary section, FRA states that in the past, “FRA repeatedly noted that an immediate regulatory mandate for PTC system implementation could not be justified based upon normal cost benefit principles relying on direct safety benefits.”<sup>40</sup> This conclusion is based on FRA’s flawed approach that fundamentally violates CBA principles. FRA continues to rely on an incomplete CBA structure that ignores large classes of benefits including all business and societal benefits aside from direct railroad safety benefits. FRA’s CBA methodology simply does not reflect “normal cost-benefit principles.” Cost-benefit analyses correctly incorporate both direct and indirect benefits.<sup>41</sup>

In the August 2011 RIA, FRA estimates safety benefits using the following steps:

1. FRA identified the total expected annual accident reduction benefit included in its 2010 RIA (\$55 million in 2015 and \$65 million in subsequent years);
2. FRA adjusted this benefit amount to reflect its belief that “headline accidents,” which account for 41%<sup>42</sup> of total accident reduction benefit and “involve a passenger train or a substantial release of PIH material,” are not “likely to occur on segments that would be withdrawn from the PTC network under the proposed rule;”<sup>43</sup>
3. FRA calculated the reduction in track mile coverage it assumes would occur in its base case analysis (10,000 / 70,000 = 14.29%); and

---

<sup>40</sup> **Federal Register** / Vol. 76, No. 164 / Wednesday, August 24, 2011 / Proposed Rules, pages 52918-9.

<sup>41</sup> Meyer and Miller, 2001, page 489.

<sup>42</sup> Regulatory Impact Analysis, Docket No. FRA-2011-0028, August 3, 2011, page 25

<sup>43</sup> Regulatory Impact Analysis, Docket No. FRA-2011-0028, August 3, 2011, pages 15, 25.

4. FRA multiplied the reduction factor by 60% ( $14.29\% \times 0.6 = 8.57\%$ ) to reflect the fact that “segments from which PIH traffic is rerouted or eliminated have relatively less dense traffic, which reduces accident exposure, than the average segment along which PTC must be implemented.”<sup>44</sup>

FRA’s presumption that no headline accidents will occur on segments where PTC is not implemented is unverified. The additional 60% reduction factor is also admittedly arbitrary. Furthermore, FRA’s adjustment for headline accidents already serves the stated purpose for the additional adjustment. Stated differently, the primary reason for FRA’s assumption that no headline accidents are likely to occur on segments affected by the rule change is that the subject lines have relatively less dense traffic, reducing accident exposure. For purposes of our restatement, we will accept FRA’s headline accident adjustment but reject the duplicative 60% adjustment in the absence of any supporting data. We incorporated the remainder of FRA’s estimates in our restatement. Attachment No. 3 contains a restated and corrected summary of foregone accident reduction benefits.

As shown in Attachment No. 3 to this Report, the annual foregone benefits are correctly estimated at \$3.9 million per year, not \$3.3 million as estimated by FRA. Attachment No. 3 to this Report also contains the restated and corrected base case 20-year discounted foregone benefits calculation, using a 7% discount factor. As shown in Attachment No. 3, the 20-year discounted avoided costs associated with the rules changes equal \$23 million, not \$27 million calculated by FRA.

#### **8. Annualized Costs and Benefits**

After estimating 20-year discounted costs, FRA attempts to state the costs on an “annualized” basis. However, what FRA appears to have done is reverse discounting to

---

<sup>44</sup> FRA offers no support for its 60% figure but does “request comments on this assumption.”

state the costs and benefits on a basis that is incompatible with CBA principles generally and with FRA's previous CBA's in the related RIA's associated with this rule.<sup>45</sup> FRA's annualized numbers are incorrect, unnecessary, and confusing. We have excluded them from our analysis.

**9. Final Cost-to-Benefit  
Calculation**

As discussed above, FRA configured its August 2011 RIA as a stand-alone CBA purporting to determine the costs and benefits associated with the proposed rule changes relative to a case where the changes would not have been implemented. The base case for this analysis should remain the same as it was for the preceding RIA's associated with this rule, i.e., the no-build scenario.

We have incorporated FRA's CBA components (corrected as described above) into the full CBA that FRA should have conducted to accompany the August 2011 NPRM. When incorporated into the full CBA, the cost-to-benefit ratio changes from 0.80 to 1 (2010 Analysis) to 0.77 to 1 (August 2011 Analysis). See Table 2 below for the details supporting the cost to benefit ratios.

---

<sup>45</sup> Specifically, FRA discounted its stream of assumed avoided costs, summed the total of these discounted costs, and calculated an equivalent annual payment, which over 20 years would equal the summed total on a discounted basis.

Item (1)	Source (2)	Amount (3)
1. 20-year discounted direct costs, 2010 Final Rule	1/	\$ (8,393,466,990)
2. 20-year discounted railroad safety benefits, 2010 Final Rule	1/	\$ 439,705,396
3. 20-year discounted total costs, 2010 Final Rule	1/	\$ (14,101,093,560)
4. 20-year discounted total benefits, 2010 Final Rule	1/	\$ 17,706,356,887
5. C/B ratio considering railroad safety benefits only	(Line 1 / Line 2) x -1	19 09
6. C/B ratio considering total benefits	(Line 3 / Line 4) x -1	0 80
7. Change in 20-year discounted direct costs vs. 2010 Final Rule	2/	\$ 506,747,107
8. Change in 20-year discounted railroad safety benefits vs. 2010 Final Rule	3/	\$ (22,784,309)
9. 20-year discounted direct costs, August 2011 NPRM Adjustment	Line 1 - Line 7	\$ (7,886,719,883)
10. 20-year discounted railroad safety benefits, August 2011 NPRM Adjustment	Line 2 - Line 8	\$ 416,921,087
11. 20-year discounted total costs, August 2011 NPRM Adjustment	Line 3 - Line 7	\$ (13,594,346,452)
12. 20-year discounted total benefits, August 2011 NPRM Adjustment	Line 4 - Line 8 (Line 9 / Line 10)	\$ 17,683,572,578
13. C/B ratio considering railroad safety benefits only	x -1 (Line 11 / Line 12) x -1	18 92
14. C/B ratio considering total benefits		0 77

1/ May 2010 L. E. Peabody & Associates, Inc. Report  
2/ Restated August 2011 RIA, Table 2a  
3/ Restated August 2011 RIA, Table 3

Although the August 2011 NPRM rule analysis results in a slightly lower cost to benefit ratio than the Original Rule analysis, both analyses produce cost to benefit ratios under 1.0 when considering total benefits, thus both scenarios indicate an efficient use of resources.<sup>46</sup>

#### E. SENSITIVITY ANALYSES

FRA also included in its August 2011 RIA, sensitivity analyses that measured the impact of changing the mileage assumptions of line segments that would not need to install PTC. According to a September 26, 2011 letter from Jo Strang, Associate Administrator

<sup>46</sup> Meyer and Miller, page 513.

for Railroad Safety/Chief Safety Officer to Mr. Paul Donovan representing the Chlorine Institute Inc. ("September 2011 Letter"), in preparing its August 2011 RIA, FRA accepted, without independent verification, the AAR's estimates that TIH/PIH traffic will cease on 10,000 miles of track on which PTC systems would have been required in 2008.<sup>47</sup>

The September 2011 Letter also explained how FRA decided to include in its sensitivities a low case assumption that used 7,000 miles and a high case assumption of 14,000 miles. The 7,000 mile low-case number was gathered through FRA's review of selected railroads' (BNSF, CSXT, and UP) previously submitted PTCIP filings. The September 2011 Letter stated that much of this data had been "redacted in the public docket" and we did not review that data. With regard to the 14,000 mile high-case number, FRA stated only that it "was determined using materials supplied by AAR and its member railroads," which FRA enclosed with the September 2011 Letter. FRA did not state exactly which data it used to derive the 14,000 mile figure and no summary tables were provided.

We have reviewed the AAR data on which FRA relied for the high mileage number. It appears to be data provided by individual railroads to AAR in response to a series of six questions posed by AAR for the purposes of "Economic Analysis." Much of the data is undated, but of the documents that are, the dates range from March 23, 2011 to April 19, 2011. Attached to the FRA's letter were copies of the responses from the following seven Class I railroads: BNSF, CSXT, UP, CP, CN, NS and KCS.

---

<sup>47</sup> According to the 2011 NPRM, as FRA was completing its analysis of this proposal, AAR submitted data that indicates its member railroads believe that they can cease PIH traffic on 11,128 miles of track, of which 9,566 miles have no passenger traffic. Some of the passenger traffic miles may later qualify for exclusion from the system on which PTC is required. FRA seeks comments and information on the accuracy and likelihood of estimated changes in PIH traffic.

Question No.1 of the AAR's data request stated "What line segments has/will PIH traffic been rerouted from such that they would not require PTC installation under the exclusions of the rule?" The railroads' responses to this question appear most likely to be the data that FRA relied upon to derive the 14,000 mileage assumption. If the number of track miles reported by each carrier<sup>48</sup> is totaled, the result is 14,680.86 miles. However, the level of documentation (very little) provided with the railroads' submissions make it difficult to determine exactly what the data represents.

Although most of the railroads provided data responsive to each question, the data submissions contained varying levels of explanatory information. In the railroads' responses, track segments are generally only identified by number, no location or other data is provided. It is unclear whether the numbered segments reflect an actual segment number used by the railroads in the normal course of business or whether the numbers simply were created as part of the processes used to generate the requested data. At any rate, no decoders were included with any submission. It is therefore impossible to determine exactly which portions of the systems are represented by the provided materials. The provided data do not allow for an informed critique of the validity of the railroads assertions regarding which segments may be affected by the rules changes.

FRA's reliance on this data appears to raise the same red flags discussed at length in preceding sections of this Report. Specifically, FRA does not show that it has made any attempt to understand, verify or justify use of any of the data provided by the railroads.

---

<sup>48</sup> At least one carrier, KCS, either did not answer Question No. 1 or its data was omitted from the data attached to the September 2011 Letter.

## V. CONCLUSIONS

PTC implementation is part of a concerted effort by Congress, PHMSA and others to improve the safety of the rail system in the United States. In August 2011, FRA published its third PTC rule in 20 months. In this version of the rule, FRA proposes to increase the railroads autonomy and decrease the miles of track under scrutiny before railroads are allowed to exempt them from a requirement that they be equipped with PTC. The AAR has advocated for this change in previous comments on the rule, litigation and testimony before FRA and Congress.

As shown in numerous previous reports, there is no doubt that the Class I railroads and other parties will receive substantial benefits from the installation of PTC beyond the primary benefits of risk mitigation. FRA is proposing to change the Original Rule implementing PTC by eliminating two qualifying tests thereby allowing the railroads to make final decisions on where PTC is implemented. In doing so FRA does not discuss, and evidently has not considered any impacts (economic or otherwise) on shippers or the public. In fact, the word “shipper” does not appear in either the thirty-three page August 2011 RIA or the entire August 2011 NPRM.

The railroads, through discussions with FRA and statements to Congress, continue to characterize TIH/PIH shipping as a declining market. FRA apparently agrees and estimates that removing the two qualifying tests will result in 10,000 miles (or more) of track not being equipped with PTC. The railroads have stated that the number may go higher with several years to go before the December 2015 deadline for implementation (and with increased control over the determination whether PTC is required). It is clear that TIH/PIH shippers face a real danger of reduced access to rail routes.

The Class I railroads view PTC installation as an unfunded mandate, and have called on Congress to consider various funding mechanisms to offset PTC investment, including a 25 percent infrastructure tax incentive, a fully funded Rail Safety Technology Grant Program, and a change in the reporting requirements that would include supplemental schedules that would separately identify PTC expenditures in the railroads' Annual Report, Form R-1's filed with the STB.

Economic theory holds that the railroads will attempt to recover mandated PTC investments as quickly and as efficiently as possible given the limitations placed on them by the market and industry regulators. Left unchecked, there is little doubt that the railroads will attempt to exploit their most vulnerable customers to recover their PTC investment. From a general sense, this would include all captive railroad shippers, since those shippers have little recourse against a railroad's monopoly power on a captive movement.<sup>49</sup> From a more focused position however, the railroads have stated that they will attempt to recover their investment directly from the shippers the railroads view as being responsible for the requirement to install PTC, namely TIH/PIH shippers.<sup>50</sup> The Class I railroads have requested that the STB begin collecting PTC-specific cost data so

---

<sup>49</sup> The STB defines captive locations as those rail served locations without effective intramodal or intermodal competition. In other words, those locations that are not served by two or more railroads (intramodal competition) or can be economically served by another mode of transportation such as truck, barge or pipeline (intermodal competition).

<sup>50</sup> For example, consider the comments of Mark Schulze, BNSF's Vice President of Safety, Training, and Operation Support, at the August 13, 2009 Public Hearing on the PTC NPRM in Docket Number: FRA-2008-0132. Mr. Schulze stated: "In several recent hearings, the Surface Transportation Board has recognized that there are substantial and unique costs associated with the transportation of toxic inhalant materials ranging from the additional cost elements such as equipment and facility investment associated with PTC to huge potential and largely uninsurable liability risk associated with such movements. Those TIH/PIH costs will likely continue to increase in the future, especially if the RSIA mandates are not carefully represented in regulation. Those costs require significant up-front investment which will initially be borne by railroads. In order to remain economically viable, the railroads must look to their rail shippers to contribute to these mandatory expenditures. To the extent that railroads are able to pass those costs along to shippers, shippers could reasonably be expected to adapt to increases in the relative costs of rail by shifting freight to other, less safe and less green modes of transportation. This outcome would be contrary to stated government policies. Ultimately, implementing regulations could degrade the safety of the very movements targeted for improvement by RSIA." (Page 38-39).

that the costs may be separated from other cost items in the railroads' annual cost accounting reports. The STB recently issued an NPRM that would impose such a requirement.<sup>51</sup> In the NPRM, the STB acknowledged that, "having the costs broken out may encourage carriers to seek to recover specific PTC costs in individual cases." Based on cost estimates produced by the railroad companies and using standard STB capital cost recovery procedures, we estimated that the Class I railroads will attempt to recoup \$53 million in PTC-related capital carrying charges in 2010. Capital carrying charges will increase thereafter to \$451 million in 2019.<sup>52</sup>

The railroads appear to be setting up a dynamic where they may limit routes (forcing more TIH/PIH onto trucks) and/or increase costs to TIH/PIH shippers. If this is true, the railroads' position is enhanced by the FRA's reliance on flawed reasoning and a demonstrably faulty cost-to-benefit ratio of over 20 to 1, which, when calculated correctly to include total benefits is actually 0.77 to 1.

FRA has not addressed the impact on shippers that will result from its proposed regulatory actions, except to state in the August 2011 NPRM that, "[t]he AAR and its members appear to have been more effective in the future reduction of PIH materials traffic than FRA had initially estimated..." This statement certainly gives the impression that the deck is being intentionally stacked against TIH/PIH shippers. If the PTC rule goes into effect as proposed, the negative impact on shippers, and TIH/PIH shippers in particular, in terms of reduced rail access and increased rail rates for shippers that retain rail access, could be severe and long lasting.

---

<sup>51</sup> STB's October 13, 2011 Decision in Ex Parte No. 706, "Reporting Requirements for Positive Train Control Expenses and Investments,"

<sup>52</sup> See the May 2010 L. E. Peabody & Associates, Inc. Report to Chlorine Institute at Attachment H-3.

## **VI. BIBLIOGRAPHY OF IMPORTANT PTC RELATED DOCUMENTS**

1. Association of American Railroads. "Positive Train Control." (9 September 2009). Available from: Association of American Railroads <<http://www.aar.org/safety/positivetraincontrol/ptc.aspx>>
2. Association of American Railroads. "Association of American Railroads Voices PTC Concerns." (9 September 2009) . Available from: Association of American Railroads <<http://www.aar.org>>
3. "C&S Engineers: In their Own Words; Focus on Positive Train Control." *Progressive Railroading* (March 2010)
4. Currie, Clint. "TRB Conference Takeaways." *Concept Capital: Washington Research Group, T&I Bulletin* (14 January 2009)
5. Federal Railroad Administration. "Differential GPS: An Aid to Positive Train Control." *Report to the Committees on Appropriations* (June 1995)
6. Federal Railroad Administration. "Implementation of Positive Train Control System." In *Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator* (August 1999)
7. Federal Railroad Administration. "PTC - Benefits and Costs of Positive Train Control." *Report in Response to Request of Appropriations Committees* (August 2004)
8. Federal Railroad Administration. "Implementation of PTC Systems as Required by the Rail Safety Improvement Act of 2008." (2008)
9. Federal Railroad Administration. "FRA Issues Final Rule on Advanced Train Braking Technology." (15 October 2008)
10. Federal Railroad Administration. "Intelligent Railroad Systems - Positive Train Control (PTC)." In *PTC Analyses* (30 October 2008). Available from: Federal Railroad Administration <<http://www.fra.dot.gov>>
11. Federal Railroad Administration. "Positive Train Control Overview." (10 March 2009). Available from: Federal Railroad Administration <<http://www.fra.dot.gov/pages/1521.shtml>>
12. Federal Railroad Administration. "Positive Train Control (PTC)." (26 March 2009). Available from: Federal Railroad Administration <<http://www.fra.dot.gov>>
13. Federal Railroad Administration. "Positive Train Control Systems; Proposed Rule." *Federal Register Part III 49 CFR Parts 229, 234, 235* (21 July 2009)

14. Federal Railroad Administration. "Positive Train Control Systems; Final Rule." *Department of Transportation Federal Railroad Administration 49 CFR Pars 229, 234, 235, and 236 [Docket No. FRA-2008-0132, Notice No.3]* (15 January 2010)
15. Federal Railroad Administration. "Positive Train Control Systems; Final Rule Amendments." *Department of Transportation Federal Railroad Administration 49 CFR Part 236 [Docket No. FRA-2008-0132, Notice No. 4]* (27 September 2010)
16. Federal Railroad Administration. "Positive Train Control Systems; Proposed Rule." *Department of Transportation Federal Railroad Administration 49 CFR Part 236 [Docket No. FRA-2011-0028, Notice No.1]* (24 August 2011)
17. Federal Railroad Administration. Transcript of Public Hearing on a Notice of Proposed Rulemaking for Positive Train Control Systems. *[Docket No. FRA-2011-0028]* (13 August 2009)
18. Hamberger, Edward R. and Mark D Manion, "Joint Statement before the U.S. House of Representatives, Committee on Transportation and Infrastructure. Hearing on the Rail Safety Improvement Act of 2008 (17 March 2001)
19. Hartong, M. "Key Management Requirements for Positive Train Control Communications Security." *Institute of Electrical and Electronics Engineers* (April 2006). Available from: IEEE <<http://www.ieee.org>>
20. Hawkes, Alex. "Alaska's Positive Thinking." In *Railway Technology* (27 August 2008)
21. Library of Congress. "S.3493: A Bill to Require Rail Carriers to Develop Positive Rail Control System Plans for Improving." (16 September 2008). Available from: GovTrack.us <http://www.govtrack.us>
22. Meyer, Michael D. and Eric J. Miller, "Urban Transportation Planning: A Decision Oriented Approach, Second Edition," McGraw Hill, Boston, 2001.
23. National Transportation Safety Board. "Implement Positive Train Control Systems." In *Most Wanted List Transportation Safety Improvements* (2007). Available from: NTSB <http://www.nts.gov>
24. Regulatory Impact Analysis, Docket No. FRA-2011-0020, August 3, 2011.
25. Regulatory Program of the United States Government for April 1, 1991 to March 31, 1992, "Regulatory Impact Analysis Guide, Appendix V"
26. Office of Management and Budget. "Circular A-94: Guidelines and Discount Rates For Benefit-Cost Analysis of Federal Programs." (29 October 1992). Available from: Whitehouse Website <<http://www.whitehouse.gov/omb/rewrite/circulars/a094/a094.html>>

27. Oliver Wyman, Inc. "Assessment of the Commercial Benefits of Positive Train Control." (23 April 2010). Available from: AAR  
<[http://www.aar.org/NewsAndEvents/PressReleases/2010/04/~/\\_/media/AAR/NewsFiles/2010/042710WymanPTC.ashx](http://www.aar.org/NewsAndEvents/PressReleases/2010/04/~/_/media/AAR/NewsFiles/2010/042710WymanPTC.ashx)>
28. Paterson, Rick. "Terminator V." *UBS Railroads Weekly* (18 February 2010). Available from: UBS <<http://www.ubs.com/investmentresearch>>
29. "Positive Train Control (PTC): Calculating Benefits & Costs of a New Railroad Control Technology" In *Journal of Transportation Research Forum* (Summer 2005)
30. "Railroads Question PTC Timetable." *Railway Age* (2007). Available from: Railway Age <<http://www.railwayage.com>>
31. Railroad Safety Advisory Committee. "Implementation of Positive Train Control Systems." In *Report of the RSAC to the FRA* (August 1999)
32. Roskind, Frank D. "Positive Train Control Systems: Economic Analysis." *Department of Transportation Federal Railroad Administration 49 CFR Pars 229, 234, 235, and 236 [Docket No. FRA-2006-0132, Notice No. 1]* (July 10 2009)
33. Troy, Matthew. "The ABCs of PTC: A Primer on Positive Train Control & Implications for the Rails." *Citigroup Global Markets* (22 February 2010)
34. STB Docket No. 42114, *US Magnesium, L.L.C. v. Union Pacific Railroad Company*, served August 24, 2009 ("US Magnesium")
35. STB Decision in Ex Parte No. 712, "Improving Regulation and Regulatory Review," (5 October 2011)
36. STB Decision in Ex Parte No. 706, "Reporting Requirements for Positive Train Control Expenses and Investments," (13 October 2011)
37. Union Pacific Railroad, "GO21: Positive Train Control (PTC) Update." (21 September 2009)
38. Young, Jeff (AVP - Transportation Systems, UP). "Information Technology Strategy." (12 January 2009)
39. Zeta-Tech Associates. "Quantification of the Business Benefits of Positive Train Control." *Prepared for the Federal Railroad Administration* (15 March 2004)

**TIMELINE FOR RELEVANT LEGISLATIVE AND REGULATORY ACTIVITY**

1. Oct. 2008 Rail Safety Improvement Act
2. Dec. 2008 PHMSA Rail Hazmat (PIH/TIH) final rule
3. Aug. 2009 Docket No. FRA-2008-0132 Hearing. (FRA-2008—0132-0006)
4. Jan. 2010 Final FRA rule on PTC
5. Feb. 2010 Multiple Requests for Reconsideration filed
6. Mar./May 2010 L. E. Peabody & Associates, Inc. Chlorine Institute Report
7. Apr. 2010 Oliver Wyman, Inc. Association of American Railroads Report
8. July 2010 All Requests for Reconsideration denied
9. Sep. 2010 Final Rule Amendments (allowing comment on some provisions)
10. Oct. 2010 AAR files suit against FRA (Petition for Review)
11. Jan. 2011 Executive Order 013563, directs federal agencies to reduce regulatory burdens
12. Mar. 2011 AAR/FRA Settlement filed (2<sup>nd</sup>) and Approved (3<sup>rd</sup>) - FRA agrees to issue NPRM on PTC
13. Mar. 2011 Congressional Hearings on RSIA of 2008
14. Aug. 2011 FRA issues NPRM (FRA-2011-0028) and RIA
15. Oct. 2011 STB Issues NRC (Docket No. EP 712) Improving Regulations and Regulatory Review
16. Oct. 2011 STB issue NPRM (Docket No. EP 706) Reporting Requirements for PTC Expenses and Investments

**Restated Avoided Costs for PTC Implementation  
Under August 2011 Proposed Rules Changes**

A summary of the restated initial costs avoided based on the corrections discussed in the text of this Report is provided in Table C-1 below.

