CSX Transportation, Inc.

Positive Train Control Implementation Plan

Office of the Vice President, Safety
CSX Transportation, Inc.

July 8, 2010

Abstract: This PTC Implementation Plan (PTCIP) is submitted to the Federal Railroad Administration (FRA) for FRA approval pursuant to 49 CFR §236.1009(a) and §236.1011, as mandated by the Rail Safety Improvement Act of 2008 (RSIA08). This plan addresses how CSX Transportation, Inc. will implement Positive Train Control.

Confidentiality Notice

Portions of CSXT PTC IP have been redacted because they contain:

1. **Sensitive Security Information under 49 CFR part 15 and 1520, and/or**
2. **Confidential safety risk analysis records not subject to public disclosure under the Rail Safety Improvement Act of 2008, 49 USC Sec. 201118.**

Revision History

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July 8, 2010	1.02	Revised based on FRA, June 9, 2010 comments	CSXT

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1.0 INTRODUCTION

1.1 Overview

This section provides an overview of the CSX Transportation, Inc. (CSXT) plan for implementation of positive train control (PTC) in accordance with the mandate of RSIA08, and the requirements of FRA's PTC Final Rule, 49 CFR Part 236, Subpart I [1], and in particular, §236.1011.[1]

CSXT will be deploying a vital overlay PTC system as defined in §236.1015(e)(2). The Vital Electronic Train Management System (V-ETMS®) Development Plan describes development of the WRE V-ETMS*, an interoperable PTC system developed in compliance with requirements and standards defined through the Interoperable Train Control ("ITC") industry effort. The deployment of V-ETMS* on CSXT lines will be referred to as Vital Communications Based Train Management (V-CBTM) and the two terms will be used interchangeably in this document.

This document is organized as follows:

Section 1	describes the general objectives, applicability, and scope of the PTCIP
Section 2	lists applicable documents that are referenced in this PTCIP
Section 3	describes the PTC system technology being deployed
Section 4	describes how CSXT intends to comply with § 236.1009(c) as required by § 236.1011(a)(2)
Section 5	defines how CSXT will provide for interoperability between CSXT and all tenant railroads as required by § 236.1011(a)(3)
Section 6	describes how the PTC system will be implemented to address areas of greater risk to the public and railroad employees before areas of lesser risk as required by § 236.1011(a)(4)
Section 7	defines the sequence, planned schedule, and decision basis for the line segments to be equipped, including the risk factors by line segment, as required by § 236.1011(a)(5).
Section 8	identifies the rolling stock that will be equipped with the PTC technology, a proposed schedule for installation of PTC equipment on all identified rolling stock, and communicate with tenant railroads.
Section 9	identifies the number of wayside devices required for each line segment and the schedule to complete the installations by December 31, 2015, as required by § 236.1011(a)(7).
Section 10	identifies which track segments the railroad which CSXT designates as main line and non-main line track, as required by § 236.1011(a)(8).
Section 11	identifies and describes, to the extent applicable, CSXT's basis for determining that the risk-based prioritization in Section 6 above is not practical as required by § 236.1011(a)(9)

[1] All references to the Code of Federal Regulations are to Title 49 CFR

Section 12	contains the strategy for consideration of full system-wide deployment of PTC systems beyond those line segments required to be equipped under 49 CFR Part 236, Subpart I, including the criteria that will be applied in identifying any such additional lines.
Section 13	contains the Main Line Track Exclusion Addendum (MTEA) as defined by §236.1019.
Appendices A-E	Railroad Agreements
Appendix F	Review of Previous Applicable Studies
Appendix G	CSXT PTC Implementation Cutover Phase Detail
Appendix H	Sample Letter of Understanding Provided to Tenant Railroads Operating on CSXT PTC Track Without Passengers

1.1.1 Organizationational Relationships

This section outlines the management organizational structure for development and implementation of PTC at CSXT.

1.1.1.1 PTC Organization

PTC on CSXT is managed on a day-to-day basis by the PTC Leadership Team which is comprised of Project Owner as well as members of the Finance, Technology Development, Advanced Engineering, Operations and Maintenance, and the Project Management organizations with the objective of providing cross-functional support to the PTC design, development, implementation, operation and maintenance strategies. Refer to Figure 1-1 and Table 1-1.

The PTC Leadership Team is led by the Project Owner. The Project Owner, currently the President CSX Technology[2], is appointed by the CSXT Executive Team, and is responsible for making PTC decisions. The PTC Steering Committee receives updates from, and provides advice to, the Project Owner on a monthly basis. The CSXT Executive Team also provides oversight of PTC implementation through periodic meetings with the Project Owner.

[2] CSX Technology provides technology services for CSX companies including CSXT.

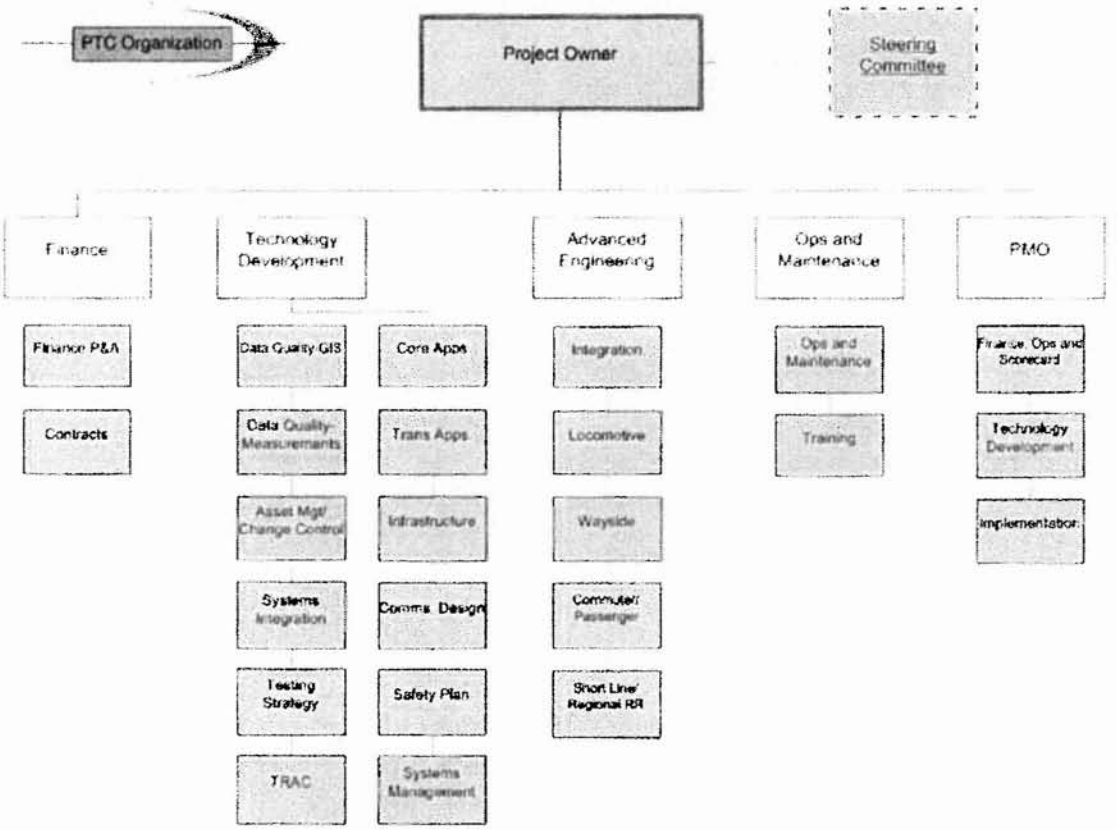

Figure 1-1 CSXT PTC Leadership Team Structure

Table 1-1 CSXT PTC Leadership Team Members

Current PTC Leadership Team Member	Role
Project Owner (President – CSX Technology)	Project Owner - leads the CSXT PTC Leadership Team, responsible for implementing PTC at CSXT in accordance with the RSIA08 and the Final Rule. Appointed by the CSXT Executive Team
Finance (Vice President Finance Operations)	Finance - leads the Finance Team, responsible for traditional finance functions as well as oversight of the contract management and purchasing activities.

Current PTC Leadership Team Member	Role
Technology Development (Assistant Vice President PTC Technology)	Technology Development - leads the Technology Development Team, accountable for the development of the core PTC technologies, technical interoperability, interfaces with CSXT systems, Geographic Information Systems, Communications, System Integration, Systems Management, Asset Management and Change Control. This position is also accountable for the creation and submission of the PTC Development and Safety Plans.
Advanced Engineering (Assistant Vice President Advanced Engineering)	Advanced Engineering - leads the Implementation Team, responsible for implementation of the Locomotive and Wayside components as well as the interactions and interoperability with Class 1, short line and passenger agencies. This position is also responsible for the creation and submission of the PTC Implementation Plan.
Operations and Maintenance (Assistant Vice President PTC)	Operations and Maintenance - leads the Operations and Maintenance Team, accountable for Operating Rule changes, ongoing maintenance strategies and training. This leadership team member represents the CSXT Safety Department
Project Management Office (Director PTC)	Project Management Office - accountable for project plan creation, maintenance and tracking as well as score card development and risk mitigation strategies

The PTC Steering Committee meets monthly to review PTC development and deployment progress. The Steering Committee also identifies and evaluates any issues and risks affecting the PTC implementation schedule and PTC functional requirements. Refer to Table 1-2.

Table 1-2 PTC Steering Committee Structure

PTC Steering Committee
Vice President - Mechanical
Vice President - Service Design and Advanced Technology
General Counsel – Corporate and Transportation Law
President – CSX Technology
Vice President – Operations Finance
Vice President - Engineering

Periodic reports are also made to the CSXT Executive Team.

1.1.1.2 Key Suppliers and Contractors

Refer to Figure 1-2 for an illustration of the CSXT PTC key supplier and contractor organizational relationship.

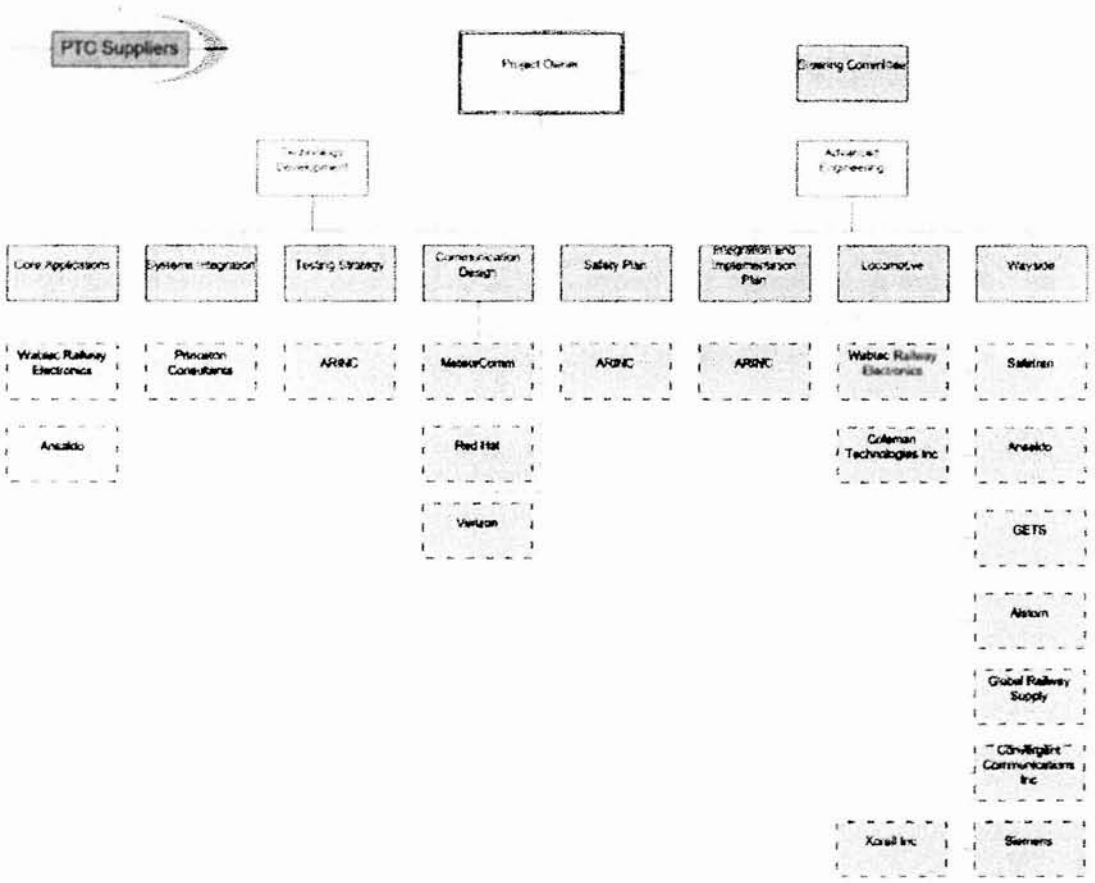

Figure 1-2 Key Suppliers and Contractors Organization

Refer to Table 1-3 for the functions performed by each key contractor and/or supplier.

Table 1-3 Key Suppliers and Contractors Description

CSXT PTC Supplier/Contractor	Function
Ansaldo STS	Dispatch-Back Office Interface
ARINC	Testing and PTC Documentation: 1 Develop the Master Test Strategy for PTC 2 Assist in testing and simulator development 3 Support the development of the PTC Implementation and Safety Plans 4 Back Office Server development as a subcontractor to Wabtec

CSXT PTC Supplier/Contractor	Function
Coleman Technologies, Inc (CTI)	Coleman Technologies, Inc is developing and delivering a Mobile Access Router (MAR) enclosure and antenna bar system for deployment on CSXT PTC locomotives. Coleman is also providing management tools, service, support, and training
Meteorcomm	220 MHz Radio Development and Communication Protocols. 1. Communication Protocol Software: Software implementations of Class C, Class D (High Availability profile), EMP, and ITP (and AMQP if selected) Protocol Software running on both Communications Devices and Communications Gateways. Note: Red Hat is engaged as a sub-contractor to deliver the Communication Protocol Software. 2. Communications Devices: Design of 220Mhz radios designed for locomotives, wayside, and base station environments, including all software. 3. Communications Gateways: Software platforms that support the above mentioned Communications Protocols in a distributed and centralized Back-Office environment, including all required ITC Networking and ITC Type interfaces. 4. Systems Management Software: Software to permit the monitoring of Communication System performance, remote diagnostics, configuration management and other capabilities defined in the ITC System Management Requirements Document
Princeton Consultants	Princeton Consultants is supporting system integration efforts with the creation of interface control documents (ICD) between the key PTC components.
Verizon	Verizon Business is responsible for overall PTC communication systems design and implementation for CSXT. Scope includes design and deployment of the PTC communications segments which include 220Mhz RF engineering, wayside network integration, locomotive network components and the PTC office network.
Wabtec Railway Electronics	Wabtec Railway Electronics is providing the onboard and back office PTC software Wabtec sub-contracted the Back Office Server software to ARINC.
WIU Suppliers: Alstom, Ansaldo, Convergent Communications Inc, GETS, Global Railway Supply, Safetran, Siemens, Xorail Inc	These suppliers are responsible for design, manufacturing and/or application of WIUs and associated peripheral equipment for the wayside PTC system.

1.1.2 Request for Amendment of a PTCIP [§ 236.1009(a)(2)(ii)]

This section describes how CSXT will make and file a Request for Amendment (RFA) of its PTCIP in accordance with § 236.1021.

1.1.2.1 Establishing and filing a Request For Amendment (RFA) of the PTCIP

CSXT will establish organizational oversight and responsibilities, and configuration management processes in order to determine whether an RFA of its PTCIP is required (see "Review and approval process for generating amendments to the PTCIP" section below).

When it has been determined that an RFA is required, the modified PTCIP and the corresponding RFA will be subject to a formal review and configuration management process whereby they are properly controlled, reviewed, revised and approved.

Once the modified PTCIP and RFA are approved internally by CSXT, the VP Safety shall file the required RFA, PTCIP and supporting documentation in accordance with applicable FRA regulations including §236.1021 (Discontinuances, material modifications, and amendments) with the Associate Administrator for Safety, Federal Railroad Administration, Washington DC.

1.1.2.2 Review and approval process for generating amendments to the PTCIP

CSXT has established a cross-functional PTC Leadership Team as described in Section 1.1.1 above. Representatives from this cross functional team are assigned to the Implementation Plan Control Board (IPCB) in order to monitor, evaluate and implement changes to the PTCIP.

The IPCB will keep under periodic review the data and information that may contribute to material modifications in the PTCIP, and if necessary, submit an RFA in accordance with § 236.1021. Changes affecting the MGT/PIH data will be reviewed at least once a year, with all other data also being reviewed at least once a year. Records will be maintained of the review, and the decision of whether an RFA is required. Any significant or major changes in the basis of the data and information (e.g. acquisition of a new route, change in routing of PIH traffic, change in passenger traffic) will also be reviewed at least once per year.

The Assistant Vice President Advanced Engineering, as the leader of CSXT's PTC Implementation Plan team, is currently responsible for ensuring that the annual review is completed by April 16 of each year, and that all of the monitoring, reviews, analysis and submittals that are required to complete the annual review are completed and adequately documented prior to April 16.

1.1.2.2.1 Implementation Plan Control

The CSXT IPCB will be responsible for controlling the PTCIP and data and information that is used to generate the PTCIP. The IPCB is also responsible for monitoring, evaluating and approving or disapproving any changes that may contribute to a material modification in the PTCIP, and for generating any RFA and associated modified PTCIP.

The IPCB will be made up of the following representatives:

Nominee of the Vice President, Safety

Nominee of President, CSX Technology (or current Project Owner)

Nominee of Vice-President Mechanical

Nominee of Vice-President Service Design and Advanced Technology

Nominee of General Counsel – Corporate and Transportation Law

Nominee of Vice President – Operations Finance

Nominee of Vice President – Engineering

Nominee of Assistant Vice President – Advanced Engineering (original responsibility for the development of the PTCIP)

The IPCB will meet at least once every twelve months during the life of the PTCIP.

1.1.2.2.2 Requesting Changes

Proposed changes may be generated from a number of different sources within CSXT, such as Technology, Operations and Maintenance, PMO, Implementation and Finance. A proposed change must be sent to the IPCB for review.

1.1.2.2.3 Approval Or Disapproval Of Changes

The IPCB will review the proposed change and make a decision to approve or reject it, or send it back to the originator for further clarification.

1.1.2.2.4 Implementing Changes

Changes to the PTCIP and preparation of any required RFA will be addressed once the IPCB has approved a change and determined whether an RFA is required. The IPCB will allocate the modifications and RFA generation to the appropriate staff. The modified PTCIP and any RFA will be presented to the IPCB for review and approval. The IPCB will decide whether to approve the modified PTCIP and RFA that correspond to the approved change, send them back for further modification, or reject the proposed change should further information be available that was not available during the initial review in Section 1.1.2.2.3 above.

Since the FRA Associate Administrator must approve any modified PTCIP and RFA, any new PTCIPs and RFAs that are approved by the IPCB but not yet approved by the FRA will be given a status indicating "Pending FRA Approval". Only upon FRA approval of the modified PTCIP and RFA will the modified PTCIP be given the status indicating the document is "Released to Production".

1.1.2.3 Meeting distribution, version control, and configuration management requirements for PTC safety documentation.

Distribution, version control and configuration management of the PTCIP is the responsibility of the Assistant Vice President – Advanced Engineering or his designee/successor.

The *PTC Safety Plan* will specify how distribution, version control, and configuration management requirements for all other PTC safety documentation is conducted.

1.1.2.4 Routing changes affecting the annual MGT or PIH traffic

If the routing of annual MGT or PIH traffic on a non-PTC equipped portion of CSXT increases, then PTC might be required where it is not required by the current PTCIP. For a CSXT line planned to be equipped with PTC, an increase in MGT or PIH traffic could affect the installation risk prioritization analysis, and a decrease could result in the line no longer needing to be equipped with PTC.

CSXT will monitor and review at least once a year the MGT/PIH traffic levels for the preceding twenty-four months for each track. If the traffic levels indicate that the track in question may be subject to being equipped with PTC, would be a candidate for removal of PTC, or that the PTCIP needs modification, the process described above for generating amendments to the PTCIP will be followed. As a result, a RFA may be generated and the PTCIP updated and submitted to the FRA for approval.

1.2 Goals and Objectives

Pursuant to the RSIA08, the primary goal for the deployment of PTC technologies on the CSXT network is to prevent train-to-train collisions, over-speed derailments, incursions into established work zone limits, and movement of trains through improperly-positioned switches. Enhancements to system safety will be achieved as a PTC vital overlay system is progressively deployed across all portions of the CSXT network for which PTC deployment is required by §236.1005(b), with all required portions of the network to be fully equipped and operational by December 31, 2015. Goals and objectives relating to various aspects of PTC deployment are described in additional detail below.

1.2.1 Progressive Risk-Based Deployment

PTC will, to the extent practical, be implemented across CSXT's subdivisions to address areas of greater risk to the public and railroad employees before areas of lesser risk. CSXT will also achieve progressive implementation of onboard and wayside systems such that the safety benefits of PTC are achieved through incremental growth in the percentage of equipped controlling locomotives operating on PTC lines. The specific goals used to track progressive implementation appear in Section 1.3.

1.2.2 Interoperability

The PTC system will provide for interoperability between CSXT and all tenant railroads required to be equipped with PTC pursuant to the Final Rule. Interoperability between CSXT and its tenant railroads will be achieved through product testing, industry partnership, common technology, and standard implementation. In addition to interoperability understandings with tenant railroads, CSXT will adhere to industry standards and recommendations, such as those from the ITC and the Railroad Electronics Standards Committee (RESC). CSXT and its tenant railroads will work closely together throughout the PTC deployment process to ensure that all aspects of interoperability are fully addressed, and this partnership will continue as the railroads operate on these PTC equipped lines.

1.2.3 Regulatory Compliance

In order to meet the December 31, 2015 deadline mandated by Congress, CSXT has developed and is submitting this PTCIP in accordance with §236.1009 and §236.1011 prior to the April 16, 2010 deadline.

CSXT has previously submitted its PTCDP to FRA for approval in accordance with §236.1009 and §236.1013. It is CSXT's intent to achieve FRA PTC System Certification by March 31, 2012 and to deploy PTC on all required portions of the network by December 31, 2015.

1.2.4 Quality and Safety

Deployment of PTC technologies will be conducted in full compliance with all applicable Federal requirements, including those specified in 49 CFR Part 236 Subpart I, and an acceptable level of safety will be maintained in the development, functionality, architecture, installation, implementation, inspection, testing, operation, maintenance, repair, and modification of the PTC technologies to be deployed. To ensure that an acceptable level of safety is achieved, the methodologies and activities to be defined in the PTC Safety Plan (PTCSP), as required by §236.1015, will be followed, and CSXT will use good-faith efforts to ensure that all vendors from whom PTC technologies are acquired will have an acceptable quality assurance program for both design and manufacturing processes. The "systems" approach that will be employed by CSXT will also help ensure functionality and interaction between the wayside, on-board, and office components of the PTC system, with the communications component of the system playing a crucial role in accommodating this safe and reliable interaction.

1.2.5 System Coverage

Of 247 subdivisions, CSXT will be equipping all or a portion of 171 subdivisions. Of the 21,281 total network track miles, approximately [redacted] track miles (approximately [redacted]) will be equipped with PTC.

1.3 Success Criteria

CSXT has established goals that will be applied to gauge both successful long term and intermediate implementation of PTC.

1.3.1 Implementation Goals

CSXT has established the following goals for PTC Implementation.

1.3.1.1 PTC Implementation

A segment of track will be considered complete when the PTC system has been cutover for service.

Cutover will not occur until:

- Infrastructure installation is complete;
- GIS survey has been performed and validated;
- 90 % of CSXT crews are trained;
- Field testing is completed (CSXT and interoperability).

CSXT has established the following annual goals for the number of track miles to be cutover by December 31st of each calendar year:

2013 - [redacted] track miles have been cutover [redacted]
2014 - [redacted] track miles have been cutover [redacted]
2015 - [redacted] track miles have been cutover [redacted]

1.3.1.2 Locomotive Installation

CSXT has established the following annual goals for the number of locomotives that it shall have equipped with PTC by December 31st of each calendar year:

2010 - 32 of 3,600 locomotives have been equipped 1%
2011 - 542 of 3,600 locomotives have been equipped 15%
2012 - 1,292 of 3,600 locomotives have been equipped 36%
2013 - 2,142 of 3,600 locomotives have been equipped 60%
2014 - 2,992 of 3,600 locomotives have been equipped 83%
2015 - 3,600 of 3,600 locomotives have been equipped 100%

1.3.1.3 Methods for Communicating Progressive Implementation to the FRA

Per §236.1006(b), CSXT will report to the FRA annually its progress towards achieving the goal of complete PTC implementation. CSXT has established the following annual goals for the progressive implementation of PTC expressed as an annualized (calendar year) percentage:

Percent of PTC active trains on PTC cutover territories during 2013 - [redacted]
Percent of PTC active trains on PTC cutover territories during 2014 - [redacted]
Percent of PTC active trains on PTC cutover territories during 2015 - [redacted]

These ranges represent CSXT's goal for the percentage of trains on PTC cutover territories that operate with active PTC during each calendar year from 2013 through 2015. The annual goal for calendar year 2015 is less than 100% because PTC will not be fully implemented until December 31, 2015. In accordance with the RSIA08 and the Final Rule, CSXT will complete PTC implementation by December 31, 2015, and all trains on PTC territory will operate in accordance with the Final Rule thereafter.

