A Balancing Act: Positive Train Control

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In August 1999, the Federal Railroad Administration's Safety Advisory Committee issued a report stating that out of a sample of 6,400 train accidents of all types, 2,659 could have been prevented by some form of positive train control.

INTRODUCTION

In response to increased public concern relevant to recent high profile rail incidents which have resulted in lose of life, multiple injuries, and damage to equipment, US Congress passed into law the Rail Safety Improvement Act of 2008 (RSIA08), requiring affected railroads to install positive train control (PTC) systems by December 31, 2015.

This paper will provide an analysis of the interrelationship between performance-based rail safety regulatory policy and the development and implementation of PTC technologies relevant to potential improvements to both safety and efficiency of rail operations. This paper provides a general overview of RSIA08 impacts and is not intended to address specific railroad statutory requirements of the final regulation.

The first part of this paper will provide a brief historical perspective of railroad regulatory policy, providing contrast to historical standards based regulations and contemporary performance based policies applicable to the development of PTC final standards. The second part of this paper will present some challenges associated with PTC implementation. We will conclude by summarizing policy, practical impacts, and regulatory implications for the future.

HISTORY OF RAILROAD REGULATORY STANDARDS

In order to fully understand current regulatory methodologies one must be able to contrast performance based policies against the historical Common Carrier based regulatory standards, which are best characterized by the pervasive regulatory practices under the Interstate Commerce Commission (ICC). Government regulation has traditionally taken two approaches – regulators can prescribe exactly what actions regulated entities must take, or incorporate regulatory goals into performance-based targets and allow the regulated entities to determine how to achieve desired performance standards.

Transportation regulation was not always extensively applied during the early period of the US transportation system development. Case in point, since the 1830s, railroads have enjoyed a laissez-faire government approach. This hands-off attitude led to widespread financial mismanagement and corruption, which eventually led to calls for railroad regulation. Unfortunately, early regulatory attempts by states were ineffective because of the interstate nature of railroad operations.

Meanwhile, railroad predatory abuses began to attract congressional attention. Congress responded by passing the Act to Regulate Commerce in 1887, thereby establishing the Interstate Commerce Commission (ICC). This would eventually become the cornerstone of US transportation regulatory policy governing all modes of transportation, with the ICC holding regulatory jurisdiction over all railroad operating functions, such as entry into service markets, abandonment of services, rates and pricing, sale of securities, and mergers.

The nature of railroad regulation and its possible linkage to the industry's financial problems was extensively debated during the period that preceded the regulatory reform movement of the 1970s. It was widely contended by government critics that over-regulation was the most serious problem faced by the railroad industry (Lieb, 1994). Extensive regulatory policy by the ICC was seen as a major cause of the financial meltdown of the Northeast railroad systems in 1970. Congress responded with passage of two acts aimed at providing railroads greater pricing flexibility – the Railroad Revitalization and Regulatory Reform Act of 1976 and the Staggers Rail Act of 1980. These acts initiated the regulatory reform movement, eventually culminating in the ICC Termination Act of 1995 and ending nearly a century of

extensive regulation of the rail industry under the ICC (Wikipedia, 1980). Termination of the ICC completed the regulatory reform movement. The Federal Railroad Administration (FRA) assumed federal control over railroad safety and enforcement of regulatory standards.

Performance-Based Regulatory Standards

Deregulation of the transportation industry ushered in a movement of global impact, opening the industry to free market competition. Free from the ICC pervasive regulatory practice of forced competition, the railroad industry experienced a resurgence in the 1980s and 1990s. Opponents of regulatory reform raised concerns about potential safety issues due to intense price competition and tendency to cut back on safety in order to improve profit margins. There are no simple answers to questions of safety in terms of cost-benefit analysis – safety measures generate sizable costs that are borne either directly or indirectly by the general (Lieb, 1994) so the safety debate will likely continue in perpetuity.

The movement towards performance-based regulatory standards seeks to balance the need for the government to meet its public safety role while allowing the railroad industry to ensure that safety policy development takes into account practical cost-benefit analysis. Performance-based standards identify goals and performance objectives to be achieved, and describe the methods used to validate performance against the standards and objectives. Performance standards focus on quantifiable outcomes and measurement metrics used to verify the success or failure of a product, service, or process. The major advantage of performance-based standards is that they allow greater flexibility in determining the means by which performance goals and objectives are met.