<u>Item</u> (1)	<u>Source</u> (2)	<u>2010 Final Rule</u> (3)	<u>August 2011 NPRM</u> (4)	<u>Difference <sup>2/</sup></u> (5)
1. Total System Miles	FRA Work Papers	69,933	69,933	-
2. Miles of mitigation installation	FRA Work Papers	3,204	550	(2,654)
3. PTC rule mitigation cost/mile	FRA Work Papers	(\$10,000)	(\$10,000)	\$0
4. Total mitigation installation costs	Line 2 x Line 3	(\$32,040,000)	(\$5,500,000)	\$26,540,000
5. PTC miles avoided, freight	FRA Work Papers	304	9,450	9,146
6. PTC miles avoided, passenger	FRA Work Papers	1,900	1,900	-
7. PTC wayside installation miles	Line 1 - Line 2 - Line 5 - Line 6	64,525	58,033	(6,492)
8. PTC wayside installation costs per mile	FRA Work Papers	(\$50,000)	\$50,000	\$0
9. Total wayside installation costs	Line 7 x Line 8	(\$3,226,250,000)	(\$2,901,650,000)	\$324,600,000
10. Total PTC wayside costs	Line 4 - Line 9	(\$3,258,290,000)	(\$2,907,150,000)	\$351,140,000
11. Total Class II and III Locomotives	FRA Estimate	960	960	-
12. Percent Reduction in Miles	<sup>3/</sup>	0.00%	-10.06%	-10.06%
13. Relative Locomotive Intensity	FRA Assumption	80.00%	80.00%	0.00%
14. Percent Reduction in Locomotives	Line 12 x Line 13	0.00%	-8.05%	-8.05%
15. Reduction in Locomotives	Line 11 x Line 14	-	(77)	(77)
16. Adjusted Locomotive Pool	Line 11 + Line 15	960	883	(77)
17. PTC analysis -- locomotive installation cost	FRA Work Papers	(\$55,000)	(\$55,000)	\$0
18. PTC analysis -- locomotive installation cost	FRA Work Papers, Corrected	(\$50,000)	(\$50,000)	\$0
19. Initial Locomotive Cost, expected case	Line 16 x Line 18	(\$48,000,000)	(\$44,136,493)	\$3,863,507
20. Total Affected Cost Items	Line 10 + Line 19	(\$3,306,290,000)	(\$2,951,286,493)	\$355,003,507

<sup>1/</sup> Costs are treated as negative and benefits are treated as positive in CBA.  
<sup>2/</sup> Column (4) - Column (3)  
<sup>3/</sup> Line 7, Column (3) - Line 7, Column (4) - Line 7, Column (3)

Table C-2 below contains the restated and corrected base case 20-year discounted avoided costs calculation, using a 7% discount factor.

**Restated Avoided Costs for PTC Implementation  
Under August 2011 Proposed Rules Changes**

Table C-2 Restated and Corrected Base Case Discounted Avoided Costs - 7 % Discount Factor					
<u>Year</u> (1)	<u>Discount Factor</u> (2)	<u>Initial Costs Avoided</u> (3)	<u>Maintenance Avoided</u> (4)	<u>Annual Cost Avoided</u> (5)	<u>Discounted Costs Avoided</u> (6)
1.	2009	1.00	\$0	\$0	\$0
2.	2010	0.93	\$0	\$0	\$0
3.	2011	0.87	\$0	\$0	\$0
4.	2012	0.82	\$0	\$0	\$0
5.	2013	0.76	\$0	\$0	\$0
6.	2014	0.71	\$177,501,754	\$0	\$177,501,754
7.	2015	0.67	\$177,501,754	\$22,187,719	\$199,689,473
8.	2016	0.62	\$0	\$44,375,438	\$44,375,438
9.	2017	0.58	\$0	\$44,375,438	\$44,375,438
10.	2018	0.54	\$0	\$44,375,438	\$44,375,438
11.	2019	0.51	\$0	\$44,375,438	\$44,375,438
12.	2020	0.48	\$0	\$44,375,438	\$44,375,438
13.	2021	0.44	\$0	\$44,375,438	\$44,375,438
14.	2022	0.41	\$0	\$44,375,438	\$44,375,438
15.	2023	0.39	\$0	\$44,375,438	\$44,375,438
16.	2024	0.36	\$0	\$44,375,438	\$44,375,438
17.	2025	0.34	\$0	\$44,375,438	\$44,375,438
18.	2026	0.32	\$0	\$44,375,438	\$44,375,438
19.	2027	0.30	\$0	\$44,375,438	\$44,375,438
20.	2028	0.28	\$0	\$44,375,438	\$44,375,438
21.	2029	0.26	N/A	N/A	N/A
22.	2030	0.24	N/A	N/A	N/A
23.	2031	0.23	N/A	N/A	N/A
24.	<b>Totals</b>			\$954,071,926	\$506,747,107

**Restated Avoided Costs for PTC Implementation  
Under August 2011 Proposed Rules Changes**

Table C-3 below contains a restated and corrected summary of avoided costs broken into components.

<u>Item</u> (1)	<u>Source</u> (2)	<u>Amount 1/</u> (3)
1. Total Avoided Costs	Table C-2	\$506,747,107 <sup>2/</sup>
2. Avoided Mitigation-Related Costs	Work Papers	\$37,884,325
3. Avoided Wayside Equipment-Related Costs	Work Papers	\$463,347,848
4. Avoided Locomotive-Related Costs	Work Papers	\$5,514,934
5. Avoided Maintenance Costs	Work Papers	\$261,913,897

<sup>1/</sup> All costs are 20-year discounted costs  
<sup>2/</sup> L2 + C3 + C4

**Restated Foregone Benefits for PTC Implementation Under  
August 2011 Proposed Rules Changes**

A summary of the restated foregone direct safety benefits based on the corrections discussed in this Report is provided in Table B-1 below.

<u>Item</u> (1)	<u>Source</u> (2)	<u>Amount</u> (3)
1. Annual Accident Reduction Benefit, 2016-2028	FRA Work Papers	\$65,118,854
2. PTC wayside installation miles, 2010 Final Rule	Restated Table 1	64,525
3. PTC wayside installation miles, August 2011 NPRM	Restated Table 1	58,033
4. PTC wayside installation mile reduction	Line 3 - Line 2	(6,492)
5. PTC wayside installation percentage reduction	Line 4 / Line 2	-10.06%
6. Proportion of Non-Headline Accidents	FRA Work Papers	58.92%
7. Relative Traffic Risk	FRA 60% Assumption (Rejected)	100.00%
8. Proportion of Risk Avoided	Line 5 x Line 6 x Line 7	-5.93%
9. Annual Foregone Benefit, 2016-2028	Line 1 x Line 8	(\$3,860,290)
10. Percent of Benefit Reduction in 2015	FRA Assumption	50.00%
11. Annual Foregone Benefit, 2015	Line 9 x Line 10	(\$1,930,145)

Table B-2 below contains the restated and corrected base case 20-year discounted foregone benefits calculation, using a 7% discount factor.

**Restated Foregone Benefits for PTC Implementation Under  
August 2011 Proposed Rules Changes**

	<u>Year</u>	<u>Discount Factor</u>	<u>Foregone Benefits</u>	<u>Discounted Foregone Benefits</u>
	(1)	(2)	(3)	(4)
1.	2009	1.00	\$0	\$0
2.	2010	0.93	\$0	\$0
3.	2011	0.87	\$0	\$0
4.	2012	0.82	\$0	\$0
5.	2013	0.76	\$0	\$0
6.	2014	0.71	\$0	\$0
7.	2015	0.67	(\$1,930,145)	(\$1,286,137)
8.	2016	0.62	(\$3,860,290)	(\$2,403,995)
9.	2017	0.58	(\$3,860,290)	(\$2,246,724)
10.	2018	0.54	(\$3,860,290)	(\$2,099,742)
11.	2019	0.51	(\$3,860,290)	(\$1,962,376)
12.	2020	0.48	(\$3,860,290)	(\$1,833,996)
13.	2021	0.44	(\$3,860,290)	(\$1,714,015)
14.	2022	0.41	(\$3,860,290)	(\$1,601,883)
15.	2023	0.39	(\$3,860,290)	(\$1,497,087)
16.	2024	0.36	(\$3,860,290)	(\$1,399,147)
17.	2025	0.34	(\$3,860,290)	(\$1,307,614)
18.	2026	0.32	(\$3,860,290)	(\$1,222,069)
19.	2027	0.30	(\$3,860,290)	(\$1,142,121)
20.	2028	0.28	(\$3,860,290)	(\$1,067,402)
21.	2029	0.26	N/A	N/A
22.	2030	0.24	N/A	N/A
23.	2031	0.23	N/A	N/A
24.	Totals		(\$52,113,921)	(\$22,784,309)

As shown above, the 20-year discounted avoided costs associated with the rules changes equal \$23 million.

# Report

to



---

**Positive Train Control:  
Statement of Updated Total Benefits and Costs, Restatement of FRA  
Cost-Benefit Analysis Based on Updated FRA Benefits and Costs,  
and Statement of Economic Harm to TIH Shippers**

---

by

**L. E. PEABODY & ASSOCIATES, INC.**  
ECONOMIC CONSULTANTS

1501 Duke Street, Suite 200  
Alexandria, Virginia 22314

Date: May 24, 2010

## TABLE OF CONTENTS

	Page
<b>I. INTRODUCTION.....</b>	<b>1</b>
<b>II. SUMMARY AND FINDINGS .....</b>	<b>8</b>
<b>A. RESTATED PTC BENEFITS ANALYSIS.....</b>	<b>8</b>
<b>B. RESTATED PTC COST ANALYSIS.....</b>	<b>9</b>
<b>C. POTENTIAL ECONOMIC HARM TO TIH SHIPPERS FROM         THE RAILROADS IMPLEMENTATION OF PTC .....</b>	<b>10</b>
<b>III. POSITIVE TRAIN CONTROL BENEFITS ANALYSIS: UPDATED STATEMENT OF TOTAL BENEFITS AND RESTATEMENT OF FRA COST-BENEFIT ANALYSIS BASED ON FRA COSTS AND UPDATED FRA BENEFITS .....</b>	<b>11</b>
<b>A. THEORETICAL PROBLEMS WITH THE FRA FINAL RULE RIA .....</b>	<b>13</b>
<b>B. CALCULATION OF TOTAL BENEFITS, HISTORICAL OVERVIEW .....</b>	<b>15</b>
<b>C. ERRORS CONTAINED IN THE 2004 FRA REPORT .....</b>	<b>23</b>
<b>D. MECHANICAL AND THEORETICAL ERRORS CONTAINED IN THE         2009 FRA RESTATEMENT .....</b>	<b>25</b>
1. Mixing Of Costs And Benefits .....	27
2. Shipper Direct Benefits .....	27
3. Other Railroad Direct Benefits.....	28
4. Modal Diversion Factor.....	30
5. Inconsistent Application Of Modal Diversion Benefits And Costs .....	31
6. Retstatement .....	33
<b>E. INTERMEDIATE RESTATEMENT OF FRA FINAL RULE RIA.....</b>	<b>35</b>
<b>IV. POSITIVE TRAIN CONTROL COST ANALYSIS: UPDATED STATEMENT OF TOTAL COSTS AND RESTATEMENT OF FRA COST-BENEFIT ANALYSIS BASED ON UPDATED FRA COSTS AND BENEFITS.....</b>	<b>37</b>
<b>A. CALCULATION OF TOTAL COSTS, HISTORICAL OVERVIEW .....</b>	<b>38</b>
1. 2004 Report to FRA (ZETA-TECH).....	41
2. 2004 Report to Congress (FRA).....	44
3. July 2009 Notice of Proposed Rule Making (FRA) .....	46
4. January 2010 Final Rule (FRA).....	49

**TABLE OF CONTENTS**

	<b>Page</b>
<b>B. PROBLEMS WITH THE 2010 FRA COST ESTIMATE .....</b>	<b>50</b>
1. Overstated Locomotive Adaptation Costs.....	51
2. Overstated Maintenance Costs .....	52
3. Overstated Wayside Equipment Installation Costs .....	54
4. Retstatement .....	54
<b>C. RESTATEMENT OF FRA FINAL RULE RIA .....</b>	<b>55</b>
<b>V. POTENTIAL ECONOMIC HARM TO TIH SHIPPERS RESULTING FROM THE RAILROADS IMPLEMENTATION OF POSITIVE TRAIN CONTROL .....</b>	<b>57</b>
<b>A. RAILROADS' POSITION ON COST RECOVERY .....</b>	<b>57</b>
<b>B. QUANTIFICATION OF COSTS ALLOCATED TO TIH SHIPPERS .....</b>	<b>58</b>
<b>C. PTC INVESTMENTS WILL IMPACT REGULATED TIH SHIPPER RATES.....</b>	<b>64</b>
<b>VI. SUMMARY OF KEY LITERATURE REVIEWED .....</b>	<b>66</b>
<b>A. A BRIEF SUMMARY OF SELECTED KEY DOCUMENTS (IN CHRONOLOGICAL ORDER).....</b>	<b>66</b>
1. Federal Railroad Administration, June 1995 - <i>Differential GPS: An Aide To Positive Train Control</i> .....	66
2. Railroad Safety Advisory Committee, August 1999 - <i>Implementation Of Positive Train Control Systems</i> .....	66
3. Zeta-Tech Associates, March 15, 2004 - <i>Quantification Of The Business Benefits Of Positive Train Control</i> .....	67
4. Federal Railroad Administration, August 2004 - <i>Benefits And Costs Of Positive Train Control</i> .....	68
5. Federal Railroad Administration, July 21, 2009 - <i>Positive Train Control Systems; Proposed Rule</i> .....	70
6. Federal Railroad Administration, July 10, 2009 - <i>Positive Train Control Systems; Economic Analysis</i> .....	71
7. Federal Railroad Administration, January 15, 2010 - <i>Positive Train Control Systems; Final Rule</i> .....	72
<b>VII. BIBLIOGRAPHY OF IMPORTANT PTC-RELATED DOCUMENTS.....</b>	<b>74</b>

## **LIST OF ATTACHMENTS**

<b><u>Attachment No.</u></b>	<b><u>Title</u></b>
(1)	(2)
B-1	Intermediate Restatement of PTC Cost-Benefit Analysis (Twenty-year Costs and Benefits on a Present-Value Basis Assuming a 7% Discount Rate)
B-2	Intermediate Restatement of PTC Cost-Benefit Analysis (Twenty-year Costs and Benefits on a Present-Value Basis Assuming a 3% Discount Rate)
B-3	Restatement of Indirect Benefits Factor (Based on Corrections to FRA 7/10/2009 Economic Analysis)
B-4	Summary of Errors In and Corrections To the 2004 and 2009 FRA Economic Analysis Benefits Calculations
C-1	Restatement of PTC Cost-Benefit Analysis (Twenty-year Costs and Benefits on a Present-Value Basis Assuming a 7% Discount Rate)
C-2	Restated PTC Costs Based on Changes to FRA's Maintenance and Onboard Cost Estimates
H-1	Estimated PTC Installation Capital Costs By Year
H-2	Estimated Percentage Of PTC Costs To Be Recovered From TIH Shippers
H-3	Estimated Annual Capital Carrying Charges Railroads Will Allocate To TIH Shippers For PTC Installation

## **LIST OF ACRONYMS**

AAR	Association of American Railroads
ABS	Automatic Block Signal System
ARES	Advanced Railroad Electronics System
ARR	Alaska Railroad
ATCS	Automatic Train Control System
BNSF	BNSF Railway Company
CBA	Cost-Benefit Analysis
CBTC	Communication Based Train Control
CFR	Code of Federal Regulations
CONRAIL	Consolidated Rail Corporation
CPU	Central Processing Unit
CSXT	CSX Transportation
CTC	Centralized Traffic Control
DCF	Discounted Cash Flow
DTC	Direct Traffic Control
FRA	Federal Railroad Administration
GDP	Gross Domestic Product
GPS	Global Positioning System
ITIC	Intermodal Transportation and Inventory Cost Model
MOW	Maintenance of Way
NPRM	Notice of Proposed Rulemaking
NPV	Net Present Value
NS	Norfolk Southern Railway Company
OMB	Office of Management and Budget
PTC	Positive Train Control

## **LIST OF ACRONYMS**

(continued)

PV	Present Value
RIA	Regulatory Impact Analysis
RSAC	Railroad Safety Advisory Committee
RSIA	Rail Safety Improvement Act of 2008
R/VC	Revenue/Variable Cost
SEC	Securities and Exchange Commission
SPMS	Switch Point Monitoring System
STB	Surface Transportation Board
TFT	Track Force Terminal
TIH	Toxic Inhalation Hazard
TIWS	Track Integrity Warning System
UP	Union Pacific Railroad Company
UHF	Ultra High Frequency
URCS	Uniform Railroad Costing System
VRE	Virginia Railway Express
V-TMS	Vital Train Management System

## **I. INTRODUCTION**

Positive Train Control (“PTC”) is a generic term for technology systems that monitor train movements and that can automatically stop trains to avoid imminent collisions or other incidents. The Rail Safety Improvement Act of 2008 (“RSIA”) directed the Federal Railroad Administration (“FRA”) to develop regulations requiring PTC installation on rail lines traversed by passenger traffic and certain hazardous materials shipments. On January 15, 2010, FRA issued its final rule on PTC implementation, which requires PTC systems to be up and running on affected rail segments by the end of 2015.

As part of its rulemaking process, FRA conducted several Regulatory Impact Analyses (“RIA”) in which it developed estimated costs and benefits (over a 20-year time horizon) associated with the impending PTC implementation. Curiously, FRA's statement of benefits in the final rule RIA included only the railroad safety benefits expected to result from PTC installation. As such, FRA's stated cost-benefit analysis (“CBA”)<sup>1</sup> and resulting cost-benefit ratio associated with the rule ranges from 19.6 (based on a 3% discount rate) to 21.7 (based on a 7% discount rate).

The FRA acknowledged in its discussion of costs and benefits that two other large pools of benefits would also accrue as a result of PTC implementation,<sup>2</sup> but it chose not to include them in its total statement of benefits for purposes of comparing costs to benefits (and developing a cost-benefit ratio) associated with the rule. As discussed in more detail below, FRA's reasoning

---

<sup>1</sup> A cost-benefit analysis framework is used to evaluate the desirability of a posited action. The aim is to gauge the efficiency of the action relative to the status quo. It monetizes all gains (benefits) and losses (costs) and weighs them against one-another. A project's desirability is ranked by the weight of its costs relative to its benefits, stated on a present value basis.

<sup>2</sup> **Federal Register** / Vol. 75, No. 10 / Friday, January 15, 2010 / Rules and Regulations, page 2684. The FRA uses the term “business benefits” to describe its assessment of what are actually benefits to both industry (e.g., direct benefits from efficiency gains) and society (e.g., indirect benefits from reduced highway crashes and reduced emissions.)

supporting its exclusion of the other benefits is flawed and is contradictory to RIA guidelines<sup>3</sup>.

Many preceding studies of PTC -- some of which were prepared by FRA -- did properly include these other benefits categories. In fact, in the July 10, 2009 Economic Analysis which FRA prepared in support of its July 21, 2009 Notice of Proposed Rulemaking ("NPRM"), FRA included an updated calculation of the *total* benefits resulting from PTC implementation. The FRA even discussed this analysis in the final rule RIA, despite its decision to exclude these other benefits categories from its final evaluation.

In March 2010, at the request of The Chlorine Institute Inc., we restated the benefits anticipated to result from PTC implementation. Our benefits restatement was developed using unit-cost estimates and methodologies included in FRA's 2009 and 2010 economic analyses supporting its July 2009 PTC NPRM and January 2010 PTC final rule, respectively. Specifically, we developed updated business and societal benefits estimates using FRA's business benefits framework corrected to account for methodological and mathematical errors. We also restated FRA's benefits estimates on a 2009-real-dollar basis by indexing the FRA's unit-cost components to account for inflation. Our restatement showed that FRA incorrectly excluded large classes of benefits from its RIA CBA's, and that including these benefits as developed by FRA (corrected and updated as discussed above) resulted in a far different CBA outcome and conclusion regarding the desirability and net economic impact of the final rule. Whereas FRA's final rule, based on consideration of all costs and a narrow selection of benefits classes (specifically railroad-related safety benefits), presented a cost-benefit ratio over 20 to 1 (anticipated costs were twenty times greater than anticipated benefits), a complete unbiased presentation of all costs and all benefits anticipated by FRA results in a cost-benefit ratio under 1.0 (anticipated costs are less than anticipated benefits.)

---

<sup>3</sup> See: OMB Circular A-94, "*Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*," Section 6: Identifying and Measuring Benefits and Costs.

The railroads' Washington, D.C. based lobby group, the Association of American Railroads ("AAR"), took exception to our findings and hired Oliver Wyman, Inc. ("Wyman") to "provide an independent evaluation of the potential commercial benefits of PTC"<sup>4</sup> which AAR claims "clearly dispels assertions that there will be substantial business benefits to railroads that implement positive train control ("PTC") technology under federal regulations."<sup>5</sup> In its report, Wyman addressed certain of the specific business benefits incorporated in FRA's business benefits estimates (and updated in this Report). For each of the items discussed in the Wyman report, Wyman broke down the underlying assumptions and cost components, opined as to the validity of the assumptions and unit costs, and restated the benefits based on its own assessment. The Wyman report concluded that the cost-benefit ratio is in the neighborhood of 11 to 1, when considering railroad safety and business benefits.

Cost-benefit analyses require the employment of several imprecise analytical techniques, such as forecasting the effect of a proposed action or actions on industry, government, and society (e.g., changes in efficiency, productivity, or safety), and assigning monetary values to non-monetary items (e.g., the value of time or of human life). As such, this Report focuses primarily on the framework, methodologies, and calculations underlying FRA's regulatory impact analyses and underlying economic analyses. When we use the proper framework, methodologies, and calculations, *and used FRA's own assumptions regarding the quantity and value specific benefits arising from PTC implementation*, we demonstrate that the cost-benefit analysis presented in the final rule regulatory impact analysis was erroneous and incomplete, and the results were misleading.

---

<sup>4</sup> "Assessment of the Commercial Benefits of Positive Train Control," Oliver Wyman, Inc. April 23, 2010, page 1.

<sup>5</sup> AAR press release dated April 27, 2010. accessed on the web at <http://www.aar.org/NewsAndEvents/PressReleases/2010/04/042710-PTCclaimsOverblown.aspx> on April 28, 2010.

We focus this Report on FRA's cost-benefit model, not its inputs or assumptions.<sup>6</sup> By using FRA's forecasts and unit-cost estimates (developed over several years through research, evaluation, and discussion with rail carriers), we present a fair and impartial assessment of the process and tools used by FRA in its required analysis of the rule.

The Wyman report most specifically attacks our reliance on benefits estimates developed by FRA, which we updated in our restatement of PTC "business benefits." Our reliance on those estimates was done to ensure impartiality and credibility. Our use of the term "business benefits" to describe non-railroad-safety benefits was taken directly from FRA's nomenclature. The "business benefits" included in FRA's economic analyses and in this Report include benefits accruing to the railroads, to shippers, and to society. These benefits include cost savings to railroads and shippers resulting from improved supply-chain efficiencies (e.g., reduced fuel consumption, lower inventory carrying costs) *and* they include other benefits accruing to society from modal diversion of freight from highways to rail (e.g., reduced emissions, reduced crashes, reduced highway congestion) in response to improved rail service resulting from PTC and precision dispatching. The Wyman analysis concludes that, "the net benefit to shippers from the planned implementation of PTC will be zero."<sup>7</sup> The Wyman report excludes societal benefits from its analyses. The Wyman statement of "business benefits" comprises only business benefits accruing to the railroads. This narrow view of benefits ignores benefits accruing to other parties, including general societal benefits, and as such it violates Federal cost-benefit analysis policy.<sup>8</sup>

As support for its dismissal of all shipper benefits, the Wyman report states:

"Substantial benefits can be realized through improvements in railroad on-time performance.... [which] would divert some traffic from truck to rail, yielding benefits to shippers in the form of lower transportation

---

<sup>6</sup> It is impossible to completely separate the model from the assumptions, and judgment must be exercised in conducting or restating CBAs. Our primary focus, however, was on the methodologies used by FRA.

<sup>7</sup> "Assessment of the Commercial Benefits of Positive Train Control." Oliver Wyman, Inc. April 23, 2020, page 6.

<sup>8</sup> Office of Management and Budget ("OMB") Circular A-94: "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs." Section 6.

rates. Improved railroad reliability would also enable shippers to reduce safety stock levels and thus lessen inventory carrying costs.

However, improvements in railroad on-time performance, and subsequent shipper benefits, would be attributable to precision dispatching, which as mentioned is currently not in production use, is being developed independently from the PTC initiative, is not part of the FRA mandated PTC implementation, and is likely to be only marginally influenced by the roll-out of PTC.”<sup>9</sup>

A PTC webinar presentation on December 17, 2008, entitled “Train Control Systems and Vital Train Management System (VTMS)” by the Union Pacific Railroad Company (“UP”)<sup>10</sup> contradicts Wyman’s findings.

The presentation explicitly lists objectives and benefits of UP’s Vital Train Management System (the version of PTC that the UP is implementing) as being, in part, to “improve safety, velocity, and fuel conservation”, to “reduce fuel consumption and carbon emissions” and to “improve train handling and rule compliance.”<sup>11</sup> Obviously, UP considered PTC and precision dispatching as integral parts of its business plan. If PTC and precision dispatching were independent from one another, as Wyman and AAR have said, the UP would not have been able to list improved velocity, improved fuel consumption, reduced carbon emissions, and improved train handling as being expected benefits of the implementation of VTMS PTC.