CSXT's Assistant Vice President Advanced Engineering, as the leader of the PTC Implementation Plan team, will monitor and review on a monthly basis progress on the locomotive installation, wayside installation, and PTC territory cutover schedules. CSXT's Vice President Safety will submit an annual progress report by April 16th of each calendar year.

1.3.1.4 PTCSP Submission

As set forth in §236.1015, before placing its PTC system into service, CSXT is required to submit a PTCSP to FRA in order to receive PTC System Certification. This long term goal shall be considered complete once the PTCSP has been submitted to FRA. CSXT plans to submit the PTCSP by June 15, 2012. Interim drafts will be submitted prior to June 15, 2012 for preliminary FRA review.

1.3.1.5 PTC System Certification

§236.1015(a) states that the "receipt of a PTC System Certification affirms that the PTC system has been reviewed and approved by the FRA in accordance with, and meets the requirements of, this part." Once the CSXT Office of the Vice President – Safety receives the PTC System Certification, this long-term goal shall be considered completed.

1.4 Applicability

This section provides pertinent rail network information regarding CSXT's PTC implementation.

1.4.1 CSXT PTC Track Segments Based on 2008 Traffic

Table 1-4 below contains track segments where PTC will be installed based upon 2008 traffic levels in accordance with the requirements of RSIA08 and the Final Rule. The table is organized by Subdivision name, milepost Prefix, and Start/End milepost (MP). The information in the table was compiled using the baseline calendar year of 2008 in order to provide the [redacted] for each line segment. The information is designated as an annual average because it may represent an average of data on individual track segments comprising the subdivision.

Table 1-4 CSXT PTC Track Segments Based on 2008 Traffic

Subdivision	Prefix	Start MP	End MP	[redacted]
ABBEVILLE	SG	442.0	562.3	
ABERDEEN	S	156.8	164.8	
ABERDEEN	S	164.8	241.6	
ACHAN	SVH	6.8	7.1	
ALLEGHENY	CA	276.0	354.6	
ANDREWS	SH	254.0	364.0	
ATLANTA TERMINAL	0WA	0.0	22.4	
ATLANTA TERMINAL	ANB	826.7	863.8	
ATLANTA TERMINAL	SG	562.3	574.7	
ATLANTA TERMINAL	SGB	567.5	569.9	
ATLANTA TERMINAL	XXB	6.0	15.5	
ATLANTA TERMINAL	YYG	147.5	167.0	
AUBURNDALE	SX	820.1	955.8	
AUGUSTA	AK	419.0	455.4	
AUGUSTA	AMH	442.6	501.2	
AWP W OF A	XXB	15.5	69.4	
AWP W OF A	XXB	71.2	171.8	
BALTIMORE TERMINAL	BAA	0.2	5.8	
BALTIMORE TERMINAL	BAK	87.0	96.0	
BALTIMORE TERMINAL	BAK	96.0	96.6	
BALTIMORE TERMINAL	BAM	0.0	3.0	

Subdivision	Prefix	Start MP	End MP
BALTIMORE TERMINAL	BAO	0.0	3.2
BARR	BI	236.6	248.8
BARR	DC	0.0	15.5
BARR	DIH	14.9	28.1
BELLWOOD	S	0.0	10.0
BELLWOOD	SAC	7.5	8.0
BELLWOOD	SRN	0.0	0.4
BELLWOOD	SRN	0.4	4.0
BELT	QDB	0.0	7.2
BERKSHIRE	QB	92.0	191.9
BIG COAL	CLL	0.0	31.1
BIG SANDY	CMG	0.0	128.0
BIG SANDY	CMO	0.0	3.2
BIRMINGHAM MINERAL	00L	394.7	404.1
BIRMINGHAM MINERAL	0LB	388.3	388.9
BIRMINGHAM MINERAL	0LC	403.9	421.4
BIRMINGHAM MINERAL	0LK	421.3	422.7
BIRMINGHAM MINERAL	ANJ	974.3	978.9
BLUE ISLAND	DC	15.5	30.2
BLUE RIDGE	SF	404.5	405.5
BLUE RIDGE	Z	133.7	277.2
BOSTON	QB	0.3	1.2
BOSTON	QB	1.2	92.0
BOYLES TERMINAL	000	383.5	396.5
BREWSTER	SVC	835.8	845.9
BRIDGEPORT	BA	281.6	303.5
BRUCETON	00N	3.0	91.3
BUFFALO TERMINAL	QC	429.8	437.5
BUFFALO TERMINAL	QD	0.0	2.3
C E AND D	0ZA	128.9	273.7
C N AND L	C	0.7	63.3
C N AND L	C	65.5	71.5
CALLAHAN	SM	0.0	20.0
CAPITAL	BAA	5.8	38.7
CAPITAL	CFP	112.4	121.0
CARTERS	A	841.0	851.6
CARTERSVILLE	0JG	0.0	2.8
CARTERSVILLE	SGC	632.4	638.6
CASTLETON	QG	8.5	8.7
CASTLETON	QG	8.7	13.7
CHARLESTON	A	292.9	490.4
CHARLOTTE	SF	306.2	404.5
CHATTANOOGA	00J	7.2	149.9
CINCINNATI	CA	543.5	650.0

Subdivision	Prefix	Start MP	End MP
CINCINNATI CORBIN	00C	136.9	171.3
CINCINNATI CORBIN	0KC	9.9	151.6
CINCINNATI TERMINAL	00T	104.2	105.7
CINCINNATI TERMINAL	0KC	2.4	9.9
CINCINNATI TERMINAL	BB	0.0	7.5
CINCINNATI TERMINAL	BE	0.7	25.4
CINCINNATI TERMINAL	CA	650.0	665.0
CL AND W	BJ	120.0	135.5
CLEVELAND	BJA	138.5	156.2
CLEVELAND	BJA	156.2	161.2
CLEVELAND	BJB	69.5	72.5
CLEVELAND SHORT LINE	QDS	0.0	16.8
CLEVELAND SHORT LINE	QDS	16.8	22.0
CLEVELAND SHORT LINE	QI	13.3	13.6
CLEVELAND TERMINAL	QD	171.3	175.0
CLEVELAND TERMINAL	QD	175.0	182.5
COAL RIVER	CLF	0.0	37.3
COLUMBIA	S	359.5	497.3
COLUMBUS	CD	0.7	87.7
COLUMBUS	CK	0.2	4.2
CRAWFORDSVILLE BRANCH	QSC	12.5	46.2
CUMBERLAND	BA	78.8	173.5
CUMBERLAND TERMINAL	BA	173.5	178.9
DANVILLE	QSD	72.1	104.1
DECATUR	BD	209.2	235.0
DETROIT	CH	1.0	24.7
DOTHAN	AN	694.1	898.8
E AND BV	CMO	3.2	42.4
EASTOVER	AKA	331.5	374.2
ERIE WEST	QD	98.1	171.3
ETOWAH	00C	333.4	422.8
EVANSVILLE TERMINAL	0ZA	273.7	287.4
FITZGERALD	ANB	587.8	787.2
FITZGERALD	AP	587.8	592.2
FOSTORIA	BI	34.9	36.9
FOSTORIA	CD	87.7	88.0
FREMONT	CGC	23.3	33.6
GARRETT	BI	62.1	236.6
GEORGIA	AK	460.2	460.5
GEORGIA	YYG	0.4	147.5
GRAND RAPIDS	CG	3.5	136.6
GRAND RAPIDS TERMINAL	CG	0.0	1.8
GRAND RAPIDS TERMINAL	CGE	0.0	3.0
GRAND RAPIDS TERMINAL	CH	148.1	151.8

Subdivision	Prefix	Start MP	End MP
GREENWICH	QI	13.6	83.9
HAMLET	S	253.6	359.5
HAMLET TERMINAL	S	241.6	253.6
HAMLET TERMINAL	SE	253.3	253.7
HAMLET TERMINAL	SE	253.7	254.0
HAMLET TERMINAL	SF	253.3	264.9
HAMLET TERMINAL	SH	254.0	254.0
HENDERSON	00H	176.8	321.3
HENDERSON	0HC	267.9	276.8
HOPEWELL	SAC	8.0	17.1
HUDSON	QC	75.5	169.0
HUDSON	QC	169.0	169.1
ILLINOIS	BC	188.5	335.0
INDIANA	BC	1.5	15.0
INDIANAPOLIS	BD	25.4	124.1
INDIANAPOLIS LINE	QI	137.4	273.5
INDIANAPOLIS LINE	QII	245.6	249.1
INDIANAPOLIS TERMINAL	BD	124.1	124.4
INDIANAPOLIS TERMINAL	QI	273.5	283.7
INDIANAPOLIS TERMINAL	QS	0.0	1.0
INDIANAPOLIS TERMINAL	QS	1.0	14.7
INDIANAPOLIS TERMINAL	QSC	0.4	12.5
JACKSONVILLE TERMINAL	A	635.2	648.2
JACKSONVILLE TERMINAL	ASJ	640.2	640.4
JACKSONVILLE TERMINAL	ASK	635.4	640.3
JACKSONVILLE TERMINAL	SNF	0.0	2.5
JACKSONVILLE TERMINAL	SP	634.9	652.6
JAMES RIVER	CAB	119.2	229.4
JESUP	AN	548.5	587.6
JESUP	ANA	587.6	621.2
KANAWHA	CA	427.9	524.0
KD	00C	171.3	333.4
KEYSTONE	BF	178.4	266.0
KINGSPORT	Z	0.1	133.7
L H AND STL	0HR	7.0	143.0
LAKE SHORE	QD	2.3	98.1
LAKELAND	A	851.6	861.1
LAKELAND	A	861.1	873.1
LAKELAND	AY	855.4	863.7
LANE	AL	342.0	382.1
LCL	00T	2.8	104.2
LINEVILLE	ANJ	788.2	967.4
LINEVILLE	XXB	69.4	71.2
LOCKPORT	QDL	58.5	69.7

Subdivision	Prefix	Start MP	End MP
LOCKPORT	QDL	69.7	70.3
LOUISVILLE TERMINAL	000	1.3	9.2
LOUISVILLE TERMINAL	00T	1.7	2.8
LOUISVILLE TERMINAL	0HR	6.0	7.0
LOUISVILLE TERMINAL	0TR	0.5	4.7
LURGAN	BAE	86.3	106.4
LURGAN	BAS	109.6	110.0
LURGAN	BAV	0.0	20.7
M AND M	000	485.0	665.2
M AND M	SL	831.0	834.6
M AND M	XXB	175.1	175.5
MAIN LINE	000	9.2	174.7
MANCHESTER	ANB	787.2	826.7
MEMPHIS	00F	263.3	368.8
MEMPHIS	00N	91.3	116.7
MEMPHIS TERMINAL	00F	368.8	373.4
MEMPHIS TERMINAL	0NI	224.1	224.3
METROPOLITAN	BA	1.0	1.0
METROPOLITAN	BA	1.0	78.8
MIAMI	SX	955.8	965.9
MOHAWK	QC	175.5	295.1
MON	PLM	15.3	47.0
MONON	00Q	26.0	27.9
MONON	00Q	27.9	148.4
MONON	00Q	148.4	172.4
MONROE	SF	264.9	306.2
MONROE	SG	306.2	442.0
MONTREAL	QM	160.5	183.2
MOUNT VICTORY	QI	83.9	137.4
MOUNTAIN	BA	178.9	178.9
MOUNTAIN	BA	178.9	281.6
McCORMICK	AK	460.5	525.6
NAHUNTA	A	510.0	635.2
NASHVILLE	000	196.6	227.4
NASHVILLE TERMINAL	000	174.7	196.6
NASHVILLE TERMINAL	00J	1.4	7.2
NASHVILLE TERMINAL	00N	0.0	3.0
NASHVILLE TERMINAL	0BA	181.0	188.1
NASHVILLE TERMINAL	0DL	0.0	4.0
NEW CASTLE	BG	54.4	192.6
NEW CASTLE	BGA	80.4	81.1
NEW CASTLE	PLE	62.8	64.1
NEW RIVER	CA	354.6	427.9
NIAGARA	QDL	70.3	74.6

Subdivision	Prefix	Start MP	End MP
NIAGARA	QDL	74.6	75.8
NIAGARA	QDN	0.0	28.2
NO AND M	000	665.2	803.6
NORLINA	S	147.4	154.7
NORTH END	A	0.0	118.5
NORTH END	ARN	3.3	3.6
NORTH END	SA	78.5	82.8
NORTHERN	CA	531.7	543.5
NORTHERN	CJ	0.0	92.3
NORTHERN	CK	6.5	6.6
OHIO RIVER	BA	382.4	384.0
OHIO RIVER	BN	32.7	211.3
OLD MAIN LINE	BAC	7.1	54.0
OLD MAIN LINE	BAC	54.0	64.8
ORANGEBURG	AK	331.8	366.3
P AND W	BF	319.2	323.4
P AND W	BF	323.4	327.9
PA	00K	650.3	808.1
PALMETTO	AZA	885.0	914.5
PD	00K	606.9	645.0
PEMBERVILLE	CD	88.0	114.4
PENINSULA	CA	14.2	82.3
PENINSULA	CA	82.3	85.5
PENINSULA	CAB	-0.4	-0.2
PHILADELPHIA	BAK	2.0	87.0
PITTSBURGH	BF	266.0	310.8
PITTSBURGH	BG	51.1	54.4
PITTSBURGH	PLE	0.0	47.0
PITTSBURGH	PLY	0.0	9.1
PITTSBURGH	PLY	9.1	17.5
PITTSBURGH	POR	0.0	8.0
PLANT CITY	SVA	825.6	826.9
PLYMOUTH	CH	24.7	148.1
POND FORK	CLI	0.0	5.7
POND FORK	CLK	0.0	1.2
PORTER	QFP	246.4	259.4
PORTSMOUTH	SA	4.1	77.5
PORTSMOUTH	SA	77.5	78.2
RICHMOND FREDERICKSBURG	CFP	4.8	112.4
RICHMOND FREDERICKSBURG	CFQ	0.0	9.9
RICHMOND TERMINAL	ARN	0.0	3.3
RICHMOND TERMINAL	CFP	0.3	4.8

Subdivision	Prefix	Start MP	End MP
RIVANNA	CAB	-0.2	119.2
RIVER	QR	1.6	132.6
ROCHESTER	QC	295.1	429.8
ROCKHOUSE	0VG	280.4	286.0
ROCKHOUSE	0VM	280.3	282.1
ROCKHOUSE	CMO	42.4	43.8
RUSSELL	CA	524.0	531.7
S AND N A NORTH	000	293.2	305.9
S AND N A NORTH	000	307.1	383.5
S AND N A NORTH	0BA	196.5	290.1
S AND N A SOUTH	000	396.5	485.0
SAGINAW	CC	33.6	105.0
SANFORD	A	648.2	841.0
SANFORD	AU	766.9	769.7
SAVANNAH	A	490.4	510.0
SAVANNAH	S	499.8	509.5
SCOTTSLAWN SECONDARY	QT	82.3	126.3
SELKIRK	QC	169.1	175.5
SELKIRK	QG	13.7	42.3
SHORT LINE	BNA	0.0	58.1
SOUTH END	A	118.5	292.9
SPARTANBURG	AK	530.6	593.5
SPARTANBURG	C	71.5	74.0
ST LAWRENCE	QM	2.0	158.6
ST LOUIS LINE	QS	14.7	237.0
TALLAHASSEE	SP	652.6	841.5
TAMPA TERMINAL	A	873.1	881.7
TAMPA TERMINAL	AZA	877.3	885.0
TAMPA TERMINAL	SY	843.2	843.6
TARBORO	AB	119.9	135.2
TERRELL	SFE	0.0	24.0
THOMASVILLE	AN	592.8	689.0
TOLEDO	BE	25.4	193.6
TOLEDO BRANCH	QT	4.0	82.3
TOLEDO TERMINAL	BE	193.6	196.4
TOLEDO TERMINAL	CC	105.0	131.6
TOLEDO TERMINAL	CD	114.4	118.5
TOLEDO TERMINAL	CTT	0.0	5.0
TOLEDO TERMINAL	CTT	16.4	29.0
TRENTON	QA	1.4	57.0
TRENTON	QH	4.0	5.3
VALRICO	SV	841.1	842.7
VITIS	AR	836.8	856.6
W AND A	0WA	22.4	137.3

Subdivision	Prefix	Start MP	End MP
WEST SHORE	QW	349.5	368.8
WILDWOOD	AR	824.4	836.8
WILDWOOD	ARF	836.8	840.7
WILDWOOD	S	652.5	792.1
WILLARD	BI	4.2	34.9
WILLARD	BI	36.9	62.1
WILLARD TERMINAL	BG	192.6	204.0
WILLARD TERMINAL	BI	0.0	4.2
WILMINGTON	SE	254.0	284.3
WILMINGTON	SE	284.3	285.7
WILMINGTON	SE	285.7	347.7
WOODLAND	0ZA	82.6	128.9
YEOMAN	S	808.5	839.2

1.4.2 De minimis PIH Risk Track Segments

In accordance with §236.1005(b)(4)(ii)(A), CSXT requests review of the requirement to install PTC on the track segments identified in

These track segments meet the criteria for de minimis PIH risk as specified in this section of the Final Rule. The table is organized by Subdivision name, milepost Prefix, and Start/End milepost (MP). The counts shown below were compiled using the baseline calendar year of 2008 in order to provide the for each track segment. Note that the Avg Passenger column shows zero for each of the identified track segments, indicating that no passenger traffic travels on these segments The information is designated as an annual average because it may represent an average of data on individual track segments comprising the subdivision.

A five year forecast was conducted on the de minimis track segments.

In accordance with §236.1019, CSXT will utilize temporal separation for the following line segments so that trains carrying cars with PIH materials and other freight trains do not operate on any segment of shared track during the same period. There are no passenger operations on any of these line segments.

Verification that separation is established and maintained at all times between trains carrying cars with PIH materials and other freight trains will be achieved using the following Alert Zone process:

The CSXT dispatching system is currently capable of creating and managing Alert Zones for trains carrying PIH cars. The zones can be specified by:

- Starting limit with time and date (Entrance Point)

- Ending limit with time and date (Exit Point)

The last two digits of the Train ID will display in a "RED" type font color on the Train Dispatcher's graphic display to indicate that a train is carrying PIH cars.

The dispatching system will be modified to prevent the dispatcher from creating an authority or clearing a signal for:

- A non-PIH train to enter an Alert Zone occupied by a train carrying PIH cars, or
- A PIH train to enter an Alert Zone occupied by other trains with or without PIH cars

An alarm will be generated when any type of train either enters the specific limits of an Alert Zone or when it exits the Alert Zone (to indicate that the limits are now clear).

Alert Zones can be modified based on railroad operational changes and there is no limit to the number of Alert Zones that can be established. [redacted]

[redacted]

Subdivision	Prefix	Start MP	End MP
ACHAN	SVH	6.8000	7.0800
ANDREWS	SH	302	364
BIRMINGHAM MINERAL	OOL	394.6500	399
BIRMINGHAM MINERAL	OLC	403.9100	421.3600
BIRMINGHAM MINERAL	ANJ	974.6700	978.9100
BREWSTER	SVC	835.7700	845.9100
DANVILLE	OSC	91.3000	104.0700
DECATUR	BD	209.2000	235
DOTHAN	AN	726.9500	729.5000
FITZGERALD	AP	588.9900	592.2000
FREMONT	CGC	23.3100	33.6000
GRAND RAPIDS TERMINAL	CH	148.1200	151.7600
ILLINOIS	BC	188.4900	189.2000
LURGAN	BAV	0	20.3100
MONON	OOQ	148.3700	162.6000
NORLINA	S	147.4000	154.7000
PLYMOUTH	CH	88.3000	89.5000
SAGINAW	CC	36.1000	37.7000

[redacted]

1.4.3 CSXT PTC Track Segments based on 2009 traffic

A review of 2009 data showed [redacted] that would be required to have PTC installed as a result of PIH and/or passenger traffic.

1.4.4 Additional Track Segments where PTC will be installed

This section identifies in [redacted] track segments on which PTC will be installed where not required by the Final Rule. The table includes track segments of the [redacted] that is not required to install PTC under the Final Rule. The table is organized by Subdivision name, milepost Prefix, and Start/End milepost (MP). The counts shown below were compiled using the baseline calendar year of 2008 in order to provide the [redacted] for each track segment.

[redacted]

Subdivision	Prefix	Start MP	End MP
BARR	BI	236.6	248.81
BARR	DC	0	15.5
BARR	DIH	14.9	28.1
BLUE ISLAND	DC	15.5	30.2

[redacted]

1.4.5 Track Segments Requested to be Excluded due to Routing Changes

[redacted] identifies track segments with no Passenger traffic and which no longer carry PIH traffic. These track segments thus are requested to be excluded from CSXT's PTC implementation plan pursuant to §236.1005(b)(4)(i)(A)(2). The table is organized by Subdivision name, milepost Prefix, and Start/End milepost (MP). The information in the table was compiled using the baseline calendar year of 2008 in order to provide the [redacted] for each line segment.

[redacted]

Subdivision	Prefix	Start MP	End MP
PA	00K	645.0	808.1
PA	00K	808.1	810.7
PD	00K	606.9	645.0
TALLAHASSEE	SP	652.6	842.2

[redacted]

CSXT voluntarily changed the routing of PIH traffic, beginning in July 2009, from the line segments listed in the [redacted] above to route via [redacted] in its operating plan. The tactical reroute was completed prior to and apart from the reroutes implemented as a result of the DOT Route Risk Analysis.

Pursuant to §236.1005(b)(4)(i), CSXT conducted a route risk analysis of this rerouting using the Rail Corridor Risk Management System, which indicated that the [redacted] was significantly more safe and secure than the prior [redacted]. The results of the route risk analysis can be found in APPENDIX I.

FRA is in the process of clarifying how the analysis of remaining risk of PTC preventable accidents required by §236.1005(b)(4)(iii) should be conducted. CSXT will provide the analysis after FRA has issued its clarification.

1.5 Terms, Abbreviations, and Acronyms

This section includes definitions of all terms, abbreviations, and acronyms required to properly interpret the Implementation Plan. Refer to Table 1-8 to properly interpret the Implementation Plan.

Table 1-8 Terms, Abbreviations, and Acronyms

Term	Definition
ABS	Automatic Block Signal
ACSES	Advanced Civil Speed Enforcement System
ASCES II	Advanced Civil Speed Enforcement System II
AMTRAK	National Railroad Passenger Corporation
BCP	Base Station Control Points
CBTM	Communications Based Train Management
CCB	Configuration Control Board
DCS track warrant	A method of TWC operation for authorizing main track movement in which the specified limits are designated by EC-1 authority
DOT	Department of Transportation
DTC	Direct Traffic Control
DTC track warrant	A method of TWC operation for authorizing main track movement in which the specified limits are designated in the timetable as blocks and copied on the specified DTC block form when issued.
Final Rule	FRA PTC Final Rule 75 Federal Register 2598 (January 15, 2010)
FRA	Federal Railroad Administration
Intermediate Signal	A block signal equipped with either a number plate, a "G" marker, or "P" marker. It conveys Proceed at Restricted Speed as its most restrictive indication.
IPCB	Implementation Plan Control Board
ITCM	Interoperable Train Control Messaging - a routed network transport protocol similar to the Internet Protocol (IP), designed to transport client messages such as EMP, ATCS spec 250, US&S peer-to-peer,

Term	Definition
	and other industry standards in a consistent manner end-to-end over the extended North-American railroad infrastructure.
IP	Internet Protocol
ITP	Interoperable Transport Protocol - a routed network transport protocol similar to the Internet Protocol (IP), designed to transport client messages such as EMP, ATCS spec 250, US&S peer-to-peer, and other industry standards in a consistent manner end-to-end over the extended North-American railroad infrastructure.
Mobile Access Router	Mobile Access Router
Mandatory Directive	An instruction required to be recorded in writing, such as: a DTC block authority, 707 authority, 704 authority, or dispatcher message. Note: Train dispatcher authority to enter a signaled track, to pass a stop signal, make a reverse movement, or permission of an employee-in-charge to enter work limits are not considered mandatory directives.
MBTA	Massachusetts Bay Transportation Authority
MGT	Million Gross Tons
MTA	Maryland Transit Authority
NGD	Next Generation Dispatch
PIH	Poison Inhalation Hazard
PTC Segments	Locomotive Segment, Communications Segment, Office Segment, Wayside Segment
PTCDP	PTC Development Plan
PTCIP	PTC Implementation Plan
PTCSP	PTC Safety Plan
RESC	Railroad Electronics Standards Committee
Restricted Speed	A speed that will permit stopping within one-half the range of vision. It will also permit stopping short of a train, a car, an obstruction, a stop signal, a derail or an improperly lined switch. It must permit looking out for broken rail. It will not exceed 15 MPH.
RFA	Request for Amendment
ROCC	Rail Operations Control Center
RSIA08	Rail Safety Improvement Act of 2008
SEPTA	Southeastern Pennsylvania Transit Authority
SFRTA	South Florida Regional Transportation Authority
Subdivision	A portion of the railroad designated by timetable
TSR	Temporary Speed Restriction
TWC	Track Warrant Control
VDD	Version Description Document
VRE	Virginia Railway Express
WEU	Wayside Encoder Units

Term	Definition
WIU	Wayside Interface Unit - part of the Wayside Segment of PTC
WRE	Wabtec Railway Electronics - provider of the Train Management Computer (TMC), an onboard computer, part of the Locomotive Segment of PTC

2.0 APPLICABLE DOCUMENTS

This section provides a list of documents and other sources referenced in the CSXT PTC Implementation Plan.