Many parties, including government agencies, equipment manufacturers, carriers, unions, and the general public, are involved in the promotion of transportation safety. The Railroad Safety Advisory Committee (RSAC) is an example of a vital existing public private partnership involved in the promotion of railroad safety regulation, and playing a key role in development of PTC performance standards. The RSAC was established by the FRA in 1996 to develop consensus recommendations on railroad safety issues such as development of PTC system standards. The FRA is not obligated to accept RSAC recommendations if they conflict with agency goals.

In December 2008, RSAC accepted the PTC implementation task to provide advice regarding development and implementation of PTC regulations in support of the Rail Safety Improvement Act of 2008 (RSIA08), which mandates that affected railroads implement an operating PTC system by December 31, 2015. Performance-based standards provide the greatest flexibility to allow free market forces to drive development of emerging technologies needed to meet PTC system performance mandates. Given the time specific statutory mandates for PTC system implementation, performance-based standards provide the framework necessary to affectively harness the synergies that arise when regulatory, industry, and public sector forces join to address national level issues of public safety.

Performance standards move away from development and enforcing of a “one size fits all” set of technical and/or design standards, and toward standards that enhance technological innovation and development of alternative means to achieve statutory performance requirements. The FRA final rules provide railroads with the freedom to develop specific PTC systems that best align with their specific operating characteristics and corporate cultures, while allowing the FRA to manage the implementation of these systems by setting basic parameters and guidelines for development of system architecture and functionalities. The final rules provide guidance to railroads in determining what PTC technology they choose to implement, thus ensuring a level of product confidence. Ultimately, the FRA is mandated with the responsibility to determine whether each PTC system’s performance provides an acceptable level of safety, as well as whether or not a system receives certification.

The applying railroad is responsible for making a persuasive case in its filing documentation supporting the performance of the proposed system. The railroad may be assisted by the PTC system manufacturer or supplier in making their application. The FRA expects that all safety and risk-related data will be supported by credible evidence or information, which is best achieved by using a combination of qualitative and quantitative risk assessment methods.

RAIL SAFETY IMPROVEMENT ACT OF 2008 (RSIA08)

The objectives of the final rule are as follows: provide performance standards for implementation and operation of PTC systems; detail the minimum process

and procedures to be followed by applicants; and identify the documents which must be incorporated into PTC implementation plans.

RSIA08 affects Class I railroad carriers and each entity providing regularly scheduled intercity or commuter rail passenger transportation service, and requires implementation of a certified operating PTC system by December 31, 2015. The final rules require the affected operating entity to develop and submit to the FRA their plan for PTC system implementation. Furthermore, the FRA will not permit the installation of any PTC system or component in revenue service unless the Administrator has certified them through the approval process (FRA, 2009).

PTC system core functionality, each system shall be designed to prevent the following hazards:

- Train to train collisions;
- Over-speed derailments;
- Incursions into established work zone limits;
- Movement of a train through an improperly aligned switch.

The mandate specifically restricts regularly provided intercity and commuter passenger operation to PTC controlled mainline tracks. By statute, passenger service will not be allowed on mainline track that does not have an operating PTC system installed after December 31, 2015, except as described in the final rule.

The PTC System Certification Process

The following provides an overview of the procedural processes, requirements and document submittal timelines for the FRA approval process. The FRA will not allow the implementation of any PTC system or component into service until the system has been certified by the Administrator. Implementation is understood to consist of the following key program functions: design, testing, verification and validation, installation, and operations. In order to provide the best regulatory framework in which to meet the aggressive schedule for PTC system implementation set by Congress, the FRA enacted subpart I which provided modifications intended to improve on existing subpart H rules. Subpart I lay out the specific methods by which each railroad shall ultimately receive PTC system certification.