FRA’s statement of costs in the final rule RIA included four categories of railroad costs: (1) central office and development costs; (2) wayside equipment installation costs; (3) onboard equipment installation costs; and (4) annual maintenance costs. In developing its cost estimates for the four included cost categories, FRA departed from its positions and assumptions included in preceding reports regarding certain cost estimates.

---

<sup>9</sup> “Assessment of the Commercial Benefits of Positive Train Control,” Oliver Wyman, Inc. April 23, 2010, page 6.

<sup>10</sup> [www.uprr.com/news/info/attachments/media\\_kit/ptc/ptc\\_webinar.pdf](http://www.uprr.com/news/info/attachments/media_kit/ptc/ptc_webinar.pdf).

<sup>11</sup> Union Pacific Railroad. PTC webinar, “Train Control Systems and Vital Train Management System (VTMS)”, December 17, 2008, slide 4.

In this Report, we examine FRA's cost estimates and underlying assumptions, inputs, and algorithms, identify errors in the assumptions and inputs used, update the calculations as necessary, and restate the FRA's cost estimates. Cost estimates are fairly straightforward inasmuch as unit costs for specific items are known and required quantities may be estimated with greater precision than can benefits resulting from their installation.

In developing our cost restatement, we have reviewed the PTC implementation plans filed with FRA on April 16, 2010 by the railroads as required by the final rule. We intended to use data from those reports to update FRA's cost estimates, but we were unable to review and incorporate the results of the implementation plans because the pertinent information was redacted. We reserve the right to augment our findings if and when we are allowed to review the individual implementation plans. We have thus relied on public data and preceding reports to make our restatement.

As shown in both this Report and in the Wyman report, there is no doubt that the Class I railroads will receive numerous benefits from their installation of PTC beyond the primary benefits of risk mitigation. FRA also believes that the railroads will pass through some of these benefits to shippers in the form of rate reductions and other direct operating benefits.<sup>12</sup> These benefits do not obviate the fact that the Congressional mandate to implement PTC will require the railroads to expend billions of dollars in capital expenditures over the next six years.

Economic theory holds that the railroads will attempt to recover mandated PTC investments as quickly and as efficiently as possible given the limitations placed on them by the market and industry regulators. There is little doubt that the railroads will attempt to exploit their most vulnerable customers to recover their PTC investment. From a general sense, this would include all captive railroad shippers, since those shippers have little recourse against a railroad's

---

<sup>12</sup> FRA bases this assumption on the railroads' pass through of historic productivity improvements as exemplified by the decline in real rates per ton-mile over the last 25 years. However, much of what FRA assessed as passing through of benefits was in fact due to cost shifting from railroads to shippers. The shifting of costs from railroads to shippers would be perceived as productivity improvement from the railroads perspective, but was perceived as a cost increase to affected shippers.

monopoly power on a captive movement.<sup>13</sup> From a more focused position however, the railroads have stated that they will attempt to recover their investment directly from the shippers the railroads view as being responsible for the requirement to install PTC, namely Toxic Inhalation Hazard (“TIH”) shippers.

The railroads’ focus of recovering their investment costs from TIH shippers will have a direct, quantifiable impact on TIH shippers. Additionally, TIH shippers will be impacted by PTC installation through higher regulated rail rates due to the railroads rolling their PTC investment into their regulatory investment bases. This could lead to an effective “double recovery” of PTC costs well into the future.

The remainder of this report discusses our study approach, summarizes our findings and is organized under the following topical headings:

- II. Summary and Findings
- III. Positive Train Control Benefits Analysis: Updated Statement of Total Benefits and Restatement of FRA Cost-Benefit Analysis Based on FRA Costs and Updated FRA Benefits
- IV. Positive Train Control Cost Analysis: Updated Statement of Total Costs and Restatement of FRA Cost-Benefit Analysis Based on Updated FRA Costs and Benefits
- V. Potential Economic Harm To TIH Shippers Resulting From The Railroads Implementation Of Positive Train Control
- VI. Summary of Key Literature Reviewed
- VII. Bibliography of Important PTC-Related Documents

---

<sup>13</sup> The Surface Transportation Board (“STB”), the U.S. agency responsible for the economic regulation of the railroad industry, defines captive locations as those rail served locations without effective intramodal or intermodal competition. In other words, those locations that are not served by two or more railroads (intramodal competition) or can be economically served by another mode of transportation such as truck, barge or pipeline (intermodal competition).

## **II. SUMMARY AND FINDINGS**

This Report summarizes the prior cost-benefit analyses performed by FRA and other public and private organizations related to the design and implementation of PTC systems by freight and passenger railroads. This Report also updates and restates the business and societal benefits anticipated to result from PTC implementation. The primary basis of this restatement was FRA's 2009 and 2010 economic analyses supporting FRA's July 2009 PTC NPRM and their January 2010 PTC Final Rule. In addition to restating the benefits expected to accrue due to the installation of PTC, this Report restates the FRA's final costs estimates for design, installation and maintenance of PTC systems on a national basis and updates the cost-benefit ratios calculated by FRA in its 2010 Final Rule. This Report also estimates the potential economic harm that may flow to TIH shippers, as the railroads attempt to pass through their PTC design, investment and maintenance costs to shippers of TIH materials.

A summary of our findings include:

### **A. RESTATED PTC BENEFITS ANALYSIS**

1. FRA made several theoretical errors in developing its Final Rule RIA. Specifically, FRA excluded the potential impacts of future benefits on the theory that uncertainty surrounds whether and when benefits may accrue. FRA also excluded some PTC benefits because the benefits may be achievable through the development of alternative systems.
2. A 2004 report commissioned by FRA and performed by ZETA-TECH identified numerous business benefits associated with the implementation of PTC. FRA supplemented the ZETA-TECH report with the results of a peer review workshop, which included representatives of freight and passenger railroads, shippers, labor organizations and suppliers, and through the inclusion of societal benefits developed using a FRA developed model. The total PTC benefits calculated by the FRA in its supplemented report ranged from \$2.4 to \$3.9 billion, annually.
3. In 2009, FRA finalized its NPRM on PTC implementation including an update of its 2004 benefits calculations. However, in developing its NPRM RIA, FRA excluded its updated societal and other business benefits, and included only railroad safety benefits in its economic analyses. With the

exclusion of these additional benefits, FRA's NPRM estimated that the cost-benefit ratio associated with PTC implementation would equal 16.47. When all FRA calculated benefits are included in the cost-benefit analysis, the cost-benefit ratio drops to 1.19.

4. In January 2010, FRA published its Final Rule on PTC implementation. FRA continued to only include railroad safety benefits and exclude all other benefits from its analysis. By including only railroad safety benefits, FRA's cost-benefit ratio in its 2010 Final Rule increased to 21.71. Had FRA included all of the benefits it calculated, the cost-benefit ratio would have declined to 1.15.
5. A review of FRA's 2004 and 2009 benefits calculations identified several mathematical errors and omissions that collectively understated the total benefits associated with PTC implementation. These errors included FRA's failure to index different cost and benefit figures to the same year price levels, improper commingling of costs and benefits to develop net benefits (which is a fundamental violation of CBA principles), incorrect calculations of direct benefits and modal diversion factors, and misapplication of FRA's ITIC model. These issues led to an overstatement by FRA of indirect societal and add-on system costs by 85% and an understatement of positive benefits by 3%.
6. Accepting FRA's estimate of the total PTC implementation costs and railroad safety benefits included in the Final Rule RIA, and including the corrected societal and other business benefits lowers the cost-benefit ratio from the 21.71 included in the FRA's Final Rule RIA to a 0.86 cost-benefit ratio.

## **B. RESTATED PTC COST ANALYSIS**

7. FRA undertook, supervised or commissioned several studies investigating the costs to install and maintain PTC systems. A 1999 Railroad Safety Advisory Committee Report estimated that the cost to implement a PTC system similar to the one mandated in the FRA's Final Rule would equal \$7.8 billion over 20-years on a discounted cost basis.
8. By 2009, FRA had updated its PTC cost estimates. While updating and restating the cost categories from its 2004 Report to Congress, FRA added additional cost categories to account for the initial design of the PTC system and the cost to develop the stand-alone system for the Alaska Railroad. By 2009, FRA estimated the total costs to design, install and maintain PTC systems would equal \$10.0 billion on a discounted cost basis.

9. In developing its Final Rules on PTC implementation, FRA in 2010 revised its cost estimates to reflect policy changes and other modifications to its 2009 cost estimates. The end result was to decrease the estimated PTC design, implementation and maintenance costs to \$9.5 billion on a discounted cost basis from the prior \$10.0 billion estimate in 2009.
10. FRA's 2009 and 2010 estimates of PTC implementation costs contain three primary issues that lead to overstated costs. These issues include overstated locomotive adaptation costs, overstated maintenance costs, and overstated wayside equipment installation costs. Adjusting for these overstatements reduces FRA's PTC implementation costs to \$8.4 billion.
11. Combining the restated total benefits, including benefits improperly excluded by FRA, with the restated costs produces a cost-benefit ratio of 0.80 versus the 21.71 cost-benefit calculated by FRA and included in their Final Report RIA.

**C. POTENTIAL ECONOMIC  
HARM TO TIH SHIPPERS  
FROM THE RAILROADS  
IMPLEMENTATION OF PTC**

12. The Class I railroads view PTC installation as an unfunded mandate and have called on Congress to consider various funding mechanisms to offset PTC investment, including a 25 percent infrastructure tax incentive and a fully funded Rail Safety Technology Grant Program.
13. Without support from Congress, the railroads have indicated that they will attempt to recoup PTC costs from TIH shippers through higher rail rates because of their view that TIH shipments are the primary reason railroads must install PTC systems.
14. Based on railroad cost estimates and using standard STB capital cost recovery procedures, we estimated that the Class I railroads will attempt to recoup from TIH shippers PTC capital carrying charges that equal \$451 million per year by 2019.
15. In addition to incurring higher shipping costs through higher transportation rates, TIH shippers whose rates are set under the STB's regulatory procedures, will be impacted as the railroads' PTC investment is rolled into the railroads' investment bases. The impact of higher rates charged by railroads and the increase in regulatory costs from inclusion of PTC investment in railroad investment bases could lead to a double-recovery of PTC costs for certain TIH shippers.

**III. POSITIVE TRAIN CONTROL BENEFITS ANALYSIS: UPDATED  
STATEMENT OF TOTAL BENEFITS AND RESTATEMENT OF FRA COST-  
BENEFIT ANALYSIS BASED ON FRA COSTS AND UPDATED FRA BENEFITS**

In this section of our Report, we examine FRA's decision to exclude certain benefits from its RIA, identify the total benefits that will accrue as a result of PTC implementation, update the underlying methodologies and calculations as necessary, and restate the FRA's CBA to include total benefits.

Our updated benefits analysis shows that when full costs and benefits are properly included and assessed, the cost-benefit ratio associated with the PTC rule ranges from 0.70<sup>14</sup> (based on a 3% discount rate) to 0.86<sup>15</sup> (based on a 7% discount rate).

Table 1 below compares FRA's flawed CBA results and our corrected CBA results, based on a 7% discount rate.

---

<sup>14</sup> See Attachment No. B-2, Column (5), Line 28.

<sup>15</sup> See Attachment No. B-1, Column (5), Line 28.

**Table 1**  
**Comparison of FRA CBA to Corrected and Restated CBA**  
(\$ in millions)

<u>Item</u> (1)	<u>FRA Final Rule RIA</u> (2)	<u>Restated</u> (3)
1. Railroad Direct Costs <sup>1/</sup>	\$9,547.5	\$9,547.5
2. Other Direct, Indirect, and Societal Costs <sup>2/</sup>	Improperly Excluded by FRA	\$5,707.6
3. Railroad Safety Benefits <sup>3/</sup>	\$439.7	\$439.7
4. Other Railroad, Shipper, and Societal Benefits <sup>4/</sup>	Improperly Excluded by FRA	\$17,266.7
5. Total Costs (L1 + L2)	\$9,547.5	\$15,255.1
6. Total Benefits (L3 - L4)	\$439.7	\$17,706.4
7. Cost-Benefit Ratio (L5 - L6)	21.71	0.86

1/ Attachment No. B-1, Column (2), Line 5.

2/ Attachment No. B-1, Column (5) sum of lines 18,19,20,21.

3/ Attachment No. B-1, Column (2), Line 16.

4/ Attachment No. B-1, Column (5), sum of lines 22,23,24,25.

As shown in Table 1 above, when the CBA is properly expanded to encompass all costs and all benefits, the benefits outweigh the costs over a 20-year time horizon on a present value basis.

The remainder of this section of our Report is organized under the following topical headings:

- A. Theoretical Problems With FRA Final Rule RIA
- B. Calculation of Total Benefits, Historical Overview
- C. Errors Contained in the 2004 FRA Report
- D. Mechanical and Theoretical Errors Contained in the 2009 FRA Restatement
- E. Intermediate Restatement of FRA Final Rule RIA

**A. THEORETICAL PROBLEMS  
WITH THE FRA FINAL RULE RIA**

In its regulatory impact analysis presented in the PTC final rule, FRA made the following statements:

"Two types of benefits are expected to result from the implementation of this final rule -- benefits from railroad accident reduction and business benefits from efficiency gains."<sup>16</sup>

\*\*\*

"FRA also expects that once PTC systems are refined, there would likely be substantial additional business resulting from more efficient transportation service; however, such benefits are not included because of significant uncertainties regarding whether and when individual elements will be achieved and given the complicating factor that some benefits might, absent deployment of PTC, be captured using alternative technologies at lower cost."<sup>17</sup>

The RIA presents a 20-year analysis of the total costs and "railroad safety (railroad accident reduction)" benefits resulting from implementation of PTC systems under the final rule. FRA's stated logic for limiting its benefits quantification is based on two flawed lines of reason.

First, FRA cites uncertainty regarding "whether and when" the benefits will accrue. There is always uncertainty in developing cost-benefit analyses, and particularly in deriving benefits estimates. As the future is uncertain, this is the nature of the analysis. However, this uncertainty does not excuse FRA from its obligation to make an effort to develop a good-faith estimate of the benefits. In fact, the Office of Management and Budget ("OMB") Circular A-94 is titled "*Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*" and

---

<sup>16</sup> **Federal Register** / Vol. 75, No. 10 / Friday, January 15, 2010 / Rules and Regulations, page 2684.

<sup>17</sup> *Id.*

provides general guidance for conducting cost-benefit analyses. Section 6 of OMB Circular A-94 reads, in part:

"Analyses should include comprehensive estimates of the expected benefits and costs to *society* based on established definitions and practices for program and policy evaluation. Social net benefits, and not the benefits and costs to the Federal Government, should be the basis for evaluating government programs or policies that have effects on private citizens or other levels of government. Social benefits and costs can differ from private benefits and costs as measured in the marketplace because of imperfections arising from: (i) *external economies or diseconomies* where actions by one party impose benefits or costs on other groups that are not compensated in the market place; (ii) monopoly power that distorts the relationship between marginal costs and market prices; and (iii) taxes or subsidies." (emphasis in original)

Uncertainty regarding whether and when benefits will accrue is an inherent challenge with cost-benefit analyses, hence it has become customary to develop a range of costs and benefits, or high and low values for all components in a cost-benefit analysis.

Second, FRA attempts to justify its exclusion of "business benefits" from its cost-benefit comparison because some of the benefits may be achievable through the deployment of alternative systems. This logic is fundamentally flawed. Exclusion of a benefit resulting from one action because the same benefit would result from some other action defeats the purpose of the cost-benefit analysis. The correct action is to include the benefit in both analyses, not to exclude it from both. Furthermore, if this logic was reasonable, and it is not, then one would never include any benefits in a cost-benefit analysis, as all benefits are attainable through more than one means.

Interestingly, in a 2004 FRA Report to Congress containing an assessment of total benefits attributable to PTC implementation, FRA stated that:

"Railroad safety benefits are a very small proportion, less than 1% of total benefits.... The bulk of the benefits go to highway users (and the general public) who avoid accident costs, and to shippers, who as a result of competition in their own markets will have to pass the benefits on to society at large."<sup>7</sup>

Even FRA's estimate of railroad safety benefits is understated, as it acknowledges in the final rule RIA. In describing its calculation of safety benefits, FRA identifies the nine categories of benefits it did include in its railroad safety estimate. and then makes the following statement:

"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."<sup>19</sup>

Surely, FRA could have developed an estimate for these benefits.

## **B. CALCULATION OF TOTAL BENEFITS, HISTORICAL OVERVIEW**

In 2004, ZETA-TECH prepared a report for FRA which quantified the business benefits of PTC.<sup>20</sup> At the time the ZETA-TECH report was prepared, there were several schools of thought on exactly what a PTC system would comprise and how an integrated system would work. In the study, ZETA-TECH evaluated a system it called "PTC A" and another system it called "PTC B." PTC A was defined as "an 'overlay' system that provides enforcement of movement authorities, but does not incorporate a 'vital' central safety system," and PTC B was

---

<sup>18</sup> "Benefits and Costs of Positive Train Control: Report in Response to Request of Appropriations Committees," USDOT, FRA, August 2004. page 5.

<sup>19</sup> **Federal Register** / Vol. 75, No. 10 / Friday, January 15, 2010 / Rules and Regulations. page 2684.

<sup>20</sup> Zeta-Tech Associates. "Quantification of the Business Benefits of Positive Train Control." Prepared for the Federal Railroad Administration, March 15, 2004.

defined as "a stand-alone vital system."<sup>21</sup> The elements of the PTC B system evaluated by ZETA-TECH in the 2004 report are very comparable to the PTC system being mandated by the FRA's final rule. We, therefore, will focus on ZETA-TECH's PTC B system evaluation in this section of our Report.

ZETA-TECH identified and quantified direct and indirect business benefits in the following six (6) distinct categories in its PTC B system:

1. Line capacity enhancements;
2. Dispatching efficiency gains;
3. Work order issue flexibility;
4. Loco diagnostics;
5. Fuel savings; and
6. Shipper benefits.

ZETA-TECH estimated that annual business benefits resulting from PTC implementation would be in the range of \$2.2 to \$3.8 billion (in 2001 dollars).<sup>22</sup> The first five categories of business benefits are direct benefits to the railroads (e.g., reduced track investment, better equipment utilization, reduced fuel consumption), although they also would provide indirect benefits to shippers (e.g., better equipment utilization which could lead to reduced equipment capital, lease and maintenance costs).

Line capacity enhancements result from closer train spacing and more precisely-planned train meets. Dispatching efficiency gains result from dispatcher improved (real-time) train location information. ZETA-TECH posited that this location information also would allow dispatchers to pace trains between meets to optimize fuel consumption. ZETA-TECH also believed that the ability to issue work orders to train crews in real time and to automatically receive diagnostic data from linked-up locomotives would provide efficiencies.<sup>23</sup>

---

<sup>21</sup> 2004 ZETA-TECH Report, page 6.

<sup>22</sup> As noted in the report, the business benefits calculated by ZETA-TECH were exclusive of and additive to the railroad safety benefits of PTC. *See*: 2004 ZETA-TECH Report at page 108.

<sup>23</sup> FRA later removed this class of benefits from its restatement of the ZETA-TECH study results.

The sixth category of business benefits -- "shipper benefits" -- refers to total logistics cost reductions assuming improved service and static rates. This very specifically represents the value of improved transit times and transit time reliability to logistics networks. When shippers realize better transit times and reliability, they are able to reduce inventory carrying costs, reduce or consolidate warehouse and distribution facilities and operations, and free up capital for other investment. Importantly, this benefit is *not* a result of cost or rate changes, rather it is strictly a result of service level changes.

Table 2 below shows the PTC B benefits calculated by ZETA-TECH in 2004.

<u>Item</u> (1)	<u>Low Case</u> (2)	<u>High Case</u> (3)
1. Line Capacity (Avoided Investment)	\$299.5	\$422.0
2. Line Capacity (Avoided Maintenance)	\$508.0	\$762.0
3. Precision Dispatch (Car Ownership)	\$322.1	\$868.2
4. Precision Dispatch (Locomotive Ownership)	\$85.9	\$171.9
5. Work Order Report	\$10.1	\$10.1
6. Loco Diagnostics (Locomotive Maintenance)	\$28.6	\$28.6
7. Loco Diagnostics (Locomotive Road Failure)	\$34.6	\$34.6
8. Fuel	\$55.9	\$130.5
9. Shipper Benefits	<u>\$900.0</u>	<u>\$1,400.0</u>
10. Total Estimated Annual Business Benefits	\$2,244.7	\$3,827.8

Source: ZETA-TECH 2004 Report, Table 32. Page 110.

Later in 2004, FRA developed a Report to Congress which addressed the costs and benefits associated with PTC implementation in response to the Conference Report on the Consolidated Appropriations Resolution, 2003 (P.L. 108-7).<sup>24</sup> In the 2004 report introduction, FRA described the report development as follows:

"FRA had a contractor, Zeta-Tech Associates (Zeta-Tech), examine the business benefits and costs [of PTC]. FRA combined that analysis with FRA estimates of modal diversion and societal consequences, and with a joint effort between FRA and the Volpe National Transportation Systems Center (Volpe) to analyze potential accident cost reductions due to PTC;"<sup>25</sup> and,

\*\*\*\*

"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."<sup>26</sup>

FRA considered significant industry input (largely provided by the railroads) and revised and restated the ZETA-TECH direct business benefits estimates based on that input in its 2004 Report to Congress. In addition, FRA introduced another class of benefits attributable to PTC implementation in its 2004 report, i.e., indirect benefits to society resulting from the direct shipper benefits calculated by ZETA-TECH and revised by FRA. These indirect benefits consisted largely of reductions in highway crashes and highway-vehicle emissions as a result of shippers taking advantage of improved rail service (reduced transit times and improved

---

<sup>24</sup> In its 2004 report, FRA opined that PTC, by itself, would not result in business benefits. However, it followed that if add-on components of relatively modest cost were implemented subsequent to PTC implementation then business benefits would accrue. Thus, FRA's 2004 report evaluated costs and benefits associated with PTC implementation and a few add-on technology components. See: 2004 FRA Report to Congress at page 3.

<sup>25</sup> 2004 FRA Report to Congress, page 4.

<sup>26</sup> Id.

reliability) and shifting truck shipments to rail (modal diversion). In FRA's discussion on its indirect benefits calculation, FRA stated that:

"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," and, "Modal diversion is highly sensitive to service quality."<sup>27</sup>

The unadjusted PTC B benefits calculated by FRA in 2004 ranged from \$2.4 to \$3.9 billion annually and are shown in Columns (4) and (5) on Attachment No. B-4.

In July 2009, as FRA finalized its NPRM on PTC implementation, it conducted an economic analysis of the impact of the proposed rule. Included in that report was a 16-page appendix which updated each element of the 2004 FRA statement of business benefits associated with PTC implementation. These updated benefits were not included in the NPRM RIA (or the final rule RIA), which considered only railroad safety benefits (along with total direct implementation costs) in the cost-benefit comparison. In the NPRM, FRA estimated 20-year discounted costs to equal \$10,008 million, and safety benefits to equal \$608 million using a 7% discount rate or a cost-benefit ratio of 16.47.<sup>28</sup>

Table 3 below shows FRA's updated benefits calculation as included in the July 2009 NPRM.

---

<sup>27</sup> 2004 FRA Report to Congress, page 4.

<sup>28</sup> **Federal Register** / Vol. 74, No. 138 / Tuesday, July 21, 2009 / Proposed Rules. page 36002.

**Table 3**  
**FRA July 2009 NPRM Cost-Benefit Analysis** 1/  
(2009 Dollars in Millions)

<u>Item</u> (1)	<u>Amount</u> (2)
1. PTC Implementation Costs	\$10,007.6
2. Railroad Safety Benefits	\$607.7
3. Cost-Benefit Ratio (L1 ÷ L2)	16.47

Source: Attachment No. B-1, Column (3), Lines 1 through 17.  
1/ Net Present Value assuming 7% Discount Rate.

Had the business benefits developed by FRA in its 2009 economic analysis been properly included in the NPRM RIA, the total costs would have been restated as \$20,580 million (\$10,572 million plus \$10,008 million), total benefits would have been restated as \$17,310 million (\$16,702 million plus \$608 million), and the cost-benefit ratio would have been restated as 1.19 (\$20,508 divided by \$17,310.)

Table 4 below shows FRA's updated benefits calculation as included in FRA's July 2009 economic analysis.

**Table 4**  
**FRA July 2009 Economic Analysis Cost-Benefit Analysis** <sup>1/</sup>  
(2009 Dollars in Millions)

<u>Item</u> (1)	<u>Amount</u> (2)
1. PTC Implementation Costs	\$10,007.6
2. Railroad Safety Benefits	\$607.7
3. Additional "Business" Costs	\$10,572.5
4. Additional "Business" Benefits	\$16,702.3
5. Total Costs (L1 - L3)	\$20,580.1
6. Total Benefits (L2 + L4)	\$17,310.0
7. Cost-Benefit Ratio (L5 - L6)	1.19

Source: Attachment No. B-1, Column (3), Lines 1 through 28.  
<sup>1/</sup> Net Present Value assuming 7% Discount Rate.