The following documents and resources are referenced in the PTC Implementation Plan.

[1] 49 CFR Part 236 Subpart I, Positive Train Control Systems.

[2] V-ETMS® Concept of Operations, Submitted March 24, 2010.

[3] Vital Electronic Train Management System (V-ETMS®) Positive Train Control Development Plan (PTCDP), Submitted March 24, 2010.

[4] Federal Railroad Administration, US Department of Transportation. 49 CFR Parts 229, 234, 235 and 236, *Positive Train Control Systems; Final Rule*. Docket No. FRA-2008-0132, Notice No. 3, 75 Federal Register 2598 (January 15, 2010) ("Final Rule").

[5] Federal Railroad Administration, US Department of Transportation. *Risk Prioritization Methodology for PTC System Implementation*, January 7, 2010.

[6] Federal Railroad Administration, US Department of Transportation. *PTC Implementation Plan (PTCIP) Template*, January 7, 2010.

[7] USNRC (United States Nuclear Regulatory Commission) (1990). "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants Final Summary Report," NUREG-1150, (3 vols).

[8] Railroad Safety Advisory Committee (RSAC), Federal Railroad Administration, US Department of Transportation. *Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator: Implementation of Positive Train Control Systems*. September 1999.

[9] Railroad Systems Division (DTS-75), Office of Safety and Security, The John Volpe National Transportation Systems Center, US Department of Transportation. *Presentation for Office of Safety, Federal Railroad Administration RSAC/PTC Working Group Risk 2 Team, Base Case Risk Assessment: Data Analysis & Tests*. April 22, 2003.

[10] Carl D. Martland, Ying Zhu, Youssef Lahrech, and Joseph M. Sussman. *Risk and Train Control: A Framework for Analysis*. Center for Transportation Studies, Massachusetts Institute of Technology, Cambridge, January 2001.

[11] Congress of the United States. *Rail Safety Improvement Act of 2008*. Public Law 110-432, October 16, 2008.

[12] Federal Railroad Administration, US Department of Transportation. 49 CFR Parts 209, 234, and 236, *Standards for Development and Use of Processor-Based Signal and Train Control Systems;* Final Rule. Docket No. FRA-2001-10160. March 7, 2005.

[13] Federal Railroad Administration, US Department of Transportation. *Signals and Train Control Fact Sheet*. October 2008.

[14] Federal Transit Administration, US Department of Transportation. *Commuter Rail Safety Study*. November 2006.

[15] American Railway Engineering and Maintenance-of-Way Association, *Practical Guide to Railway Engineering*. AREMA 2003.

[16] Saat R. and Barkan C., University of Illinois. *Positive Train Control Toxic Inhalation Hazard Risk Analysis Methodology* Presentation. January 27, 2010.

[17] Advanced Civil Speed Enforcement System (ACSES). Docket No. FRA-2001-9972.

Note: For dated references of CSXT documents, the most current edition applies.

3.0 TECHNOLOGY [§ 236.1011(A)(1)]

This section provides a description of the CSXT PTC system technology being deployed.

49 CFR §236.1011(a)(1) requires that the PTCIP describe the functional requirements that the proposed PTC system must meet.

The functional requirements of V-ETMS® are described in detail as required in §236.1013 in CSXT's PTC Development Plan. On March 24, 2010, the PTC Development Plan ("PTCDP")[3] prepared by Wabtec Railway Electronics ("WRE"), CSX Transportation ("CSXT"), Norfolk Southern Railway ("NS"), and Union Pacific Railroad ("UPRR") was submitted to the FRA requesting Type Approval. The PTCDP was jointly submitted for FRA Type Approval as set forth in §236.1009(b) and included documentation required by §236.1013.

The plan describes development of the WRE Vital Electronic Train Management System® (V-ETMS®), an interoperable PTC system developed in compliance with requirements and standards defined through the Interoperable Train Control ("ITC") industry effort.

An overview of the V-ETMS® system, its primary functions, the architecture of the PTC system being deployed, and a high level description of the functionality of the PTC system, subsystems, and interfaces are all found in the PTCDP. Specifically, these areas are addressed in the following sections:

Vital Electronic Train Management System (V-ETMS®) Development Plan, Section 3, which provides a complete description of the V-ETMS system including a list of all product components and their physical relationships in the subsystem or system, as required by §236.1013 (a)(1).

3.1 LOCOMOTIVE SEGMENT
3.2 OFFICE SEGMENT
3.3 WAYSIDE SEGMENT
3.4 COMMUNICATIONS SEGMENT
3.5 DATA FLOW
3.6 V-ETMS®PRIMARY FUNCTIONS

Vital Electronic Train Management System (V-ETMS®) Development Plan, Section 4, which describes how V-ETMS® architecture satisfies safety requirements as required by §236.1013 (a)(4).

4 PTC Architecture
4.1 LOCOMOTIVE SEGMENT
4.1.1 V-ETMS® Train Management Computer
4.1.2 Computer Display Unit
4.1.3 GPS Receiver
4.1.4 Locomotive Event Recorder
4.1.5 Train Control Application
4.1.6 Business Applications
4.2 OFFICE SEGMENT
4.2.1 V-ETMS® Office Segment
4.2.2 Office Server Platform
4.2.3 Office Segment External Interfaces

4.3 WAYSIDE SEGMENT
4.3.1 WIU Technology
4.4 COMMUNICATIONS SEGMENT
4.4.1 The Messaging System
4.4.2 Wireless Networks

Section 7 of the PTCDP is the Concept of Operations [2] as required by §236.1013(a)(3). This section of the PTCDP addresses each of the PTC functional requirements as called out in the Subpart. While the entire Concept of Operations provides a thorough understanding of the system's ability to meet the requirements, for the purpose of this document, each requirement will be addressed with a reference within the Concept of Operations as follows:

§ 236.1005 Requirements for Positive Train Control systems.

(a) *PTC system requirements*

Each PTC system required to be installed under this subpart shall:

(1) Reliably and functionally prevent:

(i) Train-to-train collisions—including collisions between trains operating over rail-to-rail at-grade crossing.

- Concept of Operations Section **4 V-ETMS® Operational Concepts**
- Concept of Operations Section **5 V-ETMS® Operations**

(ii) Overspeed derailments, including derailments related to railroad civil engineering speed restrictions, slow orders, and excessive speeds over switches and through turnouts;

- Concept of Operations Section **5.4.8 Yard Limits**
- Concept of Operations Section **5.5 Speed Limits and Restrictions**
- Concept of Operations Section **5.5.1 Permanent Speed Restrictions**
- Concept of Operations Section **5.5.2 Temporary Speed Restrictions**
- Concept of Operations Section **5.5.3 Track Authority Speed Restrictions**
- Concept of Operations Section **5.5.4 Consist or Lading Speed Restriction**
- Concept of Operations Section **5.11.1 Reactive (Overspeed) Warning and Enforcement**
- Concept of Operations Section **5.11.2 Predictive Warning and Enforcement**
- Concept of Operations Section **5.11.3 Restricted Speed Enforcement**

(iii) Incursions into established work zone limits without first receiving appropriate authority and verification from the dispatcher or roadway worker in charge, as applicable and in accordance with part 214 of this chapter; and

- Concept of Operations Section **5.6 Work Zones**
- Concept of Operations Section **5.11.2 Predictive Warning and Enforcement**

(iv) The movement of a train through a main line switch in the improper position as further described in paragraph (e) of this section.

- Concept of Operations Section **5.10 Route Integrity Protection**
- Concept of Operations Section **5.10.1 Monitored Hand-Operated Switches**
- Concept of Operations Section **5.10.2 Switches in Signaled Territory**
- Concept of Operations Section **5.11.2 Predictive Warning and Enforcement**

(2) Include safety-critical integration of all authorities and indications of a wayside or cab signal system, or other similar appliance, method, device, or system of equivalent safety, in a manner
by which the PTC system shall provide associated warning and enforcement to the extent, and except as, described and justified in the FRA approved PTCDP or PTCSP, as applicable:

- Concept of Operations Section **5.10.2 Switches in Signaled Territory**
- Concept of Operations Section **5.10.3 Other Monitored Devices**
- Concept of Operations Section **5.11 Warning and Enforcement**
- Concept of Operations Section **5.11.1 Reactive (Overspeed) Warning and Enforcement**
- Concept of Operations Section **5.11.2 Predictive Warning and Enforcement**

(3) As applicable, perform the additional functions specified in this subpart;

(4) Provide an appropriate warning or enforcement when:
(i) A derail or switch protecting access to the main line required by § 236.1007, or otherwise provided for in the applicable PTCSP, is not in its derailing or protecting position, respectively;

- Concept of Operations Section **5.10.3 Other Monitored Devices**

(ii) A mandatory directive is issued associated with a highway-rail grade crossing warning system malfunction as required by §§ 234.105, 234.106, or 234.107;
PTCDP Section 7: Vital Electronic Train Management System (V-ETMS®)

- Concept of Operations Section **5.7 Malfunctioning Highway Grade Crossing Warning Systems**

(iii) An after-arrival mandatory directive has been issued and the train or trains to be waited on has not yet passed the location of the receiving train;
PTCDP Section 7: Vital Electronic Train Management System (V-ETMS®)

- Concept of Operations **Section 5.4.1.1 Track Warrant Control**

(iv) Any movable bridge within the route ahead is not in a position to allow permissive indication for a train movement pursuant to § 236.312; and

- Concept of Operations Section **5.9 Miscellaneous Track Bulletins**
- Concept of Operations Section **5.10.3 Other Monitored Devices**

(v) A hazard detector integrated into the PTC system that is required by paragraph (c) of this section, or otherwise provided for in the applicable PTCSP, detects an unsafe condition or transmits an alarm; and

- Concept of Operations Section **5.9 Miscellaneous Track Bulletins**
- Concept of Operations Section **5.10.3 Other Monitored Devices**

(5) Limit the speed of passenger and freight trains to 59 miles per hour and 49 miles per

hour, respectively, in areas without broken rail detection or equivalent safeguards.

- Concept of Operations Section **4.1.5 Train Control Application**
- Concept of Operations Section **6.5 Train Characteristics**

V-ETMS® is a locomotive-centric, vital train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety through enforcement of a train's authorized operating limits, including protection against train-to train collisions, derailments due to overspeed, unauthorized incursion into work zones, and operation through main track switches in improper position. The V-ETMS® system is designed to support different railroads and their individual methods of operations and is intended to be implemented across a broad spectrum of railroads without modification. This design approach supports interoperability across railroads as V-ETMS® equipped locomotives apply consistent warning and enforcement rules regardless of trackage ownership.

Refer to Figure 3-1 for a graphic illustration representing the V-ETMS® system segments.

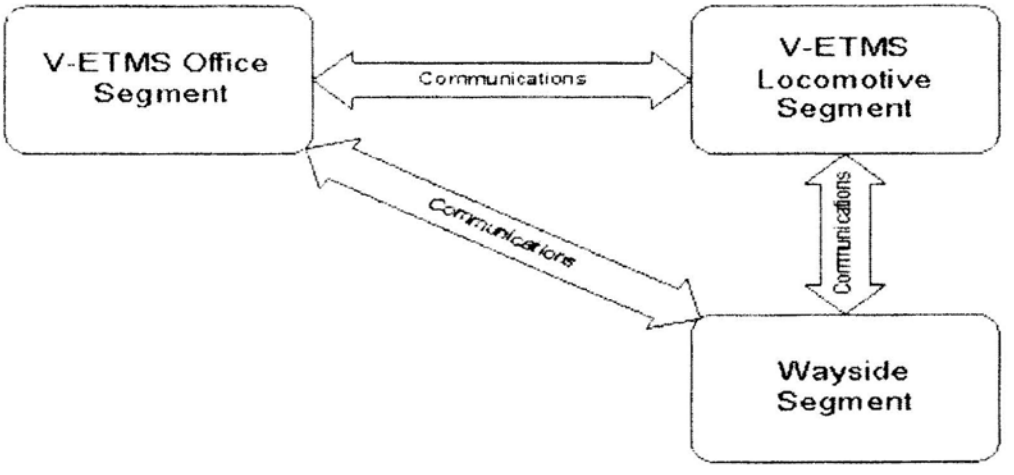

Figure 3-1 V-ETMS® System Segments

4.0 COMPLIANCE [§ 236.1011(A)(2)]

This section describes how CSXT intends to comply with § 236.1009(d), which requires the railroad to apply for and receive PTC System Certification from the FRA.

4.1 Risks to Meeting Required PTC Installation Date

Risk management will be integrated into the project plan, consistently applied, and clearly communicated throughout the life cycle of the CSXT PTC project. Potential risks will be identified during the planning phase of the project and monitored and evaluated on a regular basis by the CSXT PTC Leadership Team, CSXT Executive Team, and CSXT PTC Steering Committee. This process will ensure that the CSXT PTC System receives System Certification in a timely manner to meet the December 31, 2015 implementation schedule.

CSXT will apply a risk management process to identify, monitor and mitigate risks that could create or suggest increased difficulty in the successful completion and delivery of the PTC system installation on or prior to the required date. This risk management process:

Identifies risks to meeting the goals and objectives of CSXT's PTC deployment;

Predicts the consequences associated with risks;

Implements risk mitigation strategies;

Monitors risk status; and

Establishes contingency plans.

Table 4-1 below identifies the risks to CSXT's completion and delivery of PTC installation on or prior to December 31, 2015, the predicted consequences of the risk should it occur, CSXT's mitigation/containment strategy, and contingency plans.

Table 4-1 Identified Risks to CSXT's Completion and Delivery of PTC Installation by December 31, 2015

[redacted]

[redacted]

[redacted]

[redacted]

4.2 CSXT PTC System Certification Process

4.2.1 V-ETMS® System Certification

CSXT intends to comply with §236.1009(d) which requires the railroad to apply for and receive PTC System Certification from the FRA through the submission of an acceptable PTCSP prior to deploying its PTC system, V-ETMS®, in revenue service. This section describes how CSXT intends to obtain this PTC System Certification for V-ETMS®.

4.2.2 Utilization of Type Approval and/or PTCDP

In fulfillment of §236.1013, CSXT, Norfolk Southern Railway (NS), and Union Pacific Railroad (UPRR) jointly submitted a PTCDP requesting Type Approval from FRA for the Wabtec Railway Electronics (WRE) Vital Electronic Train Management System (V-ETMS®), a vital overlay system as defined in §236.1015(e)(2). CSXT intends to reference this Type Approval for its PTC System Certification.

4.2.3 Certifying the Validity of the Type Approval

§236.1013(c) states that "each Type Approval shall be valid for a period of 5 years, subject to automatic and indefinite extension provided that at least one PTC System Certification using the subject PTC system has been issued within that period and not revoked." CSXT will ensure that its applicable Type Approval remains valid for V-ETMS® operations and meets the requirements set forth in §236.1015(b).

4.2.4 Handling of CSXT-Specific Aspects

V-ETMS® is designed to support different railroads and their individual methods of operation. Therefore CSXT's specific implementation of V-ETMS® will not require any variances from the V-ETMS® Type Approval as requested in the submitted PTCDP.

4.2.5 Deliverables to be Supplied to the FRA in Support of Petition for Certification of V-ETMS®

CSXT intends to supply the FRA with the following deliverables in support of its request for System Certification of V-ETMS®:

1. PTC Implementation Plan (PTCIP) compliant with §236.1011.
2. Reference to V-ETMS® Type Approval, when granted.
3. PTC Safety Plan (PTCSP) compliant with §236.1015, including a final human factors analysis.

Further, CSXT will comply with the discontinuances, material modifications, and amendment requirements set forth in §236.1021 and the errors and malfunctions requirements set forth in §236.1022.

5.0 INTEROPERABILITY [§ 236.1011(A)(3)]

This section describes how the CSXT PTC system will provide for interoperability between all host and tenant railroads operating on CSXT track segments required to be equipped with a PTC system as defined in the Final Rule[4].

5.1 Railroad Agreement Provisions Relevant to Interoperability [§ 236.1011(a)(3)(i)]

An Interoperable Train Control (ITC) collaboration agreement was executed by and amongst several railroads mandated to achieve Positive Train Control (PTC) system interoperability through, in part, the development of an interoperable train control system which would enable locomotives of one participant to transition at track speed to the control of another participant. The collaboration agreement includes a list of interoperability requirements mutually agreed-upon by the parties:

- Definition and adoption of uniform interface standards;
- Definition, adoption and implementation of AAR-standard communications protocols;
- Definition, adoption, and implementation of common office-locomotive communications protocols and message formats;
- Definition, adoption, and implementation of a common Human Machine Interface, allowing an engineer from any of the participant's roads to utilize the system on any participant's locomotives on territory for which the engineer is qualified;
- Adoption of a coordinated plan for configuration management of the interoperable PTC onboard executable software;
- Agreement on use of radio spectrum in the 220MHz band for communications between the locomotive and wayside and the locomotive and back office;
- Agreement to acquire, develop and deploy all of the technical capabilities required to permit the use of shared communications infrastructure; and
- Definition and adoption of standards allowing each participant's locomotive engineer, at the start of a trip, to initialize the interoperable onboard system with the back offices of participants' PTC systems which may be traversed during the trip to support all interoperability scenarios which will be encountered on the line-of-road with respective locomotive fleets and run-through operations.

The ITC collaboration agreement chartered the formation of various technical working committees, each dedicated to some technical aspect of PTC interoperability. Participation in the technical working committees was expanded beyond the chartering roads to include any railroad planning to implement an interoperable PTC system and wishing to participate.

CSXT is party to the ITC collaboration agreement and is a participant on all ITC technical teams. Through the agreement and technical team activities, interoperability agreement has been established with the following carriers:

- BNSF Railway Company (BNSF)
- Union Pacific Railroad (UP)
- Norfolk Southern Railway Company (NS)

In addition, refer to APPENDIX A for the Memorandum of Understanding executed by CSXT and the other Class I carriers that are party to the ITC collaboration agreement.

CSXT has also executed a Memorandum of Understanding with the other Class I carriers that have not to date become a party to the ITC collaboration agreement. These carriers are:

- The Kansas City Southern Railway Company (KCSR)
- Canadian National Railway Company (CN)
- Canadian Pacific Railway Company (CP)

The Memorandum of Understanding with these carriers establishes an agreement between CSXT and each Class I non-ITC member in the following areas:

- Implementation of PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b);
- Participation in a PTC testing program to verify functionality and interoperability;
- Exchange of technical information needed to implement PTC in accordance with applicable FRA requirements; and
- Agreement to abide by the terms of the ITC collaboration agreement.

Refer to APPENDIX B for copies of the Memorandum of Understanding executed by CSXT and the Class I carriers that are not party to the ITC collaboration agreement.

CSXT has also executed a similar Memorandum of Understanding with Conrail, which has not to date become a party to the ITC collaboration agreement and/or participated in ITC technical team activities.

Refer to APPENDIX C for a copy of the Memorandum of Understanding between CSXT and Conrail.

CSXT has additionally requested that each of its other freight tenant carriers who operate on CSXT PTC track, with passenger traffic, and who are thus required to install and operate PTC on its rolling stock when operating on CSXT PTC equipped track, sign a Letter of Understanding. This Letter of Understanding establishes agreement between CSXT and its freight tenants in the following areas:

- Implementation of PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b);
- Participation in a PTC testing program to verify functionality and interoperability; and
- Exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

Refer to APPENDIX D for a sample of this Letter of Understanding. A complete list of the freight tenant carriers is provided in 5.1.1.6.

CSXT has additionally provided a Letter of Interoperability to each of its tenant passenger carriers who are required to install and operate PTC on rolling stock when operating on CSXT PTC equipped track, but who have not to date become party to the ITC collaboration agreement or participated in ITC technical team activities. The Letter of Interoperability establishes agreement between CSXT and its passenger tenants in the following areas:

- Implementation of PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b);
- Participation in a PTC testing program to verify functionality and interoperability; and
- Exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

In addition, the Letter of Interoperability requests each passenger carrier to review and agree to jointly file with FRA the portion of this Section 5.0 that is applicable to that passenger carrier.

Refer to APPENDIX E for these Letters of Interoperability provided to passenger carriers who are required to install and operate PTC on rolling stock when operating on CSXT PTC equipped track, but have not to date become party to the ITC collaboration agreement or participated in ITC technical team activities.

On and after December 31, 2015, the only unequipped tenant locomotives that may be operating on the CSXT network would potentially be trains operated by Class II and III railroads (although CSXT has not yet made a decision on the extent to which such operations will be permitted). Those trains, if permitted to operate in unequipped PTC status, will operate under authority of §236.1006(b)(4) and will be subject to the operating restrictions in §236.1029.

The Assistant Vice President Advanced Engineering, as the leader of the PTC Implementation Plan team, will manage the responses received from tenant railroads. CSXT is pursuing additional communications with tenant railroads via follow-up letters and telephone contact. CSXT has also established systems to receive responses electronically. CSXT's Assistant Vice President Advanced Engineering will provide monthly status updates to FRA until 100% of the requested responses have been received and appropriate interoperability agreements are in place. A carrier that has not complied with its obligation under the Final Rule to be equipped with an interoperable PTC system will not be permitted to operate on CSXT's PTC track on and after December 31, 2015.

CSXT achieves interoperable PTC operations with its tenant railroads which operate PTC systems in one of the following technical methods:

1. Native Interoperability
2. Dual Equipping

CSXT primarily achieves interoperability with its tenant railroads by means of native interoperability. This includes Amtrak operations on CSXT, which will be equipped with the V-ETMS® system by the time each line segment is cutover for PTC operation.

The ETMS PTC system being installed by BNSF on its locomotives will be fully interoperable with CSXT's V-ETMS® system when operating on CSXT's track that has been cutover. BNSF's locomotives will exhibit the characteristics of native interoperability described below while operating on CSXT, except that the BNSF system is non-vital.

Currently, the only non-native interoperable tenant is SEPTA, and how interoperability is achieved with SEPTA using dual equipping is described below in section 5.1.2.

5.1.1 Native Interoperability

For Native Interoperability, CSXT and its interoperability partner shall both install and operate the Vital Electronic Train Management System® (V-ETMS®) on their respective locomotives with interoperable offices and waysides. V-ETMS® provides for full functionality for any equipped locomotive, regardless of ownership, with any office or wayside correspondingly equipped. Interoperability is achieved through native operation of V-ETMS® without the need for data, function, or human-machine interface (HMI) translation. Interoperable communications are achieved through adoption of the common communications and message protocols, and application behavior specifications. V-ETMS® encompasses the methods of operation and rules of both CSXT and its interoperability partner and accommodates any differences in the data provided by back office systems. V-ETMS® and its operations are fully described in the Vital Electronic Management System Positive Train Control Development Plan (PTCDP) [3], submitted to FRA on March 24, 2010.

V-ETMS® interoperability is achieved through the specification and implementation of standard behavioral components which communicate via standard interfaces. The V-ETMS® locomotive segment communicates continuously and simultaneously with the Office Segment infrastructures that govern each and every V-ETMS® -controlled track segment on which the V-ETMS® train will traverse during the trip of a particular train crew, regardless of locomotive owner or operator. When the V-ETMS® locomotive system is initialized for a trip, the railroads over which the train will operate are selected from a list. The V-ETMS® Locomotive Segment uses this list to determine the track segments, usually at the subdivision or district level, on which it will operate based on the business processes in place on each road for route determination. Failure of the initialization will cause V-ETMS® to prevent entry onto V-ETMS® tracks for which the Locomotive Segment has not been initialized. Once initialized; the V-ETMS® Locomotive Segment communicates continuously and concurrently with the separate office infrastructure for each railroad over which the train will operate; all data needed to cross a railroad boundary is thus onboard and current before the train actually reaches the boundary and no special "hand-off" processing is required at that time. This approach is premised on existing railroad operations – a train's movement may be simultaneously governed by mandatory directives, signal aspects, and rules from multiple railroads as it nears a transition point. For example, a train operating on a CLEAR signal indication on one railroad may be approaching the limits of another road – where a temporary speed restriction is in effect. V-ETMS® will display and provide predictive enforcement of the speed restriction before the train actually crosses an interline boundary.