The PTC system certification process consists primarily of the following three key elements:

1. PTC Implementation Plan
2. PTC Development Plan
3. PTC Safety Plan

Positive Train Control Implementation Plans (PTCIP) are required to be submitted by April 16, 2010 for host and tenant railroads. The PTCIP defines the specific details of how and when the railroad will implement their specific and unique system. New railroads beginning operations after April 16, 2010 must install PTC and are required to file a PTCIP as soon as possible after the decision to proceed. New railroads starting after December 31, 2015 will not be authorized to commence revenue operations until PTC implementation is complete.

The Positive Train Control Development Plan (PTCDP) provides a detailed discussion of specific elements of the proposed technology and product that will be used to implement the railroad PTC system. PTCDP approval is granted in the form of a Type Approval number that applies to the subject PTC system. To receive a Type approval number the railroad must submit a PTCDP draft concurrently with its PTCIP. By requiring the applying railroad to submit both documents concurrently, the FRA believes it is possible to achieve the maximum time utilization needed to successfully complete PTC implementation requirements, and provides the FRA with the opportunity to apply its regulatory review as early in the approval process as possible. The Positive Train Control Safety Plan (PTCSP) is the core document which provides the Associate Administrator with the information necessary to certify that the as-built railroad-specific PTC elements demonstrate that the system, as installed, meets the required statutory performance objectives. The PTCSP must include information relating to the operation and safety of the PTC system as defined in the PTCDP. For the approval, PTCSP comes in the form of a PTC System Certification.

RSIA08 and High Speed Rail Service

In anticipation of high speed rail service and to ensure public safety, the FRA proposes a multi-tiered requirement for high speed PTC systems. The goal of the mandates is to increase safety performance parameters as maximum speed limits increase in order to compensate for increased risks at higher speeds. Speed-related tiers are as follows: (a) 50-60 MPH freight and passenger rail requires block signal and PTC system; (b) greater than 90 MPH requirements in all of (a) plus fail-safe incursion protection; (c) greater than 125 MPH requirements all of (a, b) plus provide additional safety analysis show greater

safety than comparable systems; (d) greater than 150 MPH requirements in all of (a, b, c) plus rule of particular applicability to be developed as part of PTCSP.

CHALLENGES OF IMPLEMENTATION

The Costs

The impact of the new PTC Rules is pervasive and will ultimately have wide-ranging implications for railroad operations, financials, and corporate culture. Under the new rule, tens of thousands of positive train control devices will be installed nationally along 69,000 miles of track and aboard 30,000 engines. The systems are estimated to cost about $5.5 billion to install and $820 million annually to maintain and repair.

In a report issued by the Association of American Railroads, the costs of implementing PTC are discussed in detail. The investments railroads will need to make are not small. Radio systems are expensive, as are the network of antennas that need to be placed along the route and the electronics needed to interconnect the lines (i.e. the infrastructure). The distances between each location needs to be verified, so topography, curves, and speed restrictions are all things that need to be calculated in order to ensure an accurate gradient.

While the Rail Safety Improvement Act allows for grants of up to $50 million per year toward railroad safety technology, this barely scratches the surface of the billions of dollars PTC needed for implementation. Railroads are facing shouldering this cost in order to improve or install enhanced communication systems, advanced location determination systems, and sophisticated fail-safe information processors. Another costly key element of a successful PTC system is sophisticated and reliable software that takes into account the complexities of rail operations.

One solution proposed by the AAR is to spread the funding responsibility to the public who will ultimately benefit from the installation of PTC systems. Every dollar a railroad spends on PTC is a dollar that can't be spent to increase capacity or implement other safety measures. With the benefits of PTC primarily benefiting the traveling public, extending the investment responsibility to the public seems logical.

Another option railroads are considering is passing on some of the cost to the shippers of toxic inhalation hazard (TIH) chemicals. This has been a less-favored approach by potential cost-sharers. The Chlorine Institute recently commissioned their own cost-benefit analysis and is now urging the FRA to revise the benefits they include in the rule. According to the Institute, the FRA underestimated the benefits of implementing PTC by over $12 billion and that many additional benefits would be realized by the railroads and the traveling public. While the Institute fully supports PTC implementation, they feel this misjudgment opens the door for railroads to attempt to shift more cost than is appropriate to the TIH shippers.