In January 2010, FRA published its Final Rule on PTC implementation. As in July 2009, FRA's RIA considered only railroad safety benefits and total direct implementation costs in the cost-benefit comparison. FRA's revised estimate of 20-year discounted costs equaled \$9,548 million, and its revised safety benefits estimate equaled \$440 million using a 7% discount rate or a cost-benefit ratio of 21.71.<sup>29</sup> Table 5 below reproduces FRA's updated costs and benefits as included in FRA's January 2010 Final Rule.

<sup>29</sup> **Federal Register** / Vol. 75, No. 10 / Friday, January 15, 2010 / Rules and Regulations, page 2685.

**Table 5**  
**FRA January 2010 Final Rule Cost-Benefit Analysis** 1/  
(2009 Dollars in Millions)

<u>Item</u> (1)	<u>Amount</u> (2)
1. PTC Implementation Costs	\$9,547.5
2. Railroad Safety Benefits	\$439.7
3. Cost-Benefit Ratio (L1 ÷ L2)	21.71

Source: Attachment No. B-1. Column (2), Lines 1 through 17.  
1/ Net Present Value assuming 7% Discount Rate.

Had business benefits calculated in July 2009 been properly updated and included in the final rule RIA, the total costs would have been restated as \$19,642 million (\$10,094 million plus \$9,548 million), total benefits would have been restated as \$17,142 million (\$16,702 million plus \$440 million), and the cost-benefit ratio would have been restated as 1.15 (\$19,642 divided by \$17,142.), as shown in Table 6 below.

**Table 6**  
**FRA January 2009 Final Rule Cost-Benefit Analysis**  
**Restated to Include FRA July 2009 Economic Analysis "Business" Benefits 1/**  
(2009 Dollars in Millions)

Item (1)	Amount (2)
1. PTC Implementation Costs	\$9,547.5
2. Railroad Safety Benefits	\$439.7
3. Additional "Business" Costs	\$10,094.2
4. Additional "Business" Costs	\$16,702.3
5. Total Costs (L1 + L3)	\$19,641.7
6. Total Benefits (L2 + L4)	\$17,142.0
7. Cost-Benefit Ratio (L5 - L6)	1.15

Source: Attachment No. B-1. Column (4), Lines 1 through 28.  
1/ Net Present Value assuming 7% Discount Rate.

These simple restatements using FRA's own economic analysis would have greatly changed the tone of the cost-benefit analysis presentation in the NPRM and in the Final Rule, as the demonstration would not have been that this rule equates to an unfunded mandate, but rather that the costs are largely recovered over a 20-year time horizon. However, as discussed below, there are several mechanical and theoretical errors in FRA's 2004 report and 2009 economic analysis that, when corrected, demonstrate that over 20-years, the benefits of PTC outweigh the costs.

**C. ERRORS CONTAINED  
IN THE 2004 FRA REPORT**

The 2004 FRA Report to Congress included a restatement of the six benefits categories included in the ZETA-TECH report, new calculations for direct safety benefits co-developed with

VOLPE, as well as indirect societal benefits.<sup>10</sup> There are three (3) main problems with the FRA's 2004 statement of benefits:

1. FRA included ZETA-TECH costs and benefits at 2001 real dollar levels and introduced new cost and benefit estimates based on 2003 real dollar levels;<sup>11</sup>
2. FRA erred in its calculation of indirect shipper benefits (based on an assumed 80% pass-through of railroad direct benefits to shippers in the form of reduced rates); and
3. FRA improperly included annual maintenance costs in its benefits calculation.<sup>12</sup>

The 2004 FRA Benefits calculation is reproduced in Attachment No. B-4 to this Report, along with notes describing the issues and errors contained therein. Attachment No. B-4 also shows the 2004 FRA report values corrected and updated to reflect 2003 constant dollars for all categories.<sup>13</sup> As shown, the error in the calculation of indirect shipper benefits (overstatement) and the improper inclusion of costs in the benefits estimate (understatement) carry forward to the statement of total benefits. Also, the inclusion of 2001-level costs for certain elements leads to an understatement of those elements. Although the overstatement caused by the erroneous indirect shipper benefit calculation and the understatement caused by the improper inclusion of costs in the benefits calculation are both significant in scale, they roughly cancel each-other and the compound result of these and other errors is a 2% understatement of

---

<sup>30</sup> Indirect societal benefits are based on FRA's Intermodal Transportation and Inventory Cost ("ITIC") modal diversion model and encompass crash reduction and environmental benefits associated with modal diversion resulting from shippers shifting volumes to rail from truck transport because of improved rail transit times and service reliability.

<sup>31</sup> With one exception, FRA-developed costs and benefits reflect 2003 dollar values. The terminal track force cost reductions are expressed in 2002 dollars.

<sup>32</sup> These costs were improperly included in the benefits side of the ledger and should be removed. Furthermore, these maintenance costs are already included in FRA's RIA cost statement.

<sup>33</sup> See: Attachment No. B-4, Columns (7) to (9).

benefits.<sup>34</sup> However, the errors contained in FRA's 2004 statement of benefits carry forward to FRA's 2009 update of "business" benefits where their impacts are larger.

**D. MECHANICAL AND  
THEORETICAL ERRORS  
CONTAINED IN THE  
2009 FRA RESTATEMENT**

The July 2009 FRA economic analysis contained a restatement of the benefits categories included in the FRA 2004 Report to Congress and a new calculation for indirect societal costs.<sup>35</sup> There are five main problems with FRA's 2009 restatement of benefits:

1. Rather than including separate cost and benefits estimates, costs are subtracted from benefits to develop a statement of net benefits (which is a fundamental violation of CBA principles);
2. To update the dollar amounts to 2009 real dollars, FRA applied a GDP inflation index based on the change in GDP from 2003 to 2009 to the restated ZETA-TECH costs and benefits which are included at 2001 real dollar levels in the 2004 FRA report. This affects several calculations including the calculation of shipper direct benefits;
3. FRA's calculation of other direct benefits (railroad direct benefits) is erroneous;
4. FRA's calculated modal diversion factor (indirect benefits factor) is erroneous; and
5. FRA's application of its calculated modal diversion factor to assumed passed-through shipper costs (manifested in increased rates) is a fundamental misapplication of the ITIC model results included in the 2004 report. Even if inclusion of this additional cost is warranted, FRA was inconsistent in its application of the benefit.

---

<sup>34</sup> Attachment No. B-4, Column (6), Line 20 – Column (9), Line 20.

<sup>35</sup> The indirect societal costs are purported to be based on a factor developed from FRA's Intermodal Transportation and Inventory Cost ("ITIC") model and used as a proxy for crash reduction and environmental benefits associated with modal diversion resulting from shippers shifting volumes to truck from rail transport *because of increased rates resulting from passed-through railroad direct costs*.

The 2009 FRA "business benefits" calculation is reproduced below in Table 7, along with notes describing the issues and errors contained therein.

<u>Item</u> (1)	<u>Amount</u> (2)	<u>Notes</u> (3)
1. Indirect Societal Cost, Modal Diversion Resulting from Increased Rail Rates	(\$10,403.8)	Calculated Using Incorrect Indirect Benefits Factor, Overstated by 92%
2. Add On Productivity System Costs	(\$82.0)	Calculation is Correct
3. Add On Productivity System Maintenance Costs	(\$86.8)	Calculation is Correct
4. Indirect Societal Cost, Modal Diversion Resulting from Further Increased Rail Rates	2/	Improperly Excluded from Analysis
5. Shipper Direct Productivity Benefit	\$4,336.3	Calculated Using Incorrect Inflation. Understated by 3%
6. Indirect Societal Benefit, Modal Diversion Resulting from Increased Rail Efficiency	\$7,292.5	Calculated Using Incorrect Indirect Benefits Factor, Overstated by 77%
7. Railroad Direct Productivity Benefit	\$5,073.5	Erroneous Calculation, Overstated by 1%
8. Indirect Societal Benefit, Modal Diversion Resulting from Reduced Rail Rates	2/	Improperly Excluded from Analysis
9. Total Costs (Sum of Lines 1-4)	(\$10,572.5)	xxx
10. Total Benefits (Sum of Lines 5-8)	\$16,702.3	xxx

Source: Attachment No. B-1, Column (3).  
1/ Net Present Value Assuming a 7% Discount Rate.  
2/ Not included by FRA.

Each of the errors summarized in Table 7 is discussed below.

**1. Mixing Of Costs And Benefits**

FRA's business benefits model erroneously included costs in the benefits side of the ledger. This is a fundamental violation of CBA principles. A simple example shows the ramification of this careless exercise. In Table 8 below, we compare FRA's methodology with a correct CBA methodology to show the effect of FRA incorrectly categorizing costs as benefits before calculating the Cost/Benefit ratio.

<b>Table 8</b>		
<b><u>Demonstration of FRA's Flawed CBA Methodology</u></b>		
<u>Item</u>	<u>FRA Calculation</u>	<u>Correct Calculation</u>
(1)	(2)	(3)
<b><u>INPUTS</u></b>		
1. RR Direct Costs	(\$10,007.6)	(\$10,007.6)
2. RR Safety Benefits	\$607.7	\$607.7
3. "Business" Costs	(\$10,572.5)	(\$10,572.5)
4. "Business" Benefits	\$16,702.3	\$16,702.3
<b><u>FRA Calculation</u></b>		
5. "Net Business" Benefits (L3 + L4)	\$6,129.8	xxx
6. FRA Total Costs (L1)	(\$10,007.6)	xxx
7. FRA Total Benefits (L2 + L5)	\$6,737.5	xxx
8. FRA Cost/Benefit Ratio ((L6 x -1) ÷ L7)	1.49	xxx
<b><u>Correct Calculation</u></b>		
9. Correct Total Costs (L1 + L3)	xxx	(\$20,580.1)
10. Correct Total Benefits (L2 + L4)	xxx	\$17,310.0
11. Correct Cost/Benefit Ratio ((L9 x -1) ÷ L10)	xxx	1.19
Source: Lines 1-4, 9-11 from Attachment No. B-1, Column (3); Lines 5-8 from FRA's July 2009 economic analysis.		

As shown in Table 8 above, FRA's inappropriate treatment of costs in its statement of "net business" benefits leads to a very misleading CBA result (in this case, a 25% overstatement of the Cost/Benefit ratio (1.49 - 1.19)).

## 2. Shipper Direct Benefits

FRA's calculation of shipper direct benefits is erroneous. This is due to some of the involved dollar amounts being indexed to 2009 using an incorrect index. FRA developed updated direct shipper benefits by averaging the low-case (\$900 million) and high-case (\$1,400 million) values from the 2004 FRA report (taken directly from the 2004 ZETA-TECH report) and indexing the benefits to 2009 dollars based on the change in GDP from 2003 to 2009 (1.1007) as shown below:

$$[ (\$900 \text{ million} + \$1,400 \text{ million}) - 2 ] \times 1.1007 = \$1,266 \text{ million}^{36}$$

The ZETA-TECH low and high case benefits were stated in 2001 dollars. Therefore, FRA should have indexed the values by the change in GDP from 2001 to 2009 (1.1385).

$$[ (\$900 \text{ million} + \$1,400 \text{ million}) / 2 ] \times 1.1385 = \$1,309 \text{ million}^{37}$$

## 3. Other Railroad Direct Benefits

The FRA's calculation of other (railroad) direct benefits is erroneous. After restating the direct shipper benefits, FRA stated that it developed other direct benefits as follows:

"FRA averaged inflated low and high Direct Benefits from the 2004 report, using the GDP deflator, 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."<sup>38</sup>

---

<sup>36</sup> See: Attachment No. B-4 at Column (10), Line 12.

<sup>37</sup> See: Attachment No. B-4 at Column (11), Line 12.

<sup>38</sup> 2009 FRA Economic Analysis, page A-4.

The FRA's figures are not supported by its stated methodology. Using FRA's stated methodology and FRA's dollar amounts,<sup>39</sup> the other railroad direct benefits result would be:

$$[ (\$1,614,751,993 + \$2,814,146,206) / 2 ] \times 1.1007 = \$2,437,444,124$$

$$\$2,437,444,124 - \$1,265,805,000 = \$1,171,639,124$$

There are several problems with FRA's calculation of other railroad direct benefits as summarized below:

1. FRA did not do what it said it did;
2. As with the calculation of shipper direct benefits, FRA used the incorrect index to restate the dollar amounts on a 2009 basis;
3. The total direct benefits figures purportedly used by FRA in this analysis incorporate mathematical errors<sup>40</sup> and are unreliable;
4. The calculation of other direct benefits in this case should be limited to direct railroad business benefits, not total direct benefits including railroad safety benefits; and
5. The calculation fails to account for (or incorrectly accounts for) a separate fuel adjustment FRA described elsewhere in its methodology discussion.

The corrected methodology and results are shown below.

1. Average of FRA 2004 low- and high-case railroad direct benefits equals \$567,855,855.<sup>41</sup>
2. Removal of improperly included annual maintenance costs equals \$567,855,855 minus (\$428,647,500)<sup>42</sup> or \$996,503,355.
3. Removal of 2004 Report fuel savings estimate equals \$996,503,355 minus \$93,249,625<sup>43</sup> or \$903,253,730.

---

<sup>39</sup> See: Attachment No. B-4, Line 16, Columns (4) and (5) and Line 12, Column (10).

<sup>40</sup> Improperly included maintenance costs and erroneous shipper indirect cost calculation.

<sup>41</sup> See: Attachment No. B-4 at Column (6), Line 9.

<sup>42</sup> See: Attachment No. B-4 at Column (6), Line 8.

4. Index non-fuel benefits to 2009 equals  
\$903,253,730 times 1.1327<sup>44</sup> or \$1,023,145,948.
5. Replacement of 2009 fuel savings estimate equals  
\$1,023,145,948 plus \$437,500,000<sup>45</sup> or \$1,460,645,948.<sup>46</sup>

**4. Modal Diversion Factor**

The modal diversion factor developed by FRA in its 2009 restatement is erroneous. This is partly due to some of the involved dollar amounts being indexed to 2009 using an incorrect index and it is partly due to FRA using the wrong benefits elements to derive the factor. FRA states that the modal diversion factor is based on the ratio of direct shipper benefits to derived modal diversion benefits. This is the theoretically correct formula, but FRA did not develop the numbers as it stated it did.

FRA's figures are not supported by its stated methodology. Using FRA's stated methodology and FRA's dollar amounts,<sup>47</sup> FRA's modal diversion factor would be:

$$\text{Low Case: } \$531,103,148 / \$900,000,000 = 0.59$$

$$\text{High Case: } \$698,970,714 / \$1,400,000,000 = 0.50$$

$$\text{Average: } 0.54$$

As shown above, FRA's (uncorrected 2001 dollars) statement of low-case shipper direct benefits is \$900,000,000 per year. FRA's statement of low-case modal diversion in 2010 (2003 dollars) is \$531,103,148. The low-case indirect benefits factor using FRA's 2010 numbers should be 0.59. FRA's (uncorrected) statement of high-case shipper direct benefits is \$1,400,000,000 per year. The FRA's statement of high-case modal diversion in 2010 is

<sup>43</sup> See: Attachment No. B-4 at Column (6), Line 6.

<sup>44</sup> See: Attachment No. B-4 at Column (11). Sum of Lines 1-5 and Line 7. Lines 1-5 are indexed from 2001 to 2009. Line 7 is indexed from 2002 to 2009.

<sup>45</sup> See: Attachment No. B-4 at Column (11), Line 6.

<sup>46</sup> See: Attachment No. B-4 at Column (11), Line 9.

<sup>47</sup> See: Attachment No. B-4 at Lines 12, 17, and 21, Columns (4) and (5).

\$698,970,714. Thus the high-case indirect benefits factor using FRA's 2010 numbers should be 0.50. The average of these factors is 0.54.

However, FRA cites the following (unsupported) figures as its derived modal diversion factors:

2010 low-case = 1.02; 2010 high-case = 0.86; 2010 average = 0.94.

FRA overstates the indirect societal benefits by 74%.<sup>48</sup> This problem is compounded by the fact that FRA's direct benefits figures are stated on a 2001 dollars basis and FRA's indirect benefits figures are stated on a 2003 dollars basis. We have corrected the indirect benefits factor in our restatement of indirect benefits. The corrections and restatement are shown on Attachment No. B-3.

##### **5. Inconsistent Application Of Modal Diversion Benefits And Costs**

FRA incorrectly and inconsistently applied its erroneous indirect benefits factor to related classes of benefits. As described in detail in Appendix B of the 2004 FRA Report to Congress, the indirect societal benefit derived using FRA's ITIC modal diversion model is related to changes in rail *transit time and reliability*. When shippers realize benefits from improved supply-chain speed and reliability, they adjust their logistics networks to take advantage of those efficiencies. The modal diversion model develops estimates for ton-miles diverted to rail from rail *efficiency* improvements. Then societal benefits are developed from those ton-miles using factors to estimate reductions in highway crashes, highway wear and tear caused by heavy trucks, emissions reductions, etc. FRA explicitly stated in its 2004 report that the indirect benefits calculation was based on changes in operations, not on passed through costs/benefits in the form of rate increases/decreases. Specifically, the first paragraph on page B-1 of Appendix B in FRA's 2004 report reads:

---

<sup>48</sup> This comparison is made for ease of discussion. There are other problems with FRA's data that result in the actual statement of the 2010 factor as 0.52 (See: Attachment No. B-4, Line 21, Column (11)).

"This model is dependent on the Zeta-Tech study estimates of improved transit time and reliability, and none of the estimated benefits in this model would be realized if the transit time and reliability do not improve."

Although FRA incorrectly calculated the indirect benefits factor as described above, it did apply the factor correctly to one specific class of benefits: direct shipper benefits. This is the only class of benefits to which this specific factor is directly applicable. Yet, FRA did not apply the factor only to direct shipper benefits (as it had in 2004). Rather, FRA developed a new set of indirect shipper costs to which this factor was also applied. Although the indirect shipper costs FRA developed are likely real, application of this specific factor to them is not appropriate, as explained below. Furthermore, even if it were appropriate, FRA erred in that it failed to also develop a parallel surrogate for indirect shipper benefits and apply the same factors to that set of benefits. As a result, FRA's methodology improperly increased the cost side of the ledger and did not apply any parallel adjustment to the benefits side.

The indirect shipper costs developed by FRA are based on the premise that the railroads will pass on 80%<sup>49</sup> of all incurred costs to shippers in the form of increased rates. Certainly the railroads will attempt to do so, as would any rational business. FRA then applies the indirect benefits factor to these costs to estimate modal diversion from rail to truck as shippers adjust to higher rail rates. The logic is reasonable, but the mechanics of using the specific factors used are problematic. Specifically, the 2004 modal diversion calculation measures rail demand elasticity relative to changes in service levels, not rate levels. FRA's assumption that one is a fair proxy for the other rests on the presumption that there is a one-to-one relationship between changes in service levels and changes in rates when restated on a total logistics costs basis. That is, FRA

---

<sup>49</sup> This 80% cost pass-through figure is a FRA estimate based on its observations of railroad behavior since passage of the *Staggers Rail Act of 1980*. The FRA believes that in the time since, railroads have passed on roughly 80% of productivity gains to shippers in the form of reduced rates. See, e.g., 2004 FRA Report to Congress, page D-1, notes.

assumes that a 1% increase in rail transit time will have the same impact on total logistics costs as a 1% increase in rail rates. This is, at best, a huge leap of faith. FRA made no attempt to analyze the very complex relationships between changes in transit time, rail rates, and total logistics costs. As such, the proper treatment of this questionable benefit calculation may be to exclude it from the analysis.

Barring that, at an absolute minimum, the FRA should have developed a corresponding and largely offsetting estimate of the indirect benefits associated with the direct railroad benefits that will also theoretically be passed on to shippers in the form of rate reductions. FRA's logic supporting its included calculation is as follows: as railroad costs increase, 80% of those costs are passed on to shippers (indirect shipper costs) in the form of rate increases, and some percentage of those indirect shipper costs represent the indirect societal costs resulting from modal diversion from rail to truck. If this is an acceptable proposition, then FRA must also support the opposite notion. Namely that, as railroad costs decrease through the realization of efficiency gains, 80% of those cost reductions (direct rail benefits) are passed on to shippers (indirect shipper benefits) in the form of rate reductions, and some percentage of those indirect shipper benefits represent the indirect societal benefits resulting from modal diversion from truck to rail.

## **6. Restatement**

We have restated the cost-benefit comparison with a correction that evaluates both indirect shipper costs and indirect shipper benefits. Table 9 below shows the 2009 FRA benefits values corrected and updated to reflect correct inflation, correct direct and indirect benefits, correct indirect benefits factor calculation, and correct application of indirect benefits factors.

**Table 9**  
**Restatement of FRA 2009 "Business" Benefits 1/**  
(2009 Dollars in Millions)

<u>Item</u> (1)	<u>Amount</u> (2)	<u>Notes</u> (3)	<u>Corrected</u> (4)
1. Indirect Societal Cost, Modal Diversion Resulting from Increased Rail Rates	(\$10,403.8)	Calculated Using Incorrect Indirect Benefits Factor, Overstated by 92%	(\$5,429.0)
2. Add On Productivity System Costs	(\$82.0)	Calculation is Correct	(\$82.0)
3. Add On Productivity System Maintenance Costs	(\$86.8)	Calculation is Correct	(\$86.8)
4. Indirect Societal Cost, Modal Diversion Resulting from Further Increased Rail Rates	2/	Improperly Excluded from Analysis	(\$109.9)
5. Shipper Direct Productivity Benefit	\$4,336.3	Calculated Using Incorrect Inflation, Understated by 3%	\$4,485.0
6. Indirect Societal Benefit, Modal Diversion Resulting from Increased Rail Efficiency	\$7,292.5	Calculated Using Incorrect Indirect Benefits Factor, Overstated by 77%	\$4,109.8
7. Railroad Direct Productivity Benefit	\$5,073.5	Erroneous Calculation, Overstated by 1%	\$5,003.7
8. Indirect Societal Benefit, Modal Diversion Resulting from Reduced Rail Rates	2/	Improperly Excluded from Analysis	\$3,668.1
9. Total Costs (Sum of Lines 1-4)	(\$10,572.5)	xxx	(\$5,707.6)
10. Total Benefits (Sum of Lines 5-8)	\$16,702.3	xxx	\$17,266.7

Source: Attachment No. B-1, Columns (3) and (5).  
1/ Net Present Value Assuming a 7% Discount Rate.  
2/ Not Included by FRA.

As shown above, the compound effect of the errors in the calculation and application of indices and indirect shipper benefits resulted in FRA overstating "business" costs by 85% and understating "business" benefits by 3%.

**E. INTERMEDIATE  
RESTATEMENT OF  
FRA FINAL RULE RIA**

We updated the cost-benefit comparison included in the FRA Final Rule RIA as follows:

1. Accepted FRA's estimate of total PTC implementation costs as included in the Final Rule RIA;
2. Accepted FRA's estimate of total railroad safety benefits as included in the Final Rule RIA; and
3. Included other costs and benefits (collectively referred to as business benefits by FRA) based on updated and corrected calculations contained in the July 2009 FRA Economic Analysis, the 2004 FRA Report to Congress, and the 2004 ZETA-TECH report.

Table 10 below shows the updated and corrected statement of total costs and total benefits associated with PTC implementation.

<u>Item</u> (1)	<u>FRA Final Rule RIA</u> (2)	<u>Restated</u> (3)
1. Railroad Direct Costs <sup>1/</sup>	\$9,547.5	\$9,547.5
2. Other Direct, Indirect, and Societal Costs <sup>2/</sup>	Improperly Excluded by FRA	\$5,707.6
3. Railroad Safety Benefits <sup>3/</sup>	\$439.7	\$439.7
4. Other Railroad, Shipper, and Societal Benefits <sup>4/</sup>	Improperly Excluded by FRA	\$17,266.7
5. Total Costs (L1 + L2)	\$9,547.5	\$15,255.1
6. Total Benefits (L3 + L4)	\$439.7	\$17,706.4
7. Cost-Benefit Ratio (L5 - L6)	21.71	0.86

1/ Attachment No. B-1, Line 5.  
2/ Attachment No. B-1, Column (5) sum of lines 18,19,20,21.  
3/ Attachment No. B-1, Line 16.

4/ Attachment No. B-1. Column (5), sum of lines 22.23.24.25.