Interoperability between locomotive segment and wayside segment for any combination of V-ETMS® -equipped locomotive and track segment ownership is provided through use of a WIU behavioral and communications/messaging protocol standard. This standard protocol combination is utilized by each V-ETMS® -compatible WIU and V-ETMS® locomotive segment, regardless of track segment operator, locomotive ownership, or wayside segment component manufacturers. Wayside devices, their location, and associated WIU information are identified in the track data for each track segment on which V-ETMS® is operative.

For SEPTA, interoperability will be achieved via communication between the V-ETMS and SEPTA's train management system on the Trenton line during Phase 4 of the CSXT PTC implementation.

The V-ETMS® interoperability architecture is depicted in Figure 5-1.

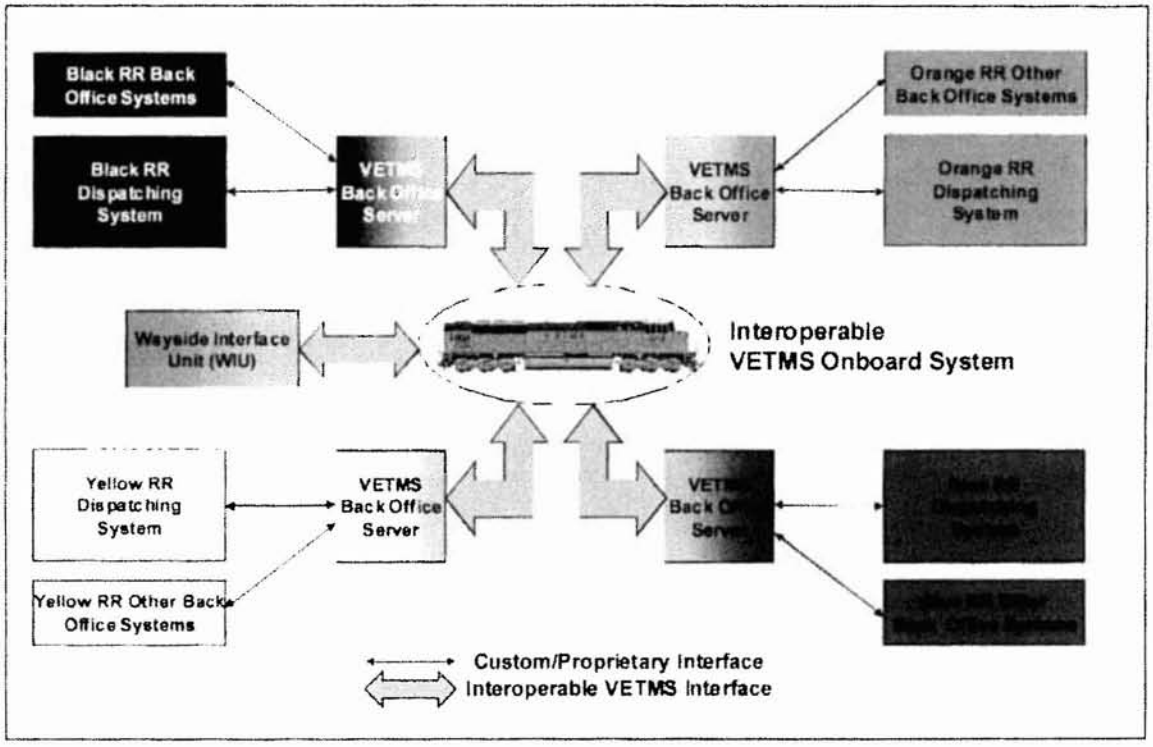

Figure 5-1 V-ETMS® Interoperability Architecture

Additionally, this architecture may be deployed by a railroad to distribute control of its own V-ETMS® tracks onto multiple Office Segment Servers to increase performance, availability, and reliability. Figure 5-2 depicts a scenario whereby a V-ETMS® locomotive scheduled to operate over three different railroads (RED, BLUE, GREEN) and 6 different subdivisions (RED-A/B, BLUE-A/B, GREEN-A/B) is communicating with 5 different Office Segment Servers.

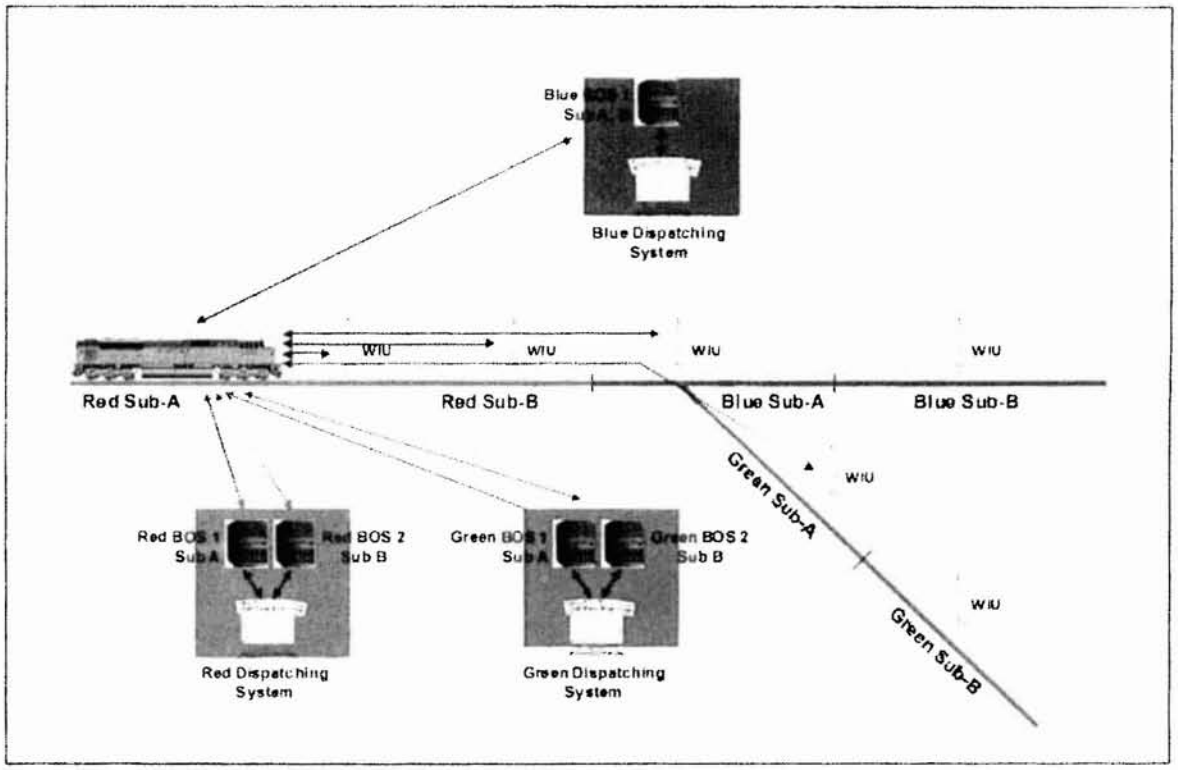

Figure 5-2 V-ETMS® Locomotive Scheduled to Operate on 3 Railroads, 6 Sub-divisions and Communicate with 5 Office Segment Servers

Railroads with which CSXT will conduct interoperable PTC operations in this manner and the systems operated on those railroads' respective properties are as follows:

5.1.1.1 Maryland Transit Authority (MTA) PTC

Background

MTA's MARC service operates on CSXT's main lines between (1) Baltimore, MD and Washington, DC (Capital Subdivision), (2) Martinsburg, WV and Washington, DC (Cumberland & Metropolitan Subdivisions) and (3) Frederick Branch connection and Point of Rocks (Old Mainline Subdivision). MARC is currently operating revenue and repositioning trains.

MTA owns 3.5 miles of track between Frederick, MD and its connection with CSXT's Old Mainline Subdivision. CSXT provides dispatching for MTA on this line segment.

Technology

In all locations where MTA operates on CSXT, MTA is responsible for equipping or retrofitting its locomotives, and MTA will purchase and install equipment compatible with CSXT's PTC technology. Refer to Table 5-1.

Table 5-1 MTA Operations on CSXT

Segment	Subdivisions	Proposed Architecture	
Camden Line (Washington - Baltimore)	Baltimore Terminal (5.6) & Capital (31)	V-ETMS®	[redacted]
Brunswick Line (Washington - Brunswick)	Metropolitan	V-ETMS®	[redacted]
Martinsburg (Washington - Martinsburg)	Metropolitan (52.2) & Cumberland (21.1)	V-ETMS®	[redacted]
Frederick (Washington - Frederick)	Metropolitan	V-ETMS®	[redacted]
Point of Rocks - Frederick	Old Main Line	V-ETMS®	[redacted]
Camden Line (Washington - Baltimore)	Baltimore Terminal (5.6) & Capital (31)	V-ETMS®	[redacted]
Brunswick Line (Washington - Brunswick)	Metropolitan	V-ETMS®	[redacted]
Martinsburg (Washington - Martinsburg)	Metropolitan (52.2) & Cumberland (21.1)	V-ETMS®	[redacted]
Frederick (Washington - Frederick)	Metropolitan	V-ETMS®	[redacted]

5.1.1.2 Massachusetts Bay Transportation Authority (MBTA)

Background

MBTA operates a commuter system with 11 lines and 123 stations. The land over which MBTA provides its Boston – Worcester service is variously owned by CSXT, MBTA, and the Massachusetts Turnpike Authority. MBTA operates over CSXT's Boston Main Line between Worcester and Framingham, Massachusetts, and on the Riverside line. CSXT operates on various MBTA lines including the mainline between Boston and Framingham and various branch lines.

Technology

CSXT and the Commonwealth Massachusetts, by and through its Department of Transportation (MassDot), are committed to complete and close a transaction whereby MassDot will purchase CSXT's line between Framingham and Worcester. Until such time as the proposed transaction is completed, CSXT will plan to install V-ETMS® between Framingham and Worcester. However, MBTA and CSXT will amend their respective Implementation Plans upon completion of the transaction to allow for MBTA to install its own PTC system on this line. CSXT and MBTA will work cooperatively to seek PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b).

MBTA will be responsible for equipping or retrofitting its locomotives, and MBTA will purchase and install equipment compatible with CSXT's PTC technology if the transaction is not completed and the implementation plans are not amended. Refer to Table 5-2.

CSXT and MBTA continue to have discussions in regard to interoperability on the line segment identified in Table 5-2.

Table 5-2 MBTA Operations on CSXT

Segment	Subdivisions	Proposed Architecture
Boston Line (Framingham - Worcester)	Boston	V-ETMS®

5.1.1.3 Virginia Railway Express (VRE) PTC

Background

The Virginia Railway Express (VRE) is a transportation partnership between the Northern Virginia Transportation Commission and the Potomac and Rappahannock Transportation Commission. VRE shares track with CSXT and Amtrak along the RF&P line from Washington's Union Station to Fredericksburg.

Technology

VRE is responsible for equipping or retrofitting its locomotives, and VRE will purchase and install equipment compatible with CSXT PTC Technology. Refer to Table 5-3.

Table 5-3 VRE Operations on CSXT

Segment	Subdivisions	Proposed Architecture	
Fredericksburg (Fredericksburg - Washington)	RF&P	V-ETMS®	

5.1.1.4 South Florida Regional Transportation Authority (SFRTA) PTC

Background

SFRTA is a regional transportation authority that coordinates, develops and implements a regional transportation system in South Florida. The SFRTA's Tri-Rail system serves Broward, Miami-Dade and Palm Beach counties. CSXT is a tenant of SFRTA, also known as Tri-Rail, on 76.2 miles of trackage between West Palm Beach and Miami, Florida.

Technology

CSXT is assisting SFRTA in developing and implementing its own Implementation Plan addressing the line segment identified in Table 5-4. SFRTA will be installing the V-ETMS® PTC System, and CSXT will work cooperatively with SFRTA on any interoperability issues that may arise.

Table 5-4 CSXT Operating on SFRTA

Segment	Subdivisions	Proposed Architecture	
West Palm Beach - Miami	Miami	V-ETMS®	

5.1.1.5 National Railroad Passenger Corporation ("Amtrak")

Background

Amtrak operates on 3,459 miles of CSXT's network serving over 120 stations.

Technology

Amtrak has been requested to sign the Letter of Interoperability (referenced in APPENDIX E) that its rolling stock will need to be equipped with the V-ETMS® PTC System when operating on the following line segments. Refer to Table 5-5.

ACSES supplements the existing cab signal/automatic train control system on the NEC, providing full PTC functionality. Amtrak intends to install ACSES between New York City and Washington, DC by 2012. Refer to Table 5-5.

CSXT and Amtrak continue to have discussions in regard to interoperability on the line segments identified in table Table 5-5.

Table 5-5 Amtrak Operations on CSXT

Segment	Subdivisions	Proposed Architecture	
Lakeland, FL - Tampa, FL	Lakeland, Tampa Terminal	V-ETMS®	[redacted]
Cove Intg, MA - Beacon Park, MA	Boston	V-ETMS®	[redacted]
CP 175 (6mi E of Clev), OH - Cleveland (CP 181), OH	Cleveland Terminal	V-ETMS®	[redacted]
Buffalo (CP 437), NY - BFX CP 7, NY	Niagara, Buffalo Terminal	V-ETMS®	[redacted]
Taft Yard (E Landstreet Rd Orlando), FL - Auburndale, FL	Sanford, Carters, Auburndale	V-ETMS®	[redacted]
Indianapolis (CP - IU), IN - Hamilton, OH	Indianapolis, Indianapolis Terminal	V-ETMS®	[redacted]
Ames, IN - Clermont (CP - IJ), IN	Crawfordsville Branch, Monon	V-ETMS®	[redacted]
Monon, IN - Reynolds, IN	Monon	V-ETMS®	[redacted]
Maynard, IN - Shelby, IN	Monon	V-ETMS®	[redacted]
Poughkeepsie (CP 75), NY - Hudson, NY	Hudson	V-ETMS®	[redacted]
Fetner, NC - Sanford, NC	Aberdeen	V-ETMS®	[redacted]
Hamlet, NC - Columbia, SC	Hamlet, Hamlet Terminal, Columbia	V-ETMS®	[redacted]
Richmond ("A.Y."), VA - Amtrak Jct (RVM), VA	Bellwood, Richmond Terminal, Peninsula	V-ETMS®	[redacted]
Amtrak Jct (RVM), VA - Newport News, VA	Peninsula	V-ETMS®	[redacted]
Savannah, GA	Savannah	V-ETMS®	[redacted]

Segment	Subdivisions	Proposed Architecture	[redacted]
- Burroughs, GA			
Jesup, GA - Folkston, GA	Nahunta	V-ETMS®	
Braddock, PA - CP Bloom, PA	P & W, Pittsburgh	V-ETMS®	
Stuyvesant (CP 125), NY - Albany, NY	Hudson	V-ETMS®	
Palmer, MA - Springfield, MA	Boston, Berkshire	V-ETMS®	
Auburndale, FL - Lakeland, FL	Carters, Auburndale, Lakeland	V-ETMS®	
Beacon Park, MA - Framingham, MA	Boston	V-ETMS®	
Framingham, MA - Worcester, MA	Boston	V-ETMS®	
Worcester, MA - Palmer, MA	Boston	V-ETMS®	
Springfield, MA - Readville (CP 187), NY	Berkshire	V-ETMS®	
Albany-Rensselaer (CP 142), NY - Schenectady (CP 160), NY	Hudson	V-ETMS®	
Hoffman, NY - Buffalo (CP 437), NY	Rochester, Mohawk, Buffalo Terminal, Selkirk, West Shore	V-ETMS®	
Buffalo (CP 437), NY - CP 175 (6mi E of Clev), OH	Lake Shore, Erie West, Cleveland Terminal, Buffalo Terminal, Niagara	V-ETMS®	
Buffalo Exch St (CP 7), NY - Niagara Falls, NY	Niagara	V-ETMS®	
Jacksonville, FL - Sanford,	Sanford, Jacksonville	V-ETMS®	

Segment	Subdivisions	Proposed Architecture
FL	Terminal	
Sanford, FL - Taft Yd (E Landstreet Rd Orlando), FL	Sanford	V-ETMS®
Auburndale, FL - South Dyer, FL	Auburndale, Miami	V-ETMS®
Ashland, KY - Huntington, WV	Kanawha	V-ETMS®
Huntington, WV - Charleston, WV	Kanawha	V-ETMS®
Charleston, WV - Clifton Forge, VA	Allegheny, New River, Kanawha	V-ETMS®
Hamilton, OH - Cincinnati, OH	Cincinnati Terminal	V-ETMS®
Cincinnati, OH - Ashland, KY	Cincinnati, Cincinnati Terminal, Northern, Russell, Kanawha	V-ETMS®
Clermont (CP - IJ), IN - Indianapolis (CP - IU), IN	Indianapolis Terminal, Crawfordsville Branch	V-ETMS®
Reynolds, IN - Ames, IN	Monon	V-ETMS®
Shelby, IN - Monon, IN	Monon	V-ETMS®
Porter, IN - Grand Rapids, MI	Grand Rapids, Grand Rapids Terminal	V-ETMS®
Hudson, NY - Stuyvesant (CP 125), NY	Hudson	V-ETMS®
Raleigh, NC - Fetner, NC	Aberdeen	V-ETMS®
Sanford, NC - Hamlet, NC	Aberdeen, Hamlet Terminal	V-ETMS®
Columbia, SC	Columbia	V-ETMS®

Segment	Subdivisions	Proposed Architecture	
- Fairfax, GA			
Fairfax, GA - Savannah, GA	Columbia, Savannah	V-ETMS®	
Washington (CP Virginia), DC - Alexandria (AF Intrlkg), VA	Richmond Fredericksburg	V-ETMS®	
Alexandria (AF Intrlkg), VA - Lorton, VA	Richmond Fredericksburg	V-ETMS®	
Lorton, VA - Fredricksburg, VA	Richmond Fredericksburg	V-ETMS®	
Fredricksburg, VA - Doswell, VA	Richmond Fredericksburg	V-ETMS®	
Doswell, VA - Richmond (RVR), VA	Richmond Fredericksburg	V-ETMS®	
Richmond (RVR), VA - Richmond ("AY"), VA	Richmond Terminal, Richmond Fredericksburg	V-ETMS®	
Richmond ("AY"), VA - Selma, NC	North End, South End, Richmond Terminal	V-ETMS®	
Selma, NC - Kingstree, SC	South End, Charleston	V-ETMS®	
Kingstree, SC - Charleston, SC	Charleston	V-ETMS®	
Charleston, SC - Savannah, GA	Charleston, Savannah	V-ETMS®	
Burroughs, GA - Jesup, GA	Nahunta, Savannah	V-ETMS®	
Folkston, GA - Callahan, FL	Nahunta	V-ETMS®	
Callahan, FL - Jacksonville, FL	Nahunta, Jacksonville Terminal	V-ETMS®	
Washington (QN), DC - Point of Rocks,	Metropolitan	V-ETMS®	

Segment	Subdivisions	Proposed Architecture	
MD			
Point of Rocks, MD - Brunswick, MD	Metropolitan	V-ETMS®	
Brunswick, MD - Martinsburg, WV	Cumberland, Metropolitan	V-ETMS®	
Martinsburg, WV - Cumberland, MD	Cumberland, Cumberland Terminal	V-ETMS®	
Cumberland, MD - Braddock, PA	Keystone, Pittsburgh, Cumberland Terminal	V-ETMS®	

Table 5-6 below identifies the passenger railroad interoperability responses

Table 5-6 Passenger Railroad Interoperability Responses

[redacted]

5.1.1.6 Class II and III Tenant Railroads Operating on CSXT PTC Track Segments with Passenger Traffic

As previously discussed in Section 5.1, the railroads identified in Table 5-7 have been requested to sign a Letter of Understanding (referenced in APPENDIX D) that their respective rolling stock will need to be equipped with the V-ETMS® PTC System when operating on the following line segments.

Table 5-7 Class II and III Tenant Railroads with Passenger Traffic

Subdivision	Railroad		States
Aberdeen	ATW (Atlantic & Western Railway)		NC
	ACWR (Aberdeen, Carolina and Western Railway)		NC
Alleghany	BB (Buckingham Branch Railroad)		VA
Auburndale	FMID (Florida Midland Railroad Co., Inc.)		FL
Berkshire	ST (Pan Am Southern)		MA
	CSO (Connecticut Southern Railroad)		CT
	HRRC (Housatonic Railroad Co.)		MA,CT
Boston	EBSR (East Brookfield & Spencer Railroad)		MA
	PW (Providence and Worchester Railroad)		MA
Buffalo Terminal	BPRR (Buffalo & Pittsburgh Railroad)		NY
	BSOR (Buffalo Southern Railroad)		NY
	SB (South Buffalo Railroad)		NY
Charleston	GITM (Golden Isles Terminal Railroad)		SC
Cincinnati Term	CIND (Central Railroad of Indiana)		OH
	IORY (Indiana & Ohio Railway)		OH
Grand Rapids Terminal	MQT (Marquette Rail)		MI
	GR (Grand Rapids Eastern Railroad)		MI
	GDLK (Watco Companies)		MI
Ind. Terminal	ISRR (Indiana Southern Railroad)		IN
	LIRC (Louisville & Indiana Railroad)		IN
Indianapolis	IERR (Indiana Eastern Railroad)		IN
Keystone	WE (Wheeling & Lake Erie)		PA,MD
	SWP (Southwest Pennsylvania Railroad)		PA
Mohawk	NYSW (New York, Susquehanna & Western Railroad)		NY
	MHWA (Mohawk, Adirondack & Northern Railroad)		NY

Subdivision	Railroad	[redacted]	States
Monon	TPW (Toledo, Peoria & Western Railway)	[redacted]	IN
P&W	AVR (Allegheny Valley Railroad)	[redacted]	PA
Rochester	DLWR (Depew, Lancaster & Western Railroad	[redacted]	NY
	RSR (Rochester Southern Railroad)	[redacted]	NY
Sanford	Conrad Yelvington	[redacted]	FL
	FCEN (Florida Central Railroad Co., Inc.)	[redacted]	FL
Savannah	GITM (Golden Isles Terminal Railroad)	[redacted]	SC
	RSOR (Riceboro Southern Railway)	[redacted]	GA
	GC (Georgia Central Railway)	[redacted]	GA
Cincinnati	TTIS (Transkentucky Transportation Railroad, Inc.)	[redacted]	KY

5.1.2 Dual Equipped Office and Wayside Interoperability

CSXT and its interoperability partner SEPTA will install and operate different systems on their respective locomotives, office, and wayside. However, the locomotive onboard system of each will be able to interoperate with the office and wayside infrastructure deployed on the other's property. This capability is achieved in the following manner:

CSXT will be implementing V-ETMS on its lines. SEPTA will be utilizing the ACSES II PTC system as a vital overlay to an ATC/CSS system. The CSXT Office Segment will be able to exchange information with the SEPTA Office Segment Safety Server, such that track database information is securely updated

To achieve functional interoperability, the wayside Automatic Block Signal (ABS) system shall be used to provide an automatic enforcement of the ABS aspects. When operating on CSXT PTC equipped track, passenger trains will be provided with a form of cab signaling, but instead of receiving the cab signals through the rails they will be provided as a radio transmission. To accomplish this, each automatic signal location will be outfitted with WIU's and Base stations for use by both the SEPTA and CSXT trains. Consistent with the operation of the ACSES II, transponders will be added at the track entrance to each block for use by SEPTA trains to direct the train's on board computer to tune to a specific radio channel to receive the cab signal indication. Freight trains will be directed to tune to the appropriate radio frequency through GPS coordinate mapping.

Section 5.1.2.1 below describes where dual equipped interoperability will be achieved on SEPTA. The Trenton subdivision is scheduled to be cutover in phase 4 (see Table 7-1), during 2013 and 2014. Additionally, the Wayside Implementation Schedule (Table 9-1) shows that wayside equipment will be installed on the Trenton subdivision between 2013 and 2014. CSXT will work closely with SEPTA to ensure that the implementation of the dual equipped technology does not adversely affect operations, including any necessary testing required for this subdivision.

5.1.2.1 Southeastern Pennsylvania Transit Authority (SEPTA)

Background

SEPTA operates on both tracks of the CSXT Trenton Line, between Wood Interlocking ([redacted]) and Trent Interlocking ([redacted]). The signal system on the Trenton Line's No. 1 and No. 2 Tracks is a NORAC Rule 261 bi-directional, Automatic Block Signaling System with color light signals. The CSXT Trenton Line territory between [redacted] is dispatched by SEPTA Train Dispatchers out of the SEPTA Rail Operations Control Center (ROCC).