An additional reality faced by local agencies is that the dynamic of these technologies is constantly changing. Engineering partners on these projects need to hold a contemporary understanding of the regulations and evolution of available resources. The agencies that are well prepared for this change in regulations are those that can clearly articulate their needs – well ahead of time – when engaging an engineering firm. When creating an RFP, the agencies need to be specific (e.g. do they want a radio based system).

Many agencies have the resources they need, but are not fluent in the intricacies of FRA compliance or in the process of implementing PTC. Those entities would benefit in engaging a trusted firm (such as Stantec Consulting or another well reputed firm with demonstrated experience in the transit sector) before they create an RFP. Specific details (e.g. system functionality issues such as radio usage, interoperability with other carriers, release from stop, integration with existing continuous cab) can be developed through this type of partnership, which can balance requirements with agency budgets, helping devise a cost-efficient plan of attack when producing a PTC Request for Proposal.

PTC systems can appear deceptively simple. In truth, the systems require a great deal of infrastructure for support, such as radio coverage, access to accurate stationing and distance measurements between control points, track gradient information and civil speed restrictions, accurate information on existing rolling stock, and, in some cases, development of a unique Aspect Display Unit to suit the individual requirements of the agency. Vehicle antennas for the on-board system must be installed and software programming for the on-board processor must be generated and verified.

Installation and verification can be an issue and Stantec Consulting can assist agencies with this task, providing a test plan to verify the contractor installation

and validation of the PTC system, based on the requirements of the specific system.

Interoperability

Interoperability is one of our key challenges since freight and passenger trains share tracks and must be able to exchange and use information in order for PTC to function appropriately."

Dennis Duffy, Union Pacific executive vice president-Operations.

In 2008, the BNSF Railway Company (BNSF), Union Pacific Railroad (UP), Norfolk Southern Railway (NS), and CSX Transportation (CSXT) announced they were partnering to develop interoperable standards for PTC systems for rail traffic outside of the Northeast Corridor (NEC). The four railroads agreed to use 220 MHz frequency for wireless communication network. The National Passenger Rail Corporation (Amtrak) is undertaking similar action for rail traffic in the NEC using the Advanced Civil Speed Enforcement System (ACSES).

In 2009, FRA conducted a demonstration project in order to address interoperability as it pertains to signaling equipment and systems. Several major suppliers of signal and train control equipment were involved, with each modifying their equipment in order to participate. The end result was the determination that interoperable PTC systems based on signaling principles are indeed practical. The dedication of these suppliers of signaling systems toward the common goal of an interoperable PTC system should serve the railroads well into the future.

CONCLUSION

The Positive Train Control Final Rule attempts to achieve a balance between public safety and ensuring that regulatory policy does not become an impediment to the vitality of the railroad industry. The performance-based framework guiding PTC mandates provides proven advantages, which include streamlined regulatory applications, reviews, and certification processes. Additionally, performance-based standards provide clear stated objectives, procedures, measurement and metrics by which it is possible to quantitatively evaluate performance to standards. The strength of the PTC Final Rule framework lies in the participation by industry stakeholders in the regulatory policy development process (RSAC).

Development and implementation of the Positive Train Control Final Rule appears to have adapted lessons learned from almost a century of excessive prescriptive based standards under the ICC policy of enforced competition. The regulatory reform movement of the late 1980's and 1990's ushered in a resurgence of the railroad industry. Here, in 2010 the atmosphere is primed for a re-regulatory resurgence. In this charged atmosphere, the performance standard to be pursued must be one of Balance.

And this balance applies to more than the performance standards; it's at the very core of some of the bigger issues facing the railroads right now. Putting the cost of PTC system implementation entirely on the shoulders of the railroads, when they're being required to install these systems by federal mandate, is not balanced. Working together with the FRA and other involved parties, there is hope that the railroads will be able to come up with a solution to this issue. Otherwise, implementation of these systems to the degree that is mandated is at jeopardy. Looking at interoperability issues, we see a prime example of balance at its finest. The railroad companies and signal system companies have already begun working together in an attempt to develop across the board standards to ensure the greatest degree of interoperability possible. There is definitely a lesson here that will hopefully be noticed and adapted by other key stakeholders as PTC implementation moves forward.

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