As shown in Table 10 above, when the total costs and total benefits are evaluated over a 20-year time horizon, the benefits of PTC implementation outweigh the costs. The cost-benefit ratio assuming a 7% discount rate is properly restated as 0.86.

**IV. POSITIVE TRAIN CONTROL COST ANALYSIS: UPDATED  
STATEMENT OF TOTAL COSTS AND RESTATEMENT OF FRA COST-  
BENEFIT ANALYSIS BASED ON UPDATED FRA COSTS AND BENEFITS**

Our updated cost analysis shows that when full costs and benefits are properly included and assessed, the cost-benefit ratio associated with the PTC rule is restated at 0.80 (based on a 7% discount rate). Table 11 below compares FRA's flawed CBA results and our corrected CBA results, based on a 7% discount rate.

<u>Item</u> (1)	<u>FRA Final Rule RIA</u> (2)	<u>Restated</u> (3)
1. Railroad Direct Costs <sup>1/</sup>	\$9,547.5	\$8,393.5
2. Other Direct, Indirect, and Societal Costs <sup>2/</sup>	Improperly Excluded by FRA	\$5,707.6
3. Railroad Safety Benefits <sup>3/</sup>	\$439.7	\$439.7
4. Other Railroad, Shipper, and Societal Benefits <sup>4/</sup>	Improperly Excluded by FRA	\$17,266.7
5. Total Costs (L1 - L2)	\$9,547.5	\$14,101.1
6. Total Benefits (L3 + L4)	\$439.7	\$17,706.4
7. Cost-Benefit Ratio (L5 - L6)	21.71	0.80

1/ Attachment No. C-1, Line 5, Columns (2) and (6).  
2/ Attachment No. C-1, Column (6) sum of lines 18,19,20,21.  
3/ Attachment No. C-1, Line 16, Columns (2) and (6).  
4/ Attachment No. C-1, Column (6), sum of lines 22,23,24,25.

As shown in Table 11 above, when the CBA is properly expanded to encompass all correct costs and benefits, the benefits outweigh the costs over a 20-year time horizon on a present value basis.

The remainder of this section of our Report summarizes our findings related to total PTC costs and is organized under the following topical headings:

- A. Calculation of Total Costs, Historical Overview
- B. Problems with the 2010 FRA Cost Estimate
- C. Restatement of FRA Final Rule RIA

#### **A. CALCULATION OF TOTAL COSTS, HISTORICAL OVERVIEW**

In August 1999, the Railroad Safety Advisory Committee ("RSAC") produced a report for FRA quantifying total costs and benefits of nationwide PTC implementation. RSAC evaluated four different levels of PTC (numbered 1 through 4) with each level becoming progressively more advanced in its structure and benefits and becoming progressively more expensive.

PTC level 1 addressed the core functions required by PTC. PTC level 2 was designed with the same functionality as PTC level 1 and also included a computer-aided dispatch system and digital communications between the dispatch system and the locomotives. PTC level 3 built upon PTC level 2's functionality and also included wayside interface units for monitoring track conditions. PTC level 4 was designed with the functionality of all preceding systems, and also included track force terminals, additional track circuits and additional protective devices.<sup>50</sup> The elements of PTC level 4 in the 1999 report are most comparable to the PTC system being mandated by FRA's final rule. Therefore, we will focus on RSAC's PTC level 4 system evaluation in this section of our Report.

---

<sup>50</sup> Railroad Safety Advisory Committee. "Implementation of Positive Train Control Systems." In Report of the RSAC to the FRA, August 1999, page 83.

The RSAC identified and quantified PTC implementation costs in the following three (3) areas in its report:

1. Costs Per Locomotive;
2. Costs Per Mile; and
3. System Unit Costs.

Costs per locomotive included the costs to install the required on-board equipment. Costs per mile include the costs of installing equipment along the affected railroad right-of-way. Per-mile costs are estimated on a track-mile basis for items that are installed into individual tracks, and on a route-mile basis for items that are installed adjacent to the track(s) (such as communications devices.) System unit costs "cover hardware for a central office or intellectual property like software/hardware development."<sup>51</sup> Each of the RSAC report cost estimates included initial costs as well as ongoing maintenance costs. The RSAC estimated that maintenance costs would equal 10 percent of the initial annual cost.<sup>52</sup>

For PTC level 4, RSAC estimated that locomotive installation costs would equal \$75,000 per unit. In RSAC's discussion of its costs per mile estimates, RSAC stated that the costs were dependent on "the existing infrastructure"<sup>53</sup> along the affected routes, and therefore, RSAC's calculations included a cost-per-mile breakdown for each category of preexisting radio technology (i.e., track with Centralized Traffic Control ("CTC"), Automatic Block Signal Systems ("ABS"), and "Dark" territory each received different cost estimates per mile.) The RSAC system-unit cost estimates included the costs associated with the following activities: "implementing operating rules; building databases; generating software; developing messages;

---

<sup>51</sup> 1999 RSAC Report, page 83

<sup>52</sup> 1999 RSAC Report, page 84

<sup>53</sup> Id.

designing communication infrastructure; software development and, if needed central office costs."<sup>54</sup>

The RSAC cost estimates were based on its assessment of the five largest railroads (UP, BNSF Railway Company ("BNSF"), CSX Transportation ("CSXT"), Norfolk Southern Railway Company ("NS"), and Consolidated Rail Corporation ("Conrail")) discounted over a twenty-year period using a discount rate of 7%. When calculating the 20-year discounted cost, RSAC assumed all installation costs would occur in the first year. In summarizing its methods for developing costs, RSAC noted that:

"This is only a demonstration exercise to illustrate an upper bound to costs. No one believes this is a practical implementation. Many of the low density lines on those railroads would be poor candidates for an upgrade to PTC. When railroads implement PTC, the most likely migration path would be to implement PTC first on those corridors where PTC returns the highest net benefit. These probably will be high density lines with passenger or hazardous material traffic. Even if a railroad were to adopt PTC "completely", it might not equip all of its locomotives or power units, and it might not equip lines where traffic density is so low as to preclude collisions."<sup>55</sup>

Table 12 below shows the PTC level 4 implementation costs estimated by RSAC in 1999.

---

<sup>54</sup> 1999 RSAC Report, page 88.

<sup>55</sup> 1999 RSAC Report, page 96.

**Table 12**  
**RSAC August 1999 Implementation of Positive Train**  
**Control Systems Analysis Total Acquisition Cost of PTC Level 4**  
(1999 Dollars in Millions)

<u>Item</u> (1)	<u>Amount</u> (2)
1. Locomotives (Vehicle Adaptation)	\$1,390.6
2. CTC (Wayside Equipment)	\$1,174.8
3. ABS (Wayside Equipment)	\$556.2
4. DTC (Wayside Equipment)	\$1,162.7
5. Development Costs (Central Office and Development)	\$235.0
6. Total Installation Cost (Sum of Lines 1-5)	\$3,965.9
7. Annual Maintenance (10% of Line 6)	\$396.6
8. 20-Year Total Discounted at 7% (including maintenance)	\$7,796.6

Source: 1999 RSAC Report

**1. 2004 Report to FRA (ZETA-TECH)**

In March 2004, ZETA-TECH developed a report for FRA quantifying the total costs and benefits of nationwide PTC implementation. In the ZETA-TECH report, and as noted in the previous section of this Report, two PTC systems were evaluated, "PTC A" and "PTC B." PTC A was defined as "an 'overlay' system that provides enforcement of movement authorities, but does not incorporate a 'vital' central safety system." In contrast, PTC B was defined as "a stand-alone vital system."<sup>56</sup> The elements of the PTC B system evaluated by ZETA-TECH in the 2004 report are most comparable to the RSAC's PTC 4 system and the PTC system mandated by FRA's final

<sup>56</sup> 2004 ZETA-TECH Report, page 6.

rule. Therefore, we will focus on ZETA-TECH's PTC B system evaluation in this section of our Report.

ZETA-TECH identified and quantified PTC implementation costs in the following three (3) categories in its PTC B system:

1. Vehicle Adaptation Costs;
2. Wayside Installation Costs; and
3. Central Office Installation and Development Costs.

The three ZETA-TECH cost categories closely mirror the three categories included in the 1999 RSAC report. Vehicle adaptation costs include costs of equipping locomotives with the proper global positioning systems ("GPS"), central processing units ("CPU"), crew equipment, accelerometers, gyroscopes, vehicle control equipment, and related equipment. Wayside installation costs include costs of installing the required communications and detection systems along applicable system track. Central office costs represent the estimated cost of purchasing or building a central office, purchasing and installing the appropriate computer hardware and communications systems and developing software and IT technology required to monitor the entire railroad from one central office. Initial training and staffing costs were included in the central office cost and, beginning in year 6, training costs are included in the "maintenance" costs, which were quantified in this Report, but kept separate from installation costs.<sup>57</sup>

The ZETA-TECH vehicle adaptation and wayside installation cost estimates were drawn primarily from real-world data provided by manufacturers and railroads. Specifically, ZETA-TECH obtained cost estimates from CSXT for adapting locomotives and installing the proper wayside equipment. These cost estimates were based on CSXT's South Carolina pilot project. ZETA-TECH estimated the number of Class I railroad locos in service at 20,506 and

---

<sup>57</sup> 2004 ZETA-TECH Report, page 12.

route miles in service at 99,250 (in 2001). These factors were applied to the unit cost estimates obtained from CSXT to derive the total vehicle adaptation and wayside installation costs.

In contrast, ZETA-TECH's central office cost estimate was largely speculative. ZETA-TECH's report noted that, "the full cost of the necessary programming, graphical user interface, and other equipment and software will not be clear"<sup>58</sup> until one of the PTC test sites enters full operation. ZETA-TECH assumed that the cost of the central office would vary with the number of track miles and number of trains operated by each central office. Given the uncertainty with respect to central office costs, ZETA-TECH developed high- and low-cost estimates ranging from \$2.3 billion to \$4.4 billion for PTC B (in 2001 dollars).

ZETA-TECH stated that its initial cost estimates may have been overstated because much of the PTC-compatible equipment had already been purchased by the railroads. Specifically:

UP had reported that "2,600 of its 6,847 locomotives, or 38%, are equipped with ATCS radio" and "25% of UP route miles (9,600 route miles) are covered by ATCS UHF repeaters. BNSF had reported that "1,900 route miles are covered by ATCS-type radio" and CSX had "3,000 route miles of radio coverage."<sup>59</sup>

At the time of the ZETA-TECH report, it was unclear whether these technologies would need to be upgraded to be compatible with PTC B. Per the FRA's final rule, each railroad may determine how it designs and implements its PTC system as long as the system performs up to the required standard.

Table 13 below shows the PTC B initial costs calculated by ZETA-TECH in 2004.

---

<sup>58</sup> 2004 ZETA-TECH Report, page 98.

<sup>59</sup> 2004 ZETA-TECH Report, page 100.

**Table 13**  
**ZETA-TECH Summary of Estimated PTC B Initial Installation Costs**  
 (All Costs in 2001 Dollars, Millions)

<u>Item</u> (1)	<u>Low Case</u> (2)	<u>High Case</u> (3)
1. Locomotives (Vehicle Adaptation)	\$615.2	\$1,537.9
2. Route Miles (Wayside Equipment)	\$1,588.0	\$2,382.0
3. Central Office	<u>\$100.0</u>	<u>\$500.0</u>
4. Total Estimated System Costs	\$2,303.2	\$4,419.9

Source: ZETA-TECH 2004 Report, Table 30, Page 100.

ZETA-TECH estimated that annual training, maintenance, and tech obsolescence<sup>60</sup> costs would equal 15% of the total capital cost. ZETA-TECH noted in its analysis that BNSF used a value of 10% of its total capital cost when developing annual training, maintenance and tech obsolescence costs for BNSF's ARES project. However, ZETA-TECH used the electronics industry standard of 15%.<sup>61</sup>

**2. 2004 Report to Congress (FRA)**

Later in 2004, FRA developed a Report to Congress that contained cost and benefits estimates associated with PTC implementation in response to the Conference Report on the Consolidated Appropriations Resolution, 2003 (P.L. 108-7). FRA used the ZETA-TECH analysis as the basis for its report, and retained most of the cost estimates without revision.<sup>62</sup>

<sup>60</sup> 2004 ZETA-TECH Report, page 100.

<sup>61</sup> Id.

<sup>62</sup> FRA opined that PTC, by itself, would not result in business benefits. However, it followed that if add-on components of relatively modest cost were implemented subsequent to PTC implementation then business benefits would accrue. As such, FRA evaluated "a reasonable version of PTC and add-on components likely to generate business benefits." See: 2004 FRA Report to Congress at page 3.

In developing its 2004 Report to Congress, FRA conducted a peer-review workshop where it asked representatives from the railroads, shippers, suppliers and labor organizations to comment on the ZETA-TECH report. Based on comments made in the peer-review workshop by Alan Polivka, director of the North American Joint PTC project, FRA changed the estimated cost per locomotive from the \$30,000 to \$75,000 estimated in the ZETA-TECH report, to "\$20,000 to \$35,000 (for PTC B)."<sup>63</sup> This change reduced the total estimated Vehicle Adaptation costs by roughly half.

FRA retained ZETA-TECH's Central Office cost estimates despite comments in the peer-review workshop that no plans were under consideration for a central office like the one envisioned in the ZETA-TECH report. FRA noted that ZETA-TECH's estimates included development costs for software and IT infrastructure for use in the central office. FRA believed "this cost would be reduced substantially if the railroads were to develop only one system and apply it on all major railroads,"<sup>64</sup> but FRA retained the high estimate because it did not believe such a system existed. FRA also adopted ZETA-TECH's Wayside Equipment cost estimate without changes.

FRA introduced and quantified an additional cost category not contained in the ZETA-TECH report: Track Force Terminals ("TFT"). Theoretically, TFT would provide maintenance of way ("MOW") forces with the ability to request authority to occupy track and release authorities in real time. It was believed that these terminals, combined with the functionality of PTC, could yield substantial benefits in the efficiency of MOW work.

FRA also calculated and included a number for annual maintenance fees. However, the maintenance fees were applied as a negative benefit in FRA's corresponding benefits estimate.

---

<sup>63</sup> 2004 FRA Report to Congress, page 22.

<sup>64</sup> 2004 FRA Report to Congress, page 23.

Table 14 below shows the PTC B installation costs calculated by FRA in 2004.

<u>Item</u> (1)	<u>Low Case</u> (2)	<u>High Case</u> (3)
1. Locomotives (Vehicle Adaptation)	\$307.6	\$717.7
2. Route Miles (Wayside Equipment)	\$1,588.0	\$2,382.0
3. Central Office	\$100.0	\$500.0
4. Track Force Units	<u>\$48.0</u>	<u>\$72.0</u>
5. Total Estimated System Costs	\$2,043.6	\$3,671.7

Source: August 2004 FRA Report to Congress, Table 3, page D-3.

### 3. July 2009 Notice of Proposed Rule Making (FRA)

In July 2009, FRA finalized its NPRM on PTC implementation, including a 167 page supporting economic analysis with a 16 page appendix which updated each element of the 2004 FRA report. This 2009 analysis retained the same cost categories as the 2004 report. In addition, FRA introduced two new costs: (1) costs associated with developing implementation plans; and (2) Alaska Railroad ("ARR") implementation costs. The estimated costs for the ARR are static in the FRA report at a cost of \$30 million and represent costs "for more extensive switch monitoring and track integrity circuits."<sup>65</sup> The ARR cost estimate was kept separate from the primary cost estimate because ARR is not connected to the rail system in the lower 48 and will be implementing a different version of PTC.

<sup>65</sup> 2009 FRA Economic Analysis, page 114.

In the 2009 analysis, FRA abandoned some of the cost estimates it developed in 2004, on the basis that the estimates "were both overly optimistic, and excluded installation costs, as well as higher costs which stem from meeting the [new] performance standards.... in light of current discussions with railroads, the cost estimates in the 1998 report seem more accurate."<sup>66</sup> (The "1998 report" that FRA referenced is actually the RSAC report published in August 1999 and described above.) In developing the restated costs for its 2009 report, FRA stated that it derived its new cost estimates based on "discussions with RSAC participants and others over the course of more than a decade of experience in estimating PTC costs."<sup>67</sup>

For the revised locomotive adaptation costs, FRA derived its locomotive counts from "The Official 2009 Edition, Locomotive Rosters and News" by totaling the locomotive counts for each of the seven Class I railroads. FRA made the assumption that

"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, FRA believed, 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."<sup>68</sup>

For freight locomotives, FRA assumed a V-TMS<sup>69</sup> adaptation cost of \$55,000 per locomotive for 29,461 of the 32,264 total locomotive units to be fitted (unit costs for the other 2,793 units ranged from \$15,000 to \$125,000.) This is a significant change from the decision in FRA's 2004 report to reduce its adaptation cost estimate from approximately \$52,500 (per ZETA-TECH) to approximately \$27,500 (per comments received at the 2004 peer-review workshop). FRA did not provide support for its 2009 locomotive adaptation cost estimate, however FRA did

---

<sup>66</sup> **Federal Register** / Vol. 74, No. 138 / Tuesday, July 21, 2009 / Proposed Rules, page 36003.

<sup>67</sup> 2009 FRA Economic Analysis, page 117.

<sup>68</sup> 2009 FRA Economic Analysis, page 113.

<sup>69</sup> V-TMS stands for Vital Train Management System and is UP's version of PTC. The FRA presumably used this nomenclature to denote all Class I railroad PTC systems.

state that it, "believes that its onboard equipment cost estimates are likely in the upper bound" and suggests a range of \$33,000 to \$68,750 per unit.<sup>70</sup>

The wayside equipment costs developed in FRA's 2009 analysis include a breakdown of mileages for affected track segments as well as the applicable communications devices to be installed, including new costs for various commuter railroads and cab signals. The largest single cost item in the wayside equipment cost calculation is associated with 68,700 miles to be fitted with V-TMS systems. FRA assumed a cost of \$50,000 per track-mile with no clear support for that number, stating only that it "believes that its wayside costs may be in the lower bound" and suggesting a range of \$40,000 to 100,000 per unit<sup>71</sup> The 2009 wayside equipment cost estimate (\$3.6 billion) is substantially higher than the 2004 estimate (\$1.6 to 2.4 billion).

For its 2009 central office cost estimate, FRA assumed there would be 20 "units" required at a cost of \$15 million per unit, citing no concrete support for its assumed unit cost. The FRA did state that it "believes that its central office and development costs are likely in the upper bound," and suggests a range of \$6.0 to \$22.5 million per unit.<sup>72</sup>

The FRA phased in central office costs over the first five years at 20% per year, and phased in on-board equipment and wayside installation costs in years 3 through 7. The FRA treated all ARR costs as wayside installation costs and phased them in years 3 through 7.

The FRA calculated annual maintenance costs starting in year 2 at 15% of the cumulative investment to date.

After the total initial acquisition and annual maintenance costs were calculated, FRA restated the costs on a net-present-value basis over a 20-year time horizon. Table 15 below shows FRA's updated cost calculation as included in the July 2009 NPRM and the supporting analysis.

---

<sup>70</sup> 2009 FRA Economic Analysis, page 117.

<sup>71</sup> Id.

<sup>72</sup> Id.

**Table 15**  
**FRA July 2009 Proposed Rule NPRM Cost Estimate 1/**  
 (2009 Dollars in Millions)

<u>Item</u> (1)	<u>Amount</u> (2)
1. On-Board Equipment (Vehicle Adaptation)	\$1,416.7
2. Wayside Equipment	\$2,586.5
3. Central Office and Development	\$263.2
4. Maintenance	<u>\$5,741.2</u>
5. Total Expected System Cost	\$10,007.6

Source: Attachment No. C-1, Column (3).  
 1/ Net Present Value assuming 7% Discount Rate.

**4. January 2010 Final Rule (FRA)**

In January 2010, FRA published its Final Rule on PTC implementation. The Final Rule contained a policy change from the NPRM where, in response to comments from the railroads, FRA introduced a new *de minimis* (low-volume) exception for freight railroads in 49 CFR Part 236.<sup>73</sup> The final cost estimates reflect this change, and as a result wayside costs are lower than those estimated in the NPRM RIA. The *de minimis* provision reduced costs by avoiding 304 miles of right-of-way modifications on freight rail lines, and reduced costs by 80% on an additional 3,204 miles on freight rail systems. The Final Rule also includes provisions that permit passenger railroads to exclude 1,900 miles of track from the requirements to install PTC. Altogether, these changes result in a reduction in wayside costs of over \$238 million, or roughly 6.7%. Additionally, FRA made some minor adjustments to its on-board installation estimates. Specifically, FRA adjusted costs for certain units based on an assumption that some equipment

<sup>73</sup> §236.1006(b)(4)(ii)

would be installed regardless of the promulgation of the Final Rule. The FRA also slightly adjusted its total locomotive count from 32,254 units to 32,154 units. These costs led to a \$34 million reduction (1.8%) in locomotive adaptation costs.

Table 16 below shows FRA's updated costs as included in its January 2010 Final Rule.

<b>Table 16</b>	
<b><u>FRA January 2010 Final Rule Cost Estimate</u> 1/</b>	
(2009 Dollars in Millions)	
<b><u>Item</u></b> (1)	<b><u>Amount</u></b> (2)
1. On-Board Equipment (Vehicle Adaptation)	\$1,390.6
2. Wayside Equipment	\$2,414.8
3. Central Office and Development	\$263.2
4. Maintenance	<u>\$5,478.9</u>
5. Total Expected System Cost	\$9,547.5

Source: Attachment No. C-1, Column (2).  
1/ Net Present Value assuming 7% Discount Rate.

**B. PROBLEMS WITH  
THE 2010 FRA  
COST ESTIMATE**

The July 2009 FRA economic analysis contained a restatement of all the costs identified in the 1999 RSAC report and the 2004 FRA Report to Congress (based largely on the 2004 ZETA-TECH report). The economic analysis also contained a new calculation for ARR PTC implementation. There are three main problems with FRA's 2009 restatement of costs:

1. Locomotive costs are overstated;
2. Maintenance costs are overstated; and

3. Wayside equipment costs are likely overstated.

Each of the three issues is discussed below.

1. **Overstated Locomotive Adaptation Costs**

In its 2004 report, FRA adjusted the \$30,000 to \$75,000 locomotive unit costs estimated by ZETA-TECH (cost range for PTC B) downward to \$20,000 to \$35,000 per unit based on comments made in its peer-review workshop by Alan Polivka (director of the North American Joint PTC project), who opined that in a PTC B system, locomotives could be equipped at a cost of \$25,000 per unit.<sup>74</sup>

In its 2009 economic analysis, FRA increased its estimated locomotive unit costs to \$55,000 per unit (in the middle range of the 2004 ZETA-TECH report estimate it rejected in preparing its 2004 Report to Congress.) The FRA stated that it based its new 2009 estimate on "discussions with RSAC participants and others over the course of more than a decade of experience in estimating PTC costs."<sup>75</sup>

Now that PTC is mandated, it is reasonable to assume that locomotive manufacturers will begin to include integrated PTC control systems on their products. Over time, this could simplify or eliminate the PTC vehicle adaptation process and reduce costs associated with installing PTC on new locomotives.<sup>76</sup> FRA is aware of this probability and is in the process of reviewing and enhancing the Locomotive Safety Standards so as not to "restrict the adoption of new locomotive control functions and technologies by imposing regulations on locomotive control systems."<sup>77</sup>

In December 2008, The Virginia Railway Express ("VRE"), which interfaces with CSXT and NS, announced that it would "install [PTC compatible] devices on 41 locomotives at a

---

<sup>74</sup> FRA 2004 Report to Congress, page 22.

<sup>75</sup> FRA 2009 Economic Analysis, page 117.

<sup>76</sup> FRA 2009 Economic Analysis, page 95.

<sup>77</sup> FRA 2009 Economic Analysis, page 16.

cost between \$1.2 million and \$2 million."<sup>78</sup> That equates to \$29,000 to \$49,000 per unit.

Given that: (1) the FRA based its locomotive adaptation cost estimate of roughly \$35,000 in its 2004 report based on "actual purchases"; (2) VRE recently reported average equipment purchases of \$39,000 per unit; and (3) FRA believes locomotive manufacturers will begin to facilitate the PTC implementation process on new locomotives, FRA's \$55,000 per unit estimate is at or very near the upper bound of reasonable estimates. We have thus reduced the estimate to \$50,000 per unit (which is higher than VRE's recently reported installation costs but a reduction from FRA's estimate).<sup>79</sup> The result is a \$112 million reduction in base-case locomotive adaptation costs over the 20-year analysis period on a net present value ("NPV") basis.<sup>80</sup>

## **2. Overstated Maintenance Costs**

All of the reports relied on and analyses developed by FRA were consistent in the methodology used to estimate PTC system maintenance costs. In each case, annual maintenance costs were assumed to equal a percentage of the total investment costs. However, the reports were inconsistent with respect to the percentage used to derive the maintenance cost estimates. FRA noted in its 2004 Report to Congress that "the RSAC report used a figure of 10% of initial acquisition costs, while the ZETA-TECH study used a figure of 15%. There does not seem to be much basis to prefer one number over the other."<sup>81</sup> However, FRA adopted the 15% figure in its 2004 Report to Congress and has retained the use of that figure to develop its maintenance cost estimates through its final rule RIA. In its 2009 economic analysis, FRA supported its use of the 15% figure with the following language:

---

<sup>78</sup> "Railroads Set Positive Train Control (PTC) Development & Interoperability Strategies to Meet 2015 Mandate." *Progressive Railroading*, 12/10/2008; Accessed on-line at <<<http://www.progressiverailroading.com/news/article.asp?id=18969>>> on April 16, 2010.