Technology

SEPTA's onboard PTC system will consist of cab signals and ACSES II. CSXT's track will be equipped with the Wabtec V-ETMS® PTC system. Based on description of Functional Interoperability set forth in 5.1.2, SEPTA and CSXT will achieve functional interoperability on the line segments identified in Table 5-8. There are no plans to install cab signaling on the CSXT territory.

Table 5-8 SEPTA Operations on CSXT

Segment	Subdivisions	Proposed Architecture	
Trenton Line (Trks #1 and #2)	Trenton	V-ETMS® (CSXT) and/or ASCES II (SEPTA)	

5.2 Technology Applicable to Interoperability [§ 236.1011(a)(3)(ii)]

CSXT and its interoperability partners utilize methods in three areas to obtain and maintain interoperability of its PTC system(s):

Technical interoperability is achieved through the use of documented common interface definitions. These definitions include one or more radio protocols (220MHz) and hardware interfaces to radio equipment, a common standard messaging protocol (ITC Messaging), and standard data element and application message format and content definitions (V-ETMS® interface control documents). Use of and compliance with these common interface definitions ensures the ability to exchange data messages between interoperable system components.

Semantic interoperability is achieved through the common use of documented system behavioral specifications. In the current ITC architecture, standard application-level specifications define the behavior of the interoperable office, locomotive, and wayside segments. Use of and compliance with these common behavioral specifications ensures each interoperable system segment properly interprets and acts upon exchanged data messages.

Organizational interoperability is achieved primarily through industry-wide forums, such as committees chartered by ITC and AAR Technical teams operating under both the ITC and AAR charters are tasked with developing and maintaining the common technical standards in the areas of technical and semantic interoperability described above. These teams have worked to establish a baseline level of interoperability required for industry-wide PTC implementation. The teams will work on a continuing basis to provide configuration management and ensure that interoperability is maintained as the interoperable PTC system(s) are enhanced. ITC and AAR teams will also work to establish organizational interoperability in the areas of interchange and infrastructure sharing.

5.3 Obstacles to Interoperability [§ 236.1011(a)(3)(iii)]

CSXT continues to have discussions with its tenant railroads with regard to issues related to interoperability, including with entities that have not as yet executed the documents provided to them by CSXT. Thirty-three percent of the carriers contacted have responded. Based upon CSXT's use of Native Interoperability and Functional Interoperability, no technical obstacles to interoperability have been identified to date. However, technical interoperability issues may arise at any point during the PTC implementation process. PTC technical interoperability issues will be reported to the Assistant Vice President Advanced Engineering, as the leader of the PTC Implementation Plan team, who will evaluate the issue and determine if the technical solution should be coordinated with other V-ETMS® users and/or other tenant railroads. Where required, the Vice President Safety will submit an RFA as outlined in section 1.1.2.

6.0 INSTALLATION RISK ANALYSIS [§ 236.1011(A)(4)]

This section describes how the CSXT PTC system will be implemented to address areas of greater risk to the public and railroad employees before areas of lesser risk.

6.1 Introduction

The risk prioritization model generated in response to 49 CFR Part 236 Subpart I §236.1011(a)(4), which requires that, to the extent practical, the positive train control (PTC) system be implemented to address areas of greater risk to the public and railroad employees before areas of lesser risk. The risk prioritization model assesses a number of key risk factors, which are assumed to provide an indication of the relative risk associated with the CSXT lines for which PTC deployment is required by Subpart I §236.1005(b). The relative risk rankings generated by the risk prioritization model provided the basis for prioritizing deployment of PTC on the CSXT lines for which PTC is required by Subpart I §236.1005(b). The risk prioritization model did not assess other CSXT lines for which PTC deployment is not required by Subpart I §236.1005(b). This document describes the risk prioritization approach, the risk factors that were assessed, and the model results.

CSXT has not received all of the PIH data from freight tenant railroads for inclusion in CSXT's risk analysis. Both tenant passenger train information and the number of freight tenant trains have been included in the risk analysis as this data was available within the CSXT data system. CSXT is attempting to collect the PIH data from freight tenant railroads and include this data in the CSXT risk model. If additional information is received after initial submission of this PTCIP, the CSXT risk model will be updated no later than the first annual report of progress toward achieving implementation goals established in the approved PTCIP, and any changes that result in a material change to the approved PTCIP will be submitted as a Request For Amendment (RFA) in accordance with Section 1.1.2 of the PTCIP.

6.2 Risk Prioritization Model

The CSXT risk prioritization model is based heavily on the sample methodology provided by the Federal Railroad Administration (FRA) in the *Risk Prioritization Methodology for PTC System Implementation* [5] (hereafter referred to as the *Risk Prioritization Template*). This is a basic weighted score approach in which a number of risk factors, as identified in the *Risk Prioritization Template* and *PTC Implementation Plan Template* [6], were assigned integer scores, corresponding with levels of risk, ranging from 0 (lowest risk) up to 5 (highest risk) for each of the CSXT subdivisions to be equipped with PTC. Each risk factor was also assigned a weight, which provided an indication of the "relative importance" of the factor in determining the overall risk ranking. [redacted]

[redacted]

In order to perform the above calculations, the following activities were undertaken:

1) Identify risk factors to include in the risk prioritization model
2) Estimate risk factor weights (FW_i)
3) Define the risk factor levels (from 0 to 5) used to assign scores to the line segments for each risk factor
4) Assign integer scores (FR_i) to each subdivision using the risk factor levels defined in activity 3 above
5) Calculate the line segment Relative Risk Score (LS_i) using (*Equation 1*) and average the results for the entire subdivision using (*Equation 2*)

Details of each of the activities listed above are provided in the subsections following.

Due to the complex nature of the CSXT rail network, risk assessment for each subdivision is conducted by means of analyzing the various line segments that comprise that specific subdivision.

The CSXT rail network includes many line segments. A subdivision is comprised of one or more line segments. Each line segment is assessed for each particular risk factor (e.g. [redacted]), and is then assigned the appropriate risk level, using the 0 - 5 scale or 1 - 5 scale for that factor in a manner similar to that described in the *Risk Prioritization Template*. The result is then multiplied by a constant that represents the weight for that risk factor to produce the line segment factor risk.
The line segment factor risks for each risk factor are calculated, and the results are then summed to produce the line segment risk.

Two calculations are then performed for the subdivision:

1. To determine the overall risk sequence number of a subdivision, all of the line segment risks are summed and then divided by the number of line segments in the subdivision. The highest resultant number represents the subdivision with the highest risk and is given the sequence number of 1. The next highest number is given a sequence number of 2 and so on.
2. To determine the overall risk for each subdivision for each risk factor, the particular line segment factor risks are summed for the subdivision, and then divided by the number of line segments in the subdivision.

These two methods allow the risk factors to be analyzed at an individual level (e.g. [redacted]) and also at a composite level (all risk factors for a subdivision). It should be noted that the division by the number of line segments for a subdivision is necessary to avoid duplicate counting of the risk factors.

Sequence numbers, and a number of other railroad specific technical, logistical, organizational and geographical factors are then taken into account to assign a subdivision to an implementation phase. Lower implementation phases will be completed before higher phase numbers, although multiple phases may be active at once. See Section 7.0 below for further details.

6.2.1 Identification of Risk Factors

The *Risk Prioritization Template* includes a list of seven risk factors, which are identified as "a minimum set of risk factors that are to be considered" in the risk prioritization model. These seven risk factors, listed below, correspond with the risk factors identified in §236.1011(a)(5) as the minimum risk factors that must be addressed to determine the sequence in which track segments will be equipped:

1. Annual million gross ton (MGT) levels
2. Presence and volume of passenger traffic
3. Presence and volume of PIH material (loads and residue) transported
4. Number of tracks
5. Method of operation
6. Speeds of train operations
7. Track grades and curvatures.

In addition to the seven minimum risk factors identified above, the *Risk Prioritization Template* also identifies the following 11 "other route attributes bearing on risk that may be considered":

1. Rail traffic density
2. Trip length for route
3. Track type, class, and maintenance schedule
4. Presence or absence of block signal, train control, or cab signal systems
5. Presence or absence, and types, of wayside hazard detectors
6. Number and types of at-grade crossings (both highway-rail and rail-to-rail)
7. Frequency and location of track turnouts
8. Public venues along the route (high population density, stations, events, places of congregation, etc.)
9. Presence of other equipped and non-PTC-equipped traffic along the route (shared track)
10. Past accident/incident statistics
11. Hazards to human health and the environment.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

6.2.2 Estimation of Risk Factor Weights

Ideally, risk factor weights would be assigned based on detailed computations, using a probabilistic risk assessment (PRA) with sensitivity analyses or by performing regression analyses of historical data. Such detailed computations, however, could not be achieved in the required timeframe, as the Final Rule [1] was published on January 15, 2010, and submission of the *Positive Train Control Implementation Plan (PTCIP)* is required on or before April 16, 2010.

Due to the fact that time was not available for a detailed study and no other quantitative information was identified as appropriate for direct application as risk factor weights, the estimation of risk factor weights relied heavily on expert judgment. Discussions with the other six North American Class I railroads resulted in a collaborative process so that the culmination of information from a number of experts throughout the industry could be taken into consideration in estimating risk factor weights, thereby augmenting CSXT's perspective. Although considerable weight was given to the input received from other railroad professionals, CSXT's final risk factor weight assignments incorporated specific applicability to CSXT's subdivisions based upon CSXT's officials' knowledge regarding the CSXT system.

The individuals considered most qualified to provide the necessary judgments were representatives from the seven North American Class I railroads with significant experience and knowledge in railroad operations. Their detailed understanding of how the railroads operate and their familiarity with the various risks involved in railroad operations made these individuals the most qualified to provide these judgments. The possibility of performing formal individual elicitations of these individuals, using an elicitation approach based on the approach outlined in US Nuclear Regulatory Commission Regulation 1150 (NUREG-1150) [7] was considered, however such an approach was determined not to be ideally-suited for quantification of these risk factor weights. This determination was primarily due to the fact that the risk factor weights are "high level" and rather abstract quantities, whereas formal elicitations are generally more effective when eliciting quantities at a "lower level" (for example, asking experts to quantify the probability that a train operator fails to obey a restrictive signal indication may be an estimate that is more effectively elicited in a formal elicitation setting). Also, while those deemed most suitable to estimate risk factor weights were personnel from the railroads with significant expertise in railroad operations, these individuals were not necessarily experts in risk assessment, so it was recognized that additional collaboration among railroad operations individuals and risk assessment individuals would be beneficial. Lastly, the time limitation in performing the risk prioritization exercise also presented a challenge, as a more formal elicitation process would have required a significantly longer period of time to conduct. As a result a more collaborative/group-oriented approach was taken, with railroad professionals in risk assessment interacting with railroad professionals in estimating risk factor weights.

Although a formal elicitation approach such as that documented in NUREG-1150 was not followed, some aspects of this type of approach were implemented, wherever feasible. Some key topics that would normally be discussed during an elicitation kick-off/training meeting were covered with the railroad

operations experts, as they were made aware of a number of common pitfalls that may be encountered when providing judgments, including susceptibility to various types of biases and also weaknesses related to providing estimates in a group setting.

Among the primary biases of concern in this exercise was the "anchoring" bias, which refers to the tendency of starting with an initial estimate and failing to move from that estimate. In the case of risk factor weights, a potential source of anchoring bias was the *Risk Prioritization Template*, as many of the risk factor contributors could potentially be biased by the weighting values included in this document even though the FRA had indicated that the values in the template were for illustrative purposes only. Another type of bias that experts were made aware of was the "availability" bias, which is the tendency to give too much weight to easily accessed or remembered information. An event receiving much attention often may result in a similar event being given a higher probability of occurring. For example, it is possible that one or more of the risk factors could have contributed significantly to a recent accident that is fresh in the minds of the experts, thereby creating the potential for the assigned to give extra weight to that factor. Thus, they were cautioned that, while all relevant information should be taken into consideration when providing estimates, they should take care not to provide too much weight to something due to the fact that it stands out in their minds simply due to the fact that it was a recent occurrence.

While there are various other types of biases that provide a challenge when eliciting judgments, one final bias that was identified as a particular concern in performing an activity such as this is the "motivational" bias. This bias is related to consciously providing judgments that do not reflect the expert's true beliefs, which could result when the expert has an economic, political or other stake in the results of the assessment. While this is not at all to suggest that any of the individuals involved in this estimation exercise expressed this bias, it was a topic that was addressed so as to make the individuals aware that this type of bias is possible. It is thought that one of the most effective ways to eliminate these various biases, after all, is to be aware of their potential to exist.

In addition to the various biases described above, other topics that were discussed with those involved in the risk factor estimation prior to estimating risk factor weights were the advantages and disadvantages of the group discussions that took place during this process. In general, group discussions provide an opportunity to take advantage of the collective experience of the individual members of the group. Being able to draw upon the different experiences of multiple railroad professionals can be quite valuable and allows different perspectives to be taken into consideration. The group setting can also lead to significant synergy, as ideas of the group may form a greater whole than the sum of individual ideas. The group setting also comes with some disadvantages, however, and similar to the different types of biases, it was thought that the best way to address, and to the extent possible, minimize the disadvantages of group discussion, was to be aware of their potential to exist. Among the identified disadvantages are the potential for discussions to be dominated by one or only a couple of members of the group, the potential for group members to bias other group members, the potential for polarized opinions to create extra complexity, and also the potential for "groupthink". Detailed discussions of these and other related topics are widely available in a number of sources.

Another key topic that was discussed with the railroad operations professionals, which is important to note, is the fact that there would likely be a significant amount of uncertainty in their estimates, meaning that there would be significant uncertainty in the final risk factor weights, and ultimately a great deal of uncertainty in the priority with which CSXT subdivisions should be equipped with PTC. Even if the risk factor weights could have been arrived at through intensive computations, such as PRA or regression analyses, results of such computations would also come with a great deal of uncertainty. While

quantitative expression of uncertainty is often recommended when estimating quantities and generating risk results (primarily so that those making decisions based on the results can take the level of uncertainty into account), whether in the form of distributions, confidence intervals, or similar expressions, the uncertainty was not quantified in this risk prioritization model.

The *Risk Prioritization Template* was provided to offer guidelines for assessing the prioritization with which segments should be equipped, and CSXT assumes that these guidelines provide a reasonable indication of the level of detail that the FRA expects to see in each railroad's risk prioritization model. The *Risk Prioritization Template* does not indicate that quantification of uncertainty is expected in the risk prioritization model, and therefore, no attempts were made to quantify the uncertainty in the results. Since the results of the risk prioritization are presented as risk scores, with no error bars or similar quantification, it is important for those using the results in their decision-making process (in this case, personnel at CSXT who will decide the sequence with which subdivisions should be equipped) to understand that there is a significant amount of uncertainty in these results. The results should be interpreted as "best estimates", based on the experienced judgment of rail operations experts.

Due to the fact that the estimation of risk factor weights relied heavily on expert judgments, CSXT made an effort to generate a base of evidence that could be used to provide a rationale for these judgments. In addition, gathering this information prior to estimation of the risk factor weights was intended to provide a slight reduction in the uncertainty in the estimates. This information gathering involved the activities described below.

1. **Review of previous applicable studies and existing FRA data**: Previous studies whose findings could be taken into consideration were identified and reviewed when estimating the risk factor weights to be used in the risk prioritization model. A summary of the reviews of previous applicable studies is included in section 6.2.2.1, with more detailed discussion of these reviews provided in APPENDIX F.

   A review of a number of other sources of FRA data was also performed in an attempt to identify any key data that should be taken into consideration when estimating risk factor weights. Due to the fact that the majority of available FRA data is not specific to PTC-preventable accidents, it was assumed that usefulness of FRA data would be limited.

2. **Written description of risk factors:** Section 6.3 below includes a description of the risk factors generated as a result of the collaborative effort of the operations experts from the seven North American Class I railroads. Where findings/data from the studies and other data reviewed in 1 above were considered applicable, this information was cited or included in the discussion of the individual risk factors, as appropriate.

After these information-gathering activities were completed, the experts were asked to provide quantitative estimates, taking the compiled information into consideration. Since the experts agreed that their respective railroads may want to consider different subsets of the risk factors identified in [redacted] in their risk prioritization models, all were asked to only provide estimates for the seven "minimum critical risk factors that must be addressed", and railroads then used those estimates as they saw fit for their own assessment and considered additional risk factors beyond this minimum set, as appropriate for their specific railroad.

6.2.2.1 Review of Previous Applicable Studies and FRA Data

This section briefly summarizes previous research related to the railroad risk factors that were included in the risk prioritization model. The three key references that were reviewed are identified in the bulleted list below. In addition to considering information from these sources, reviews of various other railroad-related reports and FRA data was also performed. Any relevant information identified in these other sources has been included in other sections of this document, along with citations as appropriate, but sources beyond the three listed below are not addressed in this subsection.

- Railroad Safety Advisory Committee (RSAC), Federal Railroad Administration, US Department of Transportation. *Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator: Implementation of Positive Train Control Systems*. September 1999. [8]
- Railroad Systems Division (DTS-75), Office of Safety and Security, The John Volpe National Transportation Systems Center, US Department of Transportation. *Presentation for Office of Safety, Federal Railroad Administration RSAC/PTC Working Group Risk 2 Team, Base Case Risk Assessment: Data Analysis & Tests*. April 22, 2003. [9]
- Carl D. Martland, Ying Zhu, Youssef Lahrech, and Joseph M. Sussman. *Risk and Train Control: A Framework for Analysis*. Center for Transportation Studies, Massachusetts Institute of Technology, Cambridge, January 2001. [10]

For each of the above-cited references, the following subsections provide a brief overview of the contents of each reference and a discussion of key results/findings that were considered when assigning risk factor weights for use in CSXT's risk prioritization model. These references provided supporting information for the development of CSXT's risk prioritization model. Further information on the references are provided in APPENDIX F .

6.2.2.1.1 Report of the Railroad Safety Advisory Committee: Implementation of Positive Train Control Systems

The RSAC Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator: Implementation of Positive Train Control Systems [8] made use of historical data to help estimate PTC benefits by evaluating PTC-preventable accidents (PPAs). RSAC identified 819 PPAs out of the more than 25,000 accidents reported to FRA between 1988 and 1997 and attempted to estimate the benefits of PTC by evaluating how many accidents would have been eliminated were a given type of PTC system in place. These data were input into the Corridor Risk Assessment Model (CRAM) model, which was used to estimate the safety benefits of PTC by relating the historic occurrence and consequences of accidents that may have been prevented by a PTC system to specific track features and traffic.

Some of the details of the regression analyses that led to the findings/results identified in APPENDIX F are not included in the RSAC report, and therefore, the findings/results were considered with some caution. There is nothing, however, to indicate that the analysis contained in this report is not valid or useful.

In general, the conclusions of the report indicate that the 'Annual MGT Level' risk factor should potentially be assigned a relatively high weight. The 'Curvature' risk factor may not be a very strong indicator of risk, so it should potentially be assigned a relatively low weight. 'Speed of Train Operations' actually had a counter-intuitive effect on predicting the occurrence of accidents, but this may not be an unreasonable conclusion due to the fact that authorized speeds may be lower/higher on a section of track depending on the presence/absence of other risk factors. The report also provides information that helps

illustrate the effect on risk that 'Presence and Volume of PIH Material' could potentially have, indicating that this factor should be weighted fairly high.

6.2.2.1.2 Base Case Risk Assessment: Data Analysis & Tests (Volpe Center)

The *Base Case Risk Assessment* presentation [9] describes work performed by the Volpe Center in summarizing the "current level of risk" for a number of territories, as it summarizes results from various linear and anti-log multiple regression analyses that were performed. The study examines segments where PPAs have taken place, as well as other mainline railroad segments. The analyses described in this presentation are assumed to be a follow-on to the analyses documented in the RSAC report summarized in the previous section.

For reasons discussed in additional detail in APPENDIX F , most of the conclusions of this presentation were not taken into consideration when assigning risk factor weights. However, data that was taken into consideration include data on annual PPA cost/train-mile, which were estimated to be 0.0544 for "Auto" territory, 0.0675 for TCS territory, 0.0590 for ABS territory, and 0.122 for non-signaled territory. These data indicate that risk per train mile in non-signaled territory is approximately two times the risk of other territories.

6.2.2.1.3 Risk and Train Control: A Framework for Analysis

The report *Risk and Train Control: A Framework for Analysis* by Martland et al. [10] documents a Probabilistic Risk Assessment (PRA) study which examined the effects of train control strategies on the risks of railroad operations. The research was initiated to address the question of how risk and the potential for risk reduction varies from one rail corridor to another, and it also attempts to assess how much reduction in risk can be expected from different train control strategies. The study considers a hypothetical corridor, which the report indicates was similar to the 183 actual corridors analyzed in the RSAC *Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator: Implementation of Positive Train Control Systems* [8], discussed in Section 6.2.2.1.1 above.

While this study seems to provide an indication of the extent to which different risk factors affect total risk under different methods of operation, it is acknowledged that various aspects of the CSXT subdivisions that are subject to the risk prioritization model vary from the segments that compose the hypothetical corridor assessed in this study. CSXT was mindful of these differences when considering its estimation of risk factor weights. It was also acknowledged that the PRA and sensitivity analysis results presented in this study should only be considered directly applicable within the variable ranges assessed for the hypothetical corridor, such that extrapolation beyond these ranges is generally not recommended.

Keeping the above caveats in mind, it is also true that the results of this PRA study are among the few available data points that are somewhat applicable to the risk factor weighting exercise, and while it may not be advisable to give too much weight to the results of this study, it did seem reasonable to consider how the risk factors rank with regard to the extent to which they affect risk, and it also seemed reasonable to consider the results as "rough order of magnitude" estimates to be considered when assigning risk factor weights.

The approximations discussed in APPENDIX F were made in order to arrive at rough order of magnitude estimates for risk factor weights. Figure 6-1 below shows the relative weights of the four risk factors that were approximated. These approximations are also briefly discussed in Section 6.3 under the various risk factors to which these estimates are applicable. The approximations were just one set of inputs to be

considered when assigning risk factor weights and were interpreted simply as rough approximations that were made using available information.

[redacted]

Figure 6-1 Approximations for Consideration in Estimation of Risk Factor Weights

6.2.3 Definition of Risk Factor Levels

A discussion of each of the risk factors identified in Table 6-1 above is provided in Section 6.3 below. Included with the discussions of each risk factor in Section 6.3 are the definitions of the various scoring levels (from 0 to 5) that were used to rate the subdivisions for each risk factor. In general, risk factor levels were defined by looking at the range of data for a risk factor across all subdivisions and assigning factor levels based upon quintiles, such that each quintile contained 20% of the subdivisions. In some cases, the data did not lend itself to equitable distribution via quintiles, in which case the levels were adjusted to provide a spread of data that would allow differentiation of the factor. The factor scoring levels are typically provided in small tables towards the end of the discussion of each risk factor in Section 6.3. The upper and lower limits of each scoring level are defined in these tables. Where applicable, plots of available CSXT risk factor data, which show the distribution of subdivisions among the factor levels defined for each risk factor, are also provided.

6.2.4 Assignment of Risk Factor Levels to Subdivisions

The data used to quantify the various risk factors for each of the CSXT subdivisions included in the risk prioritization model were collected from the appropriate departments within CSXT. Data was converted, as necessary, to be compatible with the factor levels that were defined for each risk factor so that the CSXT subdivisions could be assigned a score (also referred to as 'Risk Factor Levels') for each of the risk factors. Section 6.3 below provides additional information on the risk factor levels that were defined for each risk factor and describes how the data were used to quantify the various risk factors included in the risk prioritization model. The actual risk factor scores assigned to each subdivision for each risk factor are provided in Table 6-13 in Section 6.4 later in this report.

6.3 [redacted]

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[redacted]

[redacted]

6.3.1.1 [redacted]

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6.3.1.2 [redacted]

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6.3.2.3 [redacted]

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6.3.4.3 [redacted]

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6.3.6.2 [redacted]

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6.3.6.3 [redacted]

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6.3.7.2 [redacted]

6.3.7.3 [redacted]

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Annual Number of Trains

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6.3.10.3 [redacted]

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6.4 [redacted]

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6.5 Risk Prioritization Model Results

[redacted]

[redacted]

[redacted]

7.0 DEPLOYMENT SEQUENCE AND SCHEDULE [§ 236.1011(A)(5)]

This section defines the sequence, planned schedule, and basis for scheduling decisions for line segments to be equipped, including the identified risk by line segment.

The deployment sequence and schedule is based on segment traffic characteristics outlined in Section 6.0.

The 171 subdivisions were analyzed using the Risk Prioritization Model described in Section 6.0, resulting in the Phased Deployment schedule set forth below. Each Phase consists of multiple subdivisions of similar attributes.

Deployment will occur in phases. Refer to Figure 7-1 for an illustrative map showing the implementation phases. Refer to APPENDIX G for further details regarding the individual subdivisions included in each phase.

Figure 7-1 PTC Cutover Phases

Table 7-1 shows the PTC Implementation Schedule by phase and is color coded to correspond with Figure 7-1. The Phase End Date identifies when each PTC segment in that phase has been equipped, cutover, and is fully capable of operating as a PTC route in accordance with the progressive implementation schedule.

CSXT primarily relied on the results of the Risk Prioritization model as the basis for decisions on the cutover phase for each subdivision. Consideration was also given to availability of resources, operational

impact, the requirement for progressive implementation, as well as the requirement to meet the implementation deadline of December 31, 2015. Variations from the Risk Prioritization model are explained in Section 11.0.

[redacted]

[redacted]

[redacted]

7.1 Segment Traffic Characteristics [§ 236.1011(a)(5)(i)]

The CSXT PTC segment traffic characteristics are described according to [redacted] Refer to Table 7-2 below.

[redacted]

Table 7-2 Segment Traffic Characteristics

[redacted]		[redacted]
	RICHMOND FREDERICKSBURG NORTH	
	ABERDEEN	
	ANDREWS	
	ROCHESTER	
	METROPOLITAN	

BOSTON WEST
MOHAWK
BUFFALO TERMINAL
CAPITAL
CUMBERLAND
HUDSON
BELT
CUMBERLAND TERMINAL
NIAGARA
OLD MAIN LINE
BALTIMORE TERMINAL
RICHMOND FREDERICKSBURG SOUTH
SOUTH END
NORTH END
ERIE WEST
CHARLESTON
LAKE SHORE
RICHMOND TERMINAL
PENINSULA
CLEVELAND SHORT LINE
RIVER
SELKIRK
CLEVELAND TERMINAL
CASTLETON
HOPEWELL
BERKSHIRE
LOCKPORT
BELLWOOD
CLEVELAND
RUSSELL
NAHUNTA
CINCINNATI
KANAWHA
MIAMI
CARTERS
YEOMAN
AUBURNDALE
SANFORD
CALLAHAN
CINCINNATI TERMINAL
NORTHERN
NEW RIVER
ALLEGHENY

SAVANNAH
LAKELAND
JACKSONVILLE TERMINAL
TAMPA TERMINAL
CRAWFORDSVILLE BRANCH
FITZGERALD
KEYSTONE
PITTSBURGH
INDIANAPOLIS
MONON
INDIANAPOLIS TERMINAL
COLUMBIA
JESUP
GRAND RAPIDS
HAMLET TERMINAL
TRENTON
HAMLET
P AND W
GRAND RAPIDS TERMINAL
NO AND M
M AND M
S AND N A NORTH
HENDERSON
ST LOUIS LINE
BRUCETON
S AND N A SOUTH
INDIANAPOLIS LINE
C E AND D
NASHVILLE TERMINAL
BOYLES TERMINAL
WOODLAND
MAIN LINE
LCL
CINCINNATI CORBIN
CHATTANOOGA
KD
AUGUSTA
LOUISVILLE TERMINAL
MONROE
SPARTANBURG
McCORMICK
BLUE RIDGE
MOUNTAIN
E AND BV

ROCKHOUSE
KINGSPORT
BIG SANDY
PD
PA
MEMPHIS
OHIO RIVER
AWP W OF A
SCOTTSLAWN SECONDARY
CHARLOTTE
WILMINGTON
C N AND L
INDIANA
THOMASVILLE
VALRICO
MEMPHIS TERMINAL
PORTSMOUTH
CL AND W
ILLINOIS
SHORT LINE
TARBORO
PALMETTO
DOTHAN
GEORGIA
EASTOVER
BREWSTER
LANE
LURGAN
ACHAN
BIRMINGHAM MINERAL
GARRETT
WILLARD
NEW CASTLE
WILLARD TERMINAL
FOSTORIA
BOSTON EAST
TOLEDO
GREENWICH
PEMBERVILLE
COLUMBUS
ETOWAH
WILDWOOD
TALLAHASSEE
MANCHESTER

W AND A
ABBEVILLE
MOUNT VICTORY
WEST SHORE
EVANSVILLE TERMINAL
TOLEDO TERMINAL
JAMES RIVER
LINEVILLE
VITIS
BLUE ISLAND
ATLANTA TERMINAL
PHILADELPHIA
RIVANNA
DETROIT
BARR
CARTERSVILLE
ST LAWRENCE
L H AND STL
NORLINA
DANVILLE
BRIDGEPORT
SAGINAW
FREMONT
DECATUR
BIG COAL
NASHVILLE
COAL RIVER
MON
TOLEDO BRANCH
PLYMOUTH
ORANGEBURG
POND FORK
TERRELL
MONTREAL
PORTER

7.2 Segment Operational Characteristics [§ 236.1011(a)(5)(ii)]

The CSXT PTC segment operational characteristics are detailed according to route miles, track miles, signaled miles, non-signaled miles and maximum speed. Refer to Table 7-3 below.

Table 7-3 Segment Operational Characteristics

[redacted]	Subdivision	[redacted]
	RICHMOND FREDERICKSBURG NORTH	
	ABERDEEN	
	ANDREWS	
	ROCHESTER	
	METROPOLITAN	
	BOSTON WEST	
	MOHAWK	
	BUFFALO TERMINAL	
	CAPITAL	
	CUMBERLAND	
	HUDSON	
	BELT	
	CUMBERLAND TERMINAL	
	NIAGARA	
	OLD MAIN LINE	
	BALTIMORE TERMINAL	
	RICHMOND FREDERICKSBURG SOUTH	
	SOUTH END	
	NORTH END	
	ERIE WEST	
	CHARLESTON	
	LAKE SHORE	
	RICHMOND TERMINAL	
	PENINSULA	
	CLEVELAND SHORT LINE	

Subdivision
RIVER
SELKIRK
CLEVELAND TERMINAL
CASTLETON
HOPEWELL
BERKSHIRE
LOCKPORT
BELLWOOD
CLEVELAND
RUSSELL
NAHUNTA
CINCINNATI
KANAWHA
MIAMI
CARTERS
YEOMAN
AUBURNDALE
SANFORD
CALLAHAN
CINCINNATI TERMINAL
NORTHERN
NEW RIVER
ALLEGHENY
SAVANNAH
LAKELAND
JACKSONVILLE TERMINAL
TAMPA TERMINAL
CRAWFORDSVILLE BRANCH
FITZGERALD
KEYSTONE

Subdivision
PITTSBURGH
INDIANAPOLIS
MONON
INDIANAPOLIS TERMINAL
COLUMBIA
JESUP
GRAND RAPIDS
HAMLET TERMINAL
TRENTON
HAMLET
P AND W
GRAND RAPIDS TERMINAL
NO AND M
M AND M
S AND N A NORTH
HENDERSON
ST LOUIS LINE
BRUCETON
S AND N A SOUTH
INDIANAPOLIS LINE
C E AND D
NASHVILLE TERMINAL
BOYLES TERMINAL
WOODLAND
MAIN LINE
LCL
CINCINNATI CORBIN
CHATTANOOGA
KD
AUGUSTA

Subdivision
LOUISVILLE TERMINAL
MONROE
SPARTANBURG
McCORMICK
BLUE RIDGE
MOUNTAIN
E AND BV
ROCKHOUSE
KINGSPORT
BIG SANDY
PD
PA
MEMPHIS
OHIO RIVER
AWP W OF A
SCOTTSLAWN SECONDARY
CHARLOTTE
WILMINGTON
C N AND L
INDIANA
THOMASVILLE
VALRICO
MEMPHIS TERMINAL
PORTSMOUTH
CL AND W
ILLINOIS
SHORT LINE
TARBORO
PALMETTO
DOTHAN

Subdivision
GEORGIA
EASTOVER
BREWSTER
LANE
LURGAN
ACHAN
BIRMINGHAM MINERAL
GARRETT
WILLARD
NEW CASTLE
WILLARD TERMINAL
FOSTORIA
BOSTON EAST
TOLEDO
GREENWICH
PEMBERVILLE
COLUMBUS
ETOWAH
WILDWOOD
TALLAHASSEE
MANCHESTER
W AND A
ABBEVILLE
MOUNT VICTORY
WEST SHORE
EVANSVILLE TERMINAL
TOLEDO TERMINAL
JAMES RIVER
LINEVILLE
VITIS

Subdivision
BLUE ISLAND
ATLANTA TERMINAL
PHILADELPHIA
RIVANNA
DETROIT
BARR
CARTERSVILLE
ST LAWRENCE
L H AND STL
NORLINA
DANVILLE
BRIDGEPORT
SAGINAW
FREMONT
DECATUR
BIG COAL
NASHVILLE
COAL RIVER
MON
TOLEDO BRANCH
PLYMOUTH
ORANGEBURG
POND FORK
TERRELL
MONTREAL
PORTER

7.3 Route Attributes [§ 236.1011(a)(5)(iii)]

[redacted] Refer to Table 7-4

[redacted]

Table 7-4 Route Attributes

[redacted]	Subdivision	[redacted]
	RICHMOND FREDERICKSBURG NORTH	
	ABERDEEN	
	ANDREWS	
	ROCHESTER	
	METROPOLITAN	
	BOSTON WEST	
	MOHAWK	
	BUFFALO TERMINAL	
	CAPITAL	
	CUMBERLAND	
	HUDSON	
	BELT	
	CUMBERLAND TERMINAL	
	NIAGARA	
	OLD MAIN LINE	

[redacted]	Subdivision	[redacted]
	BALTIMORE TERMINAL	
	RICHMOND FREDERICKSBURG SOUTH	
	SOUTH END	
	NORTH END	
	ERIE WEST	
	CHARLESTON	
	LAKE SHORE	
	RICHMOND TERMINAL	
	PENINSULA	
	CLEVELAND SHORT LINE	
	RIVER	
	SELKIRK	
	CLEVELAND TERMINAL	
	CASTLETON	
	HOPEWELL	
	BERKSHIRE	
	LOCKPORT	
	BELLWOOD	
	CLEVELAND	
	RUSSELL	
	NAHUNTA	
	CINCINNATI	
	KANAWHA	
	MIAMI	

Subdivision
CARTERS
YEOMAN
AUBURNDALE
SANFORD
CALLAHAN
CINCINNATI TERMINAL
NORTHERN
NEW RIVER
ALLEGHENY
SAVANNAH
LAKELAND
JACKSONVILLE TERMINAL
TAMPA TERMINAL
CRAWFORDSVILLE BRANCH
FITZGERALD
KEYSTONE
PITTSBURGH
INDIANAPOLIS
MONON
INDIANAPOLIS TERMINAL
COLUMBIA
JESUP
GRAND RAPIDS
HAMLET TERMINAL

Subdivision
TRENTON
HAMLET
P AND W
GRAND RAPIDS TERMINAL
NO AND M
M AND M
S AND N A NORTH
HENDERSON
ST LOUIS LINE
BRUCETON
S AND N A SOUTH
INDIANAPOLIS LINE
C E AND D
NASHVILLE TERMINAL
BOYLES TERMINAL
WOODLAND
MAIN LINE
LCL
CINCINNATI CORBIN
CHATTANOOGA
KD
AUGUSTA

Subdivision
LOUISVILLE TERMINAL
MONROE
SPARTANBURG
McCORMICK
BLUE RIDGE
MOUNTAIN
E AND BV
ROCKHOUSE
KINGSPORT
BIG SANDY
PD
PA
MEMPHIS
OHIO RIVER
AWP W OF A
SCOTTSLAWN SECONDARY
CHARLOTTE
WILMINGTON
C N AND L
INDIANA
THOMASVILLE
VALRICO
MEMPHIS TERMINAL
PORTSMOUTH
CL AND W
ILLINOIS
SHORT LINE

Subdivision
TARBORO
PALMETTO
DOTHAN
GEORGIA
EASTOVER
BREWSTER
LANE
LURGAN
ACHAN
BIRMINGHAM MINERAL
GARRETT
WILLARD
NEW CASTLE
WILLARD TERMINAL
FOSTORIA
BOSTON EAST
TOLEDO
GREENWICH
PEMBERVILLE
COLUMBUS
ETOWAH
WILDWOOD
TALLAHASSEE
MANCHESTER
W AND A
ABBEVILLE
MOUNT VICTORY
WEST SHORE

Subdivision
EVANSVILLE TERMINAL
TOLEDO TERMINAL
JAMES RIVER
LINEVILLE
VITIS
BLUE ISLAND
ATLANTA TERMINAL
PHILADELPHIA
RIVANNA
DETROIT
BARR
CARTERSVILLE
ST LAWRENCE
L H AND STL
NORLINA
DANVILLE
BRIDGEPORT
SAGINAW
FREMONT
DECATUR
BIG COAL
NASHVILLE
COAL RIVER
MON
TOLEDO BRANCH
PLYMOUTH
ORANGEBURG

Subdivision
POND FORK
TERRELL
MONTREAL
PORTER

8.0 ROLLING STOCK [§ 236.1011(A)(6)]

This section identifies CSXT's rolling stock installation plans including the classes of rolling stock to be PTC equipped, the schedule for completion of rolling stock PTC equipment implementation by December 31, 2015, and communications with tenant railroads not filing a PTCIP regarding their plans for rolling stock to be equipped with compatible PTC for operation on CSXT PTC territories.

8.1 Locomotives to be Equipped

CSXT rolling stock to be equipped with PTC is organized by locomotive class. The locomotive fleet will change during the deployment of PTC as new units are acquired and units are retired. Refer to Table 8-1 for the total number of locomotives, at this time, to be equipped with PTC technology.

Table 8-1 CSXT Rolling Stock To Be Equipped With PTC

PTC Locomotive Candidates					
CLASS	AXLE	LOCAL	ROAD	OFC	TOTAL
B40-8	4		43		43
F40PH2	4			4	4
GP15	4	30			30
GP15T	4	20			20
GP38-2	4	205			205
GP382S	4	46			46
GP39-2	4	20			20
GP40-2	4	310			310
GP60	4		3		3
Road Slug	4		175		175
C40-8	6		156		156
CW40-8	6		375		375
CW40-9	6		24		24
CW44-9	6		28		28
CW44AC	6		462		462
CW44AH	6		120		120
CW60AC	6		117		117
ES40DC	6		206		206
ES44AH	6		250		250
ES44DC	6		96		96
SD40-2	6		366		366
SD50	6		9		9
SD50-2	6	8	145		153
SD50-3	6		14		14
SD60	6		25		25

PTC Locomotive Candidates					
CLASS	AXLE	LOCAL	ROAD	OFC	TOTAL
SD60I	6		34		34
SD60M	6		31		31
SD70AC	6		220		220
SD70AE	6		20		20
SD70M	6		25		25
SD80AC	6		13		13
	TOTAL	639	2957	4	3600

8.2 Schedule [§ 236.1011(a)(6)(ii)]

The PTC rolling stock implementation schedule is organized by year. Refer to Table 8-2 for the number of CSXT rolling stock to be equipped each year to achieve complete rolling stock implementation by December 31, 2015. Locomotives equipped with a PTC system will become active in accordance with CSXT's PTC Progressive Implementation Schedule.

CSXT will monitor and review on a monthly basis the Locomotive installation schedules. CSXT's Assistant Vice President Advanced Engineering, as the leader of the PTC Implementation Plan team, will submit an annual progress report by April 16th of each calendar year.

Table 8-2 Proposed Schedule for PTC Rolling Stock Implementation

Year	Count
2009	12
2010	20
2011	510
2012	750
2013	850
2014	850
2015	608
Total	3600

8.3 Tenant Railroads [§ 236.1011(a)(6)(iv)(A) and (B)]

This section identifies communications with Class II/III tenant railroads regarding rolling stock to be equipped by the tenant with compatible PTC for operation on CSXT's PTC territories.

The Assistant Vice President Advanced Engineering, as the leader of the PTC Implementation Plan team, will manage the responses received from tenant railroads. CSXT is pursuing additional communications with tenant railroads via follow-up letters and telephone contact. CSXT has also established systems to receive responses electronically. CSXT's Assistant Vice President Advanced Engineering will provide monthly status updates to FRA until 100% of the requested responses have been received and appropriate

interoperability agreements are in place. The monthly updates will include information from tenant railroads on their locomotive equipment installation schedules.

Table 8-3 lists the Tenant Railroads operating on CSXT PTC track segments which have passenger traffic. CSXT sent each of these railroads a letter requesting in part that the railroad advise CSXT of its plans to equip rolling stock with a PTC system interoperable with CSXT's PTC system. APPENDIX D contains a sample copy of this letter and information in regard to responses received.

Table 8-3 Class II and III Tenant Railroads Operating on CSXT PTC Track Segments with Passenger Traffic

Subdivision	Railroad		States
Aberdeen	ATW (Atlantic & Western Railway)		NC
	ACWR (Aberdeen, Carolina and Western Railway)		NC
Alleghany	BB (Buckingham Branch Railroad)		VA
Auburndale	FMID (Florida Midland Railroad Co., Inc.)		FL
Berkshire	ST (Pan Am Southern)		MA
	CSO (Connecticut Southern Railroad)		CT
	HRRC (Housatonic Railroad Co.)		MA,CT
Boston	EBSR (East Brookfield & Spencer Railroad)		MA
	PW (Providence and Worchester Railroad)		MA
Buffalo Terminal	BPRR (Buffalo & Pittsburgh Railroad)		NY
	BSOR (Buffalo Southern Railroad)		NY
	SB (South Buffalo Railroad)		NY
Charleston	GITM (Golden Isles Terminal Railroad)		SC
Cincinnati	TTIS (Transkentucky Transportation Railroad, Inc.)		KY

Subdivision	Railroad		States
Cincinnati Term	CIND (Central Railroad of Indiana)		OH
	IORY (Indiana & Ohio Railway)		OH
Grand Rapids Terminal	MQT (Marquette Rail)		MI
	GR (Grand Rapids Eastern Railroad)		MI
	GDLK (Watco Companies)		MI
Ind. Terminal	ISRR (Indiana Southern Railroad)		IN
	LIRC (Louisville & Indiana Railroad)		IN
Indianapolis	IERR (Indiana Eastern Railroad)		IN
Keystone	WE (Wheeling & Lake Erie)		PA,MD
	SWP (Southwest Pennsylvania Railroad)		PA
Mohawk	NYSW (New York, Susquehanna & Western Railroad)		NY
	MHWA (Mohawk, Adirondack & Northern Railroad)		NY
Monon	TPW (Toledo, Peoria & Western Railway)		IN
P&W	AVR (Allegheny Valley Railroad)		PA
Rochester	DLWR (Depew, Lancaster & Western Railroad		NY
	RSR (Rochester Southern Railroad)		NY
Sanford	Conrad Yelvington		FL
	FCEN (Florida Central Railroad Co., Inc.)		FL
Savannah	GITM (Golden Isles Terminal Railroad)		SC
	RSOR (Riceboro Southern Railway)		GA
	GC (Georgia Central Railway)		GA

Table 8-4 lists the tenant railroads operating on CSXT PTC track segments without Passenger traffic. CSXT sent each of these railroads a letter requesting in part that the railroad advise CSXT of its plans, if any, to equip rolling stock with a PTC system. APPENDIX H contains a sample copy of this letter.

Table 8-4 Class II and III Tenant Railroads Operating on CSXT PTC Track Segments without Passenger Traffic

Subdivision	Railroad	[redacted]	States
Andrews	CALA (Carolina Southern Railroad)		SC
Barr	CSS (Chicago South Shore & South Bend Railroad)		IL
Barr / Chicago Heights	IHB (Indiana Harbor Belt Railroad)		IL
Blue Island	BRC (Belt Railway Company of Chicago)		IL
	CRL (Chicago Rail Link, L.L.C.)		IL
Boyles Term /Birmingham Mineral Sub	KCS/ABS (Watco Companies)		AL
Boyles Terminal Sub	ATN (Alabama & Tennessee River Railway)		AL
Bruceton	SCTR (South Central Tennessee Railroad)		TN
CE&D	INRD (Indiana Rail Road Company)		IN
	INRD (Indiana Rail Road Company)		IN
	INRD (Indiana Rail Road Company)		IN
	INRD (Indiana Rail Road Company)		IN
	INRD (Indiana Rail Road Company)		IN
Cincinnati Corbin	RJCC (RJ Corman Central Kentucky Line)		KY
	RJCC (RJ Corman Central Kentucky Line)		KY
Cleveland Short line	(WE) Wheeling and Lake Erie		OH
Columbus	CUOH (Ohio Central)		OH
Dothan	BAYL (Bay Line Railroad)		AL
Evansville Term	EVWR (Evansville Western Railway Inc.)		IN
	ISRR (Indiana Southern Railroad)		IN
Freemont	MS (Michigan Shore Railroad)		MI
Greewich	WE (Wheeling & Lake Erie Railway)		OH

Subdivision	Railroad		States
Henderson	PAL (Paducah & Louisville Railroad)		KY
	RJCM (RJ Corman Memphis Line)		KY
Ind. Terminal	INRD (Indiana Rail Road Company)		IN
Indianapolis Line	CEIW (Central Indiana and Western)		IN
Jacksonville Terminal	FEC (Florida East Coast)		FL
LCL/Lou. Term	RJCC (RJ Corman Central Kentucky Line)		KY
M&M	TASD (Terminal Railway, Alabama State Docks)		AL
M&M/PD	AGR (Alabama & Gulf Coast Railway)		AL
Memphis	KWT (KWT Railroad Inc.)		TN
	WTNN (West Tennessee Railroad)		TN
Mountain	AO (Appalachian and Ohio Railroad)		WV
New Castle	AB (Akron and Barberton Cluster Railway)		OH
	RJCL (R J Corman Cleveland Line)		OH
	WE (Wheeling & Lake Erie Railway)		OH
	WE (Wheeling & Lake Erie Railway)		OH
	OHCR (Ohio Central)		OH
	OHCR (Ohio Central)		OH
NO&M	NOPB (New Orleans Public Belt Railroad)		LA
Northern	CUOH (Columbus & Ohio River Railroad)		OH
	USRP (U.S. Rail Corp.)		OH
Plymouth	GLC (Great Lakes Central)		MI
Porter	CFE (Chicago, Ft. Wayne & Eastern Railroad)		IN
Riverline	Conrail (Conrail)		NJ, PA, MI
Scottslawn	Savidge (CANAC)		OH
St. Louis	ALS (The Alton & Southern Railway Co.)		IL

Subdivision	Railroad	[redacted]	States
	INRD (Indiana Rail Road Company)		IN
Toledo	IORY (Indiana & Ohio Railway)		OH
Toledo Terminal	AA (Ann Arbor Railroad)		OH
Toledo Terminal	WE (Wheeling & Lake Erie Railway)		OH
West Shore	RSR (Rochester Southern Railroad)		GA
Willard	NOW (Northern Ohio & Western Railroad)		OH
	ASRY (Ashland Railway)		OH
Willard Terminal	WE (Wheeling & Lake Erie Railway)		OH
	WE (Wheeling & Lake Erie Railway)		OH

9.0 WAYSIDE DEVICES [§ 236.1011(A)(7)]

This section identifies wayside devices or subsystems which must be installed for the CSXT PTC system.

CSXT plans to install wayside interface units (WIU) at control points and intermediate signal locations. Additionally, WIUs will be installed at main line switches in non-signaled territories to convey the switch position. At each location a communications package will be installed or upgraded as necessary to build upon CSXT's existing IP infrastructure and provide a reliable transport medium. A 220 MHz radio infrastructure will also be installed on all PTC designated routes to meet interoperability requirements between railroads.

[redacted]

The Wayside Implementation schedule is organized by phases. [redacted]

Table 9-1 Wayside Implementation Schedule

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

10.0 DESIGNATING TRACK AS MAIN LINE OR NON-MAIN LINE [§ 236.1011(A)(8)]

This section identifies which track segments CSXT identifies as main line and non-main line track.

10.1 Main Line Track

The criteria used to designate track as Main Line or Non-Main Line are described in §236.1003(b).

Each track segment was evaluated according to the following two conditions:

1. CSXT is the host railroad as defined in §236.1003(b).

2. The track segment meets the definition of Main Line track as provided in §236.1003(b).

Refer to [redacted] for the track segments designated as Main Line in accordance with the mandate of RSIA08, and the requirements of the PTC Final Rule as defined by §236.1003(b).

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

10.2 Non-Main Line Track Segments

Refer to [redacted] for the track segments designated as Non-Main Line in accordance with the mandate of RSIA08, and the requirements of the PTC Final Rule as defined in §236.1003(b). [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

11.0 EXCEPTIONS TO RISK-BASED PRIORITIZATION [§ 236.1011(A)(9)]

This section identifies and describes the basis for any determinations by CSXT that the risk-based prioritization in §236.1011(a)(4) is not practical in specific cases.

[redacted] outlines cases where deployment of the PTC system for a subdivision was assigned to a phase sequence later than suggested by the risk prioritization analysis.

Refer to the list below for further explanation for the Reasons identified in Table 11-1.