<sup>79</sup> The restated annual locomotive installation costs are shown on Attachment No. C-2, Column (6).

<sup>80</sup> NPV calculated using a 7% discount rate. See: Attachment No. C-1, Line 3, Columns (5) and (6).

<sup>81</sup> FRA 2004 Report to Congress, page 23.

"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."<sup>82</sup>

In developing its 2009 estimates for cost categories other than annual maintenance, FRA largely eschewed its 2004 cost estimates (based primarily on the 2004 ZETA-TECH report) and replaced them with estimates based on the preceding RSAC study, stating that, "in light of current discussions with railroads, the cost estimates in the 1998 report seem more accurate."<sup>83</sup> However, the referenced RSAC report included a 10% maintenance rate estimate. FRA did not incorporate all components of "the 1998 report." Additionally, ZETA-TECH noted in its 2004 report that BNSF used a 10% factor for its ARES project.<sup>84</sup>

As noted by FRA in 2004, there is no definitive reason to use either the 10% figure or the 15% figure employed by the various parties over the last decade in estimating ongoing maintenance costs. As such, the proper way to include maintenance costs in the analysis is as a range from 10% (low) to 15% (high). In the base case, the middle of the range (12.5%) should be used to estimate annual maintenance costs.

We have replaced FRA's 15% annual maintenance figures with a restated annual maintenance estimate based on 12.5% of installed system costs.<sup>85</sup> The result is a 16.7% annual

---

<sup>82</sup> FRA 2009 Economic Analysis, page 118.

<sup>83</sup> FRA 2009 Economic Analysis, page 119.

<sup>84</sup> 2004 ZETA-TECH Report, page 100.

<sup>85</sup> See Attachment No. C-2, Column (7).

reduction in base-case maintenance costs, which amounts to a reduction of \$1.042 billion over the 20-year analysis period on a NPV basis.<sup>86</sup>

### 3. **Overstated Wayside Equipment Installation Costs**

In its 1999 report, RSAC attempted to account for existing PTC-compatible wayside equipment when it evaluated PTC costs. However, in 2004 both ZETA-TECH and FRA failed to account for existing equipment that railroads could incorporate into their PTC systems. ZETA-TECH noted that its initial cost estimates may have been overstated because much PTC-compatible equipment had already been purchased. In its 2009 economic analysis as well as in the 2010 final rule, FRA failed to account for existing PTC-compatible equipment when calculating its implementation cost estimates. However, FRA did note in its final rule that BNSF had successfully demonstrated a functional Switch Point Monitoring System ("SPMS") as well as a Track Integrity Warning System ("TIWS"), and that those technologies "are forward-compatible for use with existing and new PTC systems."<sup>87</sup>

As BNSF and other Class I railroads already have PTC-compatible systems installed, implementation costs should properly be adjusted to reflect those system capabilities. However, without inventorying all currently-installed PTC-compatible components on all affected rail systems, it is impossible to restate the wayside costs accurately. Therefore, for purposes of this Report we have retained the FRA cost estimate as included in the final rule, although we believe this cost category is overstated.

### 4. **Restatement**

Table 17 below shows the total restated costs including the adjustments to maintenance and locomotive adaptation costs described above.

---

<sup>86</sup> NPV calculated using a 7% discount rate. See: Attachment No. C-1, Line 4, Columns (5) and (6).

<sup>87</sup> **Federal Register** / Vol. 75, No. 10 / Friday, January 15, 2010 / Rules and Regulations, page 2601.

**Table 17**  
**Restated FRA January 2010 Final Rule Cost Estimate** 1/  
 (2009 Dollars in Millions)

<u>Item</u> (1)	<u>Amount</u> (2)
1. On-Board Equipment (Vehicle Adaptation)	\$1,278.1
2. Wayside Equipment	\$2,414.8
3. Central Office and Development	\$263.2
4. Maintenance	<u>\$4,437.3</u>
5. Total Expected System Cost	\$8,393.4

Source: Attachment No. C-1, Column (6).  
 1/ Net Present Value assuming 7% Discount Rate.

As shown in Table 17 above, corrected total costs equal \$8.4 billion over the 20-year analysis period. FRA's estimate of \$9.5 billion (shown in Table 6 above) is overstated by roughly \$1.1 billion.

**C. RESTATEMENT OF FRA FINAL RULE RIA**

In the restated benefits section of this Report, we evaluated and restated FRA's benefits methodologies and estimates. Coupling our restated benefits analysis with this cost estimate restatement, we are able to restate FRA's overall CBA supporting its final rule RIA. Table 18 below contains a summary of the total costs and benefits (to industry, the government, and society) associated with the final rule.

**Table 18**  
**Comparison of FRA CBA to Corrected and Restated CBA**  
(\$ in millions)

<u>Item</u> (1)	<u>FRA Final Rule RIA</u> (2)	<u>Restated</u> (3)
1. Railroad Direct Costs <sup>2/</sup>	\$9,547.5	\$8,393.5
2. Other Direct, Indirect, and Societal Costs <sup>2/</sup>	Improperly Excluded by FRA	\$5,707.6
3. Railroad Safety Benefits <sup>3/</sup>	\$439.7	\$439.7
4. Other Railroad, Shipper, and Societal Benefits <sup>4/</sup>	Improperly Excluded by FRA	\$17,266.7
5. Total Costs (L1 + L2)	\$9,547.5	\$14,101.1
6. Total Benefits (L3 + L4)	\$439.7	\$17,706.4
7. Cost-Benefit Ratio (L5 ÷ L6)	21.71	0.80

1/ Attachment No. C-1, Line 5, Column (2) and (6).

2/ Attachment No. C-1, Column (6) sum of lines 18,19,20,21.

3/ Attachment No. C-1, Line 16, Column (2) and (6).

4/ Attachment No. C-1, Column (6), sum of lines 22,23,24,25.

As shown in Table 18 above, the total benefits expected from the implementation of the PTC final rule exceed the total costs, resulting in a cost-benefit ratio of 0.80.

## **V. POTENTIAL ECONOMIC HARM TO TIH SHIPPERS RESULTING FROM THE RAILROADS IMPLEMENTATION OF POSITIVE TRAIN CONTROL**

Our discussion of potential economic harm to TIH shippers is included below under the following topical headings.

- A. Railroads' Position On Cost Recovery
- B. Quantification Of Costs Allocated To TIH Shippers
- C. PTC Investments Will Impact Regulated TIH Shipper Rates

### **A. RAILROADS' POSITION ON COST RECOVERY**

While the majority of railroad company reports, regulatory filings and commentary around the design and installation of PTC systems has focused on the costs, the railroads have begun to shed light on how they plan to recover the costs of implementation. The Class I railroads and their trade organization, the AAR, have publicly stated that the desired approach for recouping PTC investments is through direct government grants or tax credits. As outlined in its PTC position paper, the AAR believes Congress should consider various funding mechanisms to offset PTC investment, including:

- A 25 percent infrastructure tax incentive to help off-set the initial start-up costs of PTC installation; and
- A fully funded and expanded RSIA Rail Safety Technology Grant program.<sup>88</sup>

So far, Congress has not addressed the AAR's and railroads' funding suggestions.

Without direct government support, the railroads will look to internal sources of funds to pay for the PTC investment, primarily TIH shippers. The most current explanation came from the UP in a case recently decided by the STB. In its evidence filed in *US Magnesium*,<sup>89</sup> UP stated

---

<sup>88</sup> See "The Need for Reasonable Implementation of the Positive Train Control Mandate." AAR, October 2009.

<sup>89</sup> Docket No. 42114, *US Magnesium, L.L.C. v. Union Pacific Railroad Company*, served August 24, 2009 ("*US Magnesium*")

that it is the railroads' position that because the majority of PTC implementation is due to the transportation of TIH materials, TIH shippers should bear the cost of the installation. As indicated by the UP:

"A large portion of UP's costs to install PTC is caused by UP's transportation of TIH. As a matter of economic efficiency and regulatory precedent, it is reasonable and appropriate for UP's rates to TIH shippers to reflect the PTC costs caused by TIH..."

\*\*\*\*

"In short, if UP did not transport TIH, its costs to install PTC would be substantially lower than the approximately \$1.4 billion that will actually be required to install PTC."

\*\*\*\*

"That is, UP is incurring substantial PTC costs to provide service to TIH traffic, and it would not be incurring those costs if it were not providing that service. Thus, he concludes that it is reasonable and appropriate to allow railroads an opportunity to charge higher rates to TIH shippers than to shippers of other freight in order to recover PTC costs."<sup>90</sup>

UP's position is clear in that it places the burden of having to install the majority of its PTC infrastructure on TIH shippers. It is equally as clear that UP, and presumably all the Class I railroads, will attempt to recoup a large portion of PTC costs through higher rates to TIH shippers.

## **B. QUANTIFICATION OF COSTS ALLOCATED TO TIH SHIPPERS**

Using data provided by the individual Class I railroads, by the UP in US Magnesium, and contained in FRA's NPRM along with standard financial models used by railroad regulators,

---

<sup>90</sup> Source: UP Opening Evidence in US Magnesium, pages 42 and 43 (internal quotations omitted).

it is possible to develop the estimated annual costs the railroads will impose on TIH shippers to recover their capital outlays for PTC.

FRA included approximately \$4.1 billion on a net present value basis in capital investment costs to install PTC in its Final Rule Cost and Safety Benefits Analysis. This figure, when accounting for the impact of discounting, is virtually the same as the figures presented by the railroads in their most recent Securities and Exchange Commission (“SEC”) filings about the costs to install PTC systems. To directly tie to the costs, the railroad companies are indicating to the investment community and, by extension, their shipping communities, that the railroads have relied upon these figures to estimate the costs expected to be the responsibility of TIH shippers.

Attachment No. H-1 contains the estimated costs by year and individual Class I railroad to design, develop and install PTC systems. While the railroads’ filings indicate their estimated expenditures for the present year and their overall estimates of capital expenditures for PTC installation, they have not indicated the phasing of the expenses over the remaining five-year period from 2011 to 2015. For this estimate, we have assumed that the railroads will roll out their additional estimated investment on a pro-rata basis for the years 2011 to 2015.

Table 19 below contains a breakdown of the railroads estimated timing of PTC investment.

Table 19  
**Estimated PTC  
Installation Capital Costs By Year**  
(Millions)

<u>Year</u> (1)	<u>PTC Installation Cost By Year</u> (2)
1. 2010	\$710
2. 2011	\$845
3. 2012	\$845
4. 2013	\$845
5. 2014	\$845
6. 2015	<u>\$845</u>
7. Total	\$4,933

Source: Attachment No. H-1

As shown in Table 19 above, the railroads are telling the markets and their shippers that they expect to incur approximately \$4.9 billion in PTC related capital expenditures.

Because the Congressional mandate requires PTC along main line railroad segments that carry TIH commodities and/or passenger traffic, it is necessary to allocate the costs between those rail lines that will exclusively carry TIH commodities, those carrying passenger traffic but not TIH traffic and rail lines carrying both TIH and passengers.

In its testimony in *US Magnesium*, UP allocated 100 percent of its PTC investment to TIH shippers on the line segments where only TIH shipments occurred, e.g., no passenger traffic. On those segments where TIH traffic and Amtrak traffic would share the UP right of way, UP assumed 75 percent of the costs would be allocated to TIH traffic and 25 percent to Amtrak.<sup>91</sup>

UP indicated in *US Magnesium* that its approach provides an extremely conservative estimate of cost sharing between TIH shippers and passenger rail traffic. This is because based on

---

<sup>91</sup> There are also rail lines covered by the PTC mandate that transport TIH traffic and passenger traffic other than that carried by Amtrak, including primarily commuter rail lines. This amount of track miles is small when compared against the TIH only traffic and TIH and Amtrak combined traffic segments.

Amtrak's 2010 Grant and Legislative Request, Amtrak is only requesting funds to pay the costs to install PTC on Amtrak-owned track and on its own locomotives, and to not contribute to PTC costs where it is the tenant railroad.<sup>92</sup>

Using these allocation percentages developed by UP and the track miles requiring PTC installation by traffic type (TIH traffic only, passenger traffic only, combination TIH and passenger) as developed by FRA, we were able to estimate the cost allocation factors the railroads will likely use to divide PTC investment costs between its users. As shown in Attachment No. H-2, we estimate that the railroads would allocate 85 percent of its PTC investment costs to TIH shippers if applied on a direct cause of expense basis.

Using the capital costs expected by the railroads for PTC installation and the allocation factors based partly on evidence presented by UP, we estimated the annual capital carrying charges the railroads will seek from TIH shippers to cover their allocated PTC investment. To develop these capital carrying charges, we relied upon the standard discounted cash flow ("DCF") model used by the STB in calculating capital carrying charges in rail rate regulation cases. The STB's DCF model develops the amount of revenue a railroad or collection of railroads would have to earn each year to provide a return on and return of their investment. The STB's model is an infinite life model in that it reflects both the return required on the initial investment, and the return required to maintain capital outlays in the investment into the infinite future. In this way, the model reflects the costs to continuously replace the capital portions of PTC infrastructure as they wear-out over time. Simply stated, the STB's model predicts the railroads' revenue requirements on a continuing basis over time, and not the cost requirement over a finite, defined period of time.<sup>93</sup>

---

<sup>92</sup> National Railroad Passenger Corporation FY 2010 Grant and Legislative Request.

<sup>93</sup> UP used a similar methodology in the *US Magnesium* in an endeavor to show the amount of recovery from TIH shippers on its own estimated PTC investment.

Using the investment discussed above and estimated railroad industry financial inputs, we developed the capital carrying charges associated with the railroads' expected investment for each year between 2010 and 2016.<sup>94</sup> Using the 85 percent TIH allocation factor and the estimated capital carrying requirements, we estimated the amount of PTC investment the railroad will expect to obtain from TIH shippers.

Table 20 below summarizes the estimated costs the railroads can be expected to try to recover from TIH shippers for the installation of PTC over the first 10 years of the PTC installation process.

<u>Year</u> (1)	<u>Allocated PTC Capital Requirements</u> (2)
1. 2010	\$52.5
2. 2011	\$116.4
3. 2012	\$181.8
4. 2013	\$249.8
5. 2014	\$320.2
6. 2015	\$393.5
7. 2016	\$407.2
8. 2017	\$421.3
9. 2018	\$436.0
10. 2019	\$451.2

Source: Attachment No. H-3

<sup>94</sup> The STB's DCF model requires the input of various financial statistics, including, but not limited to, cost of equity, cost of debt, industry capital structure, expected inflation rates, estimated asset lives, depreciation rates, Federal tax rates and state tax rates. In developing the DCF models for this analysis, we relied upon our estimate of the STB's annual railroad industry cost of equity and debt, average railroad industry asset lives as indicated in railroad company's annual reports to the STB, and statutory Federal and State tax rates.

As shown in Table 20 above, the capital requirements allocated to TIH shippers will grow over time. The costs shown in Table 20 above do not end in 2019, but continue into the future. For presentation purposes, we have only reflected the first 10 years of PTC capital recovery costs. The STB's DCF methodology assumes that the railroads will not just recover the costs of the initial investment in PTC, but also will recover the costs of replacement of future PTC assets. In other words, the costs shown above can be expected to continue to rise into the future.<sup>95</sup>

The figures contained in Table 20 above are the railroads' expected PTC investment related nominal costs that may be passed on to TIH shippers over time. Unlike the costs and benefits discussed in earlier sections of this Report that are shown on a discounted real dollar basis, the Table 20 figures are shown on a nominal dollar basis since we are estimating the annual impact on TIH shipper rates over time, which are customarily shown on a nominal dollar basis. The costs summarized above are developed using data derived from the same sources as the cost and benefit analyses discussed in earlier sections of this Report, but are not directly additive or comparable to the previous Report analyses. Rather, they reflect our estimate of the specific harm to TIH shippers from the implementation of PTC by the railroads and the railroads' expected recovery of this investment.

As indicated by the UP in *US Magnesium*, the railroads view TIH traffic as the cause of the PTC investment requirements, and will attempt to recover these costs from the TIH shippers. The railroads attempt to recover this cost, notwithstanding the PTC benefits to other shippers, will directly impact and harm TIH shippers as they will absorb much of the costs and only a small portion of the benefits.

---

<sup>95</sup> While the cost figures shown in Table 20 above may appear to be extremely large given the relatively small amount of TIH traffic transported by the railroads (less than 0.3 percent of all traffic as estimated by FRA), the railroads' cost to transport TIH before implementation of PTC are relatively high. In *US Magnesium*, the STB found the variable costs to transport chlorine traffic on 1,200 moves equaled approximately \$30 per net ton and a reasonable rail rate equaled approximately \$100 per net ton.

### **C. PTC INVESTMENTS WILL IMPACT REGULATED TIH SHIPPER RATES**

Besides directly recovering their investment costs from TIH shippers by charging them higher rates, current or future TIH shippers with rates set under the STB's regulatory procedures will be impacted by the railroads' PTC investment.

The STB, like all economic regulators, must strike a balance between protecting the market from the monopoly powers of the railroads and economically strangling the companies it is regulating. A common method to strike this balance is to allow the regulated companies to charge rates such that the return on their invested capital equals the companies' cost of capital.<sup>96</sup> In this way, a company is earning enough to repay its investors while not extracting monopoly rents from the marketplace. One way to regulate rates based on this concept of the return on investment equaling the cost of capital is to ensure the rates charged by the company do not produce a rate of return that is greater than the companies' cost of capital.

Under this rate of return type of regulation, as a company's invested capital declines, its regulated rates or prices should decline holding all else constant. This is because as the amount invested declines, the amount of return needed to generate a sufficient return on the assets also declines. On the other hand, if a company's investment increases, its prices or rates should increase as the rate of required return will increase as the company now has a larger investment to recoup. Because the railroads' PTC investment will roll into their investment bases, they will be allowed to obtain a return on this investment in regulatory proceedings, which will force increases in regulated rates.

The most direct way the PTC impact will occur is in the calculation of the STB's Uniform Railroad Costing System ("URCS") variable costs. URCS is the STB's general purpose

---

<sup>96</sup> The cost of capital reflects the costs to obtain funds from financial markets based on the relative risk of the investment compared to the market as a whole. An organization whose investments generate a return equal to the cost of obtaining the funds can be thought of as "just breaking even" on the investment. It generated enough to repay the costs of obtaining the funds, but did not generate excessive economic profit on the investment.

costing system and is used in a number of STB regulated proceedings, including the testing and setting of maximum reasonable rail rates. Under the STB's methodologies, rate reasonableness is established as a ratio of movement's revenue to URCS variable costs ("R/VC").<sup>97</sup> This means regulated rates will change over time as the underlying URCS variable costs change. With PTC investment increasing the size of the railroads' investment base and thereby increasing their allowed return, the URCS variable costs, which include return on and of investment components, will also increase. In this way, rates on regulated TIH traffic will increase with the installation of PTC.

From an economic perspective, TIH shippers will be getting harmed from several directions. First, the railroads will attempt to recover their PTC investment by directly targeting TIH shippers for the costs of PTC installation. Second, the railroads will recover their PTC investment, in part, through higher regulated tariff rates, including regulated tariff rates for TIH shippers. This means that even those shippers that seek rate relief from the STB due to excessively high rail rates imposed by railroads for recovering PTC costs, will still end-up paying the costs of PTC investment. The railroads will essentially be "double-recovering" their PTC investments.

---

<sup>97</sup> Depending upon the size of the case and the amount of relief being sought, one of three different approaches may be used to develop the regulated rates. In all cases, the rate is eventually determined by a R/VC ratio. See STB Ex Parte No. 657 (Sub-No. 1), *Major Issues in Rail Rate Cases*, served October 30, 2006 and STB Ex Parte No. 646 (Sub-No. 1), *Simplified Standards For Rail Rate Cases*, served September 4, 2007.

## **VI. SUMMARY OF KEY LITERATURE REVIEWED**

### **A. BRIEF SUMMARY OF SELECTED KEY DOCUMENTS (IN CHRONOLOGICAL ORDER)**

**1. Federal Railroad Administration, June 1995 - *Differential GPS: An Aide to Positive Train Control*** - - This report was completed by FRA at the request of the Senate Appropriations Committee to outline the benefits, costs, desirability, feasibility and implications of using Differential GPS to establish PTC. In this report, FRA suggested that the nation would save approximately \$35 million per year in avoided collision and over-speed railroad accidents alone.<sup>98</sup> The FRA referred to the Association of American Railroads' estimate that nation-wide PTC would cost over \$800 million before maintenance expenses for all major railroads in the United States. The FRA suggested that higher quality service, reduced fuel consumption, and more efficient use of existing systems could provide benefits to the railroads valued in the hundreds of millions of dollars annually.<sup>99</sup> At this time, the FRA concluded that further study was required to make more accurate estimates of costs and benefits to determine the practicality of PTC.

**2. Railroad Safety Advisory Committee, August 1999 - *Implementation of Positive Train Control Systems*** - - In this report, RSAC attempted to quantify average costs associated with avoidable railroad accidents. This included fatalities, injuries, equipment damage, track damage, off right-of-way damage, hazardous materials cleanup, evacuations, loss of lading, wreck clearing and delays.

---

<sup>98</sup> See "*Differential GPS: An Aide to Positive Train Control*" page 12.

<sup>99</sup> See "*Differential GPS: An Aide to Positive Train Control*" page 13.

The RSAC report also attempted to quantify "other" benefits that were not safety related. The report stated that reduced manpower requirements, elimination of existing wayside signals, increased capacity, increased equipment utilization, and reduced fuel consumption can all be achieved through the implementation of PTC.<sup>100</sup>

For this analysis, RSAC divided the quantification into four PTC levels numbered 1 to 4. The PTC level 1 was the least expensive implementation and PTC level 4 was the most expensive. The report claimed a total system cost for implementing PTC on the five largest railroads to be between \$1.2 billion for level 1 and \$7.8 billion for level 4. The corresponding benefits range from \$485 million to \$843 million including avoidable accidents. The analysis concluded that the highest benefit to cost ratio (of 0.42) would be achieved using the lowest cost, entry level PTC implementation.<sup>101</sup>

**3. Zeta-Tech Associates, March 15 2004 - *Quantification of the Business Benefits of Positive Train Control* - - Zeta-Tech was tasked by the FRA to prepare an in-depth analysis of all foreseeable business benefits of PTC. The Zeta-Tech report, like the RSAC report, contained a range of different PTC implementations ("PTC A" and "PTC B") and depicted both low-cost and high-cost scenarios.**

---

<sup>100</sup> See *Implementation of Positive Train Control Systems* page 92.

<sup>101</sup> See *Implementation of Positive Train Control Systems* page 95. The RSAC report developed its "Benefit to Cost" ratio by dividing benefits by costs. In such an analysis, a ratio of less than one (1) means that aggregate costs are greater than aggregate benefits. In the updated analyses presented by FRA as part of the PTC Rule Making, FRA developed "Cost to Benefit" ratios where costs are divided by benefits. In those analyses, a ratio of less than one (1) indicates aggregate benefits are greater than aggregate costs. If the RSAC ratio were calculated in manner consistent with current FRA analyses, it would report a cost to benefit ratio of approximately 2.4.

The Zeta-Tech analysis concluded that implementing PTC would result in all of the benefits listed in the RSAC and a few more, including: improved capacity utilization, efficiencies from precision dispatching, fuel savings, reduced maintenance, improved equipment utilization, real-time locomotive diagnostics, improved transit times and more reliable service.<sup>102</sup> Zeta-Tech did not attempt to quantify maintenance of way benefits because it believed there were insufficient data to estimate a benefit. In its evaluation of PTC B (most similar to the system required under the FRA final rule), Zeta-Tech estimated direct railroad benefits in the range of \$1.3 to \$2.4 billion dollars annually.<sup>103</sup>

The Zeta-Tech report further estimated benefits to shippers. Shipper benefits included total logistics cost savings resulting from improved transit times and reliability, and reduced inventory costs. Under the PTC B scenario, Zeta-Tech estimated that shipper benefits would range from \$900 million to \$1.4 billion annually.<sup>104</sup> Zeta-Tech's estimated costs of implementing PTC B for all class I railroads ranged from \$2.3 billion to \$4.4 billion dollars.<sup>105</sup>

**4. Federal Railroad Administration, August 2004 - *Benefits and Costs of Positive Train Control*** - - The FRA submitted a Report to Congress in August of 2004 in response to a request of the Senate Appropriations Committee using the Zeta-Tech report as the primary basis for its cost and benefits calculations. The FRA conducted a peer review workshop in which representatives of railroads, labor organizations, suppliers, and

---

<sup>102</sup> See "*Quantification of the Business Benefits of Positive Train Control*" page 25.

<sup>103</sup> Stated in 2001 dollars. See "*Quantification of the Business Benefits of Positive Train Control*" pages 109- 110. All estimates are in 2001 dollars.

<sup>104</sup> See "*Quantification of the Business Benefits of Positive Train Control*" pages 109-110. All estimates are in 2001 dollars.

<sup>105</sup> See "*Quantification of the Business Benefits of Positive Train Control*" page 111. All estimates are in 2001 dollars.

shippers were invited to comment on the Zeta-Tech report and other issues relevant to PTC implementation. In the 2004 report, FRA adjusted many of Zeta-Tech's estimates in response to comments generated through the peer review workshop. For example, FRA reduced Zeta-Tech's Line Capacity benefits (avoided maintenance and avoided investment) to 40% of the original estimate. The FRA also reduced equipment ownership cost benefits to 25% of the original to adjust for idle time spent out of service and eliminated the work-order efficiency benefit.<sup>106</sup> The FRA also included an additional benefit associated with reduced terminal track forces, ranging from \$130 million to \$391 million dollars annually for PTC B. The FRA estimated total direct benefits for PTC B to range from \$1.6 to \$2.8 billion dollars annually.<sup>107</sup>

The FRA also introduced a new benefit calculation for "modal diversion" arising from rail shippers taking advantage of better rail transit times and reliability. The benefits were calculated using FRA's then new ITIC modal diversion model and would accrue as shippers took advantage of lower total logistics costs resulting from improved service and altered their logistics networks to shift volumes from truck to rail transport. The benefits largely consisted of reductions in highway truck crashes and reduced truck emissions, among other items.<sup>108</sup> The report detailed the estimated monetary benefits of modal diversion in Appendix D-6. For the PTC B scenario, the indirect benefits ranged from \$531 million to \$1.1 billion dollars annually.<sup>109</sup>

FRA estimated total direct and indirect benefits for PTC B to range from \$2.1 to \$3.9 billion dollars annually.

---

<sup>106</sup> See *"Benefits and Costs of Positive Train Control"* page D-2.

<sup>107</sup> In 2001 dollars.

<sup>108</sup> See *"Benefits and Costs of Positive Train Control"* page 20.

<sup>109</sup> In 2003 dollars.

**5. Federal Railroad Administration, July 21 2009 - *Positive Train Control***

***Systems; Proposed Rule*** - - In July 2009, FRA drafted the proposed rule for nation-wide PTC implementation. The document clearly defined PTC and what is required from all Class I railroads. The FRA again acknowledged that it expects benefits from railroad accident reduction and efficiency gains.<sup>110</sup> However, FRA took a major departure from its previous PTC cost-benefits analyses. The FRA included only direct railroad implementation costs and direct railroad safety benefits in its cost-benefit estimates.

For the first time, FRA intentionally excluded direct costs and benefits accruing to shippers and indirect costs and benefits accruing to society as a result of PTC implementation. The included 20-year cost estimate on a net present value basis was \$10.0 billion assuming a 7% discount rate. Annualized costs ranged from \$0.93 billion to \$0.95 billion.<sup>111</sup> The 20-year railroad safety benefit estimate was \$608 million stated on a net present value basis assuming a 7% discount rate.<sup>112</sup>

This unprecedented exclusion of all costs and benefits aside from direct railroad implementation costs and direct railroad safety benefits resulted in a severely skewed cost-benefit ratio of 16.5. This sharply contradicts all earlier studies that placed the cost-benefit ratio near 1.0, showing that over time the total benefits carry roughly the same weight as the total costs.

In the NPRM, FRA attempted to justify its exclusion of any benefits aside from direct railroad safety benefits (reduced rail accidents) "because of significant

---

<sup>110</sup> See "*Positive Train Control Systems: Proposed Rule*" page 36002.

<sup>111</sup> See "*Positive Train Control Systems: Proposed Rule*" page 36002.

<sup>112</sup> See "*Positive Train Control Systems. Proposed Rule*" page 36002.

uncertainties regarding whether and when individual elements will be achieved."<sup>113</sup> This decision renders the cost-benefit analysis invalid, as discussed in detail in other sections of our Report.

Incredibly, FRA further stated that it had not updated its 2004 report (including total costs and benefits) because of the aggressive implementation schedule and the resulting lack of time. However, the FRA did in fact conduct a detailed economic analysis (finalized on July 10, 2009) which did just that - updated the 2004 Report. In the NPRM, FRA gives only passing mention to this update, citing calculations of likely additional fuel savings resulting from PTC implementation and referring to possible modal-diversion-related highway safety and environmental benefits.<sup>114</sup> The FRA stated that it named these benefits simply to provide "a guide to the order of magnitude of such benefits."<sup>115</sup>

**6. Federal Railroad Administration, July 10 2009 - *Positive Train Control Systems; Economic Analysis*** - - FRA produced a detailed economic analysis of total costs and benefits associated with PTC implementation concurrently with its production of the PTC NPRM. The analysis was based on an update and revision to the 2004 analysis underlying the 2004 Report to Congress. In the July 2009 economic analysis, FRA calculated costs and benefits separate from, and additive to, the direct railroad costs and benefits it presented in the NPRM RIA. However, these costs and benefits were inexplicably excluded from the RIA. In the report, FRA calculated costs in three areas:

---

<sup>113</sup> See *"Positive Train Control Systems; Proposed Rule"* page 36002.

<sup>114</sup> See *"Positive Train Control Systems; Proposed Rule"* page 36004.

<sup>115</sup> See *"Positive Train Control Systems; Proposed Rule"* page 36004.

1. Indirect societal costs associated with modal diversion from rail to truck in response to assumed rail rate increases;
2. Equipment costs associated with add-on productivity enhancement systems; and
3. Maintenance costs associated with add-on productivity enhancement systems.

Over the 20-year economic analysis period (the same period as in the NPRM RIA, FRA calculated total additional costs of \$10.6 billion on a net present value basis assuming a 7% discount rate.

The FRA also calculated benefits in three areas:

1. Direct shipper benefits resulting from improved rail service levels;
2. Indirect societal benefits associated with modal diversion from truck to rail in response to estimated rail efficiency increases; and
3. Direct railroad benefits associated with productivity gains resulting from the introduction of PTC and add-on productivity systems.

Over the 20-year economic analysis period, FRA calculated total additional benefits of \$16.7 billion on a net present value basis assuming a 7% discount rate.

The FRA subtracted the \$10.6 billion in additional costs from the \$16.7 billion in additional benefits to arrive at a statement of \$6.1 billion in what it termed "net business benefits." There are several problems with the methodology used by FRA and the calculations supporting its results (which are discussed at length in other sections of this Report.) Nonetheless, FRA clearly identified significant additional cost and benefits elements and developed updated estimates for those elements but it excluded them from its NPRM.

**7. Federal Railroad Administration, January 15 2010 - Positive Train Control Systems; Final Rule** - - The FRA published its final rule in January of 2010. In the final

rule, FRA reduced its estimated direct railroad safety benefits from \$608 to \$440 million, and reduced its estimated direct railroad implementation costs from \$10.0 to \$9.5 billion. These changes result in a restatement of the cost-benefit ratio from 16.47 to 21.71. The FRA made no other significant changes to its NPRM methodologies or statements.

## **VII. BIBLIOGRAPHY OF IMPORTANT PTC-RELATED DOCUMENTS**

1. Association of American Railroads. "Positive Train Control." (9 September 2009). Available from: Association of American Railroads <<http://www.aar.org/safety/positivetraincontrol/ptc.aspx>>
2. Association of American Railroads. "Association of American Railroads Voices PTC Concerns." (9 September 2009). Available from: Association of American Railroads <<http://www.aar.org>>
3. "C&S Engineers: In their Own Words; Focus on Positive Train Control." *Progressive Railroading* (March 2010)
4. Currie, Clint. "TRB Conference Takeaways." *Concept Capital: Washington Research Group, T&I Bulletin* (14 January 2009)
5. Federal Railroad Administration. "Differential GPS: An Aid to Positive Train Control." *Report to the Committees on Appropriations* (June 1995)
6. Federal Railroad Administration. "Implementation of Positive Train Control System." In *Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator* (August 1999)
7. Federal Railroad Administration. "PTC - Benefits and Costs of Positive Train Control." *Report in Response to Request of Appropriations Committees* (August 2004)
8. Federal Railroad Administration. "Implementation of PTC Systems as Required by the Rail Safety Improvement Act of 2008." (2008)
9. Federal Railroad Administration. "FRA Issues Final Rule on Advanced Train Braking Technology." (15 October 2008)
10. Federal Railroad Administration. "Intelligent Railroad Systems - Positive Train Control (PTC)." In *PTC Analyses* (30 October 2008). Available from: Federal Railroad Administration <<http://www.fra.dot.gov>>
11. Federal Railroad Administration. "Positive Train Control Overview." (10 March 2009). Available from: Federal Railroad Administration <<http://www.fra.dot.gov/pages/1521.shtml>>
12. Federal Railroad Administration. "Positive Train Control (PTC)." (26 March 2009). Available from: Federal Railroad Administration <<http://www.fra.dot.gov>>

13. Federal Railroad Administration. "Positive Train Control Systems; Proposed Rule." *Federal Register Part III 49 CFT Parts 229, 234, 235* (21 July 2009)
14. Federal Railroad Administration. "Positive Train Control Systems; Final Rule." *Department of Transportation Federal Railroad Administration 49 CFR Pars 229, 234, 235, and 236 [Docket No. FRA-2006-0132, Notice No.3]* (15 January 2010)
15. Hartong, M. "Key Management Requirements for Positive Train Control Communications Security." *Institute of Electrical and Electronics Engineers* (April 2006). Available from: IEEE  
<<http://www.ieee.org>>
16. Hawkes, Alex. "Alaska's Positive Thinking." In *Railway Technology* (27 August 2008)
17. Library of Congress. "S.3493: A Bill to Require Rail Carriers to Develop Positive Rail Control System Plans for Improving." (16 September 2008). Available from: GovTrack.us  
<<http://www.govtrack.us>>
18. National Transportation Safety Board. "Implement Positive Train Control Systems." In *Most Wanted List Transportation Safety Improvements* (2007). Available from: NTSB <<http://www.nts.gov>>
19. Office of Management and Budget. "Circular A-94: Guidelines and Discount Rates For Benefit-Cost Analysis of Federal Programs." (29 October 1992). Available from: Whitehouse Website  
<<http://www.whitehouse.gov/omb/rewrite/circulars/a094/a094.html>>
20. Oliver Wyman, Inc. "Assessment of the Commercial Benefits of Positive Train Control." (23 April 2010). Available from: AAR  
<[http://www.aar.org/NewsAndEvents/PressReleases/2010/04/~/\\_/media/AAR/NewsFiles/2010/042710WymanPTC.ashx](http://www.aar.org/NewsAndEvents/PressReleases/2010/04/~/_/media/AAR/NewsFiles/2010/042710WymanPTC.ashx)>
21. Paterson, Rick. "Terminator V." *UBS Railroads Weekly* (18 February 2010). Available from: UBS  
<<http://www.ubs.com/investmentresearch>>
22. "Positive Train Control (PTC): Calculating Benefits & Costs of a New Railroad Control Technology" In *Journal of Transportation Research Forum* (Summer 2005)
23. "Railroads Question PTC Timetable." *Railway Age* (2007). Available from: Railway Age  
<<http://www.railwayage.com>>
24. Railroad Safety Advisory Committee. "Implementation of Positive Train Control Systems." In *Report of the RSAC to the FRA* (August 1999)

25. Roskind, Frank D. "Positive Train Control Systems: Economic Analysis." *Department of Transportation Federal Railroad Administration 49 CFR Pars 229, 234, 235, and 236 [Docket No. FRA-2006-0132, Notice No. 1]* (July 10 2009)
26. STB Docket No. 42114, *US Magnesium, L.L.C. v. Union Pacific Railroad Company*, served August 24, 2009 ("US Magnesium")
27. Troy, Matthew. "The ABCs of PTC: A Primer on Positive Train Control & Implications for the Rails." *Citigroup Global Markets* (22 February 2010)
28. Union Pacific Railroad, "GO21: Positive Train Control (PTC) Update." (21 September 2009)
29. Union Pacific Railroad, PTC webinar, "Train Control Systems and Vital Train Management System (VTMS)", December 17, 2008.
30. Zeta-Tech Associates. "Quantification of the Business Benefits of Positive Train Control." *Prepared for the Federal Railroad Administration* (15 March 2004)

**Intermediate Restatement of PTC Cost-Benefit Analysis**  
(Twenty-year Costs and Benefits on a Present-Value Basis Assuming a 7% Discount Rate)

Item (1)	1/15/2010 FRA Final Rule (2)	7/10/2009 FRA NPRM Economic Analysis (3)	Restated Final Rule Costs and Safety Benefits, NPRM Business (Accepting FRA Calculations and Methodology) (4)	Restated Final Rule Costs and Safety Benefits, NPRM Business (With Corrected Calculations) (5)	Restated Final Rule Costs and Safety Benefits, NPRM Business (With Corrected Calc. and Alt Methodology) (6)
<b>Costs by Category</b>					
1 Central Office and Development	(\$263,232,675)	(\$263,232,675)	\$263,232,675	(\$263,232,675)	(\$263,232,675)
2 Wayside Equipment	(\$2,414,794,033)	(\$2,586,453,456)	(\$2,414,794,033)	(\$2,414,794,033)	(\$2,414,794,033)
3 On Board Equipment	(\$1,390,618,364)	(\$1,416,706,349)	(\$1,390,618,364)	(\$1,390,618,364)	(\$1,390,618,364)
4 Maintenance	(\$5,478,877,649)	(\$5,741,220,231)	(\$5,478,877,649)	(\$5,478,877,649)	(\$5,478,877,649)
5 Total PTC Implementation Costs	(\$9,547,522,721)	(\$10,007,612,711)	(\$9,547,522,721)	(\$9,547,522,721)	(\$9,547,522,721)
<b>Benefits by Category</b>					
6 RAILROAD SAFETY					
7 Fatalities	\$175,541,848	N/A	\$175,541,848	\$175,541,848	\$175,541,848
8 Injuries	\$133,114,717	N/A	\$133,114,717	\$133,114,717	\$133,114,717
9 Train Delay	\$16,008,043	N/A	\$16,008,043	\$16,008,043	\$16,008,043
10 Property Damage	\$103,857,000	N/A	\$103,857,000	\$103,857,000	\$103,857,000
11 Emergency Response	\$281,353	N/A	\$281,353	\$281,353	\$281,353
12 Equipment Cleanup	\$1,637,683	N/A	\$1,637,683	\$1,637,683	\$1,637,683
13 Road Closure	\$378,926	N/A	\$378,926	\$378,926	\$378,926
14 Environmental Cleanup	\$4,233,172	N/A	\$4,233,172	\$4,233,172	\$4,233,172
15 Evacuations	\$4,652,654	N/A	\$4,652,654	\$4,652,654	\$4,652,654
16 Total Safety Benefit	\$439,705,396	\$607,711,640	\$439,705,396	\$439,705,396	\$439,705,396
17 C/B Ratio Considering DIRECT RAILROAD COSTS but Only RAILROAD SAFETY BENEFITS ((L5 x -1) / L16)	21.71	16.47	21.71	21.71	21.71
<b>OTHER COSTS (INCLUDING INDIRECT SOCIETAL COSTS)</b>					
18 Indirect Costs (Modal Diversion, Societal Cost) 1/	N/A	(\$10,403,753,086)	(\$9,925,450,939)	(\$5,429,007,04C)	N/A
19 Add-On Productivity System Costs	N/A	(\$81,964,040)	(\$81,964,040)	\$81,964,040)	(\$81,964,040)
20 Add-On Productivity Maintenance Costs	N/A	(\$86,759,551)	(\$86,759,551)	\$86,759,551)	(\$86,759,551)
21 Add-On Indirect Costs (Modal Diversion, Societal Costs) 2/	N/A	2/	2/	(\$109,895,939)	N/A
<b>OTHER BENEFITS (INCLUDING INDIRECT SOCIETAL BENEFITS)</b>					
22 Shipper Direct Productivity Benefit	N/A	\$4,336,270,929	\$4,336,270,929	\$4,485,005,022	\$4,485,005,022
23 Indirect Benefits (Modal Diversion, Societal Benefit) 3/	N/A	\$7,292,457,508	\$7,292,457,508	\$4,109,799,418	\$4,109,799,418
24 Railroad Direct Benefits	N/A	\$5,073,542,554	\$5,073,542,554	\$5,003,737,388	\$5,003,737,388
25 Indirect Benefits (Modal Diversion, Societal Benefit) 4/	N/A	\$/	\$/	\$1,658,103,284	N/A
26 Total Costs (L5 + L18 + L19 + L20 + L21)	N/A	(\$20,880,089,389)	(\$19,641,697,251)	(\$15,215,149,280)	(\$9,716,246,312)
27 Total Benefits (L16 + L22 + L23 + L24 + L25)	N/A	\$17,309,982,631	\$17,141,976,387	\$17,706,356,887	\$14,038,247,823
28 C/B Ratio Considering TOTAL COSTS and BENEFITS ((L26 x -1) / L27)	N/A	1.18	1.15	0.86	0.69
29 Retained Railroad Costs ((L5 + L18 + L20) x 20%) 5/	N/A	(\$2,035,267,260)	(\$1,943,249,262)	(\$1,943,249,262)	(\$1,943,249,262)
30 Railroad Retained Benefits (L24 x 20%) 5/	N/A	\$1,014,706,511	\$1,014,708,511	\$1,000,747,598	\$1,000,747,598
31 C/B Ratio Considering only RAILROAD RETAINED COSTS, RAILROAD RETAINED BENEFITS, and RAILROAD SAFETY BENEFITS ((L29 x -1) / (L30 + L16))	N/A	1.25	1.34	1.35	1.35
32 Railroad Cost Pass-Through to Shippers ((L5 + L18 + L20) x 80%) 5/	N/A	(\$8,141,069,042)	(\$7,772,997,050)	(\$7,772,997,050)	(\$7,772,997,050)
33 Railroad Benefit Pass-Through to Shippers (L24 x 80%) 5/	N/A	\$4,058,834,043	\$4,058,834,043	\$4,002,990,390	\$4,002,990,390
34 C/B Ratio Considering only SHIPPER COSTS and BENEFITS ((L33 x -1) / (L22 + L32))	N/A	0.97	0.93	0.92	0.92
35 C/B Ratio Considering only SOCIETAL COSTS and BENEFITS (((L18 + L21) x -1) / (L23 + L25))	N/A	1.43	1.36	0.71	NA

1/ FRA assumed 80% of railroad costs are passed through to shippers. Indirect benefits factor applied to 80% of railroad direct cost to estimate societal costs from modal diversion (increased highway crashes, increased truck emissions, etc.)  
2/ FRA improperly excluded from analysis. Indirect benefits factor applied to 80% of railroad direct cost to estimate societal costs from modal diversion (increased highway crashes, increased truck emissions, etc.)  
3/ Indirect benefits factor applied to 100% of shipper direct benefits to estimate societal benefits from modal diversion (reduced highway crashes, reduced truck emissions, etc.)  
4/ FRA improperly excluded from analysis. Indirect benefits factor applied to 80% of railroad direct benefits to estimate societal benefits from modal diversion (reduced highway crashes, reduced truck emissions, etc.)  
5/ FRA assumes 80% of railroad costs/benefits are passed through to shippers in the form of rate increases/reductions

**Intermediate Restatement of PTC Cost-Benefit Analysis**  
(Twenty-year Costs and Benefits on a Present-Value Basis Assuming a 3% Discount Rate)

Item (1)	1/15/2010	7/10/2009	Restated Final Rule Costs and Safety Benefits, NPRM Business Benefits (Accepting FRA Calculations and Methodology)	Restated Final Rule Costs and Safety Benefits, NPRM Business Benefits (With Corrected Calculations)	Restated Final Rule Costs and Safety Benefits, NPRM Business Benefits (With Corrected Calc. and All Methodology)
	FRA Final Rule (2)	FRA NPRM Economic Analysis (3)	(4)	(5)	(6)
<b>Costs by Category</b>					
1 Central Office and Development	(\$283,025,904)	(\$283,025,904)	(\$283,025,904)	(\$283,025,904)	(\$283,025,904)
2 Wayside Equipment	(\$2,902,751,825)	(\$3,109,098,494)	(\$2,902,751,825)	(\$2,902,751,825)	(\$2,902,751,825)
3 On Board Equipment	(\$1,613,568,678)	(\$1,643,839,709)	(\$1,613,568,678)	(\$1,613,568,678)	(\$1,613,568,678)
4 Maintenance	(\$8,406,267,684)	(\$8,812,624,111)	(\$8,406,267,684)	(\$8,406,267,684)	(\$8,406,267,684)
5 Total PTC Implementation Costs	(\$13,205,614,091)	(\$13,848,587,718)	(\$13,205,614,091)	(\$13,205,614,091)	(\$13,205,614,091)
<b>Benefits by Category</b>					
6 RAILROAD SAFETY					
7 Fatalities	\$268,999,278	N/A	\$268,999,278	\$268,999,278	\$268,999,278
8 Injuries	\$203,984,196	N/A	\$203,984,196	\$203,984,196	\$203,984,196
9 Train Delay	\$24,530,630	N/A	\$24,530,630	\$24,530,630	\$24,530,630
10 Property Damage	\$159,149,846	N/A	\$159,149,846	\$159,149,846	\$159,149,846
11 Emergency Response	\$431,143	N/A	\$431,143	\$431,143	\$431,143
12 Equipment Cleanup	\$2,509,576	N/A	\$2,509,576	\$2,509,576	\$2,509,576
13 Road Closure	\$580,664	N/A	\$580,664	\$580,664	\$580,664
14 Environmental Cleanup	\$6,486,888	N/A	\$6,486,888	\$6,486,888	\$6,486,888
15 Evacuations	\$7,129,699	N/A	\$7,129,699	\$7,129,699	\$7,129,699
16 Total Safety Benefit	\$679,801,920	\$881,233,681	\$679,801,920	\$679,801,920	\$679,801,920
17 C/B Ratio Considering DIRECT RAILROAD COSTS but Only RAILROAD SAFETY BENEFITS ((L5 + L1) / L16)	19.60	14.87	19.60	19.60	19.60
<b>OTHER COSTS (INCLUDING INDIRECT SOCIETAL COSTS)</b>					
18 Indirect Costs (Modal Diversion, Societal Cost) 1/	N/A	(\$14,998,282,651)	(\$14,301,930,041)	(\$7,817,435,143)	N/A
19 Add-On Productivity System Costs	N/A	(\$115,062,980)	(\$115,062,980)	(\$115,062,980)	(\$115,062,980)
20 Add-On Productivity Maintenance Costs	N/A	(\$147,600,380)	(\$147,600,380)	(\$147,600,380)	(\$147,600,380)
21 Add-On Indirect Costs (Modal Diversion, Societal Costs) 2/	N/A	2/	2/	(\$174,670,159)	N/A
<b>OTHER BENEFITS (INCLUDING INDIRECT SOCIETAL BENEFITS)</b>					
22 Shipper Direct Productivity Benefit	N/A	\$7,505,315,578	\$7,505,315,578	\$7,762,747,902	\$7,762,747,902
23 Indirect Benefits (Modal Diversion, Societal Benefit) 3/	N/A	\$12,794,273,455	\$12,794,273,455	\$7,208,890,124	\$7,208,890,124
24 Railroad Direct Benefits	N/A	\$8,781,401,943	\$8,781,401,943	\$8,660,582,625	\$8,660,582,625
25 Indirect Benefits (Modal Diversion, Societal Benefit) 4/	N/A	4/	4/	\$6,434,132,793	N/A
26 Total Costs ((L5 + L18 + L19 + L20 + L21)	N/A	(\$29,108,533,729)	(\$27,770,207,493)	(\$21,460,382,753)	(\$13,468,277,451)
27 Total Benefits ((L16 + L22 + L23 + L24 + L25)	N/A	\$30,012,244,656	\$29,754,792,895	\$30,740,155,363	\$24,306,022,570
28 C/B Ratio Considering TOTAL COSTS and BENEFITS ((L26 + L1) / L27)	N/A	0.97	0.93	0.70	0.55
29 Retained Railroad Costs ((L5 + L19 + L20) x 20%) 5/	N/A	(\$2,822,250,216)	(\$2,693,655,490)	(\$2,681,655,490)	(\$2,693,655,490)
30 Railroad Retained Benefits (L24 x 20%) 5/	N/A	\$1,756,280,389	\$1,756,280,389	\$1,732,116,525	\$1,732,116,525
31 C/B Ratio Considering only RAILROAD RETAINED COSTS, RAILROAD RETAINED BENEFITS, and RAILROAD SAFETY BENEFITS ((L29 + L1) / ((L30 + L16))	N/A	1.05	1.11	1.12	1.12
32 Railroad Cost Pass-Through to Shippers ((L5 + L19 + L20) x 80%) 5/	N/A	(\$11,289,000,863)	(\$10,774,621,961)	(\$10,774,621,961)	(\$10,774,621,961)
33 Railroad Benefit Pass-Through to Shippers (L24 x 80%) 5/	N/A	\$7,025,121,554	\$7,025,121,554	\$6,928,466,100	\$6,928,466,100
34 C/B Ratio Considering only SHIPPER COSTS and BENEFITS ((L33 + L1) / (L22 + L32))	N/A	0.78	0.74	0.73	0.73
35 C/B Ratio Considering only SOCIETAL COSTS and BENEFITS (((L18 + L21) + L1) / (L23 + L25))	N/A	1.17	1.12	0.59	N/A

1/ FRA assumed 80% of railroad costs are passed through to shippers. Indirect benefits factor applied to 80% of railroad direct cost to estimate societal costs from modal diversion (increased highway crashes, increased truck emissions, etc.)