[redacted]

[redacted]

[redacted]

12.0 STRATEGY FOR FULL PTC SYSTEM DEPLOYMENT [§ 236.1011(B)]

This section identifies CSXT's strategy, required for Class I railroads and as an option for other railroads, for full system-wide deployment of PTC systems beyond those line segments required to be equipped under 49 CFR part 236, subpart I, including the criteria that will be applied in identifying those additional lines.

CSXT's initial strategy for PTC deployment is to ensure that a PTC system is implemented on all required track segments in accordance with the RSIA08 and FRA's PTC Final Rule, as well as B&OCT track by the statutory deadline of December 31, 2015. The task will require an intensive organizational focus and sustained effort for this entire time period in order to succeed.

CSXT will evaluate its PTC implementation experience as it develops a Railroad Safety Risk Reduction Program, including a Technology Implementation Plan, within the time frame required by 49 U.S.C. 20156 and any regulations issued thereunder. Development of a Technology Implementation Plan will include consideration of full or partial PTC deployment on additional rail lines on the CSXT network, or on rail lines of entities that it controls or engages in joint operations with, beyond those required to be equipped under 49 CFR Part 236 Subpart I.

In performing this analysis CSXT will consider the policy established by 49 U.S.C. 20156 to develop a Railroad Safety Risk Reduction Program that systematically evaluates railroad safety risks and manages those risks in order to reduce the numbers and rates of railroad accidents, incidents, injuries, and fatalities. CSXT will utilize the criteria specified in 49 U.S.C. 20156(e) – safety impact, feasibility, and costs and benefits (including non-safety business benefits, if any, that may accrue) - as well as additional criteria, if any, specified in regulations issued thereunder.

13.0 MAIN LINE TRACK EXCLUSION ADDENDUM [§ 236.1019]

CSXT is not requesting any main line track exceptions pursuant to §236.1019.

APPENDIX A Memorandum of Understanding Between ITC Carriers

MEMORANDUM OF UNDERSTANDING IMPLEMENTATION OF POSITIVE TRAIN CONTROL

AMONG

BNSF RAILWAY, INC., CSX TRANSPORTATION, INC., NORFOLK SOUTHERN RAILWAY COMPANY, and UNION PACIFIC RAILROAD COMPANY, AND

Date: March 26, 2010

This MEMORANDUM OF UNDERSTANDING is hereby made and entered into by and between BNSF Railway, Inc., CSX Transportation, Inc., Norfolk Southern Railway Company, and Union Pacific Railroad Company hereinafter referred to as "Railroads."

A PURPOSE:

In accordance with the Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), Railroads will be deploying Positive Train Control (PTC) on many line segments in order to comply with the RSIA, FRA 49 CFR 236 Subpart I and Railroads' operating and safety rules. Railroads are preparing their PTC Implementation Plan (PTCIP), required by the regulations to be submitted on or before April 16, 2010. In accordance with §236.1011(a)(3), the PTCIP Railroads submit must describe how interoperability will be achieved with other applicable railroads, list methods used to achieve interoperability, and identify the current state of interoperability arrangements with other railroads. By entering into this Memorandum of Understanding, Railroads acknowledge their ongoing mutual work toward meeting all of these objectives.

B STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

1. Railroads seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), including interoperability as that term is defined in §236.1003(b)

2. Railroads have entered into a collaboration agreement to further their efforts to achieve interoperability of their various PTC systems.

3. Railroads are planning on utilizing 220 MHz spectrum for communication functions of radios and wayside interface units.

4. Railroads desire to participate in a PTC testing program to verify functionality and interoperability.

5. Railroads will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

6. This Memorandum of Understanding does not modify or supersede any existing agreement among Railroads

IN WITNESS WHEREOF, the parties have executed this present on the day and year first above writ.

BNSF Railway Company

Title:

CSX Transportation, Inc.

Title:

Norfolk Southern Railway Company

Title:

Union Pacific Railroad Company

Title:

APPENDIX B Sample Memorandum of Understanding Provided to Class I Carriers That Are Not Party to the ITC Collaboration Agreement

MEMORANDUM OF UNDERSTANDING
Implementation of Positive Train Control

Date: July 8, 2010

This Letter of Understanding is hereby made and entered into by and between CSX Transportation, Inc., with offices at 500 Water Street, Jacksonville, Florida 32202 (hereinafter referred to as "CSXT") and Canadian Pacific (agency or carrier) with offices at 401 – 9th Ave. SW Calgary, AB, Canada (hereinafter collectively referred to as "Railroads").

A. PURPOSE:

In accordance with the Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), CSXT will be deploying Positive Train Control (PTC) on many line segments in order to comply with the RSIA, FRA 49 CFR 236 Subpart I and CSXT's operating and safety rules. CSXT is preparing its PTC Implementation Plan (PTCIP), required by the regulations to be submitted on or before April 16, 2010. In accordance with §236.1011(a)(3), the PTCIP CSXT submits must describe how interoperability will be achieved with all tenant railroads will be achieved on line segments where PTC is deployed. It has been determined your operations on CSXT include areas where PTC will be deployed. This is a Memorandum of Understanding between CSXT and CN to obtain an interoperable PTC solution on the identified line segments.

B. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

Railroads seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), including interoperability as that term is defined in §236.1003(b).

CSXT is planning to deploy the Wabtec V-ETMS PTC system which is designed to support interoperability. V-ETMS is a locomotive-centric, vital train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety.

CSXT is planning on utilizing 220 MHz spectrum for communication functions of radios and wayside interface units.

Railroads desire to participate in a PTC testing program to verify functionality and interoperability.

Railroads will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

This Memorandum of Understanding does not modify or supersede any existing agreement among Railroads.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above writ.

CSX Transportation, Inc.	**AGENCY/CARRIER**
By:	**By:**
Timothy K. Male	
Name:	**Name:**
AVP Advanced Engineering	
Title:	**Title:**

Rev. 3/29/10

*An executed copy of this agreement was sent by regular mail but has not yet been received by CSXT.

MEMORANDUM OF UNDERSTANDING
Implementation of Positive Train Control

MEMORANDUM OF UNDERSTANDING
Implementation of Positive Train Control

[illegible] April 15, 2010

This Memorandum of Understanding is hereby [illegible] entered into by and between Kansas City Southern de Mexico, S.A. de C.V. [illegible] Walnut Street, Kansas City, Missouri 64106, hereinafter referred to as "KCSM" and the Kansas City Southern Railway Company (KCSR), with offices at 427 W. 12th St., Kansas City, Mo [illegible] collectively referred to as "Railroads".

A. PURPOSE:

[illegible] Rail Safety Improvement Act of 2008 (RSIA) 49 USC 20157(a)(1), KCSM will be deploying Positive Train Control (PTC) on mainline segments in order to comply with the RSIA, FRA 49 CFR 236 Subpart I and KCSM's operating and safety rules. KCSM is preparing its PTC Implementation Plan (PTCIP) required by the regulations to be submitted on or before April 16, 2010. In accordance with 236.1011(a)(3) of the PTCIP, KCSM's subsidiary or designee Interoperability will be achieved with all [illegible] Railroads on those segments where PTC is deployed. It has been determined your operations on KCSM are safer in areas where PTC will be deployed. This is a Memorandum of Understanding between KCSM and the Railroads to obtain an interoperable PTC solution on the identified lines/segments.

B. STATEMENT OF MUTUAL BENEFIT AND INTERESTS

1. Railroads seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), including interoperability as that term is defined in 236.1003(b).

2. KCSM is planning to deploy the Wabtec VETMS PTC system which is designed to support interoperability. VETMS is a locomotive centric, virtual train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety.

3. KCSM is planning on utilizing 220 MHz spectrum for communication functions of radios and wayside interface units.

4. Railroads desire to participate in a PTC testing program to verify functionality and interoperability.

5. Railroads will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

6. This Memorandum of Understanding does not modify or supersede any existing agreement among Railroads.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above written

CSX Transportation, Inc	AGENCY/CARRIER
By:	By:
Timothy K. Male	Richard W. Stones
Name	Name:
AVP Advanced Engineering	AVP Advanced Systems Planning
Title	Title:

Rev. 3/29/10

MEMORANDUM OF UNDERSTANDING
Implementation of Positive Train Control

MEMORANDUM OF UNDERSTANDING
Implementation of Positive Train Control

[illegible]

This Letter of Understanding [illegible] made and entered into by, and between the [illegible] Transportation [illegible] Street, Jacksonville, Florida 32202 (hereinafter referred to as "CSXT") and [illegible] Railway Company [illegible] with offices at [illegible] Montreal, QC [illegible] (hereinafter collectively referred to as "Railroads").

A. PURPOSE

[illegible] with the Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1) [illegible] will be deploying [illegible] to comply with the PTC implementation requirements, [illegible] comply with the FRA 49 CFR 236 Subpart I [illegible] operating and safety rules [illegible] implementing a PTC implementation plan (PTCIP), [illegible] the regulations to be submitted [illegible] before April 16, 2010. [illegible] in accordance with [illegible] the PTC system must be able to have interoperability [illegible] achieved with all [illegible] with [illegible] PTC is deployed. It has been determined that operations [illegible] CSXT [illegible] where PTC will be deployed. This is a Memorandum of Understanding between CSXT [illegible] National Railway Company to obtain an interoperable PTC [illegible] the standard one requirements.

B. STATEMENT OF MUTUAL BENEFIT AND INTERESTS

1. Railroads seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), including interoperability as that terms is defined in § 236.1003(h).

2. CSXT is planning to deploy the Wabtec V-ETMS PTC system which is designed to support interoperability. V-ETMS is a GPS-enabled centralized train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety.

3. CSXT is planning on utilizing 220 MHz spectrum for communication functions of radios and wayside interface units.

4. Railroads desire to participate in a PTC testing program to verify functionality and interoperability.

5. Railroads will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

6. This Memorandum of Understanding does not modify or supersede any existing agreement among the Railroads.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above written

CSX Transportation, Inc.	AGENCY/CARRIER
By	By:
Timothy K. Male	Dwight Tays
Name	Name
AVP Advanced Engineering	Chief Engineering Technology
Title	Title

Rev. 3/29/10

APPENDIX C Memorandum of Understanding between CSXT and Conrail

Date: April 1, 2010

This Letter of Understanding is hereby made and entered into by and between CSX Transportation, Inc., with offices at 500 Water Street, Jacksonville, Florida 32202 (hereinafter referred to as "CSXT") and Conrail with offices at 1000 Howard Boulevard, Mt. Laurel, NJ 08054 (hereinafter collectively referred to as "Railroads").

A. PURPOSE:

In accordance with the Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), CSXT will be deploying Positive Train Control (PTC) on many line segments in order to comply with the RSIA, FRA 49 CFR 236 Subpart I and CSXT's operating and safety rules. CSXT is preparing its PTC Implementation Plan (PTCIP), required by the regulations to be submitted on or before April 16, 2010. In accordance with §236.1011(a)(3), the PTCIP CSXT submits must describe how interoperability will be achieved with all tenant railroads will be achieved on line segments where PTC is deployed. It has been determined your operations on CSXT include areas where PTC will be deployed. This is a Memorandum of Understanding between CSXT and Conrail to obtain an interoperable PTC solution on the identified line segments.

B. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

Railroads seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), including interoperability as that term is defined in §236.1003(b).

CSXT is planning to deploy the Wabtec V-ETMS PTC system which is designed to support interoperability. V-ETMS is a locomotive-centric, vital train control system designed to be overlaid on existing methods of operation and provide a high level of railroad safety.

CSXT is planning on utilizing 220 MHz spectrum for communication functions of radios and wayside interface units.

Railroads desire to participate in a PTC testing program to verify functionality and interoperability.

Railroads will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

This Memorandum of Understanding does not modify or supersede any existing agreement among Railroads.

IN WITNESS WHEREOF, the parties have executed these presents on the day and year first above writ.

CSX Transportation, Inc.	**AGENCY/CARRIER**
_____	_____
Title: AVP Advanced Engineering	**Title: Vice President/Chief Engineer**

Rev. 3/29/10

*An executed copy of this agreement was sent by regular mail but has not yet been received by CSXT.

APPENDIX D Letter of Understanding between CSXT and its Freight Tenants

3-25

CSX TRANSPORTATION

500 Water Street J948
Jacksonville, FL 32202
(904) 366-4191
Fax (904) 366-5367

March 16, 2010
Mr. Scott Corto
President
Providence & Worcester Railroad
5 Hammond St
Worcester, MA 16-10

Re: Positive Train Control ("PTC") – Rolling stock information request and interoperability agreement

Dear Mr. Corto,

The Federal Railroad Administration ("FRA") issued its *Positive Train Control Systems, Final Rule*, Federal Register Vol. 75, No. 10, on January 15, 2010 ("Final Rule").

CSX Transportation, Inc. ("CSXT") has identified the Providence & Worcester Railroad as a Tenant Railroad operating on CSXT track upon which a PTC system is required. CSXT records indicate that the Providence & Worcester Railroad operates on a track segment that has regularly scheduled intercity or commuter rail traffic located within the Boston subdivision in the Albany division. The [redacted] the Providence & Worcester Railroad operates over CSXT is within the [redacted] SXT mileposts.

CSXT intends to equip its track where required, including the track segment identified above, with the Wabtec V-ETMS PTC system. Providence & Worcester Railroad will be required to equip its locomotives operating on this track segment with a PTC system that is interoperable with CSXT's PTC system.

Pursuant to the Final Rule, CSXT is requesting that the Providence & Worcester Railroad identify each item of rolling stock that may operate on the track segment identified above, or elsewhere on the CSXT system, to be PTC system equipped and the date each will be equipped. CSXT asks that you provide the following information:

1. The type of PTC system technology that the Providence & Worcester Railroad will use;
2. The number of locomotives that the Providence & Worcester Railroad plans to equip with PTC system technology that will operate on a CSXT track segment;
3. The schedule of when the Providence & Worcester Railroad plans to equip the rolling stock identified in response to request number two; and
4. Please confirm the location by milepost and number of trains where the Providence & Worcester Railroad is operating on CSXT tracks.

In order to comply with filing deadlines, CSXT requests that you provide this information by **March 31, 2010.**

CSX TRANSPORTATION

500 Water Street, J845
Jacksonville, FL 32202
(904) 366-4191
Fax (904) 366-5069

In addition, CSXT proposes that the parties acknowledge and agree to the following principles regarding PTC system interoperability as contemplated by 49 CFR 236.101 [rail 31].

1. CSXT and the Providence & Worcester Railroad seek to implement PTC technical solutions which meet the requirements of interoperability as defined in 49 CFR §236.1003(b).
2. CSXT and the Providence & Worcester Railroad desire to participate in a PTC testing program to verify functionality and interoperability.
3. CSXT and the Providence & Worcester Railroad will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

CSXT requests that the Providence & Worcester Railroad acknowledge and agree to these principles by signing and returning a copy of this letter with the above requested information.

Thank you in advance for your cooperation. If you have any questions in regard to this request pursuant to the Final Rule, please contact Len Kellermann at (904) 366-4191 or Len_Kellermann@csx.com or you may contact your CSX Short Line representative.

Very truly yours,

Tim Male
AVP Advanced Engineering

Len Kellermann
Len Kellermann
Dir Regional and Short Line Development

Providence & Worcester Railroad acknowledges and agrees with the above statements regarding interoperability.

[Name]
[Title] VP Operations

March 30, 2010

Mr. Tim Male
AVP Advanced Engineering
CSX Transportation
500 Water Street, J848
Jacksonville, FL 32202

Dear Mr. Male:

I have attached the signed letter from you addressed to Mr. P. Scott Conti, President of the Providence and Worcester Railroad Company, (P&W), dated March 16, 2010 concerning Positive Train Control (PTC). Further, I have also attached a copy of our locomotive roster which indicates which locomotives are fully equipped with a PTC system. Since we operate over Amtrak's Northeast Corridor between New Haven, Connecticut and the Massachusetts/Rhode Island state border we have installed Amtrak's Advanced Civil Speed Enforcement System (ACSES) on our fleet.

In your letter you have indicated that the track segment on which the Providence and Worcester Railroad operates over CSXT Trackage is within th[redacted] mileposts. We have historicall[redacted] in interch[redacted] CSXT at Worcester between [redacted] As for items 1, 2, and 3 on second page of your letter P&W is i[redacted]ing with CSXT on interoperability, testing and exchanging technical data to facilitate the implementation of the PTC system.

The P&W would look to CSXT to cover any costs required for any equipment or technical data that P&W can not furnish in house to implement CSXT's VETMS system.

Yours truly,

David F. Fitzgerald
VP Operations
Providence and Worcester Railroad Company

PROVIDENCE AND WORCESTER RAILROAD COMPANY
75 HAMMOND STREET, WORCESTER, MA 01610 PO BOX 16551, WORCESTER, MA 01601
TELEPHONE (508) 755-4000

Locomotive		Model	HP	Cab Signal	ACSES Phase 1	ACSES Phase 2	Dynamic Brake	Cab Cooling Fan
PW 3001	A	GP 40	3000	N	N	N	Y	N
PW 3002	A	GP 40	3000	N	N	N	Y	N
PW 3003	A	GP 40	3000	N	N	N	Y	N
PW 3004		B30-9	3000				Y	
PW 3005		B30-9	3000				Y	
PW 3006		B30-9	3000				Y	
PW 3007		B30-9	3000				Y	
PW 3008		B30-9	3000				Y	
PW 3901	A	B39-8	3900	Y	Y	Y	Y	Y
PW 3902	A	B39-8	3900	Y	Y	Y	Y	Y
PW 3903	A	B39-8	3900	Y	Y	Y	Y	Y
PW 3904	A	B39-8	3900	Y	Y	Y	Y	Y
PW 3905	A	B39-8	3900	Y	Y	Y	Y	Y
PW 3906	A	B39-8	3900	Y	Y	Y	Y	Y
PW 3907	A	B39-8	3900	Y	Y	Y	Y	Y
PW 3908	A	B39-8	3900	Y	Y	Y	Y	Y
PW 3909	A	B39-8	3900	Y	Y	Y	Y	Y
PW 2006	A	GP38-2	2000	Y	Y	Y	Y	Y
PW 2007	A	GP38-2	2000	Y	Y	Y	Y	N
PW 2008	A	GP38-2	2000	Y	Y	Y	Y	Y
PW 2009	A	GP38-2	2000	Y	Y	Y	N	Y
PW 2010	A	GP38-3	2000	Y	Y	Y	Y	Y
PW 2011	A	GP38-3	2000	Y	Y	Y	Y	Y
PW 2201	A	B23-7	2250	Y	Y	Y	Y	N
PW 2215	A	SB23-7	2250	Y	Y	Y	Y	Y
PW 2216	A	SB23-7	2250	Y	Y	Y	Y	Y
PW 4001		B40-8	4000	Y	Y	Y	Y	Y
PW 4002		B40-8	4000	Y	Y	Y	Y	Y
PW 4003		B40-8	4000	Y	Y	Y	Y	Y
PW 4004		B40-8	4000	Y	Y	Y	Y	Y

The table below tracks the responses received by Class II and III tenant railroads operating on CSXT PTC line segments with Passenger traffic.

[redacted]

[redacted]

APPENDIX E Letters of Interoperability Provided to Passenger Carriers

CSX TRANSPORTATION

[illegible]

April 1, 2010

Mr. Dale Zehner
Chief Executive Officer
Virginia Railway Express
1500 King Street, Ste. 202
Alexandria, VA 22314

Re: Positive Train Control ("PTC") – Interoperability Agreement

Dear Mr. Zehner:

As you are aware, the Federal Railroad Administration ("FRA") issued its *Positive Train Control Systems; Final Rule*, Federal Register Vol. 75, No. 10 on January 15, 2010 ("Final Rule").

CSX Transportation, Inc. ("CSXT") has identified Virginia Railway Express ("VRE") as a Tenant Railroad operating on CSXT track upon which a PTC system is required. CSXT records indicate that VRE Railroad provides regularly scheduled intercity or commuter rail traffic on CSXT's RF&P Subdivision, between CP Virginia Interlocking at Milepost [redacted] Crossroads, south of Fredericksburg, VA.

CSXT intends to equip this track segment with the Wabtec V-ETMS PTC system. VRE will be required by the Final Rule to equip its locomotives operating on this track segment with a PTC system that is interoperable with CSXT's PTC system.

The Final Rule also requires that host railroad and passenger operator(s) sharing track jointly file with the FRA by April 16, 2010 a PTC Implementation Plan ("PTCIP") and, as appropriate, Main Line Track Exclusion Addendum(s) ("MLEA") to the PTCIP.

The purpose of this letter is for VRE to review the enclosed Exhibit A which is Section 5 – Interoperability of CSXT's PTCIP governing operators on the shared track segment identified above.

VRE
Page Two

CSXT requests that VRE acknowledge and agree to the following items regarding PTC system interoperability by returning a signed copy of this letter to CSXT by April 10, 2010:

1. CSXT and VRE seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(c)
2. CSXT and VRE desire to participate in a PTC testing program to verify functionality and interoperability
3. CSXT and VRE will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.
4. VRE adopts and agrees that CSXT will jointly file with FRA Exhibit A, which is Section 5 – Interoperability of CSXT's PTC IP, as required under §236.1009(a)(3)

Thank you in advance for your cooperation in reviewing this information. If you have any questions in regard to this interoperability information as required by the Final Rule, please contact John Bowie, CSXT's Director Joint Facilities at (904) 359-3486.

Very truly yours,

Tim Male
AVP Advanced Engineering
Facilities

Steve A. Potter
AVP Network Planning and Joint
Signature Block on Behalf of

Acknowledgement and Agreement:

VRE, having reviewed the enclosed Exhibit A, Section 5 – Interoperability of the CSXT PTC IP, acknowledges and agrees with items 1 through 4 above.

Dale Zehner
Chief Executive Officer

[illegible] Water Street
Jacksonville, FL [illegible]

April 15, 2010

Mr. John Hovatter, Jr.
Director MARC Train/Commuter Bus Services
1515 Washington Boulevard
Baltimore, Maryland 21230-1764

Re: Positive Train Control ("PTC") – Interoperability Agreement

Dear Mr. Hovatter:

As you are aware, the Federal Railroad Administration ("FRA") issued its *Positive Train Control Systems: Final Rule*, Federal Register Vol. 75, No. 10, on January 15, 2010 ("Final Rule").

CSX Transportation, Inc. ("CSXT") has identified Maryland Transit Administration ("MTA") as a Tenant Railroad operating on CSXT track upon which a PTC system is required. CSXT records indicate that MTA provides regularly scheduled commuter rail traffic on track segments identified as follows:

[redacted]

CSXT intends to equip its track where required, including the track segment identified above, with the Wabtec V-ETMS PTC system. MTA will be required by the Final Rule to equip its locomotives operating on this track segment with a PTC system that is interoperable with CSXT's PTC system. At MTA's request, the Frederick Branch is included in CSXT's Implementation Plan; however, MTA will install the PTC using subcontractors.

The Final Rule also requires that host railroad and passenger operator(s) sharing track jointly file with the FRA by April 16, 2010 a PTC Implementation Plan ("PTCIP"), and as appropriate, Main Line Track Exclusion Addendum(s) ("MTEA") to the PTCIP.

1

MTA
Page Two

The purpose of this letter is for MTA to review the enclosed Exhibit A which is Section 5 – Interoperability of CSXT's PTCIP governing operations on the shared track segment identified above.

CSXT requests that MTA acknowledge and agree to the following items regarding PTC system interoperability by returning a signed copy of this letter to CSXT by April 15, 2009.

1. CSXT and MTA seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b)
2. CSXT and MTA desire to participate in a PTC testing program to verify functionality and interoperability
3. CSXT and MTA will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.
4. MTA adopts and agrees that CSXT will jointly file with FRA Exhibit A, which is Section 5 – Interoperability of CSXT's PTCIP, as required under §236.1009(a)(3)

Thank you in advance for your cooperation in reviewing this information. If you have any questions in regard to this interoperability information as required by the Final Rule, please contact Virginia Beck.

Very truly yours,

Tim Mele
AVP Advanced Engineering Facilities

Steve A. Potter
AVP Network Planning and Joint

Acknowledgement and Agreement

Maryland Transit Administration having reviewed the enclosed Exhibit A, Section 5 – Interoperability of the CSXT PTCIP, acknowledges and agrees with items 1 through 4 above.

John Hovatter

2

CSX TRANSPORTATION

[illegible]

April 15, 2010

Mr. Michael J. Monastero
Assistant Chief Engineer
Communications & Signals
Southeastern Pennsylvania Transportation Authority (SEPTA)
1234 Market Street, 13th Floor
Philadelphia, PA 19107

Re: Positive Train Control ("PTC") Interoperability Agreement

Dear Mr. Monastero:

As you are aware, the Federal Railroad Administration ("FRA") issued its *Positive Train Control Systems, Final Rule*, Federal Register Vol. 75, No. 10, on January 15, 2010 ("Final Rule").