2/ FRA improperly excluded from analysis. Indirect benefits factor applied to 80% of railroad direct cost to estimate societal costs from modal diversion (increased highway crashes, increased truck emissions, etc.)

3/ Indirect benefits factor applied to 100% of shipper direct benefits to estimate societal benefits from modal diversion (reduced highway crashes, reduced truck emissions, etc.)

4/ FRA improperly excluded from analysis. Indirect benefits factor applied to 80% of railroad direct benefits to estimate societal benefits from modal diversion (reduced highway crashes, reduced truck emissions, etc.)

5/ FRA assumes 80% of railroad costs/benefits are passed through to shippers in the form of rate increases/reductions

**Restatement of Indirect Benefits Factor**  
**(Based on Corrections to FRA 7/10/2009 Economic Analysis)**

Year (1)	7/10/2009 FRA NPRM Economic Analysis				March 2010 Restatement				CAGR Applied (11)
	Shipper Direct Benefits 1/ (2)	Indirect Societal Benefits 2/ (3)	Indirect Benefits Factor 3/ (4)	Implicit CAGR 4/ (5)	Shipper Direct Benefits 5/ (7)	Indirect Societal Benefits 5/ (8)	Indirect Benefits Factor 6/ (9)	Implicit CAGR 4/ (10)	
2009				90.01%					49.55%
2010	1,150,000,000	615,041,931	0.94	94.00%	1,309,222,112	676,976,653	0.52		51.71%
2011				98.16%					53.96%
2012				102.51%					56.31%
2013				107.05%					58.77%
2014				111.80%					61.33%
2015				116.75%					64.00%
2016				121.92%					66.79%
2017				127.32%					69.69%
2018				132.96%					72.73%
2019				138.85%					75.90%
2020	1,150,000,000	942,118,846	1.45	1.0443	1,309,222,112	1,036,990,214	0.79	1.0436	79.21%
2021				151.42%					82.66%
2022				158.13%					86.26%
2023				165.14%					90.02%
2024				172.45%					93.94%
2025				180.09%					98.03%
2026				188.07%					102.30%
2027				196.40%					106.76%
2028				205.10%					111.41%

1/ From 2004 FRA Report to Congress, stated in 2001 real dollars.

2/ From 2004 FRA Report to Congress, stated in 2003 real dollars.

3/ It is unclear how FRA calculated these values. FRA's stated methodology does not produce these values.

4/ CAGR = Compound Annual Growth Rate: ((2020 value / 2010 value) ^ (1 / 10)).

5/ From 2004 FRA Report to Congress, updated to correct errors and restated in 2009 real dollars.

6/ Developed using FRA's stated methodology: Column (8) / Column (7).

**Summary of Errors in and Corrections To the 2004 and 2009 FRA Economic Analysis Benefits Calculations**

Item (1)	Source/ 2004 FRA Adjustment (2)	2004 FRA Report to Congress 1/ Real Dollar			Corrected 2004 FRA Report to Congress 2/ Low-Case			High-Case			FRA 2009 Update 3/ Average (10)		Corrected 2009 Update 4/ Average (11)	
		Basis Period (3)	Low-Case Estimate (4)	High-Case Estimate (5)	Average (6)	Low (7)	High (8)	Average (9)	FRA 2009 Update 3/ Average (10)	Corrected 2009 Update 4/ Average (11)				
1 Line Capacity (Avoided Investment)	40% of ZETA-TECH	2001	119,813,061	168,802,026	144,307,544	123,922,649	174,591,935	149,257,292			164,287,502			
2 Line Capacity (Avoided Maintenance)	40% of ZETA-TECH	2001	203,186,898	304,782,782	253,984,840	210,156,209	315,236,831	262,696,520			289,150,060			
3 Precision Dispatching Efficiencies	75% of 7T1A-TECH	2001	101,999,070	160,005,793	181,007,182	105,497,638	268,923,475	187,210,556			206,062,659			
4 Locomotive Maintenance Reduction	100% of ZETA-TECH	2001	28,567,603	28,567,603	28,567,603	29,547,472	29,547,472	29,547,472			32,522,902			
5 Locomotive Road Failure Reduction	100% of ZETA-TECH	2001	34,603,875	34,603,875	34,603,875	35,790,788	35,790,788	35,790,788			39,394,920			
6 Fuel Savings	100% of ZETA-TECH	2001	55,949,775	130,549,475	93,249,625	57,868,852	135,027,322	96,448,087			437,500,000			
7 Terminal Track Forces Efficiencies	FRA DEVELOPED	2002	130,393,843	391,181,530	260,787,687	132,519,263	397,557,789	265,038,526			291,727,905			
8 Annual Maintenance Costs	Based on Z-T Costs 5/ Sum of Lines 1-8	2001	(550,756,500)	(306,538,500)	(428,647,500)									
9 RR Direct Benefit	FRA ASSUMPTION	2001	123,757,625	1,011,954,084	567,855,855						1,460,645,948			
10 RR Direct Benefit Retention Rate	FRA ASSUMPTION	N/A	0.20	0.20	0.20						0.20			
11 RR Retained Benefit	Line 9 x Line 10	2001	24,751,525	202,390,817	113,571,171	139,060,574	271,335,122	205,197,848			292,129,190			
12 Shipper Direct Benefits	100% of ZETA TECH	2001	900,000,000	1,400,000,000	1,150,000,000	930,870,000	1,448,020,000	1,189,445,000			1,309,222,112			
13 Shipper pass-thru Benefits	Line 9 - Line 11 6/ Line 12 + Line 13	2001	649,762,600	1,116,101,767	882,932,184	556,242,296	1,085,340,490	820,791,393			1,168,516,759			
14 Shipper Total Benefits		2001	1,549,762,600	2,516,101,767	2,032,932,184	1,487,112,296	2,533,360,490	2,010,236,393			2,477,738,870			
15 Direct Safety Benefits	FRA/VOLPE	2003	40,237,868	95,653,623	67,945,746	40,237,868	95,653,623	67,945,746			74,787,882			
16 Total Net Direct Benefits	Sum of Lines 11, 14, 15	Mixed	1,614,751,993	2,814,146,207	2,214,449,100	1,666,410,738	2,900,349,235	2,283,379,987			2,844,655,942			
17 Estimated Indirect Societal Bennes, 2010	FRA(ITIC)	2003	531,103,148	698,980,714	615,041,931	531,103,148	698,980,714	615,041,931			676,976,653			
18 Total 2010 Benefits	Line 16 + Line 17	Mixed	2,145,855,141	3,513,126,921	2,829,491,031	2,197,513,886	3,599,329,949	2,898,421,918			3,521,632,595			
19 Estimated Indirect Societal Bennes, 2020	FRA(ITIC)	2003	815,070,747	1,069,166,945	942,118,846	815,070,747	1,069,166,945	942,118,846			1,036,990,214			
20 Total 2020 Benefits	Line 16 + Line 19	Mixed	2,429,822,740	3,883,313,152	3,156,567,946	2,481,481,485	3,969,516,180	3,225,498,833			3,881,646,156			
21 2010 Indirect Benefit Ratio	Line 17 / Line 12		0.59	0.50	0.54	0.57	0.48	0.53			0.52			
22 2020 Indirect Benefit Ratio	Line 19 / Line 12		0.91	0.76	0.83	0.88	0.74	0.81			0.79			

1/ Lines 1-20 values as included in FRA 2004 Report to Congress, Lines 21 and 22 added for this exhibit. All values are annual.

2/ Indexed all values to 2003 levels, corrected maintenance cost values, corrected shipper pass-through benefits calculation.

3/ All values as included in FRA 2009 Economic Analysis, with varying degrees of support provided.

4/ Indexed all values to 2009 levels, corrected maintenance cost values, corrected shipper pass-through benefits calculation, incorporated FRA 2009 fuel benefit estimate.

5/ FRA flip-flopped the low- and high-case maintenance cost values in its 2004 Report to Congress. These costs should not be included in the benefits calculation at any rate.

6/ FRA values in its 2004 Report to Congress do not match its stated methodologies, as FRA has done in its final rule RIA.

GDP Inflation	
2001-2002	1.0177
2001-2003	1.0343
2001-2009	1.1385
2002-2003	1.0163
2002-2009	1.1187
2003-2009	1.1007

SOURCE: <http://cost.isc.nasa.gov/mfiateGDP.html>

**Restatement of PTC Cost-Benefit Analysis**  
(Twenty-year Costs and Benefits on a Present-Value Basis Assuming a 7% Discount Rate)

Item	1/15/2010 FRA Final Rule (2)	7/10/2009 FRA NPRM Economic Analysis (3)	Final Rule Costs and Safety Benefits, Restated NPRM Business Benefits (Accepting FRA Calculations and Methodology) (4)	Final Rule Costs and Safety Benefits, Restated NPRM Business Benefits (With Corrected Calculations) (5)	Restated Final Rule Costs and Safety Benefits NPRM Business Benefits (With Corrected Calculations) (6)
<b>Costs by Category</b>					
1 Central Office and Development	(\$263,232,675)	(\$263,232,675)	(\$263,232,675)	(\$263,232,675)	(\$263,232,675)
2 Wayside Equipment	(\$2,414,794,033)	(\$2,586,453,456)	(\$2,414,794,033)	(\$2,414,794,033)	(\$2,414,794,033)
3 On-Board Equipment	(\$1,390,618,364)	(\$1,416,706,349)	(\$1,390,618,364)	(\$1,390,618,364)	(\$1,278,119,676)
4 Maintenance	(\$5,478,877,649)	(\$5,741,220,231)	(\$5,478,877,649)	(\$5,478,877,649)	(\$4,437,320,607)
5 Total PTC Implementation Costs	(\$9,547,522,721)	(\$10,007,612,711)	(\$9,547,522,721)	(\$9,547,522,721)	(\$8,393,466,990)
<b>Benefits by Category</b>					
<b>RAILROAD SAFETY</b>					
6 Fatalities	\$175,541,848	N/A	\$175,541,848	\$175,541,848	\$175,541,848
7 Injuries	\$133,114,717	N/A	\$133,114,717	\$133,114,717	\$133,114,717
9 Train Delay	\$16,008,043	N/A	\$16,008,043	\$16,008,043	\$16,008,043
10 Property Damage	\$103,857,000	N/A	\$103,857,000	\$103,857,000	\$103,857,000
11 Emergency Response	\$281,353	N/A	\$281,353	\$281,353	\$281,353
12 Equipment Cleanup	\$1,637,683	N/A	\$1,637,683	\$1,637,683	\$1,637,683
13 Road Closure	\$378,926	N/A	\$378,926	\$378,926	\$378,926
14 Environmental Cleanup	\$4,233,172	N/A	\$4,233,172	\$4,233,172	\$4,233,172
15 Evacuations	\$4,652,654	N/A	\$4,652,654	\$4,652,654	\$4,652,654
16 Total Safety Benefit	\$439,705,396	\$607,711,640	\$439,705,396	\$439,705,396	\$439,705,396
17 C/B Ratio Considering DIRECT RAILROAD COSTS but Only RAILROAD SAFETY BENEFITS ((L5 x -1) / L16)	21.71	16.47	21.71	21.71	19.09
<b>OTHER COSTS (INCLUDING INDIRECT SOCIETAL COSTS)</b>					
18 Indirect Costs (Modal Diversion, Societal Cost) 1/	N/A	(\$10,403,753,086)	(\$9,925,450,939)	(\$5,429,007,040)	(\$5,429,007,040)
19 Add On Productivity System Costs	N/A	(\$81,964,040)	(\$81,964,040)	(\$81,964,040)	(\$81,964,040)
20 Add On Productivity Maintenance Costs	N/A	(\$86,759,551)	(\$86,759,551)	(\$86,759,551)	(\$86,759,551)
21 Add On Indirect Costs (Modal Diversion, Societal Cost) 2/	N/A	2/	2/	(\$109,895,939)	(\$109,895,939)
<b>OTHER BENEFITS (INCLUDING INDIRECT SOCIETAL BENEFITS)</b>					
22 Shipper Direct Productivity Benefit	N/A	\$4,336,270,929	\$4,336,270,929	\$4,485,005,022	\$4,485,005,022
23 Indirect Benefits (Modal Diversion, Societal Benefit) 3/	N/A	\$7,292,457,508	\$7,292,457,508	\$4,109,799,418	\$4,109,799,418
24 Railroad Direct Benefits	N/A	\$5,073,542,554	\$5,073,542,554	\$5,003,737,988	\$5,003,737,988
25 Indirect Benefits (Modal Diversion, Societal Benefit) 4/	N/A	4/	4/	\$3,668,109,064	\$3,668,109,064
26 Total Costs (L5 + L18 + L19 + L20 + L21)	N/A	(\$20,580,089,389)	(\$19,641,697,251)	(\$13,235,149,290)	(\$14,101,093,560)
27 Total Benefits (L16 + L22 + L23 + L24 + L25)	N/A	\$17,309,982,631	\$17,141,976,387	\$17,706,356,887	\$17,706,356,887
28 C/B Ratio Considering TOTAL COSTS and BENEFITS (((L26 x -1) / L27)	N/A	1.19	1.15	0.86	0.80
29 Retained Railroad Costs (L5 + L18 + L20) x 20%) 5/	N/A	(\$2,035,267,260)	(\$1,943,249,262)	(\$1,943,249,262)	(\$1,712,438,116)
30 Railroad Retained Benefits (L24 x 20%) 5/	N/A	\$1,014,708,511	\$1,014,708,511	\$1,000,747,598	\$1,000,747,598
31 C/B Ratio Considering only RAILROAD RETAINED COSTS, RAILROAD RETAINED BENEFITS, and RAILROAD SAFETY BENEFITS (((L29 x -1) / (L30 + L16))	N/A	1.25	1.34	1.35	1.19
32 Railroad Cost Pass-Through to Shippers (L5 + L18 + L20) x 80%) 5/	N/A	(\$8,141,069,042)	(\$7,772,997,050)	(\$7,772,997,050)	(\$6,849,752,465)
33 Railroad Benefit Pass-Through to Shippers (L24 x 80%) 5/	N/A	\$4,058,834,043	\$4,058,834,043	\$4,002,990,390	\$4,002,990,390
34 C/B Ratio Considering only SHIPPER COSTS and BENEFITS (((L33 x -1) / (L22 + L32))	N/A	0.97	0.93	0.92	0.81
35 C/B Ratio Considering only SOCIETAL COSTS and BENEFITS (((L18 + L21) x -1) / (L23 + L25))	N/A	1.43	1.36	0.71	NA

1/ FRA assumed 90% of railroad costs are passed through to shippers. Indirect benefits factor applied to 80% of railroad direct cost to estimate societal costs from modal diversion (increased highway crashes, increased truck emissions, etc.)  
2/ FRA improperly excluded from analysis. Indirect benefits factor applied to 80% of railroad direct cost to estimate societal costs from modal diversion (increased highway crashes, increased truck emissions, etc.)  
3/ Indirect benefits factor applied to 100% of shipper direct benefits to estimate societal benefits from modal diversion (reduced highway crashes, reduced truck emissions, etc.)  
4/ FRA improperly excluded from analysis. Indirect benefits factor applied to 80% of railroad direct benefits to estimate societal benefits from modal diversion (reduced highway crashes, reduced truck emissions, etc.)  
5/ FRA assumes 80% of railroad costs/benefits are passed through to shippers in the form of rate increases/reductions

**Restated PTC Costs Based on Changes to FRA's Maintenance and Onboard Cost Estimates**

Year (1)	Discount Factor 1/ (2)	Development & Central Office Costs (3)	Wayside Costs (4)	Onboard Costs (5)	Total Installed Costs 2/ (6)	Maintenance Costs 3/ (7)	Annual Costs 4/ (8)	Discounted Annual Costs 5/ (9)
2009	1.00	\$60,000,000	\$0	\$0	\$60,000,000	\$0	\$60,000,000	\$60,000,000
2010	0.93	\$60,000,000	\$0	\$0	\$120,000,000	\$7,500,000	\$67,500,000	\$63,084,112
2011	0.87	\$60,000,000	\$167,654,736	\$333,542,000	\$681,196,736	\$15,000,000	\$576,196,736	\$503,272,544
2012	0.82	\$60,000,000	\$335,309,472	\$333,542,000	\$1,410,048,208	\$85,149,592	\$814,001,064	\$664,467,341
2013	0.76	\$60,000,000	\$502,964,208	\$333,542,000	\$2,306,554,417	\$176,256,026	\$1,072,762,234	\$818,405,172
2014	0.71	\$0	\$1,005,928,417	\$333,542,000	\$3,646,024,834	\$288,319,302	\$1,627,789,719	\$1,160,591,573
2015	0.67	\$0	\$1,341,237,889	\$333,542,000	\$5,320,804,723	\$455,753,104	\$2,130,532,993	\$1,419,664,093
2016	0.62	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$414,191,221
2017	0.58	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$387,094,599
2018	0.54	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$361,770,653
2019	0.51	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$338,103,414
2020	0.48	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$315,984,499
2021	0.44	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$295,312,616
2022	0.41	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$275,993,099
2023	0.39	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$257,937,476
2024	0.36	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$241,063,062
2025	0.34	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$225,292,581
2026	0.32	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$210,553,814
2027	0.30	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$196,779,265
2028	0.28	\$0	\$0	\$0	\$5,320,804,723	\$665,100,590	\$665,100,590	\$183,905,856
<b>Total</b>		<b>\$300,000,000</b>	<b>\$3,353,094,723</b>	<b>\$1,667,710,000</b>		<b>\$9,674,285,698</b>	<b>\$14,995,090,421</b>	<b>\$8,393,466,990</b>

1/ Based on a 7% discount rate.  
2/ Sum of columns (3) through (5) plus column (6) from prior year.  
3/ Column (6) from prior year times 12.5%.  
4/ Sum of columns (3) through (5) and column (7).  
5/ Column (8) times column (2).

**Estimated PTC Installation Capital Costs By Year**  
(millions of dollars)

	<u>Year</u>	<u>UP</u>	<u>BNSF</u>	<u>CSXT</u>	<u>NS</u>	<u>CN</u>	<u>CP</u>	<u>KSC</u>	<u>Total 1/</u>	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		
1.	2010	<u>2/</u>	\$200	\$258	\$170	\$40	\$13	\$15	\$14	\$710
2.	2011	<u>3/</u>	\$240	\$258	\$116	\$132	\$37	\$47	\$14	\$845
3.	2012	<u>3/</u>	\$240	\$258	\$116	\$132	\$37	\$47	\$14	\$845
4.	2013	<u>3/</u>	\$240	\$258	\$116	\$132	\$37	\$47	\$14	\$845
5.	2014	<u>3/</u>	\$240	\$258	\$116	\$132	\$37	\$47	\$14	\$845
6.	2015	<u>3/</u>	<u>\$240</u>	<u>\$258</u>	<u>\$116</u>	<u>\$132</u>	<u>\$37</u>	<u>\$47</u>	<u>\$14</u>	<u>\$845</u>
7.	<b>Total</b>	<u>2/</u>	\$1,400	\$1,550	\$750	\$700	\$198	\$250	\$85	\$4,933

1/ Sum of Columns (2) to (8).

2/ Source: Railroad investor reports, equity analysts conference calls and SEC reports.

3/ [Line 7 - Line 1] x 20%.

**Estimated Percentage Of  
PTC Costs To Be Recovered From TIH Shippers**

<u>Item</u> (1)	<u>Source</u> (2)	<u>Statistic</u> (3)
<b><u>Miles of Track Subject to PTC</u></b>		
1. Rail Miles Subject to PTC Installation	FRA NPRM at 35964	69,000
2. Miles Carrying Both TIH and Passengers	FRA NPRM at 35964	18,000
3. Miles Carrying Only Passengers	FRA NPRM at 35964	<u>6,000</u>
4. Miles Of Track Subject To PTC Due To Only To Carrying TIH Commodities	L.1 - L.2 - L.3	45,000
<b><u>Weighting of PTC Cost Recovery</u></b>		
5. Percentage of PTC Cost Allocated To TIH Track Without Passenger Operations	<u>1/</u>	100%
6. Percentage of PTC Cost Allocated To TIH Track Along Amtrak Routes	<u>1/</u>	75%
7. Percentage of PTC Cost Allocated To TIH Track Along Commuter Rail Routes	<u>1/</u>	0%
<b><u>Allocation of PTC Costs To TIH</u></b>		
8. Weighted Route Miles Allocated To TIH	(L. 3 x L. 5) + (L.2 x L.6)	58,500
9. Estimated TIH Cost Allocation	L.8 - L.1	85%

1/ Allocated based on Union Pacific Railroad Company's Opening Evidence in STB Docket No. 42114, US Magnesium, L.L.C. v. Union Pacific Railroad Company. August 24, 2009 (Public Version).

**Estimated Annual Capital Carrying Charges Railroads Will Allocate To TTH Shippers For PTC Installation.**

Year (1)	Annual Capital Carrying Charges Assuming Infinite Life 1/							Annual Required Capital Recovery 2/ (8)	Percentage Allocated To TTH Shippers By Railroads 3/ (9)	Estimated Annual Capital Recovery Railroads Will Allocate To TTH Shippers 4/ (10)
	2010 (2)	2011 (3)	2012 (4)	2013 (5)	2014 (6)	2015 (7)				
1	2010	\$61,784,911						\$61,784,911	85%	\$52,517,174.17
2	2011	\$63,912,071	\$73,002,410					\$136,914,480	85%	\$116,377,308.39
3	2012	\$65,863,939	\$75,231,894	\$72,746,484				\$213,892,317	85%	\$181,808,469.10
4	2013	\$68,072,145	\$77,754,157	\$75,237,102	\$72,779,186			\$293,842,590	85%	\$249,766,201.91
5	2014	\$70,430,228	\$80,447,601	\$77,843,366	\$75,300,299	\$72,761,198		\$376,782,691	85%	\$320,265,287.23
6	2015	\$72,919,156	\$83,290,502	\$80,594,246	\$77,961,304	\$75,332,463	\$72,790,829	\$462,888,500	85%	\$393,455,224.89
7	2016	\$75,463,893	\$86,197,143	\$83,406,806	\$80,681,972	\$77,961,376	\$75,331,029	\$479,042,219	85%	\$407,185,885.87
8	2017	\$78,082,048	\$89,187,629	\$86,300,502	\$83,481,123	\$80,666,120	\$77,944,494	\$495,661,917	85%	\$421,312,629.25
9	2018	\$80,806,766	\$92,299,827	\$89,311,972	\$86,394,197	\$83,480,944	\$80,664,321	\$512,958,026	85%	\$436,014,322.24
10	2019	\$83,626,603	\$95,520,668	\$92,428,570	\$89,408,965	\$86,394,029	\$83,479,094	\$530,857,929	85%	\$451,229,239.34

1/ Reflects annual capital carrying charges of investment, including replacement of

assets, assuming an infinite life

2/ Sum of Columns (2) to (7)

3/ Source Attachment No 6

4/ Column (8) x Column (9)