CSX Transportation, Inc. ("CSXT") has identified Southeastern Pennsylvania Transportation Authority ("SEPTA") as a Tenant Railroad operating on CSXT track upon which a PTC system is required. CSXT records indicate that SEPTA provides regularly scheduled intercity or commuter rail traffic on a track segment identified as follows:

[redacted]

CSXT and SEPTA install and operate different systems on their respective locomotives, office, and wayside. However, the locomotive onboard system of each is able to interoperate with the office and wayside infrastructure deployed on the other's property. This capability is described in the attached Exhibit A.

The Final Rule also requires that host railroad and passenger operator(s) sharing track jointly file with the FRA by April 16, 2010 a PTC Implementation Plan ("PTCIP"), and as appropriate, Main Line Track Exclusion Addendum(s) ("MLTEA") to the PTCIP.

SEPTA
Page Two

The purpose of this letter is for SEPTA to review the enclosed Exhibit A which is Section 5 – Interoperability of CSXT's PTCIP governing operations on the shared track segment identified above.

CSXT requests that SEPTA acknowledge and agree to the following items regarding PTC system interoperability by returning a signed copy of this letter to CSXT by April 15, 2010:

1. CSXT and SEPTA seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b).
2. CSXT and SEPTA desire to participate in a PTC testing program to verify functionality and interoperability.
3. CSXT and SEPTA will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.
4. SEPTA adopts and agrees that CSXT will jointly file with FRA Exhibit A, which is Section 5 – Interoperability of CSXT's PTCIP, as required under §236.1009(a)(3).

Thank you in advance for your cooperation in reviewing this information. If you have any questions in regard to this interoperability information as required by the Final Rule, please contact Cheryl Boehm, CSXT's Manager Joint Facilities at (904) 359-7490.

Very truly yours,

Tim Male
AVP Advanced Engineering Facilities

Cheryl Boehm on behalf of
Steve A. Potter
AVP Network Planning and Joint

Acknowledgement and Agreement:

SEPTA, having reviewed the enclosed Exhibit A, Section 5 – Interoperability of the CSXT PTCIP, acknowledges and agrees with items 1 through 4 above.

Michael J. Monastero
Assistant Chief Engineer
Communications & Signals

CSX
TRANSPORTATION

[illegible]

April [illegible]

Mr. Paul Vallier
AVP Host Railroads
National Railroad Passenger Corporation
30th Street Station 4th Floor
Philadelphia, Pennsylvania 19104

Mr. Keith Holt
Deputy Chief Engineer Communications and Signals
National Railroad Passenger Corporation
30th Street Station 4th Floor
Philadelphia, Pennsylvania 19104

Re: Positive Train Control ("PTC") Interoperability Agreement

Dear Mr. Vallier and Mr. Holt,

As you are aware, the Federal Railroad Administration ("FRA") issued its *Positive Train Control Systems, Final Rule*, Federal Register Vol. 75, No. 10, on January 15, 2010 ("Final Rule").

CSX Transportation, Inc. ("CSXT") has identified National Railroad Passenger Corporation ("Amtrak") is a Tenant Railroad operating on CSXT track upon which a PTC system is required. CSXT records indicate that Amtrak provides regularly scheduled intercity rail traffic on track several track segments along CSXT's ownership as indicated on attached Exhibit A.

CSXT intends to equip its track where required, with the Wabtec A-ETMS PTC system. Amtrak will be required by the Final Rule to equip its locomotives operating on/across these track segments with a PTC system that is interoperable with CSXT's PTC system.

The Final Rule also requires that host railroad and passenger operations sharing track [illegible] with the FRA by April 16, 2010 a PTC Implementation Plan ("PTCIP") and is appropriate Main Line Track Exclusion Validation Matrix ("MLTEVM") for the PTCIP.

[illegible]

Amtrak
Page Two

CSXT requests that Amtrak acknowledge and agree to the following items regarding PTC system interoperability by returning a signed copy of this letter to CSXT by April 15, 2010:

1. CSXT and Amtrak seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b)
2. CSXT and Amtrak desire to participate in a PTC testing program to verify functionality and interoperability
3. CSXT and Amtrak will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements
4. Amtrak adopts and agrees that CSXT will jointly file with FRA Exhibit A, which is Section 5 – Interoperability of CSXT's PTCIP, as required under §236.1009(a)(3)
5. This Letter of Understanding does not modify or supplant any existing agreements between the parties

Thank you in advance for your cooperation in reviewing this information. If you have any questions in regard to this interoperability information as required by the Final Rule please contact Virginia Beck, Director Passenger and Joint Facility Agreements, (904) 359-2469.

Very truly yours,

Tim Male
AVP Advanced Engineering

Steven A. Potter
AVP Network Planning and Joint Facilities

Acknowledgement and Agreement

National Railroad Passenger Corporation having received the enclosed Exhibit A Section 5 – Interoperability of the CSXT PTCIP acknowledges and agrees with items 1 thru 5 above.

Keith Hall
Deputy Chief Engineer
[illegible]

CSX

500 Water Street
Jacksonville, FL 32202

April 1, 2010

Mr. Stephen A. Jones
Deputy Director of Railroad Operations
Massachusetts Bay Transportation Authority
Ten Park Plaza
Boston, MA 02116

Re: Positive Train Control ("PTC") - Interoperability Agreement.

Dear Mr. Jones:

As you are aware, the Federal Railroad Administration ("FRA") issued its *Positive Train Control Systems: Final Rule*, Federal Register Vol. 75, No. 10, on January 15, 2010 ("Final Rule").

CSX Transportation, Inc. ("CSXT") has identified Massachusetts Bay Transportation Authority ("MBTA") as a Tenant Railroad operating on CSXT track upon which a PTC system is required. CSXT records indicate that MBTA provides regularly scheduled intercity or commuter rail traffic on a track segment identified as follows:

[redacted]

CSXT intends to equip its track where required, including the track segment identified above, with the Wabtec V-ETMS PTC system. MBTA will be required by the Final Rule to equip its locomotives operating on this track segment with a PTC system that is interoperable with CSXT's PTC system.

The Final Rule also requires that host railroad and passenger operator(s) sharing track jointly file with the FRA by April 16, 2010 a PTC Implementation Plan ("PTCIP"), and as appropriate, Main Line Track Exclusion Addendum(s) ("MTEA") to the PTCIP.

The purpose of this letter is for MBTA to review the enclosed Exhibit A which is Section 5 – Interoperability of CSXT's PTCIP governing operations on the shared track segment identified above.

MBTA
Page Two
April 1, 2010

CSXT requests that MBTA acknowledge and agree to the following items regarding PTC system interoperability by returning a signed copy of this letter to CSXT by April 10, 2010:

1. CSXT and MBTA seek to implement PTC technical solutions which meet the requirements of interoperability as defined in §236.1003(b).
2. CSXT and MBTA desire to participate in a PTC testing program to verify functionality and interoperability.
3. CSXT and MBTA will facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.
4. MBTA adopts and agrees that CSXT will jointly file with FRA Exhibit A, which is Section 5 – Interoperability of CSXT's PTCIP, as required under §236.1009(a)(3).

In the event this line is sold prior to the implementation date, CSXT and MBTA will amend their respective PTCIPs accordingly.

Thank you in advance for your cooperation in reviewing this information. If you have any questions in regard to this interoperability information as required by the Final Rule, please contact Joanna Griffith, CSXT's Director Joint Facilities at (904) 359-4925.

Very truly yours,

Tim Male
AVP Advanced Engineering
Facilities

Steve A. Potter
AVP Network Planning and Joint

Acknowledgement and Agreement:

MBTA having reviewed the enclosed Exhibit A, Section 5 – Interoperability of the CSXT PTCIP, acknowledges and agrees with items 1 through 4 above.

Stephen A. Jones
Deputy Director of Railroad Operations

APPENDIX F Review of Previous Applicable Studies

Introduction

This appendix briefly summarizes reviews of previous research related to the railroad risk factors that are being considered in the risk prioritization model. The three key references that are discussed in this appendix are identified in the bulleted list below (note that the reference numbers included throughout this appendix refer to references listed in Section 6.0 above).

- Railroad Safety Advisory Committee (RSAC), Federal Railroad Administration, US Department of Transportation. *Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator: Implementation of Positive Train Control Systems*. September 1999. [8]
- Railroad Systems Division (DTS-75), Office of Safety and Security, The John Volpe National Transportation Systems Center, US Department of Transportation. *Presentation for Office of Safety, Federal Railroad Administration RSAC/PTC Working Group Risk 2 Team, Base Case Risk Assessment: Data Analysis & Tests*. April 22, 2003. [9]
- Carl D. Martland, Ying Zhu, Youssef Lahrech, and Joseph M. Sussman. *Risk and Train Control: A Framework for Analysis*. Center for Transportation Studies, Massachusetts Institute of Technology, Cambridge, January 2001. [10]

For each of the above-cited references, the sections following provide a brief overview of the contents of the reference, a listing of the risk factors addressed by the reference, a listing of relevant results/findings cited in the reference, and a discussion of how results/findings were considered when assigning risk factor weights for use in the risk prioritization model.

Report of the Railroad Safety Advisory Committee: Implementation of Positive Train Control Systems

Overview: The RSAC Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator: Implementation of Positive Train Control Systems [8] made use of historical data to help estimate PTC benefits by evaluating PTC-preventable accidents (PPAs). RSAC identified 819 PPAs out of the more than 25,000 accidents reported to FRA between 1988 and 1997 and attempted to estimate the benefits of PTC by evaluating how many accidents would have been eliminated were a given type of PTC system in place. These data were input into the Corridor Risk Assessment Model (CRAM) model, which was used to estimate the safety benefits of PTC by relating the historic occurrence and consequences of accidents that may have been prevented by a PTC system to specific track features and traffic.

Risk Factors Addressed: The independent variables included in the regression analyses from the RSAC report are listed below:

1) The log of the total number of trains on a segment per year (the sum of passenger and freight trains)
2) The squared log of the total number of trains on a segment per year
3) The presence/absence of multi-track (variable set equal to 0 for single track and 1 for multi-track)
4) The ratio of passenger trains to total trains
5) The number of switches per mile

6) The number of curves per mile
7) The presence/absence of curvature on the territory
8) The length-weighted average curvature for the territory
9) The percentage of territory miles under automatic train stop (ATS) or automatic cab signaling (ACS) control
10) The percentage of territory miles signaled, but not under ATS or ACS control
11) The length-weighted average speed for a territory.

Key Findings/Results: The bulleted list below identifies findings of this study that appear to be relevant to the risk factors considered in the risk prioritization model.

- Page 79 of the RSAC report states that "...the analysis pointed out that, of the corridors studied, the highest predictor of risk was the volume of traffic (as expressed by the log squared of the total trains per year). The train control method was less important in prediction of the accidents of interest in this dataset than other factors."
- The table presenting results of the analysis of which factors are most influential in determining the occurrence of PTC-preventable accidents (on page 75) indicates that factors that were "not significant" (at confidence level of 0.05) in determining the occurrence of PTC-preventable accidents for all four levels of PTC technology were the log of the total number of trains on a segment per year, the ratio of passenger trains to total trains, curves per mile, and presence/absence of curvature.
- Pg. 78 of the report states that "Using the highest level of PTC, the model indicates that the total train flow, the number of tracks, and the number of switches and curves per mile contribute to increases in the expected number of accidents and that the presence of a train control method higher than non-signaled but lower than automatic train control will reduce that risk. In addition, two other factors contribute to lowered risk, the average length of curves at a location and the average maximum allowable speed."
- Page 79 also states that "It is counterintuitive to think that accidents decrease with speed limit increases as suggested by the parameter on length-weighted average speed. However, we might reverse the description of this variable and say that we have imposed lower speed limits where accident risk is higher; if we had the luxury of looking at a time-series model we may notice that speed limit changes have taken place over time where risk factors were present."
- One additional statement included in this report (on page 69) that is worth noting is one that relates to the risk of hazardous materials: "The trends in the derailment category indicate relatively infrequent low-consequences events, whose greatest potential hazard is in the possibility of the release of hazardous chemicals requiring an evacuation. Seventeen of four hundred twenty derailments resulted in evacuations; the average number of people evacuated was approximately 420 per incident. Two incidents resulted in over 1000 evacuations. One derailment, included in the group of accidents thought to be possibly preventable by the highest level of PTC system, accounted for 47 fatalities. This accident is not consistent with the general trend of the consequences of PTC-preventable derailments being less than collisions, but it identifies a source of risk."

General Comments on How Results Were Used In Estimation of Risk Factor Weights: Some of the details of the regression analyses that led to the findings/results identified in the bulleted list above are not

included in the RSAC report, and therefore, the findings/results were considered with some caution. There is nothing, however, to indicate that the analysis contained in this report is not valid or useful.

In general, the conclusions of the report indicate that the 'Annual MGT Level' risk factor should potentially be assigned a relatively high weight. The 'Curvature' risk factor may not be a very strong indicator of risk, so it should potentially be assigned a relatively low weight. 'Speed of Train Operations' actually had a counter-intuitive effect on predicting the occurrence of accidents, but this may not be unreasonable due to the fact that authorized speeds may be lower/higher on a section of track dependent on the presence/absence of other risk factors. The data presented in the final bullet help illustrate the noticeable effect on risk that 'Presence and Volume of PIH Material' and 'Presence and Volume of Other Non-PIH Material' could potentially have, indicating that one or both of these factors should be weighted fairly high. While the general findings/results identified above were considered when estimating risk factor weights, no quantitative data from this report were identified as suitable for direct application to risk factor weights.

Base Case Risk Assessment: Data Analysis & Tests (Volpe Center)

Overview: The *Base Case Risk Assessment* presentation [9] describes work performed by the Volpe Center in summarizing the "current level of risk" for a number of territories, as it summarizes results from various linear and anti-log multiple regression analyses that were performed. The study examines segments where PPAs have taken place, as well as other mainline railroad segments. The analyses described in this presentation are assumed to be a follow-on to the analyses documented in the RSAC report summarized in the previous section.

Risk Factors Addressed: The independent variables of the regression analyses are maximum allowable speed, average daily train count, and method of operation.

Key Findings/Results: The bulleted list below identifies findings of this study that appear to be relevant to the risk factors considered in the risk prioritization model.

- Slide 7 indicates that annual PPA cost/train-mile was estimated to be 0.0544 for "Auto" territory, 0.0675 for TCS territory, 0.0590 for ABS territory, and 0.122 for non-signaled territory. These values were calculated by dividing the annual PPA cost in territories of each method of operation by the annual train-miles for each method of operation.
- Slide 46 concludes that "Both linear and anti-log multiple regression support the conjectures that the risk increases when the speed increases in all territories."
- Although train count is included as an independent variable in these analyses, the presentation slides contain no conclusions about this factor other than to say, on Slide 46, that risk is "associated with" train count.
- Additional detailed quantitative findings are also included in this presentation, but it would be preferable to address a number of questions/concerns related to the analyses documented in this presentation before using these data.

General Comments on How Results Were Used In Estimation of Risk Factor Weights: While an approach of the nature of that documented in this presentation would seem to be a reasonable approach for generating risk factor weights, additional information about the specific analyses documented in this

presentation is needed before the findings of these analyses can be considered for use in estimating risk factor weights with a reasonable degree of confidence. While there were several questions that arose in the review of this report, only one of these questions is discussed below, as an example.

The coefficients of determination (R^2), which are provided in the column of data under "RSQ" in the tables of results throughout this presentation, are extremely low for all of the regression models. The coefficient of determination is intended to provide an indication of the "goodness of fit", as it measures the proportionate reduction of total variation in Y (which in these models was risk measured as PPA cost/train mile) associated with the use of the X variables in the model (method of operation, train count, speed). An R^2 value, by definition, is constrained to be a value between 0 and 1, with a value equal to 1 indicating that the Y observations fall directly on the fitted regression surface (perfectly explaining the observed variation in Y) and a value equal to 0 indicating that the model does not at all explain the observed variation. The lowest R^2 value of all of the regression models shown here is the 0.015% in the linear regression of risk for all territory (slides 25 and 35), while the highest R^2 value of all of the models is the 1.3% in the anti-log regression of risk in "Auto" territory (slide 29). The presence of such low R^2 values indicates that the model may not be well-suited to the data, and therefore, the results of this model were not taken into consideration when estimating risk factor weights. This lack of fit will impact both the significance and precision of the estimated parameters. Even if the parameters had suggested a slope that is consistent with theory, these slopes should not be considered to be validation of the theory as they are based upon a model that is not a strong fit to the data.

Risk and Train Control: A Framework for Analysis

Overview: The report *Risk and Train Control: A Framework for Analysis* by Martland et al. [10] documents a PRA study which examined the effects of train control strategies on the risks of railroad operations. The research was initiated to address the question of how risk and the potential for risk reduction varies from one rail corridor to another, and it also attempts to assess how much reduction in risk can be expected from different train control strategies. The study considers a hypothetical corridor, which the report indicates was similar to the 183 actual corridors analyzed in the RSAC *Report of the Railroad Safety Advisory Committee to the Federal Railroad Administrator: Implementation of Positive Train Control Systems* [8], which was discussed above. The authors of this report described the study's level of analysis as "intermediate", between highly detailed modeling of train behavior and crash analysis and the application of historical measures for accident rates and consequences. It should be noted that the cost of damage to equipment and track were not addressed in this study due to the authors' judgment that the costs from fatalities and injuries dominate these other costs.

Risk Factors Addressed: Factors addressed in this study include passenger traffic, traffic volume, number of tracks, train speed, grade, and curvature.

Key Findings/Results: The bulleted list below identifies findings/results of this study that appear to be relevant to the risk factors considered in the risk prioritization model. The report studies three different PTC technologies, identified as 'PTC1', 'PTC2', and 'PTC3'. When considering the results of this analysis, it was assumed that, of the three PTC technologies assessed, the PTC technology to be installed on CSXT's lines is closest to the 'PTC2' technology; therefore, technology-specific results/findings presented here focus on analysis results pertaining to that technology.

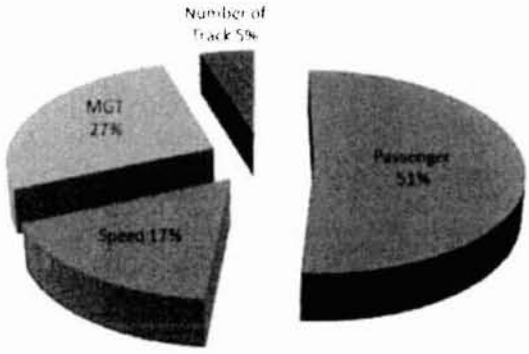
The report states that "The PTC1 system is a bare-bones system that responds to signal overruns with full-service braking; it will also warn the crew and then stop the train if it exceeds speed limits… This

unsophisticated system affords protection against signal overruns and overspeed accidents, but it responds slowly and clumsily to dangerous situations and does not use the digital communications link for further safety improvements." It states that "The PTC2 system represents PTC systems that have been widely discussed and tested in recent years. The system is quicker in informing opposing trains that there is a problem, allowing them either to stop in time to prevent an accident or to slow down and reduce the severity of the accident… The on-board computer continually updates braking distances and controls the train's speed so that it does not exceed either its operating authorities or the speed limits… This system, like PTC1, still relies on the existing signal system to provide protection against broken rails." In comparison, it notes that "The PTC3 system is more advanced, with features that can be imagined but that are not currently available (at the time of the study), including a new system for detection of broken rails." Additional detail of these technologies are provided in that PRA report.

- The first page of the report states that "Passenger traffic is the most important factor because the addition of passenger trains creates the possibility of catastrophic accidents with dozens of fatalities."
- The sensitivity study indicated that implementing 'PTC2' technology on a corridor with twice as much passenger traffic as the base case corridor would lead to a reduction in risk greater than 2.8 times that achieved by implementing 'PTC2' on the base case corridor.
- The sensitivity study indicated that implementing 'PTC2' technology on the base case corridor would lead to a reduction in risk greater than 4.2 times that achieved by implementing 'PTC2' on a corridor with half as much total train volume as the base case corridor
- The report states that "As traffic volumes increase in terms of annual tonnage, railroads tend to operate heavier trains, and they tend to provide better track in order to be able to operate at higher speeds; railroads are very concerned about safety for the higher density lines. Statistical records of accidents per million train-miles may therefore show little or no relationship between traffic density and risk. However, when all other factors are held constant, risks are predicted to rise more than linearly with traffic volume."
- The sensitivity study indicated that implementing 'PTC2' technology on a 1200-mile hypothetical corridor with all single track would lead to a reduction in risk greater than 4 times that achieved by implementing 'PTC2' on a 1200-mile hypothetical corridor.
- The report states that "The risk of collision is much greater on single track than on multiple tracks."
- The report states that "…higher train speeds increase both the likelihood and the severity of the consequences of accidents if there is a signal overrun or a failure to obey a slow order."
- Although the report does not consider accidents involving hazardous materials, the authors do point out that "Accidents involving hazardous materials could conceivably be much more catastrophic even than a high-speed collision of two passenger trains."
- While the study did incorporate route characteristics such as grade and curvature in the modeling, the report does not address to what extent these characteristics had an effect on risk.

The figure below shows the relative weights of the four risk factors approximated here. These approximations are also briefly discussed in Section 6.3 under the various risk factors to which these estimates are applicable. The approximations were just one set of inputs to be considered when assigning

risk factor weights and were interpreted simply as rough approximations that were made using available information.



Approximations for Consideration in Estimation of Risk Factor Weights

APPENDIX G CSXT PTC Implementation Cutover Phase Detail

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

APPENDIX H Sample Letter of Understanding Provided to Tenant Railroads Operating on CSXT PTC Track Without Passengers Railroads

CSX TRANSPORTATION

500 Water Street J848
Jacksonville, FL 32202
(904) 366-4191
Fax (904) 308-5060

March 18, 2010
Mr. Gerry Gates
Senior Vice President- Southern Region
KWT Railroad Inc.
4337 Pablo Oaks Court, Suite 102
Jacksonville, FL 32224

Re: Positive Train Control Rolling stock information request

Dear Mr. Gates,

As you are aware, the Federal Railroad Administration ("FRA") issued its *Positive Train Control Systems; Final Rule*, Federal Register Vol. 75, No. 10, on January 15, 2010 ("Final Rule").

CSX Transportation, Inc. ("CSXT") has identified the KWT Railroad Inc. as a Tenant Railroad operating on CSXT track upon which a PTC system is required. CSXT intends to equip its track, where required, with the Wabtec V-ETMS PTC system.

Pursuant to the Final Rule, CSXT is requesting that the KWT Railroad Inc. identify each item of rolling stock that may operate on the CSXT system to be PTC system equipped and the date each will be equipped. CSXT asks that you provide the following information:

1. The type of PTC system technology, if any, that the KWT Railroad Inc. will use;
2. The number of locomotives, if any, that the KWT Railroad Inc. plans to equip with PTC system technology that will operate on CSXT track;
3. The schedule of when the KWT Railroad Inc. plans to equip the rolling stock identified in response to request number two; and
4. The location by milepost and number of trains where the KWT Railroad Inc. is operating on CSXT tracks.

In order to comply with filing deadlines, CSXT requests that you provide this information by **April 2, 2010**.

Thank you in advance for your cooperation in providing this information. If you have any questions in regard to this request for information as required by the Final Rule, please contact Len Kellermann at (904) 366-4191 or Len_Kellermann@csx.com.

Very truly yours,

Tim Male
AVP Advanced Engineering

Len Kellermann
Dir. Regional and Short Line Development

March 29, 2010

CSX
500 Water Street J8-08
Jacksonville, FL 32202

Dear Mr. Kellermann:

KWT Railroad has received your letter regarding Positive Train Control - Rolling Stock Information. We acknowledge that in accordance with the Rail Safety Improvement Act of 2008 (RSIA), 49 USC 20157(a)(1), CSX will be deploying Positive Train Control (PTC) on many line segments in order to comply with the RSIA, FRA 49 CFR 236 Subpart I and CSX's operating and safety rules.

To the extent required by Federal laws and regulations, KWT Railroad will seek to implement PTC technical solutions which meet the requirements of Rail Safety Improvement Act of 2008 (RSIA) 49 USC 20157(a)(1), including interoperability as that term is defined in §236.1003(b) participate in a testing program and facilitate the exchange of technical information needed to implement PTC in accordance with applicable FRA requirements.

We understand that CSX is planning to deploy the Wabtec V-ETMS PTC system which is designed to support interoperability.

We acknowledge your request for information on each item of rolling stock to be PTC equipped by Atlantic & Western Railway, but at this time we have yet to make such a determination. Once determined, (which shall be no later than December 31, 2015), we will provide you with the requested information.

PLEASE BE ADVISED THAT KWT operates on CSXT tracks between [redacted]

If you have any questions, please feel free to contact me at 904-596-7783 or Tony Long at 904-596-1098.

KWT Railroad

By

Gerald T. Gates
Name

President
Title

cc: Tony Long

APPENDIX I

[redacted]